Precision Agriculture – where does it pay?

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Precision agriculture has two components

1. Guidance systems
   For example, light bars, screens and autosteer.

2. Mapping and managing variability within paddocks.
   For example, grain yield maps, crop biomass maps and applying fertiliser variably according to potential crop demand.

1. Guidance systems

There has been a rapid uptake of guidance systems in broad acre cropping in Australia over the past 5 years. This is in spite of poor returns (from dry years (2002, 2004, 2006 & 2007) and low grain prices (2005)). Current estimates are that at least 40% of farmers have at least some type of guidance system.

Key reasons for this rapid adoption are

1) Less fatigue
2) Ability to sow or spray in a wider range of conditions eg at night or when dusty. That is, not get lost! Spreading or rolling before sowing or crop emergence is more accurate using guidance systems.
3) Savings of inputs and time from less overlap when sowing, spraying or harvesting.
4) Ability to sow, spray or cultivate in the crop or stubble inter-row.
5) The cost of equipment has reduced a lot. There is also now a wide range of types with a range of accuracies, from simple light bars and screens (costing around $5,000) to 2cm auto steer systems (costing around $35,000). There are also different signal options from a free satellite or marine beacon to a subscription satellite differential signal.

2. Mapping and managing variability

Mapping (eg yield maps or biomass maps) can also increase returns for farmers but, compared with guidance systems, these generally

- are paddock and crop type specific
- need “ground truthing” to check reasons for the variability
- need greater expertise with computing systems, especially to combine data layers

Comparing and combining yield maps from several years from a paddock will show clearly whether or not there are zones with consistently better or poorer yield. Extra information, such as an electromagnetic map (EM) of the soil, a crop biomass map or an elevation map can also be used to help define zones. These zones are the basis for soil and crop testing to understand key reasons for the variability.

What next?

We have found we can reduce fertiliser rates where the crop has yielded less most years. This may be because of shallower soil row heavier clay content and drier years.

In contrast other zones with better soil types can benefit from using more fertiliser.

Changing the fertiliser rate (either through a seed drill or spreader) can be done by drawing a "prescription map" on the computer and using this to change the rate automatically on the go.

This system can also be used to change the seed rate. For example, using a higher seed rate in less fertile soils or where there are thicker patches of weeds.

Yield maps are also a god way of assessing large-scale trials. For example, comparing two crop varieties, different fertiliser rates, or testing a change in a practice (s9cy as ripping or rolling0 on part of the paddock. For a reliable yield comparison test strips need to be at least two harvester widths wide and 100m long.

On-the-go protein testing

Protein testers (such as the Zeltex) are now available to fit to harvesters but there are very few used yet. These will enable farmers t pick out different grain protein areas of the crop for either different markets or to mix grain to be above a base level. Combining a protein map with a grain yield map will produce a nitrogen removal map. This could be used as a guide for variable rate nitrogen fertiliser application in future years.

Assessing crop biomass across paddocks

We have found scanners fixed to a vehicle the most practical way of assessing biomass Examples of these scanners are the N-Sensor, GreenSeeker and Crop Circle. Compared with satellite systems, they are not affected by cloud cover and are generally cheaper and more precise. Also the data and image are available straight away.

Satellite imagery is more useful if a big area (many paddocks) needs to be done at once. Cost sharing across a big area will also reduce the cost and make higher resolution satellite imagery more economic.

Varying nitrogen fertiliser rates according to crop biomass

In our growing conditions, varying the rate of nitrogen fertiliser according to the crop nitrogen status (using the N-Sensor) increased wheat grain yield by only 1% compared with a uniform application (of the same total amount). This is the average of 10 trials over two years The largest increase was 6%.

Using crop biomass sensors to map weeds

Crop biomass sensors can also be used to map weeds, especially where they are in thick patches. In our case these sensors can be used to map areas with high densities of herbicide resistant ryegrass. Using a direct injection or variable rate spray system additional herbicide or a higher rate can be used only on these areas instead of across all of the paddock and so saving costs. This variable rate system can be computer controlled as for variable rate fertiliser or seeding rates. Auto boom section shut offs, controlled by GPS are also widely used in our regions. These are especially useful when spraying odd shaped paddocks.

Other add-ons

On-the-go weather monitoring on the tractor and recording is now available.
On-the-go soil testing (such as pH) are in various stages of development There is at least one pH testing unit (a Veris) available.

Into the future

Considering the rapid advance in prediction agriculture systems we may well have, sooner rather than later,

- improved safety systems if the driver goes to sleep!
- automatic turning at the end of each run
- fully robotic systems t sow, spray and harvest, or even to chip weeds!

About SPAA

SPAA (the Southern Precision Agriculture Association) is an independent organisation to help develop and promote precision agriculture technologies. Members include farmers, advisers, researchers and commercial industries. SPAA facilitates research and training in PA and assists farmers make PA decisions through information presented at Expos, Conferences, workshops and SPAA publications.
Annual membership so $82.50 (incl 10$ GST).
Fro more details see www.spaa.com.au