NSW DEPARTMENT OF
PRIMARY INDUSTRIES

SOILpak – vegetable growers - Readers' Note

This document is part of a larger publication. The remaining parts and full version of the publication can be found at:

http://www.dpi.nsw.gov.au/agriculture/resources/soils/guides/soilpak/vegetable

Updated versions of this document can also be found at the above web address.

PART E. KEY CHECKS

Chapter E1. Key checks for productive irrigated soils

PURPOSE OF THIS CHAPTER

To provide a simple table of the 'ideal' soil, against which you can compare and categorise your soil

CHAPTER CONTENTS

- table of 'ideal' soil characteristics
- soil categorisation flow diagram

ASSOCIATED CHAPTERS

- A3 'Features of soil'
- Part B
- E2 'Management strategies for key checks'

COMPARING YOU SOIL WITH THE IDEAL

Table E1–1 gives a general outline of desirable soil conditions. These will vary for many situations, but you can use the key checks you make against this table as a standard against which you can judge the condition of your soil.

Table E1–1. Key checks for productive irrigated soils

Key check	Ideal
Soil surface	Free from severe crusting and surface compaction.
Soil profile	Well structured (structure score of 1or better); free from compaction layers (including plough pans).
Slaking score	Loamy topsoils should score < 3. Slaking is not such a problem for swelling clay topsoils of the Murray and Murrumbidgee Valleys.
Dispersion index	Use minimum cultivation for dispersion index > 4. Periodic gypsum use for dispersion index > 8.
Soil pH	Surface pH $CaCl_2$ between 5.0 and 8.0.
Organic matter	Organic matter levels > 2%
Soil salinity	Soil salinity < 2 dS/m where possible Soils of salinity > 2dS/m may require specific management.
Soil phosphorus	Maintain soil $P_{(Colwell)}$ at > 50 ppm for most vegetable crops

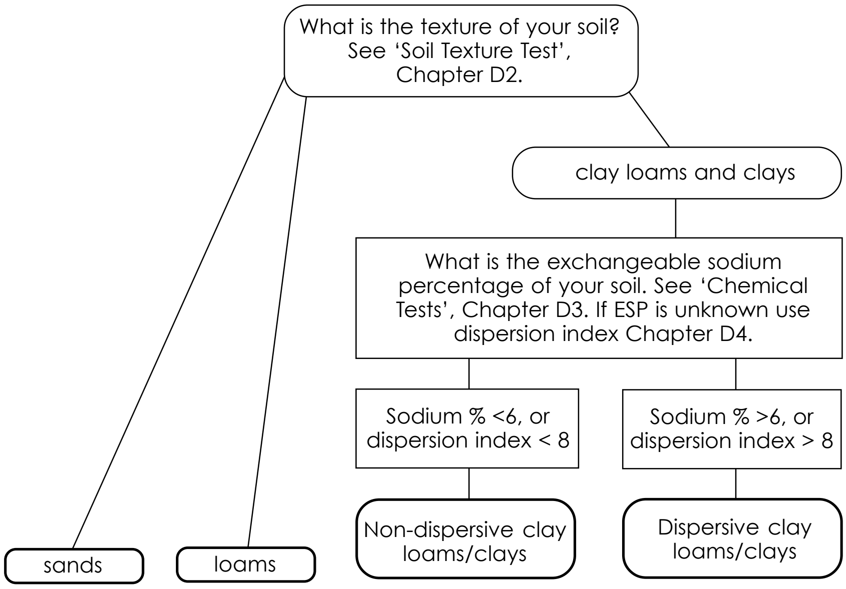
Note: The Colwell method of phosphorus extraction is the method most commonly used in inland districts.

To use the management table in the next chapter, Chapter E2, you should classify your soil (at least the cultivation layer or the top 15 cm) into one of the following three categories:

1. sand/loam
2. dispersive clay and clay loam
3. non-dispersive clay and clay loam.

   Use Figure E1 to do this, then move on to the next chapter.

Figure E1–1. Soil texture categories



Chapter E2. Management strategies for key checks

PURPOSE OF THIS CHAPTER

To list some key checks for soil problems and some management principles for dealing with them

CHAPTER CONTENTS

- table of key checks and management problems

ASSOCIATED CHAPTERS

- A3 'Features of soil'
- Part B
- E1 'Key checks for productive irrigated soils'

MANAGEMENT STRATEGIES FOR KEY CHECKS

Table E2–1 lists the management strategies that can be used to deal with unsatisfactory results from key checks.

