Southern Irrigated Wheat Varieties Achieving Target Yields - Hillston 2014

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Introduction

Previous research by NSW DPI, through the project "High yielding winter cereal genotypes for irrigated environments in south east Australia", showed variety selection and correct management practices are key factors in producing high yielding irrigated winter crops.

This trial complements the previous work by fine tuning management practices and strategies for high yielding irrigated wheat, focussing on high yields and profitability.

It aims to test the regional suitability of current commercially available wheat varieties under high yielding irrigated conditions specific to SNSW, measuring key factors such as standability, phenology, plant height, grain yield and quality. It is one of the satellite sites of the 'Southern Irrigated Cereal and Canola Varieties Achieving Target Yields' project.

Site Details

Location:	Hillston, NSW
Soil type:	Grey clay loam
Sowing dates:	TOS 1: 8th May; TOS 2: 29th May
Available N at sowing:	228 kg/ha (0-60 cm), as a result of pre-drilled N for cotton not sown in 2013
0-10cm nutrients:	28 mg/kg Colwell P, 17 mg/kg S, 3% Organic Matter, pH 7.8 ($CaCl_2$)
Previous crop:	Fallow 2013 (was planned for cotton but not sown)
Soil Moisture:	100cm depth of moisture (full profile)
Rainfall:	125mm January–March + 163mm April–October
In-crop irrigations:	Late August and mid-September (3 ML/ha)
Fungicides:	Two foliar fungicides by air, 290mL Folicur August & 800mL Amistar Xtra October
Starter fertiliser:	150 kg/ha MAP
Harvest date:	27th November 2014

Treatments

12 wheat varieties	Dart, Wallup, H45, Crusader, Spitfire, Suntop, Merinda, Lancer, Bolac, Chara, Bellaroi and Yenda
2 times of sowing (TOS)	TOS 1: 8th May 2014 TOS 2: 29th May 2014
2 nitrogen treatments	1. Pre-drill: 100kg N/ha at sowing (as urea under the plant line in a separate pass) 2. Post N: 0kg N/ha Pre-drilled + 75kg N/ha (1st Node) + 25kg N/ha start of flowering

Results

Measurements taken on this trial were establishment counts (plants/m^2), Normalised Digital Vegetation Index (NDVI), lodging scores and grain yield.

The target plant population is 200-250 plants/m^2 in irrigated wheat. Establishment counts were taken on the 28th May for time of sowing 1 and on the 25th June for time of sowing 2, when the plants were at the 3-4 leaf stage (Figure 1). Plant counts for TOS 1 ranged from 184 plants/m^2 for Chara with all nitrogen pre-drilled up to 259 plants/m^2 for Crusader with all nitrogen pre-drilled. The average plant count overall for TOS 1 was 217 plants/m^2.

For TOS 2 the plant counts ranged from 206 plants/m^2 for Suntop with all nitrogen applied post sowing up to 294 plants/m^2 for Crusader with all nitrogen pre-drilled. The overall average plant counts for TOS 2 was 241 plants/m^2.

