Irrigation Research & Extension Committee

IREC Irrigated Barley Trial 2022

Agriculture Trials with an Agronomic Focus

Optimising Irrigated Grain

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

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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 as 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 aim of the trial was to assess the influence of PGR and nitrogen rates on the standability, head loss and yield of an irrigated barley crop. We also wanted to observe the fit for PGR's in a later planted crop with perceived yield limitations due to season length.

Background:

The trial was conducted on a full field scale. The barley was direct drilled into the existing hills after cotton was harvested in the field. The field was planted to Baudin barley on the 25th of July and watered up on the 1st of August. Field was planted at 100kg seed and 70kg MAP. A blanket rate of 150kg of urea was applied to the field at late tillering.

Treatments:

Table 2: Varies treatments applied in the trial. Red cross indicating the treatments that were not applied.

Control	Promote @ Z31	~~Promote @ Z37~~	Moddus Evo @ Z31	~~Moddus Evo @ Z37~~
REP 1				

The original trial design consisted of Promote and Moddus treatments at Z31 and Z37. Unfortunately, due to continued rain through the end of winter and Spring, the Z37 treatment were not applied as the crop passed the Z37 growth stage during a period of intense wet weather. We also had ambitions to apply three different nitrogen treatments to the trial, but the nitrogen application was also abended due to rain delay.

Photo 1: Barley established at 3 leaf growth stage pre mulching.

Photo 2: Trial at Z31 1st node. This was the growth stage timing for the PGR treatments.

Photo 3: Control plot Z83

Control

Photo 4: Control plots demonstrating good standability and minimal head loss.

Promote Z31

Photo 5: Promote treatment, some lodging evident.

Moddus Z31

Photo 6 Moddus Treatment, good standability.

Results:

The purpose of the barley trial was to observe the influences of growth regulators, applied at different growth stage timing on late planted barley under different nitrogen programs. Management of cereal crops that are planted in their required planting window has been well documented, so we wanted to see how we could manipulate the management of late planted barley to maintain yield and quality. Late planted cereals is a common issue when planting cereals in wet seasons and behind summer crops.

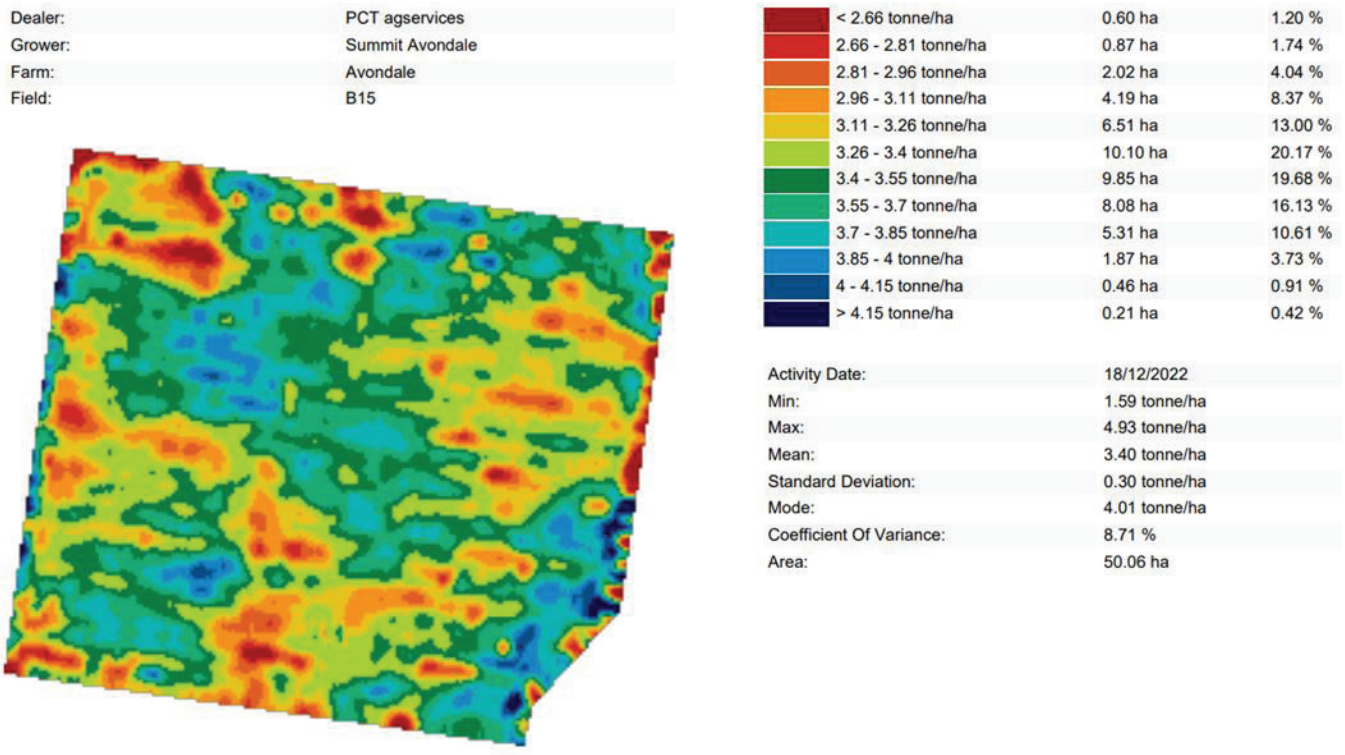
Our initial aims were to apply three different nitrogen treatments all at 1st node (Z31) and two application timings of growth regulator, at 1st node (Z31) and flag tip emergence (Z37). Due to the wet weather the nitrogen treatments the Z37 growth regulator treatments were not applied. This was disappointing as the PGR's at this later timing are targeted at mitigating head loss in the crop, which is an issue commonly observed with barley.

