Precision Ag Trials

TRIAL TYPE: Nitrogen Response

Appila SA, Upper North Farming Systems

Overview:

Precision Agriculture (PA) tools have been available to Australian grain growers for many years with the benefits well documented. It is estimated however that less than 1% of grain growers utilise PA beyond 'guidance' in any form. In fact guidance alone (driving in straight lines) is not PA.

The objective of this GRDC funded project, coordinated through SPAA is to increase the level of adoption of PA by broadacre farmers beyond 'guidance'. The project specifically aims to increase the level of adoption of variable rate (VR) by growers involved with the project to 30% by 2013. This goal will be achieved by demonstrating how to use PA tools at a regional level and by increasing the skills of growers and industry in PA to a level where they can confidently use PA tools in their farming systems to achieve economic, environmental and social benefits.

Trials and demonstrations are conducted on growers' properties and are visited throughout the season during farm walks. Workshops also mention outcomes of these trials to help farmers apply the messages to their own farming situations.

Aims:

- To compare the effects of different nitrogen rates and soil types on wheat production
- To extend information to local growers and identify where savings can be made

Background:

Nitrogen is essential for plant growth and development and crops need to have sufficient nitrogen to match crop demand. If a season has potential, post seeding nitrogen will be applied to crops. On some soil types however there is no improvement in crop performance as subsoil constraints influence water and nitrogen uptake. This trial was established to investigate the impact of varying nitrogen fertiliser rates on wheat production from different soil types. The outcomes of this research would then lead to savings on-farm through identifying soil types that will and will not respond to additional nitrogen fertiliser.

About the trial:

The trial was located about 10 km south west of the Appila township. A wheat crop was sown at the site in late May 2010. In August a Greenseeker unit was used to identify areas of the paddock that were 'dark' versus 'light' green, indicating the presence (or lack) of nitrogen. Later the same day urea was applied to the crop in strips, across a range of soil types. The crop was harvested and grain was analysed.

Treatments

Treatment	Urea rate (kg/ha)	Timing of application
1	0	
2	60	GS31*
3	100	Seeding

*GS31 is Zadok's growth stage 31, commencement of stem elongation

Assessments:

A Greenseeker unit was used across the paddock immediately prior to spreading urea. This technology measures the reflectance from a crop and converts it to a number to determine how much nitrogen is present in the crop canopy across the paddock. This information is then collated to produce a map indicating the different nitrogen levels.

Results:

The Greenseeker unit gave accurate information about nitrogen content in the crop canopy, based on sensing greenness reflected from the crop. When mapped, areas of the paddock that were low in nitrogen were contrasted against areas of high nitrogen content.

Figure 1: Greenseeker Unit mounted on a utility to detect 'greenness' of a crop and convert the information back to produce a high or low nitrogen reading

Figure 2 (below): Post seeding urea application on a wheat crop at Appila in August 2010, following Greenseeker sensing to detect 'greenness' of crop.