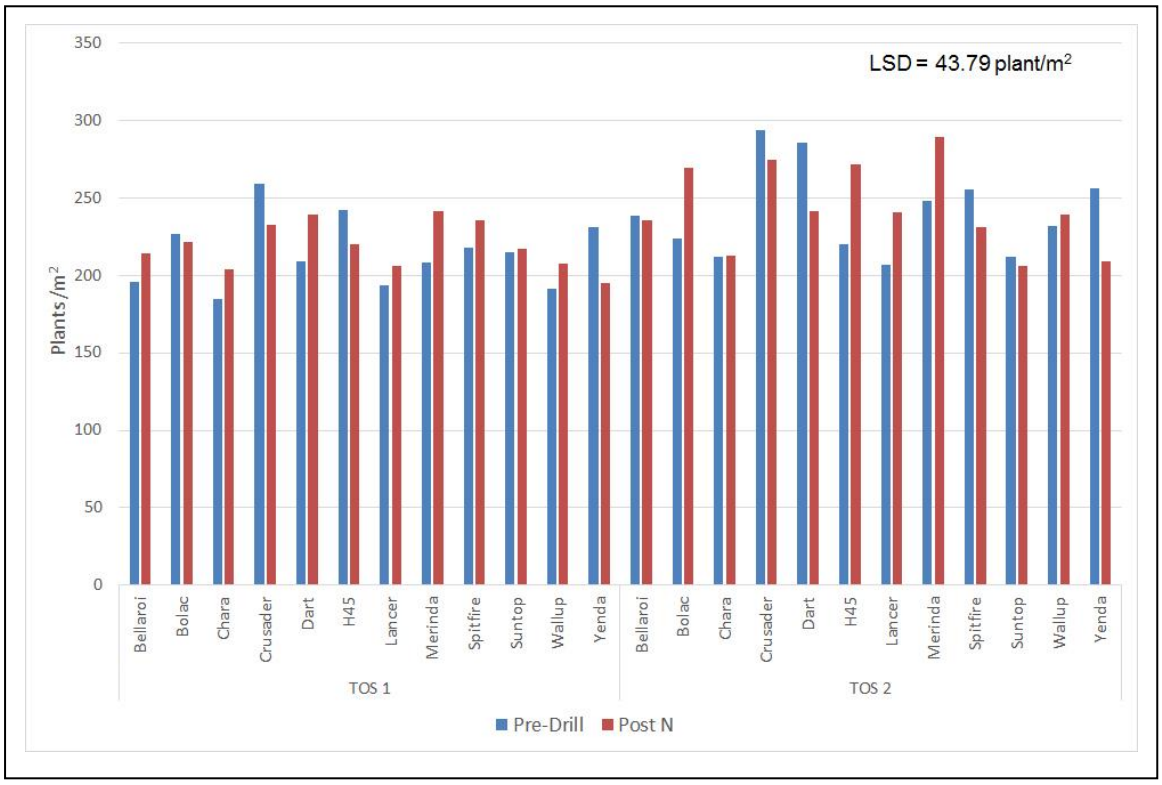

Figure 1: Average plant population (plants/m^2) for each TOS and for each nitrogen timing

Crop vigour was measured at heading/flowering using a hand held NDVI. Figure 2 shows a summary of the NDVI values by time of sowing and by nitrogen timing.

For TOS 1 the NDVI values recorded ranged from 0.64 for the variety Dart with all nitrogen applied post sowing up to 0.77 for the variety Chara will all nitrogen pre-drilled. The average NDVI value for TOS 1 was 0.72. For TOS 2 the NDVI values recorded ranged from 0.72 for the variety Crusader with all nitrogen pre-drilled up to 0.82 for the variety Lancer will all nitrogen pre-drilled. The average NDVI value for TOS 2 was 0.78.

