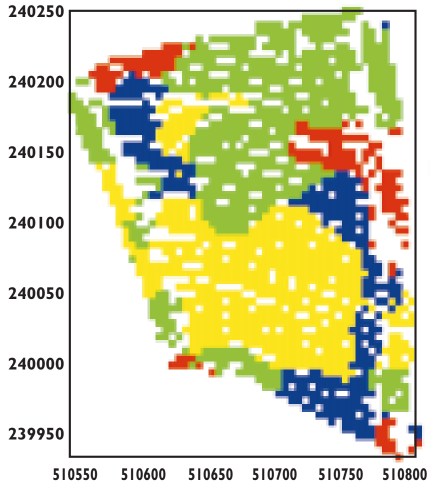
Topic Sheet No. 70

Summer 2003

Assessing within-field soil variability



Action:

- Collect good quality yield maps for use now and in future.
- Keep electronic yield data safe for future use. Make back-ups.
- Consider an EMI survey, normally at around 20 m bout widths, if significant soil variation is suspected.
- Carry out targeted soil examinations and/or sampling and analysis to confirm the soil characteristics and zone boundaries.
- Investigate the causes of low-yielding areas, eg lodging, pest damage, and remedy if possible.
- Consider adopting different management inputs, eg lime, fertiliser, to different zones. Monitor effects through yield mapping.

Assessing soil variability

Many soil physical and chemical properties vary within fields. Where this variation is large, and can be managed at practical scales, variable management within a field, eg for lime, fertiliser or cultivations, may be worthwhile.

Collecting soil information by sampling and analysis is not cheap. Therefore, low-cost methods are needed to assess whether significant soil variation exists and to help map soil boundaries within a field before investing in more detailed investigations.

An HGCA-funded project compared data from yield maps with assessments carried out by an experienced agronomist. A second one evaluated non-intrusive sensors.

Yield maps

Most modern combines have yield mapping technology. HGCA-funded work has shown that maps contain valuable information, although many farmers do not use the facility.

Researchers collected yield map sequences from over 100 fields reflecting a wide range of soil types. Maps were analysed statistically to define zones within which yield patterns were similar and where soil properties, eg droughtiness, pH and nutrient levels or compaction, might also be relatively consistent. The yield pattern was then compared to the soil physical properties at each location, eg sand and clay content. A map of four such zones is shown at the top of this page.

Some fields were sampled intensively to determine soil series, particle size distribution, organic carbon and bulk density. Others were sampled less intensively to assess the scale and magnitude of variation in key soil properties.

Next the potential for variable management was assessed both by an experienced agronomist (using the field-collected soil information) and by computer-generated predictions (using yield map statistics or a generalised variability rating within the soil landscape extracted from the national soil map). It was shown that yield data analysis could reliably predict the expert assessment of the potential of the field for variable management.

Next steps

If the analysis predicts potential benefits, a rational second step is targeted soil examination using an auger and/or spade to confirm the predicted soil

If you are unsure about any of the suggested actions, or want them interpreted for your local conditions, consult a professional agronomist.

Assessing within-field soil variability

variation and soil zone boundaries. These zones may warrant separate soil sampling and analysis.

Although not presently commercially available, this low-cost predictive method could help farmers decide whether to pay for detailed soil sampling for any, or all, fields. Collecting good quality yield data now and keeping it for future use should prove valuable.

Currently, examination of yield maps can help identify low yielding areas, and target on-site inspections to diagnose and then remedy the problem. Thus, a quick benefit can be gained from maximising yields across the whole field area.

The 'normalization' software available on many combines can also be used with sequences of maps (minimum three years). Be aware, however, that this approach can obscure important sources of spatial variation.

Sensor techniques

Soil sensors can provide useful information to help identify and characterise soil type patterns within fields. A second project evaluated the practical potential of several different sensor types, mainly electromagnetic induction (EMI) for remotely measuring and mapping soil physical properties.

EMI measures the electrical conductivity of the topsoil and subsoil, which is commonly related to soil texture and moisture content. The research showed that EMI maps can help identify soil patterns and possible management zones.

Useful maps can be produced using EMI equipment drawn at 20 m bout widths. Surveys over winter are preferable as soil moisture differences are most pronounced and most fields have little or no crop cover. The EMI sensor is commonly drawn in a metal-free cart behind an ATV.

Conventional aerial photographs can also show crop patterns, which may be related to soil patterns, especially if taken during the summer when moisture stress is present. Airborne spectral reflectance sensors used on bare soils may show up large differences in soil surface colour and indicate variations in soil organic matter.

Ground penetrating radar (GPR) was also assessed but is not yet suitable for farmer use.

HGCA

Summary

The potential for variable management within fields has partly been limited to date by difficulties in defining soil-related management zones. Two recent HGCA-funded projects involving SRI, ADAS and the National Soil Resources Institute, Cranfield University have addressed this need.

One project considered whether zones could be predicted from yield maps; a second identified a role for non-intrusive soil sensor techniques, especially EMI.

Further information:

Dr Murray Lark, SRI (yield mapping)
Tel: 01525 860000

Project Report 296

Dr Peter Dampney, ADAS Boxworth
(sensor techniques)
Tel: 01954 267666

Project Report 302

'Precision farming' of cereals – practical guidelines and crop nutrition, 2002 (HGCA) free

HGCA

Topic sheets are free

To join our mailing list contact HGCA

Home-Grown Cereals Authority

Research & Development
Caledonia House
223 Pentonville Road
London N1 9HY

Tel: 020 7520 3945
Fax: 020 7520 3992
e-mail: research@hgca.com
http//www.hgca.com