SA Graingrowing

Getting into Precision Agriculture

by Dr Rohan Rainbow

An SA Grain Industry Trust-supported project

Soils vary across farms and within paddocks but the practice has been to manage these as though variations did not exist – applying a consistent rate of fertiliser across a paddock being an example.

That method of management is being questioned as farmers strive to cut costs and improve production efficiencies. They are keen to find out where the high and low yielding areas are, and the causes of the variations.

Sometimes it is possible and practical to treat low yielding areas and make them more productive. If it is not then why waste inputs such as seed, fertiliser or chemicals, for little or no gain?

Hence the interest in Precision Agriculture (PA) which is developing because as farm size grows, farm managers need tools that enable them to capture more information at low expense and so effectively manage large areas with a high degree of local area knowledge.

Why change?

Targeting inputs – A major aim of PA is to increase farm production and profits relative to the inputs used, and their related costs. The consequence of this is the application of fewer inputs to lower yielding areas, and more inputs to higher yielding areas.

Environmental benefits – One of the significant benefits of more targeted application of crop production inputs is that there will be less chance of wastage, overlap or underlap in spraying applications and, potentially, less off-site leakage of chemicals/nutrients.

Disease management – PA can be an effective tool in the management of crop disease as through mapping, areas of lower growth and grain production can be identified and mapped and soil-borne diseases identified through soil sampling. Aerial or satellite imagery can also be 'real-time' aids in the detection of disease.

Equipment needed

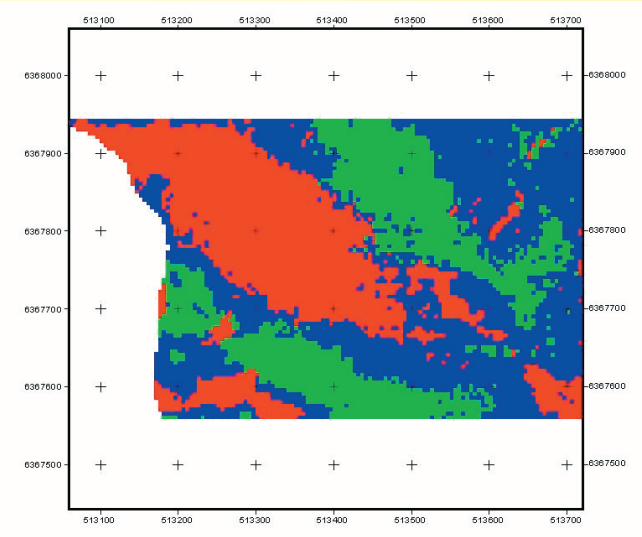
Those engaging fully in PA have yield monitors in their harvesters connected to a GPS system; this data being transferred to a home/office computer where maps showing paddock variations are produced. Images on the map are compared with those produced from an Electro Magnetic (EM) survey of the paddock which shows variations in soil characteristics.

Yield maps are produced over a number of years to document any yearly variations. Soil tests are carried out to find out the cause of variations – it may be soil-borne diseases which are causing the problem and these can generally be remedied, or it may be toxic subsoil substances, or other subsoil constraints, which are more difficult, or sometimes impractical, to overcome.

Machinery using variable rate technology, a seeder or fertiliser spreader for example, can then be used to apply differential rates of inputs to the paddock. This is achieved via a computerised map of various paddock zones being programmed into a control module with GPS positioning, then this is linked to the equipment's variable rate controller. This step is often hampered by compatibility issues, so careful planning before purchase is required.

Yield monitors – these are supplied by most major harvester manufacturers as either a standard fitment or an Original Equipment Manufacturers' (OEM) option, and also as an after-sale fitment. Output formats of many of these systems are different and data often needs post-harvest processing to correct anomalies.

GPS - farmers can utilise the basic GPS satellite signal from any handheld unit and can gain improved accuracy by using either a free marine navigation signal which is limited to a range of 450-500 km, a commercial satellite correction signal for an annual fee, or in addition to a satellite system, using a user-owned ground-station beacon. Generally the more accurate the correction the more expensive the purchase and annual costs will be.