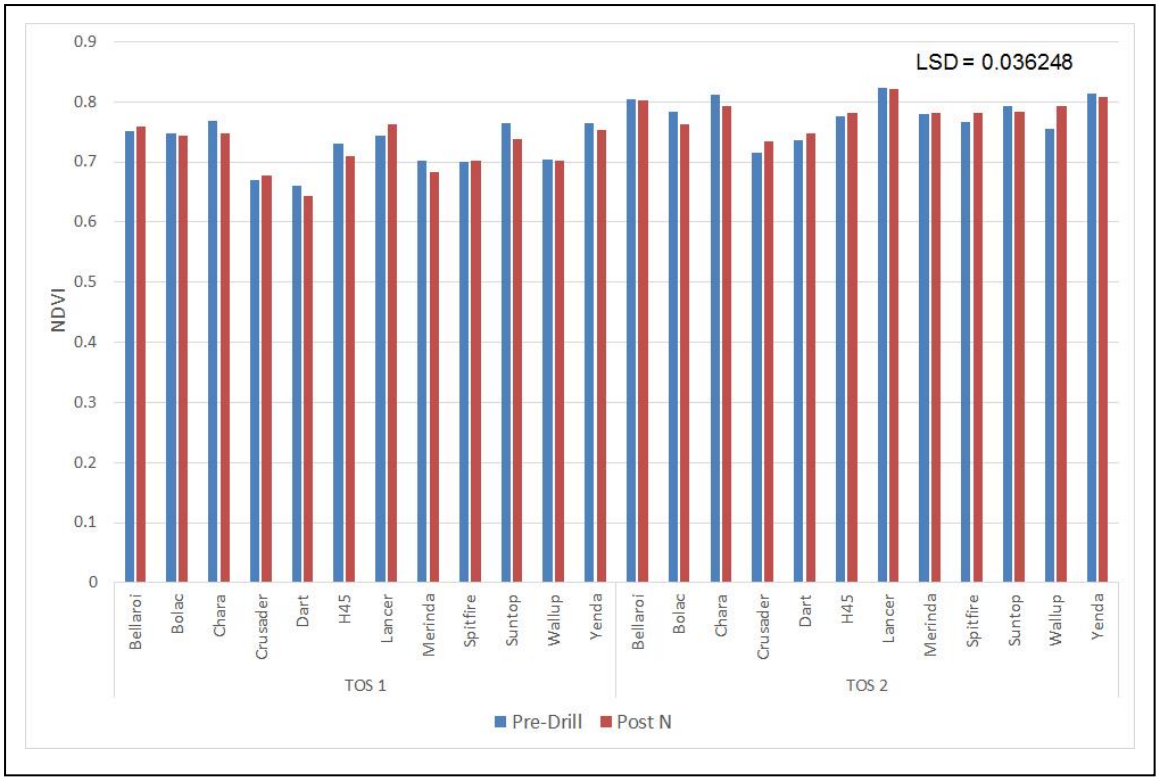

Figure 2: Average NDVI for each TOS and for each nitrogen timing

Lodging is a key performance indicator for irrigated crops. Lodging scores were taken in October and November, with the last score taken just before harvest. Lodging was scored on a scale of 0 to 9, with 0 indicating no lodging and 9 flat on the ground (Figure 3).

The first lodging score was taken on the 8th October, with no lodging recorded.

The second score was taken on the 20th October, with a few of the TOS 1 pre-drill and post N treatments starting to lodge. A third lodging score was taken on 12th November with much the same trend.

The final and most significant lodging score taken at harvest (Figure 3).

There was an effect of time of sowing on lodging, where the average lodging score for TOS 1 was 1.6, and for TOS 2 was 0.05, ie there was greater lodging when sowing early.

There was an interaction of variety and nitrogen timing on lodging. Interestingly most varieties at TOS 1 showed more lodging when the nitrogen was applied later in the season. Some varieties such as Spitfire showed a different trend of lodging more when all nitrogen was applied at sowing.

There was a three way interaction of variety x nitrogen timing x sowing date (Figure 3), however this interaction is very complex and difficult to explain.

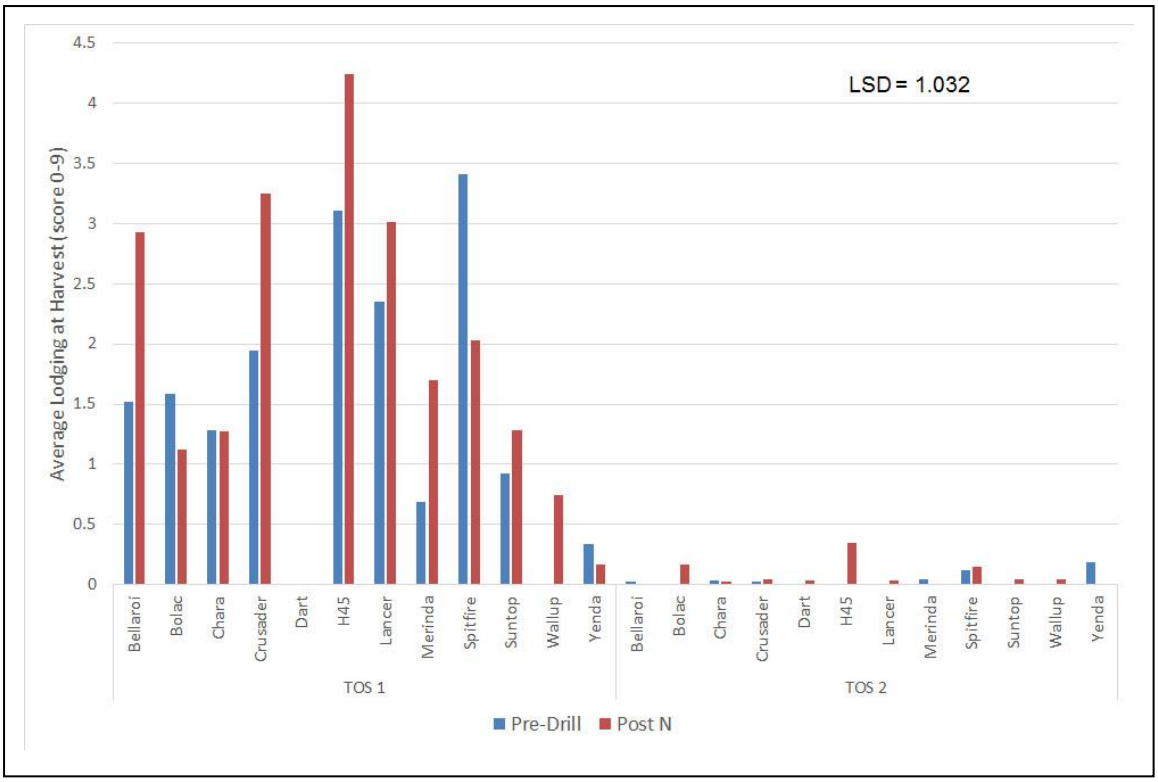

Figure 3: Average lodging scores taken at harvest for each TOS and for each nitrogen treatment

