Irrigated Durum Agronomy 2016

The aim of the trial is to examine various treatments that may assist in ensuring high protein, high yielding durum wheat on irrigation.
The key to successful durum production is grain quality – greater than 13% protein as well as grain colour and vitreous kernel requirements.
The trial examined several aspects of durum agronomy that may impact yield and grain quality.

Rancona Dimension Seed Dressing
Durum wheats are particularly sensitive to crown rot, a stubble borne disease. Crown rot has occurred every so often on the Trial Block, in particular where we grew 4 years of continuous wheat as part of a crop sequencing trial. From the sequencing trial results, one season of a non-cereal crop reduced the amount of crown rot significantly, unlike dryland situation where stubble residues can take two or more seasons to degrade. While rotation would be the first strategy to combat crown rot, an alternative is to use a seed dressing.
Arysta LifeSciences has a seed dressing registered for the suppression of crown rot and other fungal disease in the cereals. For more information, go to the Arysta LifeSciences website at: http://www.arystalifescience.com.au/products/seed-treatments/rancona-dimension.

Varieties
There are several durum varieties available. Some have proved to be high yielding, while others have had poor stem strength and lodged under irrigated conditions. DBA Aurora is a recent release, and topped the 2014 Griffith NVT trial at 8.95 t/ha and the seed for the trial was supplied by the South Australian Durum Growers Association. All treatments have been applied to Aurora, with Caparoi included to provide a yield comparison.

Micro-nutrients
In discussion with the SADGA, and previous work by Barry Haskins (ex-NSW DPI at Hay), there seems to be an interaction between some of the micro-nutrients and the ability of the plant to shift the N contained in the plant to the developing seed so as the meet the 13% protein requirement. Possible micro-nutrients that may assist N transport include calcium, sulphur and zinc.
Gypsum (Ca and S) was applied to the trial site prior to sowing at 2.5 t/ha.
Zinc was applied as a foliar spray at booting as TimacAgro “Vital” at 3.0 l/ha.
Vital has a range of macro and micro-nutrients in it (N, P, K, B, Cu, Fe, Mn, Mo and Zn) as well *as “Seactiv® patented complex” to improve uptake and distribution throughout the plant* (from the Vital brochure).
A general micro-nutrient spray (S, Ca, Mg, Mn, Fe, Cu, Zn, Mo and B are listed) was applied as a separate treatment on August 8th.

Nitrogen Management
Growing high yielding cereals requires large amounts of nitrogen to produce high grain protein. We have tried various strategies based on the assumption of durum wheat requiring 50 kg N/t (compared with APW at 40 kg N/t):

1. Standard: N applied throughout the season, starting late tillering, aiming to maximise yield.

2. Late N: A late application at head emergence aiming to increase grain protein.
3. High N: Similar to the standard, but at higher rates to ensure an adequate supply of N.

Figures are kg N/ha	Standard N	Late N	High N
Soil N	40	40	40
Mineralisation	100	100	100
Starter	20	20	20
TD1 19/07/2016	80	80	80
TD2 9/08/2016	80	50	80
TD3 29/08/2016	30	30	80
TD4 20/09/2016		80	
Fertiliser N (St + TD)	210	260	260
Total N	350	400	400

Target yield was 7 t/ha.

Plant Growth Regulator

Some durum varieties tested in the past have lodged badly. Aurora was grown for the first time at the Trial Block in 2015 and so Aurora's resistance to lodging was unknown to us. At harvest, the only Aurora plots still standing were those treated with a PGR (Moddus Evo, trinexapac-ethyl) and with a subsequent yield increase. So in 2016, all plots were sprayed with Moddus Evo at 400 ml/ha at Z31 and one treatment received a second application of 200 ml/ha at Z39.

Sowing Rates

One method of increasing grain protein is to limit early growth so as to leave more N for the plant later in the season, which is more of a dryland strategy. Instead of sowing at 144 kg/ha to achieve 175 plants/m^2 (the seed was very large at 57 g/1000 seeds), the "low sowing rate" was sown at 75% or 108 kg/ha.

The trial was sown on May 6th following pre-irrigation. The trial received the PGR Moddus Evo at Z31 or 1st node. Although there was little foliar disease, the trial received a foliar fungicide at full flag emergence (Z39).
The trial was irrigated once in spring in mid-October.
The trial was harvested on December 7th.

DBA Aurora out yielded Caparoi by nearly 1.0 t/ha (7.43 t/ha vs 6.47 t/ha)

Below are the results of the treatments applied to DBA Aurora.

Treatment	Yield t/ha	Protein %	Screenings %	Test Wt kg/hl
Late N	7.96^{a}	14.2^{ab}	0.8	82.6
Low Sowing Rate	7.85^{ab}	13.3^{c}	0.8	82.3
Vital	7.73^{ab}	13.0^{c}	0.9	83.4
Trace Elements	7.65^{ab}	13.4^{bc}	0.8	83.8
Aurora Control	7.47^{ab}	13.4^{bc}	0.9	82.0
High N	7.26^{bc}	14.3^{ab}	1.0	81.7

Rancona Dim SD	7.22[bc]	13.8[abc]	0.8	82.6
Moddus Z31 &39	6.66[c]	14.6[a]	0.9	83.1
p	0.012	0.02	0.783	0.101
lsd	0.67	0.905	NS	NS
cv%	9.90	4.0		

The single application of the PGR Moddus Evo was enough to prevent lodging, while the second application decreased yield. The second application of the PGR did increase grain protein, but this is most likely due to less “dilution” in the grain due to lower yield.
The “High N” and “Late N” treatments, which received an extra 50 kg N/ha above all other treatments, did result in higher grain protein than the control. However, if you calculate the amount of protein produced per hectare (grain yield x grain protein), all treatments apart from “Late N” produced similar protein/ha results.

Yield was maximised by the late application of N at head emergence, but was not significantly different to that of the control.
Trace element applications or the use of Rancona Dimensions did not change the yield or grain quality from that of the control.

The N budget was calculated assuming a 7 t/ha yield and an N requirement of 50 kg N/tonne of grain. This was based on last year’s trial results where we just failed to meet the 13% protein level using 40 kg N/t as the requirement. Fertiliser N seems to be more inefficient at being converted to yield and protein compared with soil N and also as you try and push for higher protein. 50% efficient (i.e. half of what is available ends up in the grain) is regarded as about the average, with a range that varies between 30 and 90% depending on source (soil or fertiliser), N status of the plant or soil or even varietal differences. The other part of the N budget is an estimate of mineralisation – we worked on 100 kg N/ha being released from the breakdown of the faba stubble. But until harvest, this was a guess. Post-harvest calculations form the various cereal trials seem to back this estimate up, with the fabas providing between 100 and 125 kg N/ha.

What does it mean?
Durum wheat can be grown under irrigation, but the N requirement is quite high. Growing durum after a legume makes sense due to the N contribution of the stubble and the disease break. Erring on the side of “a bit extra” N is cheap insurance compared to missing out on durum spec and having the grain relegated to feed quality.
Applying N “late” at head emergence can increase grain protein.
One feature of clay soils is their ability to have a broad range of nutrients available in their profiles. Micro-nutrient deficiencies are far more common on lighter sandy soils.