Chapter D4. Slaking and dispersion

PURPOSE OF THIS CHAPTER

To describe how to interpret slaking and dispersion in a soil

CHAPTER CONTENTS

- slaking
- dispersion
- slaking scores
- management decisions in relation to slaking and dispersion

ASSOCIATED CHAPTERS

- A3 ‘Features of soil’
- B6 ‘Does my soil need gypsum?’
- B8 ‘Dispersion’
- D5 ‘Sodic soil management’
- E1 ‘Key checks for productive irrigated soils’

SLAKING

Slaking is the breakdown of a lump of soil into smaller fragments on wetting. It is caused when clay swells and the trapped air bursts out. Organic matter reduces slaking by binding mineral particles and by slowing the rate of wetting. This process occurs in all soil groups of the main vegetable-growing districts.

DISPERSION

Dispersion (the separation of soil into single particles) is governed by soil texture, clay type, soil organic matter, soil salinity and exchangeable cations. The dispersion index that is calculated here combines dispersion on wetting (immersing an air-dry aggregate in water), and dispersion after remoulding (immersing a piece of soil in water that has been kneaded and worked while moist).

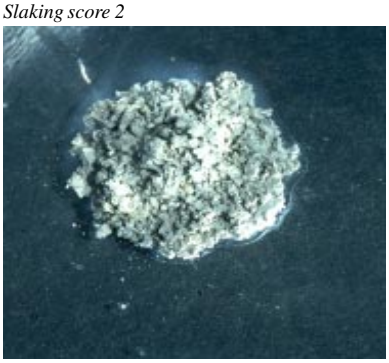
Slaking and dispersion are soil characteristics that will have a large influence on the behaviour and management of a soil. A scoring system is used to allow comparisons between different soils (Figure D4–1). The two scores that can be calculated and used are:

- the slaking score (0–4)
- the dispersion index (0–16).

Figure D4–1. Slaking scores

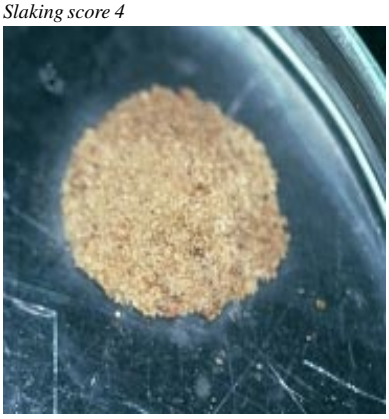
Slaking score 1

Slaking score 2



Slaking score 3

Slaking score 4



SIGNIFICANCE OF SLAKING

Most cultivated soils in Australia are prone to slaking. The results can be either good or bad, depending on the size of the fragments produced.

Slaking is involved in the process of self-mulching, which occurs in many cracking clays. Self-mulching produces a loose surface layer of granular aggregates. Sometimes a thin, fragile crust caps the layer, but the crust is not strong enough to affect seedling emergence.

Crusting or hardsetting soils slake into very small fragments that run together and then set hard on drying. This condition is evident in many red brown and transitional red brown earths. The slaking test allows you to identify such problem soils.

SIGNIFICANCE OF DISPERSION

A soil that disperses on wetting has a very unstable structure. It can form a surface crust or hard clods on drying. Pores below the surface can become blocked by dispersed soil particles. Dispersive soil is likely to swell strongly when wet, further restricting water and air movement. Dispersion of soil slows down the intake of water to the root zone following rainfall or irrigation. This condition will result in poor water storage at each irrigation. Dispersion after remoulding means that, under wet conditions, the soil is likely to disperse after cultivation.

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See Chapter D5 for more information on sodic soil management.

SLAKING SCORE

Method

1. Take soil samples (usually only surface soil is tested for slaking) and allow them to air dry for 1 to 5 days, depending on how dry or wet the soil is.

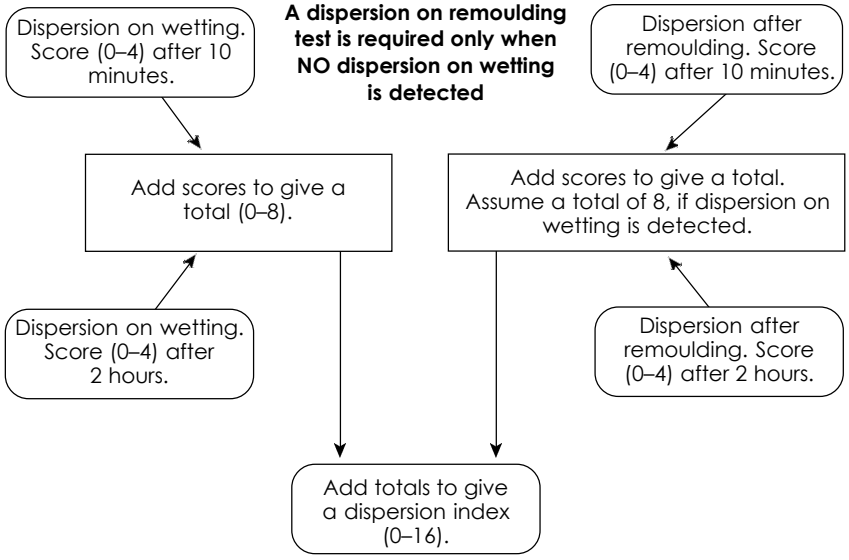
2. Take several (at least three) small (3 to 5 mm diameter) crumbs of dry soil and place them in a dish or saucer of rainwater (or distilled water) deep enough to completely cover the samples.
3. Cover the dish to prevent wind from disturbing the water.
4. Assess the slaking score (0–4) after 5 minutes.
   After five minutes, score slaking as follows:
   Score 0 if the lump remains intact
   Score 1 if the lump collapses around the edges but remains mainly intact
   Score 2 if the lump collapses into angular pieces
   Score 3 if the lump collapses into small (less than 2 mm diameter) rounded pieces, forming a cone
   Score 4 if the lump collapses into single grains (you can see sand grains).

