Using gypsum
to improve the structure of dispersive soils

What

Gypsum is calcium sulphate ($CaSO_4$) and in WA gypsum is used for two separate reasons 1; To improve soil structure on soils prone to crusting, hardsetting and slow water infiltration. 2; As a source of sulphur particularly for canola crops. This factsheet focuses on using gypsum to improve soil structure.

Key Points

- First determine if soil is dispersive and/or sodic. This can be done with soil tests and visual assessment.
- If budget is limiting it is better to get the required (often higher) rate of gypsum over a smaller area that needs it than applying an inadequate rate over the whole area.
- Test subsoil and topsoil separately to help determine gypsum requirements.

What does dispersive soil mean?

A dispersive soil is a structurally unstable soil. When the soil gets wet the individual sand, silt and clay particles collapse and separate into the water instead of remaining bound together in aggregates. The floating clay particles then clog the soils pores causing slow water infiltration. When the soil dries the separated clay particles act like cement and cause the soil to become hard, crusty and poorly structured.

What does sodic soil mean?

The soil contains so much sodium (chemical symbol Na^+) that it interferes with the soils 'normal' behaviour causing dispersion. In the Australian context, sodic soils are defined as having an exchangeable sodium percentage (ESP) greater than 6 %.

Many people confuse sodicity and salinity. Salinity is related to excessive levels of dissolved salts which reduce plant water uptake and can be toxic. Salinity is measured by electrical conductivity (EC).

Above: Stubble retention and minimum tillage, combined with gypsum have ensured good germination on this site at Dalwallinu.

Why might gypsum help

Gypsum (calcium sulphate) can improve soil structure on heavy clays by making the soil aggregates more stable. The calcium in the gypsum replaces sodium on the surface of the clays which helps the clay particles stay bound together when wet.

Other things you can do to help

- Increase soils organic matter
- Decrease machinery traffic by using controlled traffic
- Remove or reduce stock when soil is wet to minimise trampling
- Use zero or minimum tillage

Determining if your soil is dispersive or sodic

Visual signs

- Surface crusting or sealing.
- Water pooling on surface (shows slow water infiltration) and water is often milky in colour as a result of dispersed clay.
- Soil becomes very sloppy when wet.
- Patchy germination, poor plant vigor, premature haying off.
- Sometimes the soil shrinks when dry resulting in noticeable soil cracks but be aware that these are good in that they are forming structure. Soil that cracks extensively may not necessarily be dispersive and this behaviour can be a characteristic of very productive self-mulching soils.

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Soil tests

Next time you get your soil tests done ask for an Exchangeable Sodium Percentage (ESP) which can be measured as part of a standard soil test. ESP = Na+/(Ca++, Mg++, K+, Na+) x 100

Table 1: A guide to the rate of gypsum application required as affected by the exchangeable sodium percentage and pH of the soil. Visual assessments should also be used when determining if a soil is dispersive or sodic. Source: Department of Agriculture and Food WA,

	Exchangeable sodium percentage	Gypsum application rate on alkaline soils (t/ha)	Gypsum application rate on acid soils (t/ha)
Slightly sodic	<6	1-2.5	0-1.5
sodic	6-10	2.5 - 5	2.5
Highly sodic	>15	5 - 10	5

Jar test- A simple do it yourself test to determine if soil is dispersive

Materials

- 500 g glass jars (Vegemite jars are suitable)
- distilled water or fresh good quality rainwater (scheme water is unsuitable)
- dry soil clumps or clods

Method

1. Take about ten dry soil samples from the paddock to be tested.
2. Label each soil sample and break the sample into clumps, or amounts about 5 mm in diameter.
3. Pour 100 mL of distilled water into ten separate, clean containers and place on the flat surface.
4. Label the containers to identify each sample.
5. Gently place one aggregate into the centre of each jar and allow to stand for 24 hours without disturbance.

(Make at least two tests for each sample to ensure the results are consistent.)

Above: Expected responses to Jar test if soil is not sodic, slightly sodic or severely sodic. Source: Department of Agriculture and Food WA, Farmnote 386 'Identifying dispersive soils

Need to know more

Farm note 286 Identifying dispersive soils Department of Agriculture and Food WA 2009
Farm note 387 Managing dispersive soils Department of Agriculture and Food WA 2010
Farmnote 57 Identifying gypsum responsive soils Department of Agriculture and Food WA

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