

Precision Agriculture: An extension of agronomy

By Andrew Smart, Precision Cropping Technologies Pty Ltd (PCT)

Precision agriculture provides positive outcomes to sometimes very simple problems in agriculture. With this in mind Precision Cropping Technologies (PCT) has formulated plans to implement PA through single products and/or over all farm approaches.

This article introduces some products where farmers have in the past couple of seasons made some significant savings or gains.

VARIABLE RATE APPLICATIONS

There has been independent acceptance of variable rate application of gypsum and to some extent nitrogen.

Gypsum applications have been applied variably based on a couple of simple layers of information including the original cut and fill, electromagnetic surveys and soil tests collected specifically based on these layers.

The original cut and fill is a simple base layer where higher rates of gypsum are applied to cuts and lower rates to fills based on the likelihood that the cuts will expose higher sodium levels than the new topsoil area.

The use of the EM survey with properly selected soil sites allows the identification of areas most likely to respond to soil ameliorants. This approach requires the EM survey to be done at an appropriate time to gain the most agronomic benefit and soil tests to be collected immediately and sent to a certified lab.

Overall, these approaches have either reduced product requirements by up to 50 per cent or have allowed for

larger volumes to be applied to areas needing the higher volume.

Variable rate nitrogen has been used to reduce variation in

Image taken first week in January. In this case variable rate pix was applied through the aircraft. Ground truthing was carried out by Chris Maunder from B&W Rural Moree. Red indicates lower biomass and blue higher biomass.

growth on some farms. This uses the theory that nitrogen moves down the field during irrigation so variable rates have been applied to allow for this movement. Variable application of other nutrients such as P and K has been used to repair nutrient bank imbalance caused by large cuts and fills.

VARIABLE PIX BY AIR

This season saw the use of aircraft to apply variable rate Pix. The base layer of information originated from the ability to collect high quality airborne multispectral imagery, solid agronomic ground truthing and a newly designed system to allow Pix to be injected in variable volumes as required on the field.

The imagery was collected by PCT using a new camera system built by Specterra Services in Western Australia. The imagery was delivered to the farm consultant for ground truthing using an Ipac, GPS and Dlog image viewing software for use in the field.

The rates were decided on, and the variable rate map was built by PCT. In addition, an insecticide was applied with a constant water rate of 30 litres per hectare and the extra Pix was injected into the nozzles from a separate compartment in the plane at the required rates — all automatically controlled by GPS. To discuss this more, drop into the PCT or B&W Rural sites at the Australian Cotton Trade Show.

EARTHMOVING REQUIREMENTS

High quality elevation data layers have been available now for several seasons. This work allows growers to determine not only the viability of releveling fields but also where in the field or the farm you're going to get the most return for spending money on earthmoving.

This work has been done using Beeline, Autofarm, Trimble and now the new Deere system. All units provide suitable data formats for this process and with newly developed software, error from plane, cut/fill volumes and setup maps are easily extracted. The ability to contain all this within a true GIS platform means that other data information such as soil type and yield can be used in analysis to determine the viability of levelling.

AN OVERALL APPROACH

In precision agriculture (PA) we often talk about spatial variation — a term we use to describe yield variability within a field. Through our increased knowledge of field variation we can also focus on 'farm variation.'

Field variation is easily described but what do we mean

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by the term 'farm variation.' It's an issue that concerns many consultants and managers:

- Why does a farm in one year average eight bales per hectare the next it goes 11 and the next it goes nine? and,
- How do we make the best of every season when reality is we don't know what we are dealing with until it happens?

Every year we aim to improve yield. Original thoughts were to use PA to reduce inputs and so improve gross margins. Through our ability to measure, it's now very clear that potential yields in the cotton industry are much higher than those being achieved year in year out — but can they be produced every year?

With this in mind, our focus is on using PA as part of a system that delivers more yield from all crops in a rotation — not just once but every year. Critical to all this is gaining an understanding of the yield potential of every area on the farm in any given season.

A program of increasing yield by small amounts on a yearly can be difficult with extreme differences in yield experienced — especially between wet and dry years. A possible approach may be to categorise yield potential into three categories:

- Dry growing conditions which may give overall high yields — for example 12 bales per hectare;
- Average in-crop conditions which may give average yields of 11 bales per hectare; and,
- Wet in-crop conditions which may cause yield reduction to around 10 bales per hectare.

The yield potential of each year is different and we need to maximise each one.

SOURCE OF VARIATION

Most farms will have a range of physical variations including:

- Soils and slopes;
- Man-made variations including original design cuts and fills;

- Varying design issues such as head ditch heights and bad tail drains; and,
- Agronomic variations such as rotations, varieties, fertilisers, watering time and timing.

Throw into this basket some management variations such as field selection in dry years, farming timing, farming operation required (such as deep ripping) and marketing and you have a huge number of decisions to make.

The overriding factor in all this is the season. Will it be dry or wet with a hot/cold start — or somewhere in between. The nature of the season affects the interaction of all other variations.

With all this mind, PA is very much a learning procedure. There are no silver bullets and there is not a generic solution as all these issues will be different between valleys, between farms in the same valley, and between seasons.

At the moment we mostly generalise yields within fields into three categories — the low, the majority and the high. Roughly the low and the high are around 15 per cent of a field each and the majority of the field is the remaining 70 per cent. Having this information and other specific data elements allows us to gauge the magnitude of the variation — and most importantly the reasons why.

Commonly these variable areas in fields will be due to soil physical characteristics — having an impact on the water infiltration, plant available water and the degree of water logging, chemical make up and nutrient availability.

SO WHICH PART DO WE MANAGE FOR?

At PCT our initial aim is an attempt to make the biggest impact as quickly as possible. Therefore the first point of attack is the majority of the field. If we are capable of making an impact on a field, ideally the bigger the area we affect, the better the return. When you have determined that the majority of the field has hit its maximum yield potential, then move on to the other areas.

To learn more about successful use of PA contact Andrew Smart from Precision Cropping Technologies, 02 6792 2638 or 0428 922 638 or visit site 32 in the PA pavilion at the National Australian Cotton Trade Show at Moree on May 26–27.



Variable rate application is now available from the air.