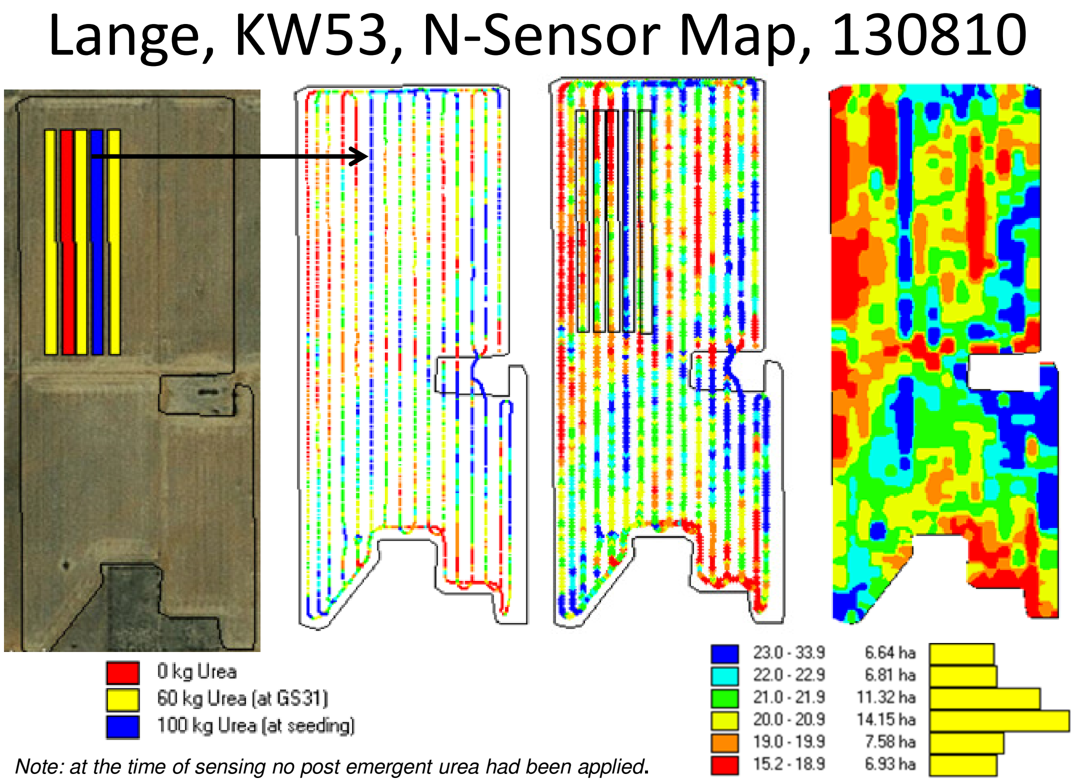

Figure 3: Application rates of urea strips superimposed on an aerial image of the paddock at Appila. The arrow indicates the 100 kg/ha strip of urea applied across varying soil types, which was also detected by the N-Sensor and mapped.