Table E2–1. Management strategies for various key checks

Key check	Management strategy to improve condition or status
Soil surface problems	**If crusted:** need to increase soil organic matter levels, protect the soil surface with a mulch, and use gypsum when soil is dispersive. **General strategies:** • use stubble on soil surface • use minimum tillage/direct drill • any cultivation should be non-inversion • use gypsum where dispersion index is greater than 8 **If hardset or compacted:** need to break up the hard layer without damaging the soil structure or burying the soil surface. **General strategies:** • minimise cultivation • use non-inversion cultivation to break up the hardset layer. Deep banding fertiliser at sowing may achieve the same result. • try a gypsum test strip where the dispersion index is greater than 8 • permanent beds reduce compaction • keep stock off wet paddocks if possible
Poor soil structure	**General strategies:** **Loam soils:** need to increase soil organic matter • reduce cultivation, and cultivate only at correct moisture content. • break up any plough pans or compaction layers with non-inversion cultivation • use less aggressive cultivation methods • rotate to a pasture phase • stubble retention may be of benefit **Dispersive clays and clay loams:** gypsum use is likely to be beneficial • gypsum or gypsum used with non- inversion cultivation will benefit these soils • minimising tillage will help stabilise the surface of these soils **Non-dispersive clays and clay loams:** compaction is the main structural problem • cultivate to break up any compacted layers or plough pans, or use a crop to dry and crack soil • permanent beds are likely to reduce compaction problems (especially if harvesting equipment runs in furrows)
Slaking score greater than 2	**Loam/clay loam soils:** slaking loam soils are likely to form crusts or set hard when dry • management as for crusted surface soils **Clay soils:** slaking does not present a major problem for clays, as they crack upon drying
Dispersion index	Gypsum application is likely to be the major form of management on dispersive soils **Dispersion index greater than 4:** • minimise cultivation **Dispersion index greater than 8:** • minimise cultivation • consider gypsum use • gypsum and deep cultivation may improve plant growth where subsoils are dispersive **Dispersion index greater than 12:** • check the exchangeable sodium percentage (see chapter D3) of the soil; if it is greater than 10, use gypsum • use minimum tillage
Soil pH	• apply lime to soils with pH ($CaCl_2$) < 5
Organic matter	**If the organic matter is below 2%:** • switch to direct drilling (using narrow points), or at least minimise tillage • retain stubble on the soil surface • rotate to a pasture phase
Soil phosphorus	If soil phosphorus is below ideal level, consult your local horticulturist or fertiliser representative for advice on the required application rates.

Chapter E3. Case study 3

PURPOSE OF THIS CHAPTER

To present a case study of management of irrigated tomatoes

CHAPTER CONTENTS

- case study

ASSOCIATED CHAPTERS

- B11 ‘Case study 1’
- C6 ‘Case study 2’

CASE STUDY 3

Roy Stillard produces processing tomatoes on two sites at Barooga in the Southern Riverina District of New South Wales. One site is a well structured clay loam; this case study looks at Roy’s second site, 45 ha of lighter soil ranging from a raw Sandmount sand through to patches of Cobram sand loam (Figure E3–1).

The perimeter of the site is protected by melaleuca windbreaks, which have also been used to divide the area into four internal sections.

Irrigation is provided by two subsurface streams. The total dissolved ion (NaCl) readings of these streams are 400 mg/L and 1400 mg/L, so salinity is a problem. To overcome this the water is ‘shandied’ from both streams via the irrigation system and leaches readily in the sandy soil.

Roy uses a fully reticulated trickle system with Netafim Dripmaster® self-compensating outlets. The trickle lines are rewound after harvest, and so far have lasted 15 years.

Soil tests are done annually, and leaf analyses are done regularly through the growing season. The pH is restored in any of the rotational crops if it falls below 6.

The base fertiliser is 1.5 t/ha of single super plus DAP at 125 kg/ha. Urea is applied as fertigation through the drip line at least twice a week, to a total of approximately 200 kg/ha. Potassium, zinc, boron and molybenum are applied as foliar sprays at rates determined by the results of leaf analyses.

Soil preparation starts with incorporation of the nitrogen-fixing lupin cover crop.

Tomato beds are initially formed in May. To overcome the serious problem of sand blasting, and to build up soil organic matter levels, barley is sown over the whole paddock. A 45-cm strip is then mulched in the middle of the reformed beds two weeks before sowing.

Devrinol® is used as a pre-sowing herbicide.

Before seed emergence the whole paddock is sprayed with glyphosate. As the tomatoes approach first flowering (when they are about 15 cm high) the barley is mulched. Two weeks later, when the tomatoes are 25 cm high, the beds are reformed. The trash from the mulched barley stabilises the soil and overcomes the sandblasting problem that can come with the strong September winds.

Roy Stillard’s rotation sequence is:

tomatoes
wheat
lupins
wheat
lupins
tomatoes

The annual average yield for tomatoes in the sandy soil is close to 100 t/ha. This compares favourable with the industry average of 66 t/ha.

Although sandy soils need precise water and nutrient management, they offer a big advantage in wet seasons, because there is less disease, as well as easier harvesting, easier maintenance of the schedule and no ‘wet feet’ problems.

Figure E3–1.

Roy Stillard standing in front of his recycled trickle irrigation lines. Roy has had 15 seasons out of these lines. (Bernie McMullen)

Figure E3–2.

Finley District Horticulturist Stephen Wade inspecting the sprayed-off oats and trickle line on Roy Stillard's tomato paddock. (Bernie McMullen)

Figure E3–3.

A well grown onion crop on red brown soil in the Griffith district. (Bernie McMullen)

Figure E3–4.

Mark Hickey, District Horticulturist, Yanco, inspecting part of the onion crop seen in the previous Figure. The poor establishment in this section has been caused by soil structural degradation through compaction. This section was formerly a roadway. Bernie McMullen