Grain yield ranged from 4.6 t/ha to 9.44 t/ha, averaging 7.59 t/ha for TOS 1 and 7.01 t/ha for TOS 2 (Figure 4). For TOS 1, the pre-drilled nitrogen treatment yields ranged from 5.72 t/ha for Crusader to 9.44 t/ha for Chara. For the post sowing nitrogen treatment yields ranged from 6.5 t/ha for Chara to 8.77 t/ha for Suntop. For TOS 2, the pre-drilled nitrogen treatment yields ranged from 4.6 t/ha for Yenda to 8.55 t/ha for H45. For the post sowing nitrogen treatment yields ranged from 4.82 t/ha for Yenda to 8.15 t/ha for Dart.

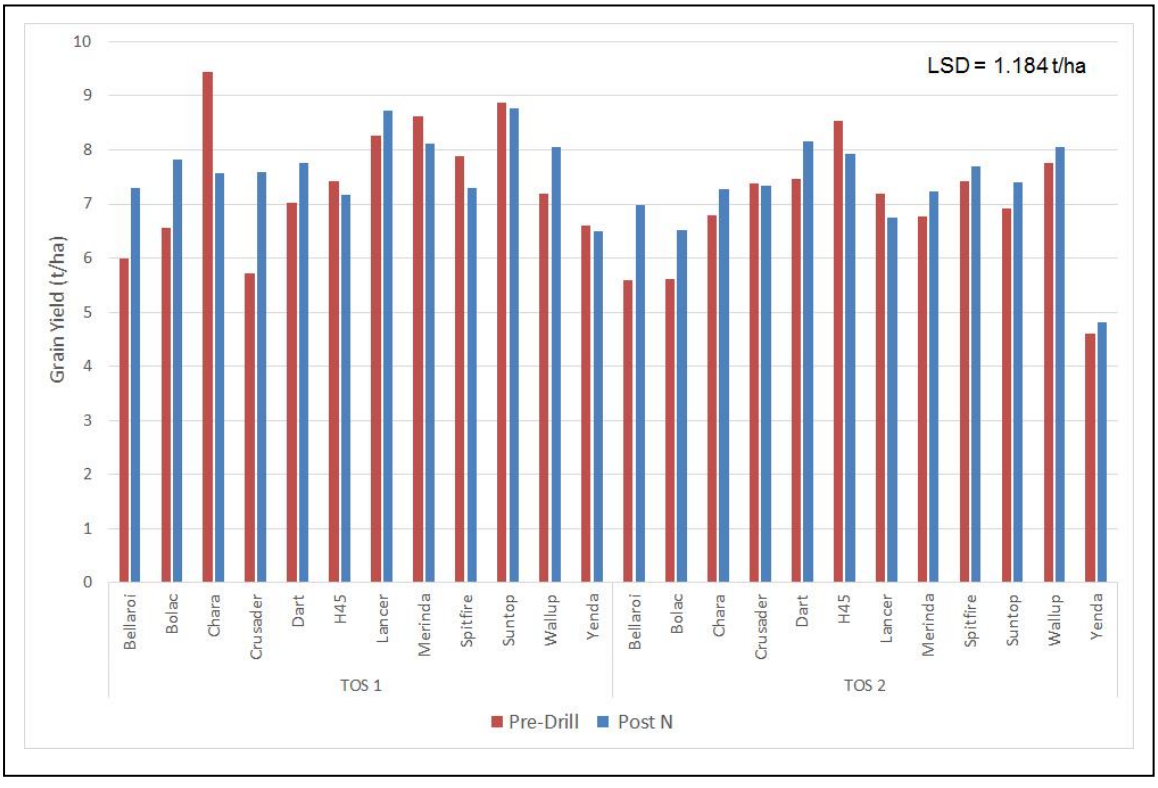

Figure 4: Average grain yield for each TOS and for each nitrogen treatment

Sowing date had the greatest impact of varietal performance in this trial. Varietal performance was closely correlated to phenology, i.e. longer season varieties such as Bolac, Chara, Lancer, Merinda and Yenda were higher yielding at TOS1 than TOS 2. Conversely, faster maturing varieties such as Crusader, Dart and H45 yielded higher at TOS 2. The remaining varieties were less affected by sowing date.

