farmtalk

This article contains information most relevant to the less than 350 mm rainfall mallee farming region

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Fact Sheet #8
Feb 2004

Farmtalk is a product of the Mallee Sustainable Farming Inc. Tri-State Research and Extension team

Identifying subsoil constraints on Mallee farms

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What's the issue?

Physical and chemical subsoil constraints are known to reduce crop growth and yield in Mallee soils. Such constraints limit root growth, water use, nutrient uptake and ultimately grain yield.

Yield losses of around 20-25% (typically 0.5 t/ha = $50/ha) have been reported. Not only yield and profit are reduced but losses of water and nutrients also occur, and significant losses of water can contribute to increased salinity in the Murray basin.

What do we know about subsoil constraints?

Significant chemical subsoil constraints to cereal cropping were first identified in the Mallee region. The problem of chemical subsoil constraints in this region is a serious problem requiring attention from both plant breeding and agronomic management.

The major constraint appears to be predominantly high salt, often **NOT** associated with a shallow watertable.

Physical or Chemical?

- **Chemical** constraints appear to be geographically more widespread than physical constraints, such as compaction.

- **Physical** constraints are significant in some places (e.g. some mallee sandhills), however it is not clear if this issue is widespread.

Identifying subsoil constraints on your farm

Indicators of potential subsoil constraints include:

Crop indicators

- Yields lower than expected for the rainfall received (rainfall use efficiency < 12 kg/ha/mm)

- High grain boron concentration (> 3 mg B/kg)

- Shallow rooting depth (< 1m)

Soil indicators

- High soil boron **(B > 15 mg B/kg)**

- High soil chloride **(Cl > 1000 mg/kg)**

- High soil EC **(EC1:5 > 0.6 dS/m, ECe > 8 dS/m)**

- High soil pH1:5 **(pHwater > 9.0, pHCaCl2 > 8.5)**

- Poor soil water extraction by the crop by harvest **(soil water content > -1500 kPa** wilting point water content).

Paddock sampling procedures

One of the limitations of using plant and soil samples to identify subsoil constraints is that we usually do not take enough samples that are representative of the paddock in question.

Also it is uneconomic to grid sample the whole farm at a density that would be useful. To overcome this limitation research by CSIRO and the Victorian DPI (supported by GRDC) are looking at ways that are practical for farmers to identify the key constraints.

EM technology

It has been found that strong correlations often exist between various subsoil constraints, and this has lead to single factors (e.g. Exchangable Sodium Potential or salt) being used to measure spatial variation across paddocks.

This correlation is the basis for the use of electromagnetic (EM) induction technology in agricultural resource management. Such technology provides measurements of bulk soil electrical conductivity. Electrical conductivity is well correlated with soil water and salt content.

Mobile EM, coupled with accurate global positioning system equipment, offers more realistic economic opportunities to map out areas of farms that are affected by subsoil constraints that are related to high salt.

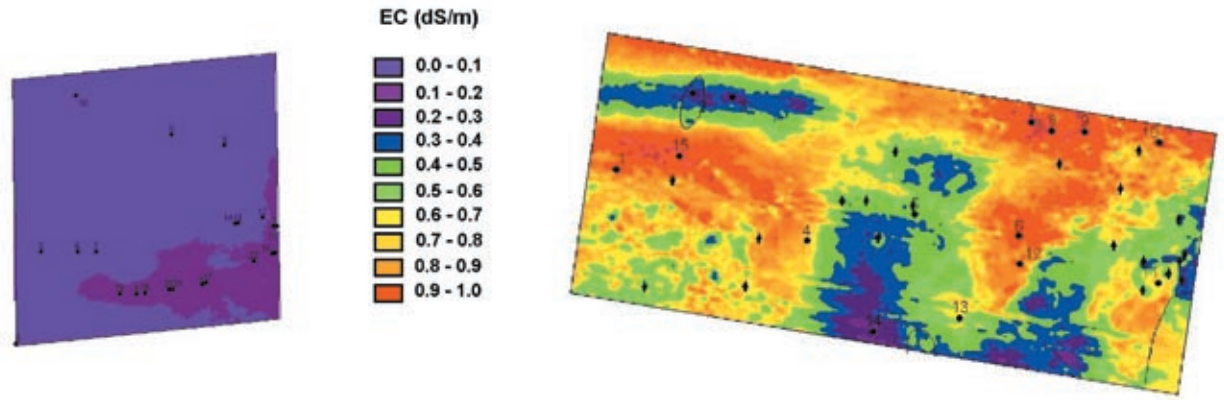

Figure 1.

This is particularly encouraging for regions like the mallee where high salt and poor crop water use is widespread. Those soils of the Mallee that have high pH typically exhibit high boron and salt, and crops often do not extract all the apparent available water by harvest. Figure 1 (above) shows two paddocks one with little and the other with high levels of salt.

The 50 ha paddock on the left shows very low soil EC1: 5 whilst the paddock on the right (100ha) shows large areas above 0.6 dS/m (yellow) with significant areas above 1 dS/m (red).

So what does this information mean?

• An improved understanding of the impacts and scale of subsoil problems provides the options for better management of individual paddocks and the whole farm.

• EM mapping with some targeted soil analysis will help determine the extent of the problem on your farm.

• Benefits from improved management of subsoil issues include better targeting of **REAL** paddock potential, better matching of inputs to potential, improved profitability and better risk management.

• Paddocks identified as having low levels of subsoil constraints may benefit significantly, in terms of productivity and profitability, from an increase in nutrient inputs.

• Where paddocks are identified as having serious subsoil constraints, nutrient inputs may need to be limited.

• Because of the nature of subsoil constraints to be variable across a paddock, the use of variable rate fertiliser technology should be considered in the future.

Actions to consider

The following actions will help you to improve your understanding and management.

• Learn more about the spatial nature of your paddocks. Consider EM mapping your farm and undertaking targeted soil sampling. This only needs to be done once to provide a sound understanding of the underlying subsoil constraints.

• Yield maps of paddocks collected over a number of seasons will help you understand the spatial variability of these paddocks and can be useful in interpreting the results of EM mapping.

• Develop a better understanding of the current water use efficiencies of your paddocks and the potential to improve these efficiencies.

Where to from here?

• Learn as much as you can about the likely problems - form interest groups - experiment on your own farm.

• Get professional help by consulting local agronomists, EM contractors and soil surveyors.

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