Soil Apparent Electrical Conductivity (ECₐ)

One data layer that is commonly used for precision agriculture is a high-resolution map of soil electrical conductivity, sometimes called an ‘ECₐ’ or ‘EM’ map.

Soil ECₐ

Soil ECₐ is a measurement of a soil’s ability to conduct electricity. This is useful because it can give an indication of soil physical and chemical properties such as:

- clay content/soil texture
- moisture content
- salinity
- cation exchange capacity (CEC)
- bulk density
- organic matter content.

Because ECₐ is affected by a variety of properties it should always be used in combination with soil samples. An ECₐ map can serve as a guide for selecting soil sample locations to give you a more representative set of samples than traditional grid sampling.

Methods of collecting ECₐ data

Currently two different instruments can be used to obtain ECₐ soil data in Australian sugarcane. The Veris 3100 is a commercial instrument that connects to the back of a truck or tractor and runs over the soil surface. The tines must be in contact with the soil to measure the electrical conductivity of the soil.

Conversely, the EM38 is an electromagnetic induction sensor that measures how much the soil resists the flow of electricity. This instrument does not have to make contact with the soil surface to take an accurate reading. Both instruments produce similar results for precision agriculture purposes. Soil ECₐ is often measured at two different depths: shallow (~30cm) and deep (~100cm).

When the Veris 3100 or EM38 are used in conjunction with a GPS, agronomists can create maps of soil ECₐ that show areas of relatively high and low conductivity in a paddock or on a farm. The data alone cannot tell you what soil properties are, and they should always be used in combination with soil samples. ECₐ can help you to identify ideal locations for soil samples that more accurately represent soil variability than traditional sample patterns like grids.

Above: ECₐ map showing variation across a paddock and strategically placed soil sample locations (blue triangles) to cover the range of ECₐ values. Image courtesy of Rob Bramley, CSIRO, Waite Campus, Adelaide.
ECₐ and precision agriculture

An ECₐ map layer can be combined with other map layers such as elevation and crop yield to give you a better understanding of why different areas are more or less productive. This can help you to create prescriptions for inputs like gypsum, lime and fertiliser applications.

Below: Example of ECₐ information overlaid with elevation and yield data to develop management zones on a Burdekin cane farm.

Obtaining an ECₐ map of your farm

Currently the easiest way to obtain an ECₐ map is to hire a contractor at a cost ranging from $35/ha and up. ECₐ maps have already been created for some areas so check with your local productivity services group to see if this information is available for your farm.