Nitrogen timing was also a key factor in maximising yield. Where all nitrogen was pre-drilled the variety Chara yielded higher than when the nitrogen was applied post sowing. The varieties Bellaroi, Bolac, Crusader, Dart and Wallup all yielded higher where nitrogen was applied post sowing (Figure 5).

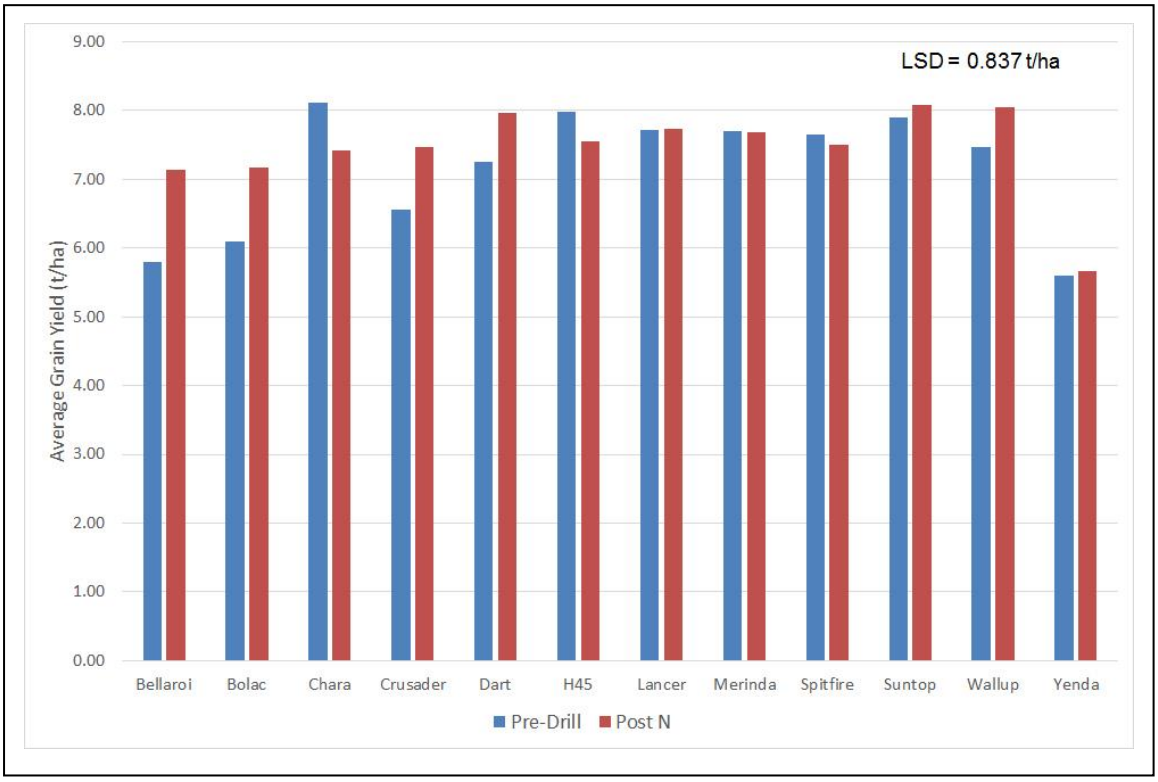

Figure 5: Grain yield for each nitrogen treatment when averaged across both sowing dates.

Summary

This trial showed that variety choice is one of the key factors for producing high yielding irrigated wheat, and the resistance to lodging was a key factor determining yield within each variety.

Chara showed that it is a superior variety on irrigation when sown early, out yielding all other varieties in this trial. This was followed by Suntop, Lancer and Merinda which also performed well, with good resistance to lodging. The varieties H45, Wallup and Dart performed well at TOS 2, which is expected given their faster maturity.

The other important treatment in this trial was nitrogen application timing, however given the high starting N level in the soil the effect may have been lower than usually expected. Applying all the nitrogen at sowing as opposed to applying all the nitrogen after sowing (split 1st node and start of flowering) had an impact on lodging, particularly at TOS 1 in varieties like Bolac and Bellaroi which have a tendency to produce a large biomass which in turn promotes lodging and reduces yield.

Acknowledgements

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