NORTHPARKES MINE BROADACRE TRIAL

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Exploring Management Impacts on Wheat Grain Quality

Key Messages

- **Severe drought conditions affected the results of this trial (grain yields 0.60 to 1.02t/ha), with only 130 mm for April – October and 171mm for the calendar year recorded at the trial site.**
- **The wheat variety Ventura, showed the benefits of quicker maturity over Sunstate in such extreme seasonal conditions.**
- **Plant density was not found affect grain yield or quality in a very tough year.**
- **Precision agriculture can be used for on-farm trials to produce statistically valid results, thereby offering an alternative to small plot trials.**
- **The broadacre trial will be repeated in 2007 at Northparkes Mine.**

Background

This trial covered three key aspects. These are covered separately below.

Grain Quality – Impacts on Profitability: When talking with growers the influence of grain quality on the profitability of wheat enterprises is clear. In the same sentence a grower will most commonly refer to grain yield, screenings % and protein % when discussing crop performance. Screenings and protein are two of the key grain quality parameters that determine wheat grade classifications and hence grain price.

High screenings (>5%) in wheat has been a common occurrence in Central West NSW for some time now, occurring across a range of seasons. The alarmingly high proportion of wheat deliveries to bulk handlers that fall within the bin grades AUH2 (max.10% screenings) and HPS1 (max. 25% screenings) provides the clearest indication of the scale of the problem.

The financial consequences of high screenings (>5%) is two fold. In the first instance, high screenings bin grades AUH2 and HPS1 have lower base prices, commonly being around $0 – 10 and $15 – 25 per tonne below that of H2, respectively. This is followed by the loss of grain quality increments for protein and moisture as AUH2 and HPS1 are 'flat' prices (ie. no quality increments paid). Typical increments for protein and moisture that are 'lost' range between $5 – 10 per tonne. In all, having a load of grain classified as AUH2 or HPS1 could result in the 'loss' of up to $20 to 35 per tonne, respectively!

As an indicator of flour yield, screenings refers to all material that passes through a 2 mm slotted screen for wheat. Screenings can comprise: small whole grain, shrivelled or pinched grain, cracked or broken grain and foreign material (eg. weed seeds). However this trial was designed to assess the impacts of agronomic management on screenings, thereby focusing on the impacts on small whole grain, shrivelled and pinched grain.

Ultimately growers aim is to maximise grain yield and minimise the risk of screenings. However, experience in commercial wheat crops suggests that maximizing grain yield results in an increase risk of screenings.

It is widely accepted that screenings are the result of an interaction between agronomic management and seasonal conditions. This trial was designed to explore the impacts of variety, plant population and nitrogen nutrition on grain quality.

Use of Precision Agriculture in Broadacre Trials: Precision agriculture (PA) has been in use within commercial cropping systems within Central West NSW for some time now, with some growers having had yield mapping capabilities since the mid 1990's. Much has been written about the potential for using PA in on-farm agronomic trials; in practice however this has not translated into widespread use.

In the context of on-farm trials, PA provides the ability to measure more accurately the response to variable inputs on a 'broadacre' scale, and so improve decisions about the use of crop inputs. The ability to measure crop yield responses and the variation across a paddock enables two questions to be answered: does this paddock respond to a given crop input and does the effect vary significantly within the paddock?

'Traditional' small plot trials, allow only the magnitude of responses to varying inputs to be measured. While, PA offers a significant additional perspective, providing an appreciation of the variability in response across paddocks with the use of yield mapping. It is likely that a greater understanding of the variability of response will allow growers to better manage the risks of adverse responses to crop inputs in grain quality and hence improve the profitability of their wheat enterprise.

This trial was designed to use yield mapping to measure the influence of variety, plant population and nitrogen nutrition on grain yield. While there are experimental systems that enable mapping of grain quality (ie. grain quality measurements taken on the go onboard harvesters), such a system was not utilised in this trial.

Use of Yield Prophet to Fine Tune Nitrogen Management Decisions: Yield Prophet® is an on-line crop production model designed to provide grain growers with real-time information about crop growth to assist with in-crop management decisions. Further details on Yield Prophet (YP) can be obtained from www.yieldprophet.com.au.

Within this trial, it was intended that YP would be used to help determine nitrogen the rate to be applied in-crop. In this way, the nitrogen rate used in the trial could be best matched to the seasonal conditions. However, the extremely dry seasonal conditions of 2006 resulted in the decision not to use YP in this trial.

Methods

The trial was conducted within a commercial crop on Northparkes Mines farming operations at Goonumbla in 2006. A 12m Conservapac planter was used for sowing with 30cm row spacing. Starter fertiliser (MAP) was drilled with the seed at 75kg/ha as standard across all treatments. All seed was treated with Premis. Weed control was achieved with the application of 2.0L/ha trifluralin (480g/L) just prior to sowing and 20g/ha chlorsufuron post sowing.

The treatments included:

- Varieties (2): Sunstate (37.5g/1000 seeds) and Ventura (42.3g/1000 seeds)
- Plant Densities (3): 75, 150 and 200 plants/m^2. Actual seeding rates to achieve the 3 target densities were 37, 74 and 99 kg/ha for Sunstate and 42, 83, and 111kg/ha for Ventura (based on 95% germination and 80% establishment).
- Applied Nitrogen In-crop (2): nil and a rate to be determined using Yield Prophet (dependant on seasonal conditions). Due to extremely poor seasonal conditions, no in-crop nitrogen was applied.

