Irrigation Research & Extension Committee

IREC Irrigated Durum Trial 2022

Agriculture Trials with an Agronomic Focus

The aim of this trial is to determine the fit for Plant Growth Regulators on Durum wheat sown in a double cropping scenario behind cotton.

Optimising Irrigated Grain

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

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Project Manager: Emma Ayliffe **Date Submitted:** March 2023

Introduction:

With increasing disease pressure in high value summer crops like cotton, reliance on winter cereal production in irrigated row cropping systems are increasing. Winter cereals have a flexible fit for our cropping systems as management levers can be manipulated to influence yield and quality in response to the volatile water market and seasonal conditions. In recent seasons with full water allocation, growers have looked to capitalise on surplus water by increasing production of their winter cereals. This has driven the need for greater understanding of yield drivers for cereal crops in an irrigated row cropping system, partially behind summer crops.

There are several management considerations to be made when producing high yielding winter cereal crops such as irrigation input and timing, nitrogen management, quality, and lodging management. Lodging management has been identified as a major limitation to production as head loss and crop lodging significantly reduce yield. This issue is also more pronounced in a row cropping system, where lodged crop in the furrows is unrecoverable at harvest.

There are several factors that influence a crops susceptibility to lodging. Crops that accumulate a lot of biomass early in the season and have a high tiller density are susceptible to lodging, hence anything that promotes excessive biomass in the crop can increase lodging risk. Variety can have a large influence as there is variation is straw strength, height, early vigour, and biomass between varieties. Sowing date will influence the amount of biomass and tiller number in the crop, prior to reproductive development. Nitrogen input and timing will influence tiller density and where the yield components are being attributed e.g. Head number, grain number, grain size. There are also environment influences that will influence lodging, such as irrigation and high winds during grain fill.

Table 1: Table demonstrates the agronomic influences that increase and decrease the risk of a crop lodging.

Decreased Risk of lodging	Increased risk of Lodging
Low soil nitrogen at planting <50kg N/ha	High soil nitrogen at planting >120kg N/ha
Crop is planted in or after the planting window	Crop is planted before the planting window
Crop is sown at <80kg seed/ha	Crop is planted at >100kg seed/ha
Variety has good straw strength and standability	Variety is susceptible to lodging
Nitrogen is applied to the crop after first node (Z31)	Nitrogen is applied early to the crop, during tillering.
<200kg N/ha are applied to the crop.	<300kg N/ha are applied to the crop.
<650 tiller/m2 in the crop.	>800 tiller/m2 in the crop

Where there are several factors increasing the risk of lodging in a crop, PGR should be used to manipulate the development of the crop and reduce the risk of lodging and head loss. PGR's are typically applied at 1st node so these factors need to be identified prior to 1st node to ensure timely application. Refer to product labels for specific application guidelines.

Aim:

The purpose of this experiment was to apply Plant Growth Regulators (PGRs) to a high input durum wheat crop to understand the impact of PGRs on standability and grain protein. The trial also included a variety split within a field to understand the interaction between durum wheat varieties.

Background & Methodology:

Durum wheat was sown into an ex-cotton field on 23 May 2022. Seasonal conditions and timely sowing put this crop in a high potential situation for the grower to achieve high yields. Initial N budgets were in the realm of 500 kg/ha urea applied and as such was identified as an ideal crop to test PGRs.

Once the crop reached Z31 (first node detectable), 0.2L Moddus Evo and 1L Errex were applied by aerial application in the replicated configuration shown in figure 1.

Figure 1. Trial Design

	DBA Mataroi						DBA Vittaroi					
	-PGR	+PGR	+PGR	-PGR	-PGR	+PGR	+PGR	-PGR	-PGR	+PGR	+PGR	-PGR
Swath Width (m)	24	24	24	24	24	24	24	24	24	24	24	24
Replicate	1	1	2	2	3	3	1	1	2	2	3	3
Plot Number	101	102	103	104	105	106	107	108	109	110	111	112

To quantify the influence of the PGR application the crop was assessed at harvest for:

- Plant height
- Tiller number
- Harvest Index
- Yield (both hand harvest and yield map)
- Grain Quality (Protein, Test Weight, 1000 Grain Weight)

Results:

Mataroi saw a 2% increase in harvest index with the application of PGR at Z31, whereas Vittaroi saw a slight reduction in harvest index with the application of PGR. Due to the poor grain fill period last season the harvest index was very low indicating that the crop struggled to convert biomass into grain. Plant height was not influenced by PGR application, however, Mataroi was 16cm taller on average than Vittaroi, a varietal trait that in another season has the potential to lodge. There was no influence on tiller number as a result of PGR application.

