Precision Ag Trials

Variety x plant density x nitrogen x time of sowing

Birchip and Kooloonong

Although PA tools have been available to Australian grain growers for many years, and the benefits have been well documented, it is estimated that less than 1% of grain growers utilise PA 'beyond guidance' in any form.

The objective of this GRDC / SPAA funded project is to increase the level of adoption of PA 'beyond guidance' by broadacre farmers. The project specifically aims to increase the level of adoption of variable rate (VR) by growers in the project to 30% by 2013. This goal will be achieved by demonstrating how to use PA tools to growers at a regional level and by increasing the skills of growers and industry in PA to a level where they can then 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 using farm walks and workshops to discuss the advantages and disadvantages of PA techniques with the involvement of other regional growers.

This information sheet presents the outcomes of the BCG & SPAA Trial **3&4** from season 2010.

Aims:

To trial and demonstrate two possible agronomic adaptations to a changing climate:

- to sow wheat varieties earlier to reduce the possibility of heat shock events during grain fill whilst taking into account the frost risk.
- to sow more than one variety in the one paddock as a mix to ensure that the whole crop is not susceptible to frost and heat shock at the same time.

Background:

Australian grain growers farm in one of the most variable climates in the world. The evidence is now clear that the climate is changing and that future crop production will have to contend with not only a higher atmospheric CO_2 content (which changes the rate at which a plant grows) but also alterations in rainfall patterns, higher temperatures during grain fill and higher evaporation rates.

The purpose of these demonstrations is to show farmers how different management practices can be manipulated to reduce the risk associated with a variable climate. What this will achieve is increase awareness and interest in Precision Agriculture and its advantages.

About the trial:

The sites were sown and harvested with farm machinery. One site was located near Birchip the other at Kooloonong, north of Swan Hill. Four adjacent strips containing four treatments were sown down the length of a paddock. Each treatment was 150m long and the width of an air-seeder. The total length of the trial, including buffer areas, was 700m.

Location:	Birchip and Kooloonong
Treatments:	Time of sowing x two varieties x two seeding densities x two N rates
Crop type:	Wheat: Yitpi (mid season) and Axe (short season)
Sowing dates:	Birchip - 20 May and 7 June; Kooloonong - 27 April and 27 May
Seeding density:	100 and 150 plants/m²
Fertiliser:	*Birchip* At sowing 50kg/ha MAP (5kg N/ha) 26 July 50kg/ha Urea (23kg N/ha) - High N plots *Kooloonong* At sowing 50kg/ha MAP (5kg N/ha) 6 July 40kg/ha Urea (18kg N/ha) – High N plots 20kg/ha Urea (9kg N/ha) – Low N plots
Replicates:	1
Trial Design:	Nearest neighbour
Previous crop:	Vetch (Birchip), Wheat (Kooloonong)
Seeding equipment:	Knife point, press wheels, 30cm spacings

Assessments:

- Establishment,
- biomass,
- regular growth stages,
- yield prophet simulations, and
- grain yield.

Results:

Birchip

The site was located in a paddock with moderate subsoil limitations (40 to 70cm layer had chloride reading of 1800ppm, and an EC of 0.6dS/m). The site had a previous legume history and was high in soil available N (prior to sowing the soil contained 230 kg available N/ha to 1m depth).

The first sowing took place on 16 April, but had to be abandoned because of extensive locust damage to the crop at the two to three leaf stage. The second sowing occurred on 20 May. There was no regrowth after the locust damage on the first time of sowing and these strips were re-sown on 7 June.

The growing season rainfall at the site was 348mm (decile 10) and the crop yield was exceptional at an average yield of 5.8t/ha. Throughout the season, Yield Prophet simulated a high probability of obtaining a 6t/ha crop, assuming the rainfall fell at the right time. Yield Prophet simulations during the season also determined that there would be no response to in-crop N applications.
No differences in yield were obtained between the two varieties, Axe and Yitpi, and there was also no response to time of sowing, seeding rate or in-crop N application (Table 2).

Table 2. Birchip on-farm demonstration, yield results for Axe and Yitpi at two times of sowing, two seeding rates and top-dressing of N fertiliser.