Table 1: Table explains the variations in tiller density, lodging and yield between different treatments.

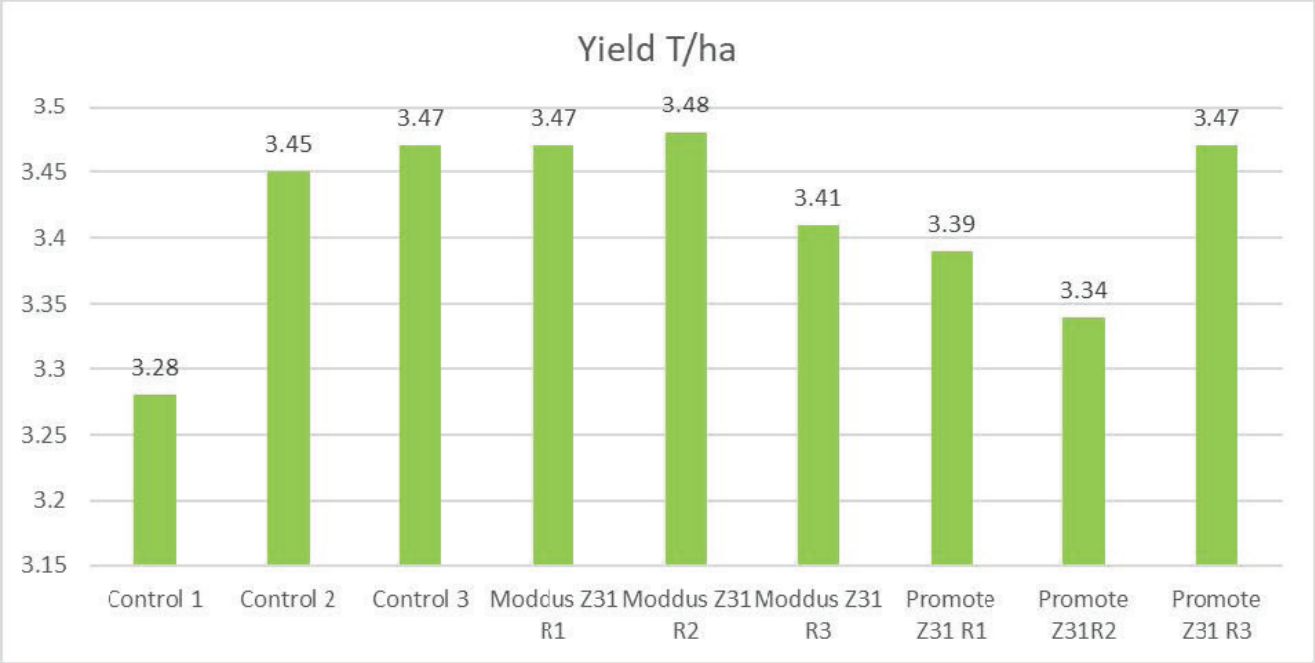
	Control	Promote Z31	Moddus Z31
Tillers/m2	612	800	524
Lodging	2.67%	4.33%	3.67%
Yield T/ha	3.4	3.4	3.45

The above table demonstrates that the growth regulator treatments did not improve yield or minimise lodging losses, although the lodging losses were minimal in the demonstration. It's also interesting to note that as the tillers/m2 increased so did the lodging losses. Typically, cereal fields with over 800 tillers/m2 are at risk of having significant lodging loss and plant growth regulators and nitrogen managementt should be implemented to mitigate these losses.