Yield data from harvest index cuts and header yield maps showed no yield response between variety or PGR application. Similar to yield there was no significant difference between treatments for protein %. The best treatment was Vittaroi with the PGR application achieving 11.35%, which almost met the 11.5% cut off for DR2, the other treatments fell short. Vittaroi achieved a higher 1000 grain weight than Mataroi but there was no influence from the PGR treatments.

Table 2. Average tiller counts, plant heights and calculated harvest index for each treatment

Trt No.	Treatment Name	Harvest Index %	Tiller Count per m2	Plant Height cm	
1	Mataroi +PGR	32.77	362.93	93.83	a
2	Mataroi -PGR	30.73	414.93	94.5	a
3	Vittaroi +PGR	28.77	402.67	77.27	b
4	Vittaroi -PGR	30.4	382.13	78.37	b
LSD P=.05		2.702	105.924	4.996	
Treatment Prob(F)		0.0577	0.6606	0.0002	

Table 3. Average grain yield (from HI cuts and yield maps), protein, test weight and 1000 grain weight for each treatment

Trt No.	Treatment Name	Grain Yield (HI Cut) t/ha	Grain Yield (Header) t/ha	Grain Protein %	Test Weight kg/hl	1000 Grain Weight g
1	Mataroi +PGR	6.263	6.19	10.203	74.33	46.897
2	Mataroi -PGR	6.59	6.46	11.123	74.5	47.577
3	Vittaroi +PGR	6.723	6.46	11.35	76.63	49.583
4	Vittaroi -PGR	6.883	6.26	10.49	74.63	49.923
LSD P=.05		3.0597	0.585	1.4271	9.822	2.5896
Treatment Prob(F)		0.9636	0.614	0.2686	0.9295	0.0721

Conclusion:

Overall the durum trial showed no significant yield or protein changes from the application of PGRs at Z31. It showed the difference in variety height suggesting that Mataroi is a good candidate for PGR application to reduce lodging in a situation where soil constraints are not limiting. PGR applied to Vittaroi showed a 'slight' increase in protein and test weight almost pushing it into DR2 grade.