Time of Sowing	Seeding Rate (plants/m^2)	Top-dress N (kg N/ha)	Yield (t/ha)	
			Axe	Yipti
20 May	100	0	5.7	5.4
20 May	150	0	5.9	5.8
20 May	100	23	5.9	5.7
20 May	150	23	5.8	5.7
7 June	100	0	5.7	5.9
7 June	150	0	6.0	5.8
7 June	100	23	5.4	5.8
7 June	150	23	5.9	5.8

The on-farm demonstration was laid out as a nearest neighbour design, there were no significant differences in yield between treatments.

Kooloonong:
The site was located on a Mallee land system, on a flat to sloping rise with a sandy loam soil to a depth of 40cm and at greater depth a sandy clay loam to at least 130cm. The soil has no subsoil limitations but because it is light and sandy, leaching of nutrients can be a problem. 2010 had a growing season rainfall of 329mm (decile 10).

The first sowing occurred on 27 April, with the second a month later on 27 May. On 16 July, treatment plots were spread with either 9 or 18kg N/ha. The plot yields are presented in Table 3. There was a large amount of variation in yield between treatments and no consistent yield response could be ascertained. The plots with the shaded yields in the table yielded very well and were located towards one end of the trial on a sloping rise. It is thought that soil type variation had a greater effect on yield than the treatments.

Yield Prophet simulations showed that all treatments were nitrogen limited towards the end of the season. Over the critical spring months when the crop was flowering and filling, 185mm of rain fell. On sandy soils, this would have resulted in leaching of available nitrogen. Yield Prophet simulated nitrogen non-limited yields for Yitpi were in the 5 to 6t/ha range.

Table 3. Kooloonong on-farm demonstration, yield results for Axe and Yitpi at two times of sowing, two seeding rates and top-dressing of N fertiliser (the shaded results refer to higher yielding plots as a result of soil variation).

Time of Sowing	Seeding Rate (plants/m^2)	Top-dress N (kg N/ha)	Yield t/ha	
			Axe	Yipti
27 April	100	9	2.75	2.61
27 April	150	9	3.17	3.37
27 April	100	18	1.43	2.57
27 April	150	18	2.26	4.10
27 May	100	9	3.50	3.51
27 May	150	9	1.47	1.82
27 May	100	18	3.32	3.24
27 May	150	18	2.55	2.46

Interpretation

BCG is investigating a range of practices which will improve our ability to manage farm production in a highly variable and changing climate. In the future, managing the farm will be even more dependent on sound business practices and linking the potential of the land to the season. Through programs such as Yield Prophet the BCG is providing farmers with tested tools to:

- assess the impact of likely rainfall outcomes during the season on yield
- determine variety flowering time by date of sowing, to assist in developing least frost and heat shock risk sowing windows
- identify when crops are likely to be nitrogen limiting and work out the dollar return on in-crop N application

All of this will assist in better decision making before and during the season.

The agronomic adaptations to manage climate change in this year's trial work was focused on gaining a better understanding of the impact of time of sowing on when a particular variety is likely to flower in order to minimise the risk of frost and heat shock damage during flowering and grain filling. By demonstrating the benefit of varying these practices through the use of PA and variable rate technology, will be more equipped to tackle a changing climate. Yield maps and VRT through this project and demonstrations thus making PA more farmer friendly.

Who was involved?

The BCG would like to thank it's collaborators for their participation in these trials. Their assistance was greatly appreciated.
- The Birchip Trial was hosted by John and David Ferrier
- The Kooloonong Trial was hosted by Roger, Lisa and Brad McQueen

Simon Craig and Harm van Rees were responsible for coordinating the trials

This project was funded by the Grains Research and Development Corporation (GRDC) and run in conjunction the Australian Government under its Climate Change Research Program, and CSIRO Climate Adaptation Flagship.

For more information

Nicole Dimos
SPAA Executive Officer
P: 0437 422 000
E: nicole@spaa.com.au

Simon Craig
BCG
P: (03) 5492 2787
E: simon@bcg.org.au

GRDC
Grains Research & Development Corporation