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

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 last. The gypsum was applied on 17th April 2010; this is the second year in which the paddock has been monitored. In the 2010 canola crop, applying gypsum had no effect on crop yield. This lack of response in 2010 could have been because lack of rainfall in 2010 limited the ability of the gypsum to dissolve sufficiently or impact on infiltration. In order to account for seasonal variability the trial is being monitored for the next two years.

Gypsum (calcium sulphate) can improve soil structure on heavy dispersive 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). Dispersive (sodic) soils can be determined by obtaining a laboratory measure of the exchangeable sodium percentage, a value greater than 6% indicating possible dispersion, or by testing the dispersion of dry soil aggregates in distilled water. 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 for soil structure has become less popular around the Liebe area with the advent of minimum tillage farming systems, which are less destructive to soil structure than conventional cultivation. However, on the south coast of WA recent work by David Hall (DAFWA) and Nigel Metz (SEPWA) has shown that gypsum can produce yield benefits in a no till system when targeted to the right soil type at the right rate. This trial will investigate whether gypsum still plays a role in a minimum tillage system.

Trial Details

Property	Ian Hyde, Dalwallinu
Plot size & replication	24m x75m x 3 replicates
Soil type	Clay
Sowing date	1/6/11
Seeding rate	60 kg/ha Wyalkatchem
Paddock rotation	2008 wheat, 2009 wheat, 2010 canola
Fertilisers	1/6/11: 70 kg/ha K-Till Extra, 50 kg/ha Urea
Herbicides	1/6/11: 1 L/ha Glyphosate, 0.22 kg/ha Logran, 1.4 L/ha Trifluralin 27/7/11: 600 mL/ha Velocity
Insecticide	1/6/11: 100 mL/ha Alpha Duo
Growing Season Rainfall	323mm

Results

Increasing the rate of gypsum (which was applied in April 2010) had no effect on wheat yield or quality in 2011 (Table 2). Application of gypsum also had no effect on crop establishment (Table 1).

Table 1: Plant germination 1 month after sowing in relation to gyprsum application of 0,2,4 t/ha.

Gypsum applied t/ha	Plant $m/^2$
0	50
2	50
4	45
LSD	*NS*

Table 2: Wheat yield and grain quality two years after gypsum was applied.

Gypsum applied t/ha	Yield (t/ha)	Protein %	Screenings %
0	3.37	10.87	3.87
2	3.66	10.48	3.22
4	3.24	10.37	3.41
L.S.D	*NS*	*NS*	*NS*

Comments

This is the second season in a row in which gypsum has not shown a yield increase or altered crop germination. The jar dispersion test conducted on the site indicated the site is not responsive to gypsum because topsoil did not disperse in water, even after 24 hours. This soil is in fact non sodic and thus gypsum is unlikely in have any impact on soil structure.

It is important to remember that not all heavier-textured soils are responsive to gypsum so it is important to conduct dispersion tests (e.g. jar tests) and soil tests (exchangeable sodium percentage) to gain an indication of the paddocks potential response to gypsum (Jarvis, 2000). In general, soils with an exchangeable sodium percentage of 6-10 will tend to be mildly dispersive, 10-15 moderately dispersive and >15 strongly dispersive. Structural decline on-heavier textured soils can occur for reasons other than dispersion. Excess cultivation and compaction by stock and machinery, particularly when the soil is wet, can also damage soil structure. In these cases where soils have poor structure but are not dispersive, minimum tillage, full-stubble retention, controlled traffic and inputs of organic matter in the form of amendments or green and brown manure crops may help build and retain soil structure.

In order to account for seasonal variation and the fact that there may be sodic layers in the subsoil which could take time for the gypsum to correct, the Liebe Group will continue to monitor this trial and see if there are any longer term benefits from gypsum application.

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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.

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