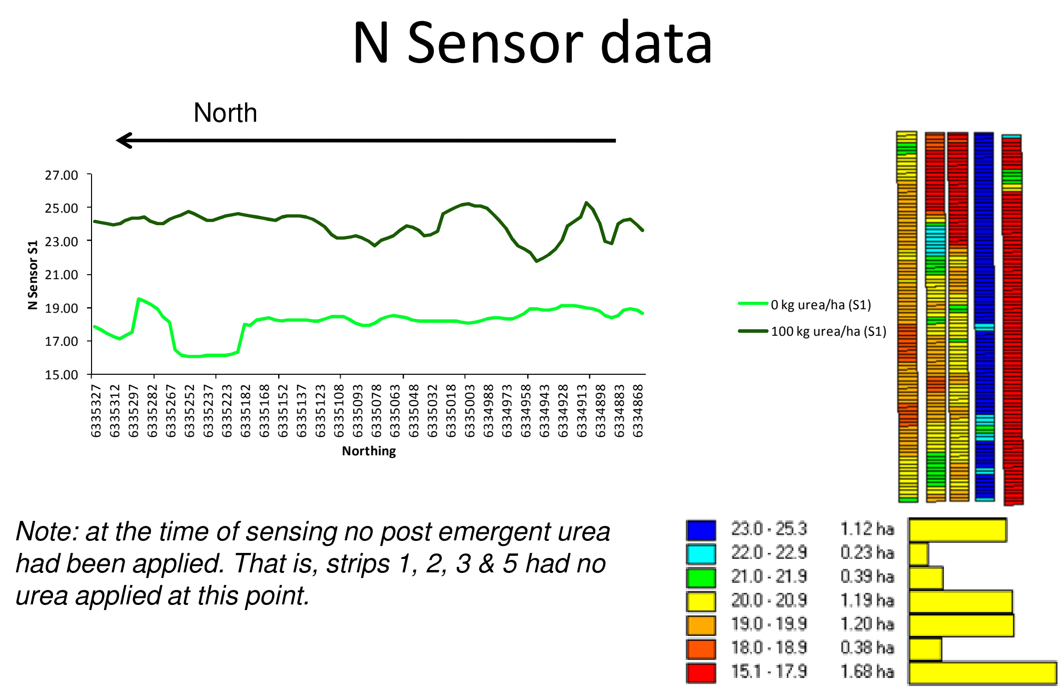

Figure 4: Results from the N-Sensor readings for each strip at Appila in 2010

Elevation along the strips

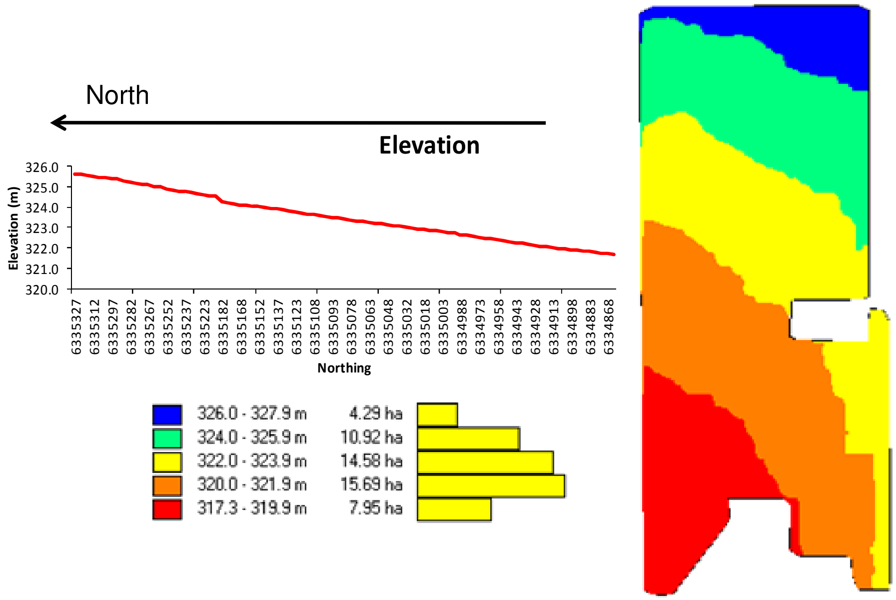

Figure 5: Impact of elevation on the trial, showing the area of the paddock at different altitudes. There was a 6 m fall from the northern end of the trial to the southern end

Grain yield results from trial strips

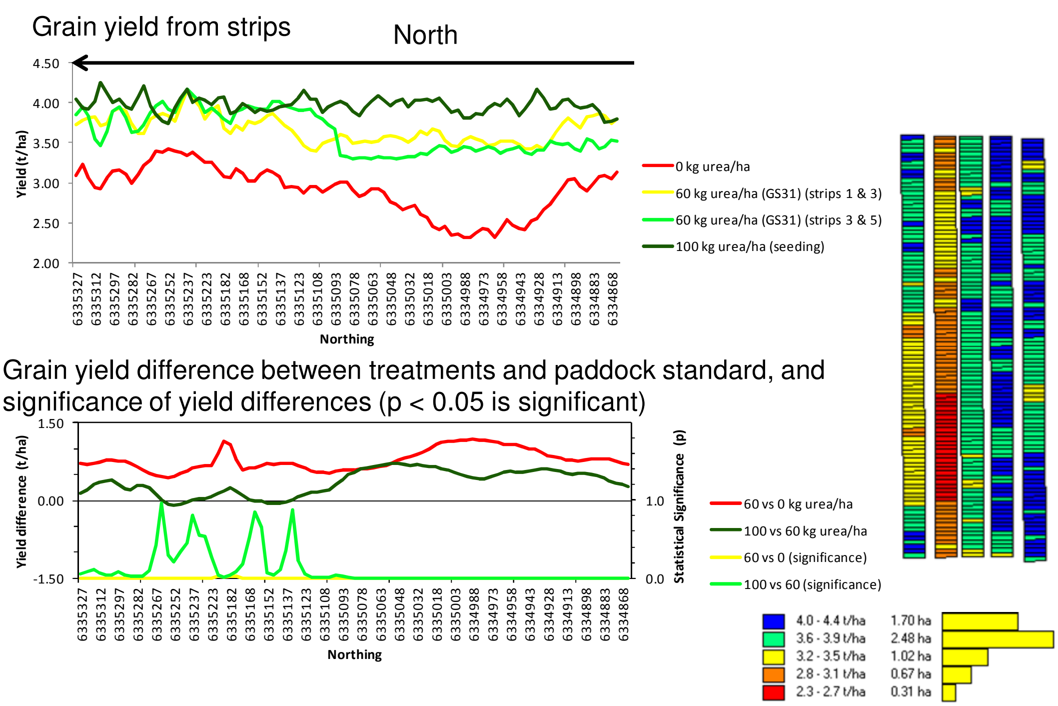

Figure 6: Variation in grain yield and response from nitrogen applications of 60 and 100 kg/ha compared with 0 kg/ha