Crop zones in a paddock at Minnipa Agriculture Centre. Blue areas yield highest, red lowest. Photo: John Heap, SARDI

In many situations however, farmers can begin yield mapping with a simple navigation beacon correction signal combined with the basic satellite GPS signal with no ongoing annual fees.

Home computer – Most late model home computers can be used for PA although considerable RAM memory is required. Careful selection of software that enables yield data to be accessed from the yield monitor, assessed, and then processed is needed.

Maps – The Southern Precision Agriculture Association (SPAA) suggests that a standard colour legend be used in paddocks with red colour showing the lowest yielding areas, through to blue being the best.

A basic map can be compiled with many software packages, however it is suggested that the raw data is processed and cleaned up with professional assistance before going further with the use of this data.

Variable Rate (VR) equipment – While VR technology, largely involving seeders and sprayers, is still developing many farmers have been able to use the technology in a cost-effective way to reduce inputs on areas that are clearly unprofitable. Sprayer guidance systems have also been able to produce significant cost savings through reduced overlap/ underlap.

Crop imagery – images of crops can be taken from satellites or aircraft and show differences in crop growth. Currently SPAA is trialing this technology which will become a useful aid in PA.

Associated issues

Complexities – PA is not ideally suited to those farmers and their employees who do not like using computer-based technologies.

Farmers interested in PA are advised to undertake training before they commit a significant amount of financial resources to it. Training can also identify the level of PA technology the business requires and what the 'real' hardware requirements will be. Specialist PA technical support and data interpretation support is essential.

Machinery and equipment - Most of the major harvester manufacturers provide an OEM yield monitor as standard on current models. Generally all that is required is a GPS location signal to enable yield mapping to begin. This may cost as little as $1,000, but some additional computer hardware may need to be purchased from the manufacturer to enable data to be captured onto a data card which is then fed into a computer to produce the yield maps.

Many current model airseeders are 'VR ready' in that they can take a signal from an OEM or after-market manufacturer to control the seed and fertiliser metering mechanisms. Buyers need to be aware that issues with data, software and hardware compatibilities can arise when mixing brands of equipment.

Incompatibility issues – There are many data and communication standards currently used in the marketplace and this has caused equipment compatibility problems. However, recent improvements in mapping programs and VR software are occurring and will enable a wider range of data formats to be imported and exported. The ability of many hardware systems to 'speak' to each other is often limited between brands of hardware. PA systems that utilise software-based solutions will be more 'future proof' as software upgrades become available with wider compatibility.

Preparation

All the farm at once? – For yield mapping and spray guidance systems, it is feasible to use the technology across the entire farm to maximise the financial benefits once the equipment is set up. However, when it comes to using VR and crop imagery technology, farmers can focus on a particular area to increase their understanding of the VR application. Some limited VR trials may be required to achieve this.

EM 38 survey – this is a useful way of identifying paddock management zones in combination with yield maps and other available data. EM 38 surveys are carried out by agri-business on contract using specialised equipment. With targeted soil sampling, EM 38 survey results are useful in correlating soil physical and chemical properties highly related to crop productivity.

Soil tests – Selected soil testing of defined areas determined from yield maps, EM 38 surveys, and airborne or satellite imagery, is a cost-effective way of determining factors, including soil diseases, which may be limiting grain yield and grain quality.

Interpreting results – Professional PA assistance, particularly when correlating information from yield maps along with that from EM 38 surveys, aerial and satellite imagery and associated soils tests, is often needed.

Further advice

SPAA – the Southern Precision Agriculture Association (SPAA), supported by the SA Grain Industry Trust, comprising farmers, researchers and commercial industry personnel, is focused on improving the use of PA technologies. President is Malcolm Sargent of Crystal Brook and executive officer is Rohan Rainbow, Clare, (08) 8842 1875. Allan Mayfield, Clare, is the research coordinator.

Further reading – SPAA e-Newsletters; Australian Centre for Precision Agriculture (ACPA) website. Copies of an SPAA e-newsletter and membership forms can be downloaded from the ACPA website at www.usyd.edu.au/su/agric/acpa then click on SPAA in the links menu. Also see www.clw.csiro.au/staff/BramleyR/publications.html

SPAA
Southern Precision Agriculture Association