A new standard for electromagnetic induction mapping of soils for the grains industry

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Abstract

A new standard has been developed for electromagnetic induction (EM) mapping of soils for the grains industry. This protocol consists of ten sections, intended to provide guidance for the standard measurement, recording and interpretation of soil conductivity data. It will be particularly useful for third parties who might receive the data for subsequent analyses and development of agronomic recommendations. Such a standard is necessary because EM data collection and interpretation is a complex process and EM contractors collect and process data of varying quality using a range of procedures. Data of different qualities and standards (e.g. in spatial resolution) may be required for particular exercises, however clear descriptions of the method used to collect the data and its accuracy are essential, but are frequently lacking. Furthermore, some contractors only provide coloured maps, without access to the actual EM data, which limits subsequent analysis by third-party consultants. From a national workshop held at Mildura, Victoria in November 2004 the EM mapping industry has agreed to some basic standards or best practice guidelines. The advantages for farmers are that consistent methodology and reporting of EM surveys will improve the quality of information available to them for the better management of soil spatial variability for crop production.

Key Words

Soil mapping, yield maps, subsoil constraints

Introduction

Electromagnetic induction technology (EM) and other soil conductive technologies (e.g. resistivity), collectively termed EM here, have been used for decades to map ground conductivities in mineral exploration. Until the advent of global positioning systems (GPS) in the early 1990's, its application in agriculture was mainly limited to salinity management in irrigated systems. There is now great interest from dryland farming enterprises, particularly the grains industry, where the management of crops at a greater spatial resolution is now achievable.

As a result of the complexities involved in collecting and calibrating EM data, US scientists, Corwin and Lesch (2003), have recently developed a protocol for characterising soil spatial variability using soil electrical conductivity methodology. Their report details the theory and practice of EM mapping. However, their protocol was developed by scientists for use by other scientists. As a result of this, it is unlikely to be of direct use in Australia's broadacre EM industry.

In addition to the grains industry, other Australian agricultural industries are also interested in the use of EM technologies to assist growers in making better management decisions. The Australian viticulture industry has already developed a protocol for the mapping of spatial yield data (Bramley and Williams 2004). This has the potential to be adapted to include spatial soil data derived from conductivity maps. EM surveying has been adopted by the Australian rice industry of southern New South Wales in a protocol for identifying land suitable for ponding during rice growing (McLeod and Shaw 2001).

Results and Discussion

A national workshop to establish a protocol for electromagnetic mapping applications in the grains industry was held in Mildura on 3-4 November 2004.

The workshop developed a framework and four working groups completed the detail. This protocol consists of ten sections, intended to provide guidance for the standard measurement, recording and interpretation of soil conductivity data; particularly for third parties that might receive the data for subsequent analyses and development of recommendations. The ten sections are:

1. EM survey objectives

2. EM survey design

3. Instrument set-up

4. Best management practise

5. Fundamental data set

6. Data management and processing

7. Presentation & reporting

8. Soil testing

9. Recommended statement of ethics

10. Opportunities for future working groups

The first section, EM survey objectives, is the most important because this defines the limits of the survey in terms of complexity, calibration and reporting. The design, set-up and best management practice deal with technical issues like the type of EM instrument, transect spacing, GPS settings etc… A fundamental data set is defined with example proforma provided. An important component of the protocol is a standard way of presenting results. Monochrome coloured map is recommended for all EM and soil derived parameters. A section on soil sampling was considered essential because it was felt that some soil sampling would be required for the majority of EM surveys. Whilst not unique to EM surveys, for completeness a statement of ethics is suggested. Copies of the protocol are available from the authors, GRDC or the Southern Precision Agriculture Association (http://www.spaa.com.au/downloads/emprotocol.pdf).

Opportunities for the future

Over the coming years workshops will be developed to progress EM training and accreditation for EM contractors. It is hoped that members of the EM surveying community will participate fully and improve the practice of EM mapping in the grains and other interested industries. The challenge is to make the protocol work and improve on it after a period of practical application and testing in the industry.

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References

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