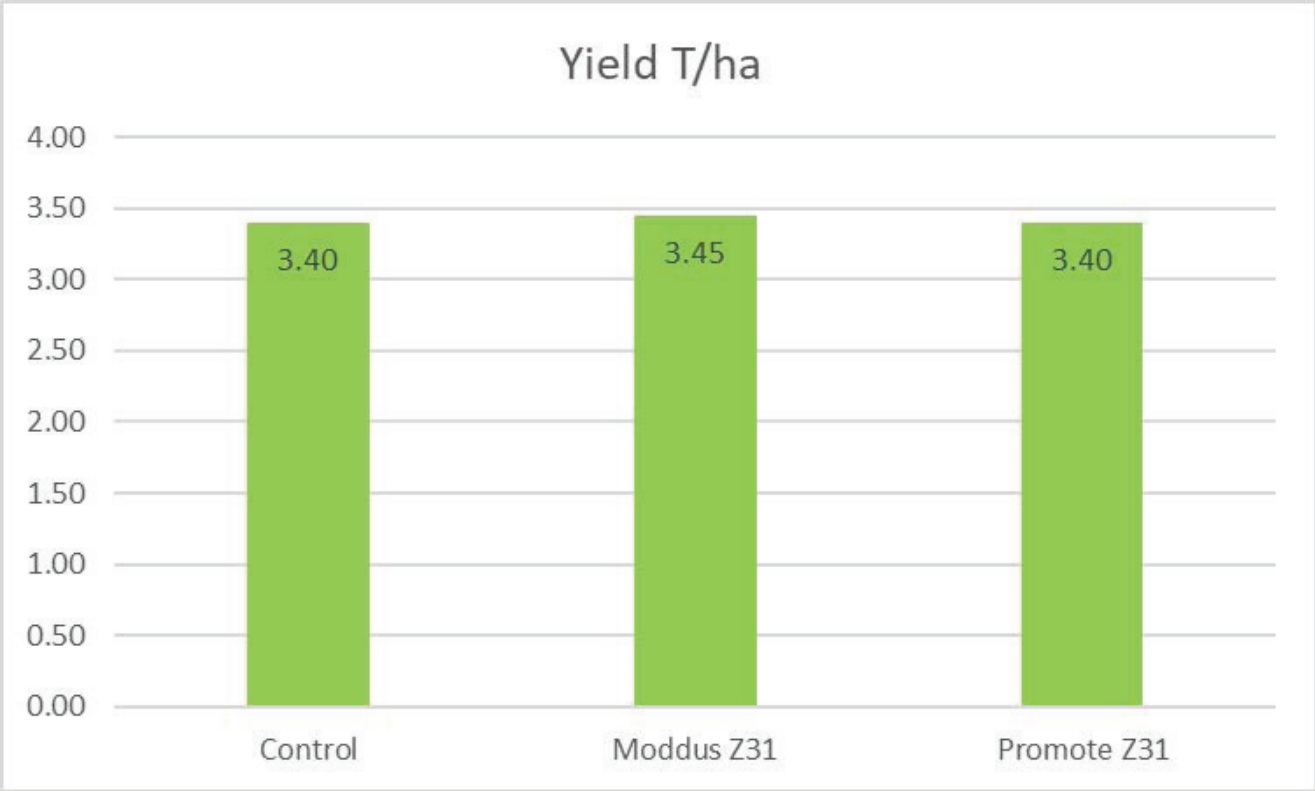
Yield



The above map shows the yield from the trial. The treatments where applied left to right across the field. The treatments were replicated three times. There is no yield variation between the treatments as indicated by the yield map.



Graph 1: Yield per each rep, indicating variability between reps.



Graph 2: Average yield for the three treatments. Little variability between treatments.