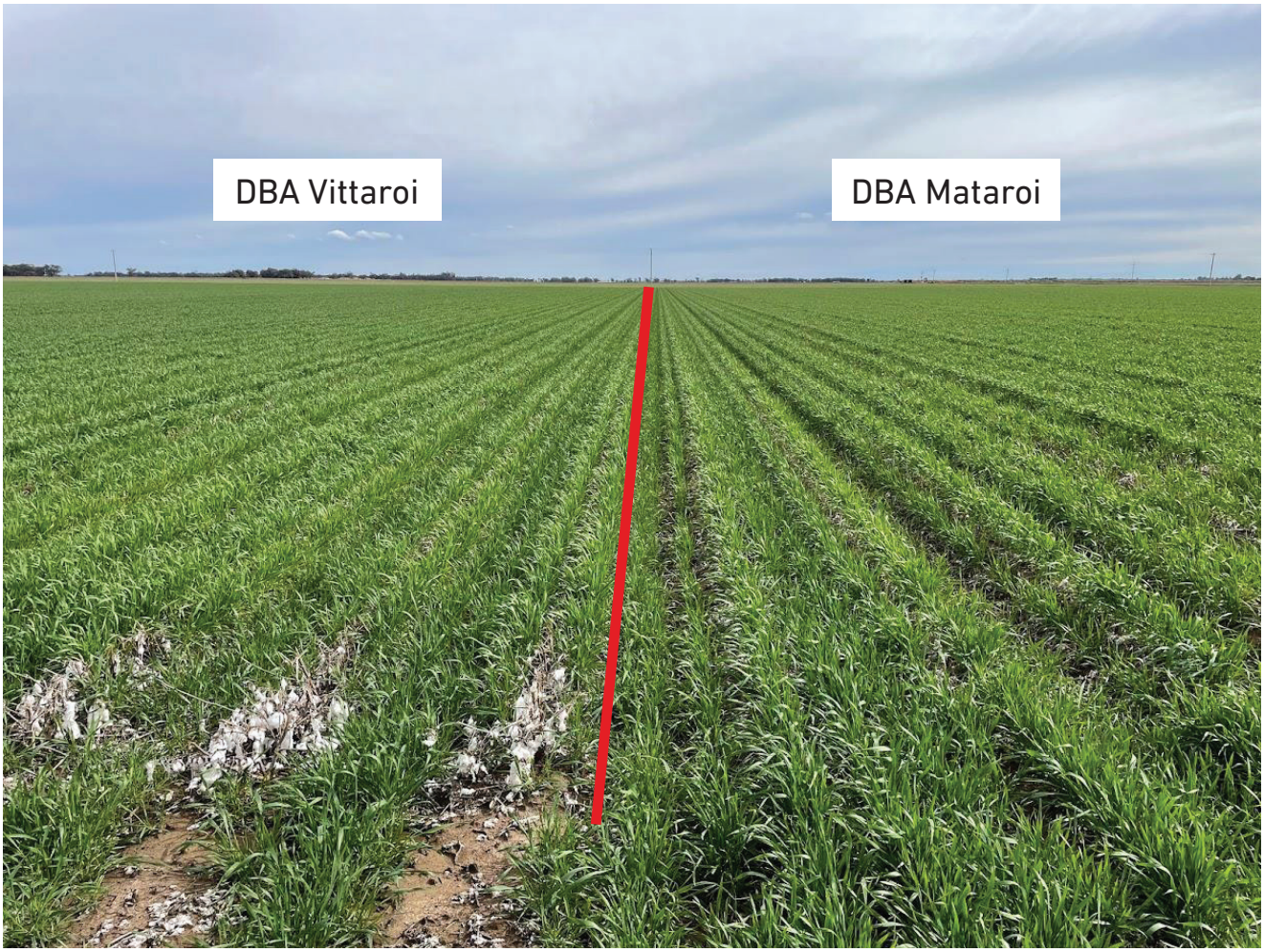

Figure 2. DBA Vittaroi (left) and DBA Mataroi (right) at Z31 just prior to PGR application.

Figure 3. Both varieties at Z31 (first node detectable) and expressing an early infection of stripe rust