Tip: You may find it easier to use soil aggregates of 10 to 20 mm diameter to assess slaking. However, for dispersion tests you need to use aggregates of 3 to 5 mm diameter; therefore if you use the smaller size you can assess both slaking and dispersion on wetting in the one test.

DISPERSION INDEX

The dispersion index combines four separate dispersion scores (0–4); see Figure D4–2 for a full explanation.

Figure D4–2. The dispersion index combines four separate dispersion scores.



Dispersion on wetting

1. Take soil samples (usually only surface soil is tested for slaking) and allow them to air dry overnight
2. Take several (at least three) small (3 to 5 mm diameter) crumbs of dry soil and place them in a dish or saucer of rainwater (distilled water) deep enough to completely cover the samples.
3. Cover the dish to stop wind disturbing the water.
4. Assess the dispersion score (0–4) after **10 minutes** and **2 hours**. See Figure D4–3.

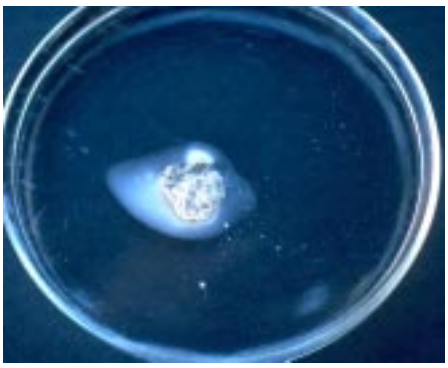
Samples used for the slaking test can be left in the distilled water and used to assess the dispersion scores.

Figure D4–3. Dispersion scores

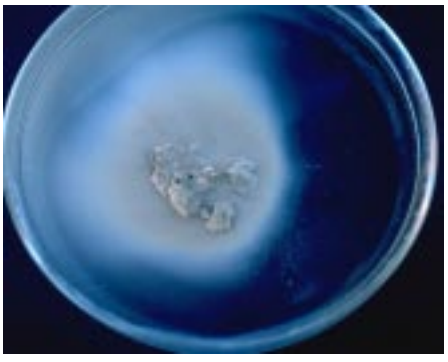
Scoring dispersion

Dispersion score 0: Nil dispersion

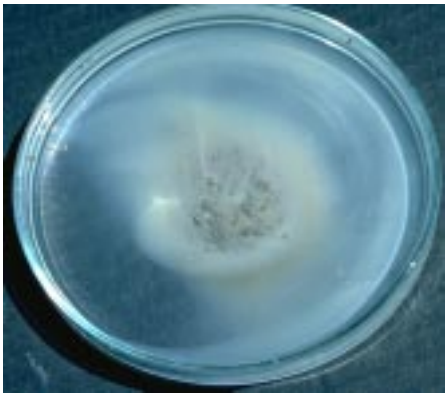
Dispersion score 1: Slight dispersion recognised by slight milkiness of water adjacent to aggregate



Dispersion score 2: Moderate dispersion with obvious milkiness



Dispersion score 3: Strong dispersion with considerable milkiness and about half of the original volume of the aggregate dispersed outwards



Dispersion score 4: Complete dispersion leaving only sand grains in a cloud of clay

Dispersion after remoulding

If the soil does not disperse on wetting, repeat the test using soil that you have remoulded. The idea is to duplicate the state of the soil after cultivation.

1. Mix some soil with rainwater (distilled water) and remould it with a knife for one minute. Alternatively, you may use the sample after kneading it by hand to determine the texture.
2. Place small lumps (3 to 5 mm diameter) of the remoulded soil into a dish of rainwater deep enough to cover the samples. Remoulded samples should not be allowed to dry before they are immersed in the water.
3. Score dispersion after remoulding in the same way as dispersion on wetting.

Scoring dispersion

Score 0 Nil dispersion

Score 1 Slight dispersion, recognised by slight milkiness of water adjacent to the aggregate

Dispersion score 2 Moderate dispersion with obvious milkiness

Dispersion score 3 Strong dispersion with considerable milkiness and about half of the original volume of the aggregate dispersed outwards

Dispersion score 4 Complete dispersion, leaving only sand grains in a cloud of clay

See Figure D4–3.

DECISIONS TO MAKE IN RELATION TO THE SLAKING SCORE

Slaking score 0–1

This soil is stable to wetting. This is typical of pasture soils. No action is needed.

Slaking score 2

This is typical of self-mulching clays. They form a loose, granular surface layer, with perhaps a thin, fragile crust. If the soil does not disperse no action is necessary.

Slaking score 3

A score of 3 suggests that the surface may form a crust. This is typical of most soils covered in this manual, especially when cultivated. However, this is only a problem in non-swelling topsoils (sands, loams and some clay loams). Reduced cultivation, stubble retention and gypsum applications are all used to overcome this problem.

Slaking score 4

This soil is very likely to crust and hardset (sands and loams). Reduced cultivation, stubble retention and more frequent irrigations may be necessary on these soils.

DECISIONS TO MAKE IN RELATION TO DISPERSION INDEX

Dispersion index

0
1 A very stable soil. Will resist dispersion after tillage.
2 Soil is still prone to compaction.
3
4 Soil will disperse if cultivated wet, and deserves caution.
5
6 Soil disperses strongly if cultivated wet.
7 May benefit from direct drilling and stubble retention.
8
9 Possible need for gypsum. Investigate further with laboratory
10 tests. See Chapter D3.
11
12
13
14 Clay disperses strongly, providing a poor environment for plant
15 growth. Gypsum application is necessary.
16