Conclusion:

Unfortunately, due to bad weather the full potential of the trial was not fulfilled as the late treatment timings where not applied. The later application of PGR would assist with mitigating head loss which is an issue commonly observed in high yielding barley crops. Due to extreme rainfall the trial was water logged for large durations of the season, particularly through critical growth stages, flowering and through grain fill. The over all yield of the trial was dramatically affected by the adverse climatic conditions, hence the trial did not reach the anticipated yield potential when lodging and head loss is commonly observed. When cereal crops begin to exceed 7T/ha, the risk of lodging affecting potential yield increases dramatically. There was no variability between the two applied treatments and the control. There was variation in tiller density between the treatments with the promote treatments having a higher tiller density then the control and moddus treatments. This resulted in more lodging in the moddus treatments and the growth regulator treatments ineffective in reducing the lodging.

GPR are a tool that can be used to manipulate the canopy of a cereal crop to reduce the risk of lodging and head loss. There was no benefit from applying PGR's in this circumstance but given more favourable seasonal conditions and a higher yielding crop benefits in harvestability and yield may have been observed.

Appendix

Yield by Treatment Analysis

This table shows the yield performance for each treatment.

Treatment	Area [ha]	Minimum [tonne/ha]	Mean [tonne/ha]	Maximum [tonne/ha]	SD [tonne/ha]	CV [%]	DMRT
Control 01 R01	1.55	2.30	3.28	3.95	0.33	9.94	a
Control 03	1.55	1.59	3.45	4.32	0.32	9.30	a
Control R02	1.56	2.12	3.47	4.13	0.25	7.18	a
Moddus Z31 R01	1.57	2.66	3.47	4.10	0.29	8.35	a
Moddus Z31 R02	1.56	2.58	3.48	4.43	0.21	5.91	a
Moddus Z31 R03	1.56	2.53	3.41	3.93	0.30	8.65	a
Moddus Z37 R01	1.56	1.97	3.36	4.00	0.31	9.16	a
Moddus Z37 R02	1.56	2.50	3.29	4.12	0.35	10.61	a
Moddus Z37 R03	1.56	2.64	3.39	3.92	0.27	7.95	a
Promote Z31 R01	1.57	1.92	3.39	4.06	0.40	11.85	a
Promote Z31 R02	1.56	2.37	3.43	3.95	0.21	6.23	a
Promote Z31 R03	1.56	1.82	3.47	4.01	0.25	7.14	a
Promote Z37 R01	1.56	2.06	3.43	3.99	0.27	7.88	a
Promote Z37 R02	1.56	2.10	3.36	3.93	0.30	8.80	a
Promote Z37 R03	1.56	2.69	3.46	4.04	0.24	6.82	a

SD 0.06 tonne/ha CV 1.83 % 5% significance level P-value 0.00

Treatments with the same DMRT letter do not significantly differ.

Summit Ag

IREC Barley PGR 2022

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

SE Description		Tillers per m2	Lodging assessm>	Yield t/ha
Trt No.	Treatment Name	1*	2*	3*
1	Control	612.00006120b	2.7-	4.133-
2	Promote Z31	800.44452451a	4.3-	4.007-
3	Moddus Evo Z31	524.44449688b	3.7-	4.153-
LSD P=.05		105.896879830	7.09	0.4763
Standard Deviation		46.713208997	3.13	0.2101
CV		7.24	87.95	5.13
Grand Mean		645.629694196	3.56	4.0978
Levene's F^		0.512	0.766	0.182
Levene's Prob(F)		0.623	0.506	0.838
Rank X2		.	.	.
P(Rank X2)		.	.	.
Skewness^		0.1719	0.3495	0.1876
P(Skewness)^		0.8416	0.6856	0.8273
Kurtosis^		-0.3434	-0.5248	-1.2677
P(Kurtosis)^		0.8379	0.755	0.4577
Replicate F		5.545	2.193	0.308
Replicate Prob(F)		0.0703	0.2275	0.7507
Treatment F		27.348	0.216	0.430
Treatment Prob(F)		0.0046	0.8146	0.6775

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means

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SE Description			Tillers per m2	Lodging assessm>	Yield t/ha
Trt No.	Treatment Name	Plot	1	2	3
1	Control	101	700.00007000	2.0	3.950
		203	566.66672337	5.0	4.130
		302	569.33339023	1.0	4.320
		Mean =	612.00006120	2.7	4.133
2	Promote Z31	102	822.66674897	7.0	4.060
		201	716.00007160	4.0	3.950
		303	862.66675297	2.0	4.010
		Mean =	800.44452451	4.3	4.007
3	Moddus Evo Z31	103	596.00005960	1.0	4.100
		202	456.00004560	10.0	4.430
		301	521.33338543	0.0	3.930
		Mean =	524.44449688	3.7	4.153