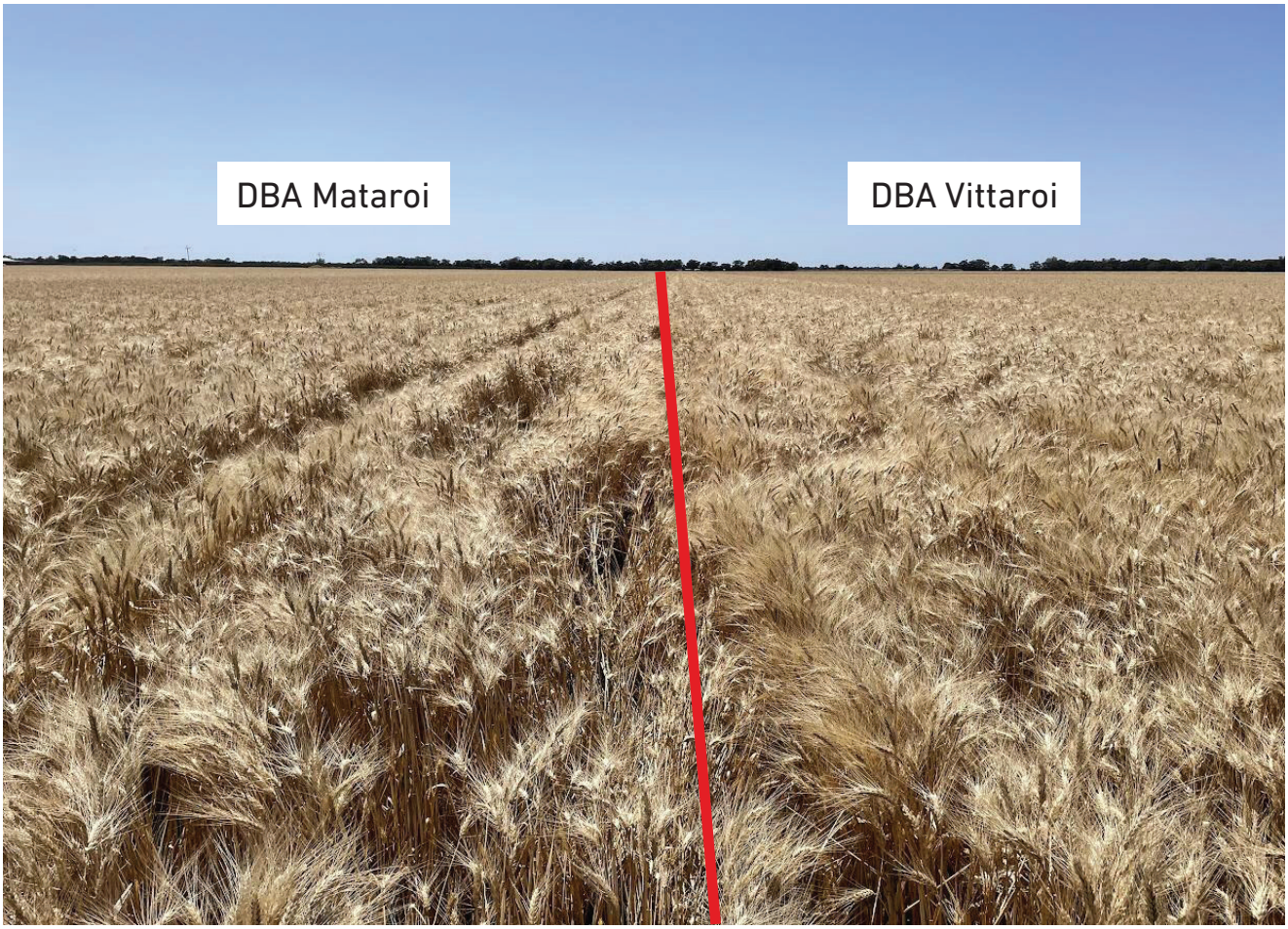

Figure 4. Both varieties at harvest. DBA Mataroi standing on average 16cm taller than DBA Vittaroi

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IREC Durum Trial 2022

Trial ID:IREC Durum Trial 2022
Protocol ID:IREC Durum Trial 2022 Location: Trial Year:2023
Project ID: Project ID 2: Project ID 3:
Study Director: Sponsor Contact:
Investigator (Creator):Hayden Petty

SE Description Part Rated Rating Type Rating Unit/Min/Max Number of Subsamples		havest index % 1	Number of tille> TILLER, - COUNT NUMBER, -, - 1	Plant Height in> PLANT, - HEIGHT CM, -, - 1	Grain yield in > GRAIN, - WEIFRE KG, -, - 1	% protein conte> GRAIN, - CONPRO %, 0, 100 1	Test Weight - G> GRAIN, - WEITES LB, -, - 1	1000 grain weig> GRAIN, - TGW G, -, - 1
Trt No.	Treatment Name	1*	2*	3*	4*	5*	6*	7*
1	Mataroi PGR	32.77-	362.93-	93.83a	6.263-	10.203-	74.33-	46.897-
2	Mataroi Nil	30.73-	414.93-	94.50a	6.590-	11.123-	74.50-	47.577-
3	Vitaroi PGR	28.77-	402.67-	77.27b	6.723-	11.350-	76.63-	49.583-
4	Vitaroi Nil	30.40-	382.13-	78.37b	6.883-	10.490-	74.63-	49.923-
LSD P=.05		2.702	105.924	4.996	3.0597	1.4271	9.822	2.5896
Standard Deviation		1.352	53.018	2.501	1.5315	0.7143	4.916	1.2962
CV		4.41	13.57	2.91	23.15	6.62	6.55	2.67
Grand Mean		30.667	390.667	85.992	6.6150	10.7917	75.025	48.4950
Levene's F^		0.08	0.678	0.402	0.665	0.282	0.562	0.937
Levene's Prob(F)		0.969	0.59	0.756	0.596	0.837	0.655	0.466
Rank X2		.	.	.	.	.	.	.
P(Rank X2)		.	.	.	.	.	.	.
Skewness^		-0.0158	-0.2962	0.4839	-0.3467	-0.2727	-0.8104	-0.1563
P(Skewness)^		0.9828	0.6865	0.5123	0.6371	0.71	0.2809	0.8309
Kurtosis^		-1.4868	0.1454	-0.8466	0.4344	-0.9156	-0.0615	0.8858
P(Kurtosis)^		0.3049	0.9181	0.5525	0.7591	0.5212	0.9653	0.5346
Analyzed as		RCB	RCB	RCB	RCB	RCB	RCB	RCB
Replicate F		0.663	0.195	2.933	0.531	0.254	0.090	1.637
Replicate Prob(F)		0.5492	0.8279	0.1293	0.6133	0.7834	0.9151	0.2707
Treatment F		4.426	0.560	42.883	0.089	1.683	0.145	3.942
Treatment Prob(F)		0.0577	0.6606	0.0002	0.9636	0.2686	0.9295	0.0721

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).
Mean separations are based on the complete error term.
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
^Calculated from residual.

