

EM survey helps identify subsoil limitations

For an investment of about \$5/ha, growers can have a contractor produce an electromagnetic map (EM) that can be used to help target inputs more effectively, offering the potential to improve the relationship between yield and fertiliser investment per hectare. The value of EM in Mallee soils is being assessed in research run by Mallee Sustainable Farming (MSF).

An electromagnetic survey (EM) measures the apparent electrical conductivity of the soil. Responding to a combination of soil texture, water and salinity to a depth of approximately one metre, the data gathered by an EM survey can provide a spatial representation of soil moisture and major subsoil constraints such as salinity. Both of these are key soil factors driving crop production potential in the Mallee.

Rick Llewellyn and colleagues at CSIRO Sustainable Ecosystems, Rural Solutions SA and Mallee Focus, have been evaluating the use of EM as a method of identifying areas where fertiliser rate can be adjusted up or down to improve the cost benefit ratio for fertiliser inputs.

“One of the big challenges for precision agriculture and site-specific management is finding a cost-effective way to map the ‘fixed’ characteristics of a paddocks’ soils, as these influence variation in yield potential and fertiliser response,” explained Rick Llewellyn.

Subsoil constraints caused by heavier textured soils with high salt levels are one of the key drivers of within-paddock yield variation and returns from fertiliser in the Mallee. These soils often contain water that cannot be extracted by the crop; in combination these three factors (texture, water and salt) make a highly conductive combination that EM is able to map.

Results from over 30 paddocks in the SA, Victorian and NSW Mallee show that typically an EM map is able to explain 80 per cent of the variation in post-harvest soil water across a paddock with an average accuracy to within 20mm. This is the water the crop was not able to access.

The nature of Mallee soils means EM works particularly well across the region, although, soil testing to validate an EM map remains important. In about 15 per cent of paddocks studied, the EM maps have not been well-correlated with salinity or soil water, in some cases this is because there is not a large amount of variability across the paddock. In others the presence of stone has led to a low EM reading that can sometimes be misinterpreted as soil with a low level of subsoil constraints.

Having the EM survey and soil validation done near the time when the crop extracted as much water as possible from the soil profile can be the simplest way for growers to obtain a good map of the Crop Lower Limit of the paddock. Knowledge of Crop Lower Limit is a key factor when estimating plant available water, yield potential and making use of tools such as Yield Prophet.

Rural Solutions SA has developed a tool that also allows Crop Lower Limit to be calculated and mapped using a pre-existing EM map.

Unfortunately the areas of salty subsoils that Mallee farmers have to deal with are not going away in a hurry, therefore, EM maps taken a few years apart are usually very similar. The project has shown that a single EM survey can provide information that is useful and relevant for many years.

“This research forms part of MSF’s work to better understand the potential of Mallee soils in different seasonal conditions, helping growers to direct their inputs to achieve the most profitable response”.