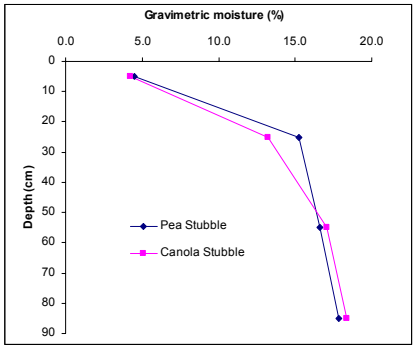
The complete trial was replicated on adjacent paddocks of different 2005 crop history. One block had fieldpeas and the other canola in 2005. Treatments were sown as two seeding runs (ie. 2 x 12m). Due to varying run lengths (variations in paddock shape) average treatment areas varied between with of 1.68 and 3.67ha for the canola and fieldpea stubble blocks respectively. The trial was arranged in a randomized block design with 2 replicates.

Soil samples were taken to a depth of 100cm for determination of soil moisture at sowing, nutrient status and soil characterisation. Field measurements to determine soil moisture characteristics required to run the Yield Prophet model were also taken. Surface soil (0-10cm) tests prior to sowing (sampling 21/3/06) showed a clay loam texture, pH ($CaCl_2$) 5.1, phosphorus (Cowell) 45mg/kg and PBI of 86.

The trial was sown on the 19 and 20 June and was harvested on 21 November. Grain samples for quality analysis were taken from the harvester grain bin for each treatment.

Results and Discussion

Figure 1: Pre-sowing soil moisture



Due to the effects of drought, the trial area sown on the canola stubble was not harvested. It was considered not economic to harvest due to low expected grain yield. Total rainfall recorded for 2006 at the trial site was 171mm, with only 130mm for April – October.

Therefore the results presented are those from the crop sown on the fieldpea stubble only.

The difference in crop performance occurred despite only minor differences in the soil moisture profile between the two blocks at sowing (Figure 1).

Due to seasonal conditions, no in-crop nitrogen was applied and the Yield Prophet model was not run for the trial. Therefore the results were analysed for variety and population effects only (Figure 2).

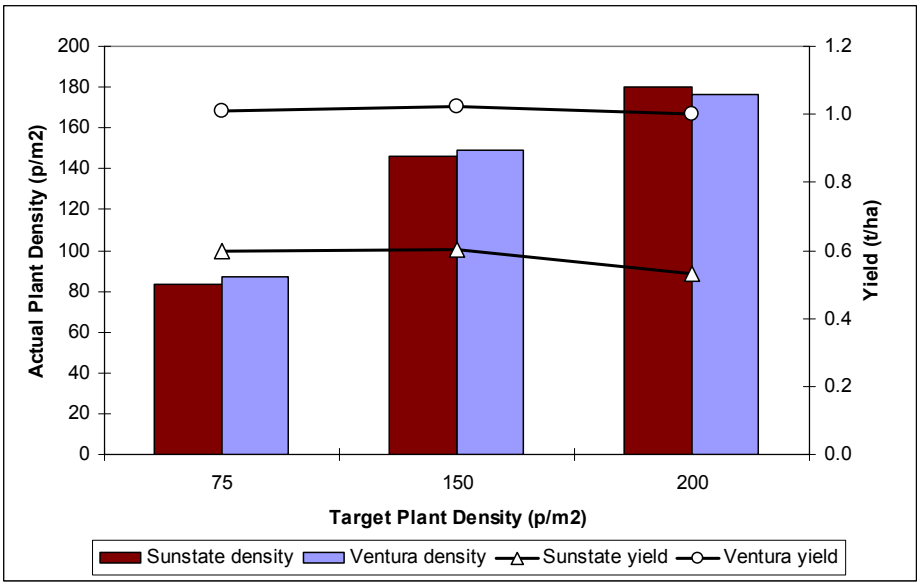
Plant Density: For both varieties, the actual plant densities approached the targets, except for the highest target densities of 200p/m^2. . This could be partly experimental error but has been reported in other trials and might result from competition within rows during emergence.

Despite the large spread in plant densities there was no significant effect of density on grain yield or quality (protein, screenings and test weight). Other local trials indicate that this is not usually the case, with increasing plant populations resulting in varying effects on yield and quality depending on the site, year and variety.

Variety: There was a significant difference in the grain yield between the two varieties, with Ventura yielding higher than Sunstate. This trend has also been shown in many long term variety trials in the district with Ventura on average yielding about 6% higher than Sunstate.

There was no significant effect of variety on screenings and test weight. However there was a significant effect of variety on protein, with Sunstate having higher protein.

Figure 2: Grain yield and quality results



Variety	Target Plant Density (p/m^2)	Actual Plant Density (p/m^2)	Grain yield (t/ha)	Protein (%)	Moisture (%)	Screenings (%)	Test weight (kg/hL)
Sunstate	75	83	0.60	15.38	8.00	1.85	81.00
Sunstate	150	146	0.60	15.88	8.03	1.70	79.88
Sunstate	200	180	0.53	16.08	8.03	2.08	79.75
Ventura	75	87	1.01	14.43	8.00	1.13	81.38
Ventura	150	149	1.02	14.90	7.98	1.30	80.63
Ventura	200	177	1.00	14.95	7.98	1.38	80.63
Mean			0.79	15.27	8.00	1.57	80.54
LSD			0.14	0.76	0.21	0.89	2.01
CV%			8.2	2.3	1.2	25.6	1.1

Acknowledgements

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