SE Description	Grain Yield hea>
Part Rated	GRAIN, -
Rating Type	WEIFRE
Rating Unit/Min/Max	KG, -, -
Number of Subsamples	1
Trt No. Treatment Name	8*
1 Mataroi PGR	6.193-
2 Mataroi Nil	6.460-
3 Vitaroi PGR	6.457-
4 Vitaroi Nil	6.263-
LSD P=.05	0.5854
Standard Deviation	0.2930
CV	4.62
Grand Mean	6.3433
Levene's F^	0.458
Levene's Prob(F)	0.719
Rank X2	.
P(Rank X2)	.
Skewness^	-0.585
P(Skewness)^	0.4304
Kurtosis^	0.4087
P(Kurtosis)^	0.7729
Analyzed as	RCB
Replicate F	2.115
Replicate Prob(F)	0.2017
Treatment F	0.645
Treatment Prob(F)	0.6141

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).
Mean separations are based on the complete error term.
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
^Calculated from residual.

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Investigator (Creator):Hayden Petty

SE Description			havest index	Number of tille>	Plant Height in>	Grain yield in >	% protein conte>	Test Weight - G>	1000 grain weig>
Part Rated				TILLER, -	PLANT, -	GRAIN, -	GRAIN, -	GRAIN, -	GRAIN, -
Rating Type			%	COUNT	HEIGHT	WEIFRE	CONPRO	WEITES	TGW
Rating Unit/Min/Max				NUMBER, -, -	CM, -, -	KG, -, -	%, 0, 100	LB, -, -	G, -, -
Number of Subsamples			1	1	1	1	1	1	1
Trt No.	Treatment Name	Plot	1	2	3	4	5	6	7
1	Mataroi	102	32.00	390.40	97.50	8.360	11.090	78.50	48.910
	PGR	103	34.00	372.00	90.40	4.410	9.130	68.30	44.010
		106	32.30	326.40	93.60	6.020	10.390	76.20	47.770
		Mean =	32.77	362.93	93.83	6.263	10.203	74.33	46.897
2	Mataroi	101	29.40	409.60	95.00	4.560	10.460	67.00	47.300
	Nil	104	30.50	426.40	92.30	7.340	11.200	78.20	47.640
		105	32.30	408.80	96.20	7.870	11.710	78.30	47.790
		Mean =	30.73	414.93	94.50	6.590	11.123	74.50	47.577
3	Vitaroi	107	29.20	455.20	78.20	7.710	11.810	77.00	49.090
	PGR	110	29.20	333.60	72.60	5.750	11.120	76.30	49.500
		111	27.90	419.20	81.00	6.710	11.120	76.60	50.160
		Mean =	28.77	402.67	77.27	6.723	11.350	76.63	49.583
4	Vitaroi	108	29.80	338.40	79.50	6.950	10.300	75.70	49.710
	Nil	109	29.10	453.60	78.90	6.390	10.890	75.80	49.120
		112	32.30	354.40	76.70	7.310	10.280	72.40	50.940
		Mean =	30.40	382.13	78.37	6.883	10.490	74.63	49.923

SE Description			Grain Yield hea>
Part Rated			GRAIN, -
Rating Type			WEIFRE
Rating Unit/Min/Max			KG, -, -
Number of Subsamples			1
Trt No.	Treatment Name	Plot	8
1	Mataroi	102	6.680
	PGR	103	5.770
		106	6.130
		Mean =	6.193
2	Mataroi	101	6.190
	Nil	104	6.410
		105	6.780
		Mean =	6.460
3	Vitaroi	107	6.740
	PGR	110	6.140
		111	6.490
		Mean =	6.457
4	Vitaroi	108	6.520
	Nil	109	6.130
		112	6.140
		Mean =	6.263