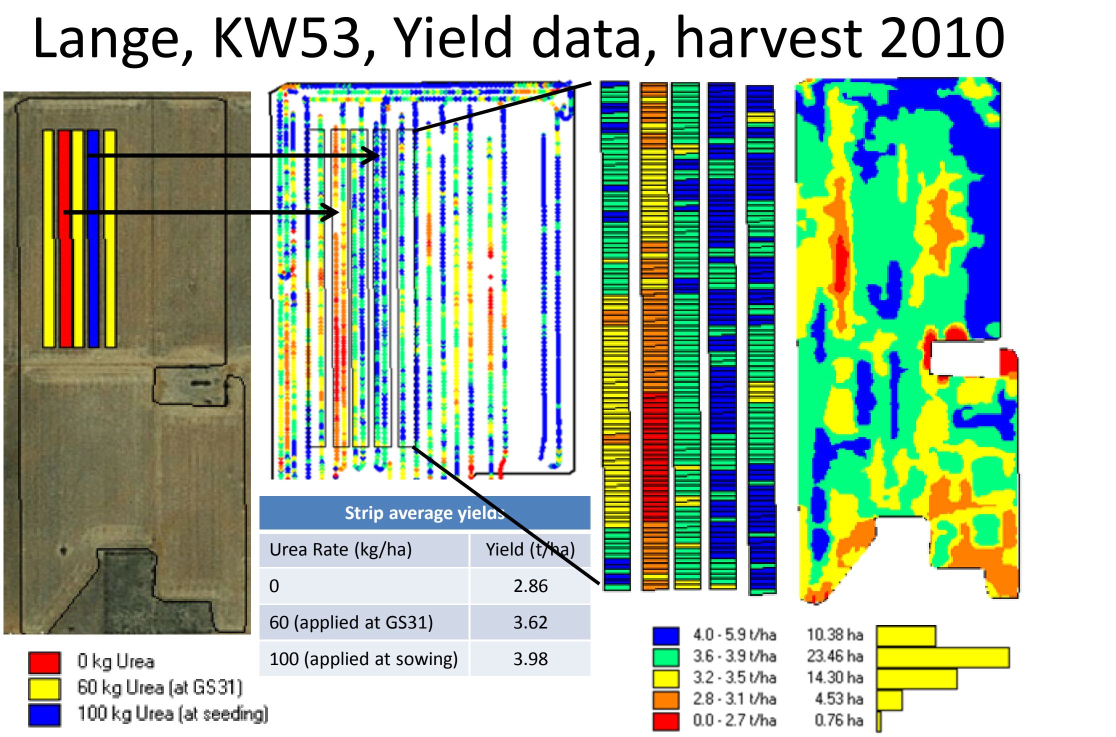

Figure 7: Yield variation in paddock as a result of nitrogen strip applications. The figure compares the N-sensor map with the yield information gathered at harvest

