



# Ground truthing

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**G**round truthing is the collection and testing of physical samples to help verify or calibrate data that has been collected remotely or automatically across the whole paddock. Sampling procedures can differ slightly depending on the parameter being tested. Here we discuss ground truthing techniques with specific reference to electromagnetic induction (EMI) surveys, and to yield maps in relation to nutrients and soil borne diseases.

For all ground truthing it is recommended that sampling should be avoided in areas of the paddock or zone that are not representative or of interest. Unrepresentative areas may include headlands, firebreaks, gateway areas, tree root zones, water troughs, stock camps, stone heaps and around power or telephone poles.

Careful attention should be paid to soil test kit instructions, especially in relation to sample collection

and processing, as these can differ depending on the soil property being tested.

## **EMI**

EMI surveys provide information about variability in soil conditions that in some instances can be accompanied by changes in soil salinity, pH and boron concentrations and other properties associated with hostile soils. Variation in soil texture may be inferred from EMI surveys and several groups are now investigating the use of EMI surveys to estimate plant available water.

Jo Peters, Farm Works, has found that it is important to take soil samples as close to the time of EMI surveying as possible. This is because soil moisture is one of the factors that contributes to soil conductivity measured by an EMI survey. Timing of sampling is particularly important for salinity and other properties that vary with changes in soil water content. If

soil moisture at the time of ground truthing is different to when the survey was conducted then it may be difficult to interpret the EMI survey in relation to the results of the soil analysis.

The location of soil sampling points to ground truth an EM38 (see page 6) survey can be determined by eye using contour maps of the EM38 survey area. However, Farm Works uses free software from the US Department of Agriculture called ESAP, to determine the best location for the soil samples, based on the EM38 survey. The software allows the user to determine if they wish to take six, 12 or 20 samples across a given area.

It is also important to consider management history when designing a ground truthing regime for an EMI survey. This is because deep rooting crops, and pasture plants such as lucerne will draw soil water from deep in the soil profile and can show a residual effect for several years.

The results of the soil analysis can be used in conjunction with the EMI survey to divide the paddock into management zones. However, it is possible to take the ground-truthing process one step further. A regression analysis may be performed between any of the soil properties measured at each ground truthing location and the EMI value at the same locations. Providing a statistically valid relationship exists between the EMI data and the soil property, the EMI survey can be used to predict the spatial variation of that soil property across the whole survey area.

For example, if the particle size distribution of each sample is determined, it may be possible to use regression analysis to establish how soil texture varies across the paddock. This, in turn, may be used to estimate the spatial variation of water holding capacity across the paddock.

#### Nutrition

Research by Brett Whelan and colleagues at the University of

Sydney has shown that a maximum distance of 60m between individual sample sites across a paddock would be required to accurately map the variability in the common soil parameters. Such intensive sampling is out of the question for farming operations. So the use of targeted sampling guided by a soil EMI map proves most useful in providing a description of the variability with a minimum of samples.

Further work suggests that soil samples taken within yield zones provide more useful information for making nutrient decisions, than random samples taken in a zig-zag pattern across the whole paddock.

The zig-zag sampling pattern remains one method that could still be used, but within each identified zone.

If the goal is to estimate nutrient levels to guide subsequent fertiliser application, samples should be gathered as close to the time of application as possible.

The more cores taken the more accurate the results, but there is a

balance between cost and accuracy. For nutrient analysis a bulked sample taken from 10 to 15 standard diameter soil cores is considered appropriate.

#### Disease

For soil borne diseases Dr John Heap, SA Research and Development Institute, has calculated that 45, 10mm diameter soil cores (100mm deep) should be collected from within the previous crop stubble row and bulked to produce the 500g sample required for the Predicta B disease tests.

Soil borne diseases can vary greatly between production zones, therefore, sampling the zones separately before seeding will provide a better indication of the disease risk than a composite sample of the whole paddock.

*A table detailing the limitations to crop yield and the appropriate methods of gathering remotely sensed data and ground truthing is found in the GRDC Precision Agriculture Manual - available free from the SPAA website.*

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