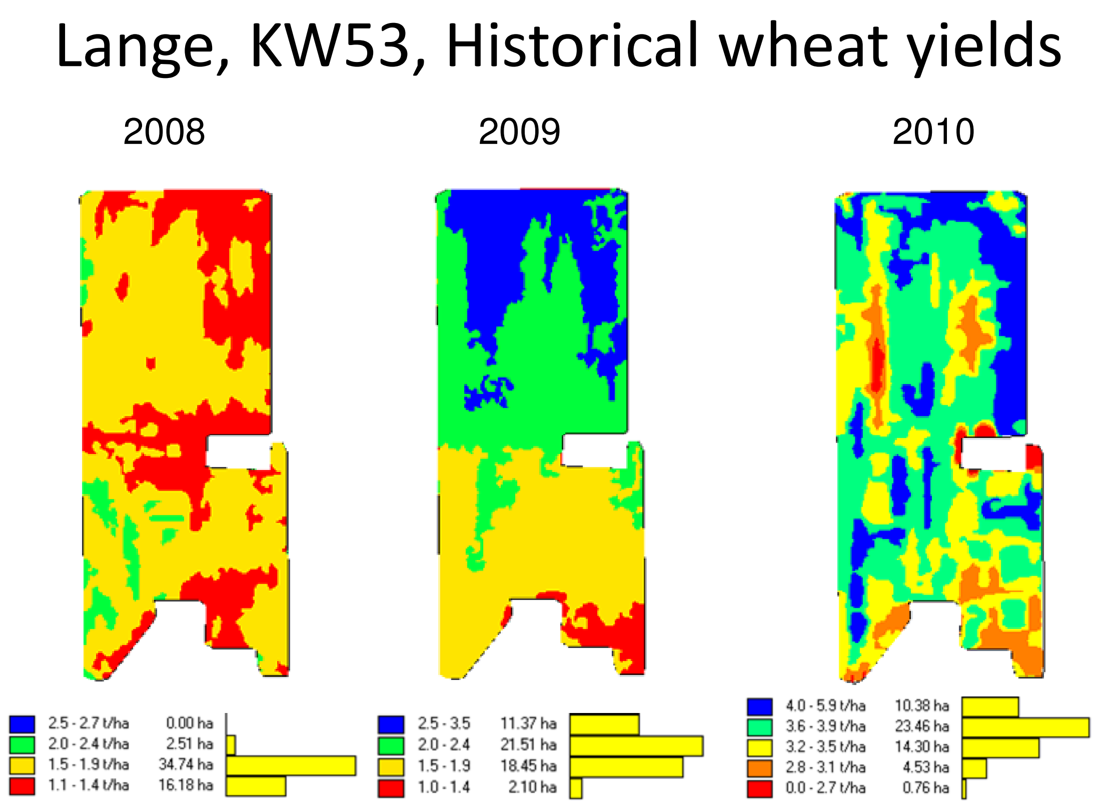

Figure 8: Comparison of wheat yields from 2008-2010 seasons. There is some consistency between the zones of each map, although there is some flip-flop between 2008 and 2009 seasons, particularly at the northern end of the paddock.

What does this mean?

The site was responsive to nitrogen, which is highlighted by the significant N-sensor response to additional nitrogen at seeding. The paddock also responded significantly with improved grain yield following both 60 and 100 kg/ha urea (figures 6 & 7). Grain yield varied from around 2.9 t/ha where no nitrogen was applied to almost 4 t/ha where 100 kg/ha was applied. The northern end of the trial was less responsive to urea applied above 60 kg/ha, whereas the southern end was responsive up to 100 kg/ha. This difference in response was not detected by the N-sensor in season.

The flip-flop effect (figure 8) between some seasons such as 2008 and 2009 is largely caused by soil type effects. In average or above years some soils can be quite productive as sufficient moisture is more often available to crop roots. In seasons with low growing season rainfall the reverse can occur where those areas that perform well in average (or better) seasons become the zones of limitation; often due to subsoil constraints.

As soil constraints at depth are often difficult or cost prohibitive to rectify, farmers need to use tools such as Greenseeker, or possibly a soil moisture probe combined with paddock knowledge to make informed decisions as to whether post-seeding nitrogen should be applied, and if so how much? Capitalising on the good seasons can help set up farmers in low rainfall districts for more challenging seasons.

Who was involved?

Property owner: Roger Lange
Data collection: Charlton Jeisman
Analysis: Sam Trengove, Sean Mason
Trials coordinator: Charlton Jeisman
FSG contact: Charlton Jeisman

Grower/Regional feedback:

The grower mentioned the usefulness of the Greenseeker map to provide a visual overview of how the crop was growing and where nitrogen was being used. This has helped with understanding how different soil types perform and allow extraction of nitrogen during a growing season.

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For more information

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GRDC Grains Research & Development Corporation