Optimising Irrigated Grains

BARLEY

GOOD MANAGEMENT GUIDELINES for Irrigated Crops:

2020 to 2022

SOWING THE SEED FOR A BRIGHTER FUTURE

Introduction

Good management guidelines for irrigated barley

This good management guidelines summary for barley has been taken from the results of the Optimising Irrigated Grain (OIG) research project, a GRDC investment conducted in south-east Australia ((FAR1906-003RTX) from 2019-23. The guidelines are laid out as key points with a small amount of supporting data taken from the trials conducted over these three years. ***Please note these guidelines only cover agronomy topics that were researched during the project (2020 – 2022), it is not intended to be a complete guide to growing irrigated crops. Instead, it carries key points noted to be instrumental in growing productive and profitable irrigated crops.*** These guidelines can be supplemented by reading the *Good Management Guidelines for Irrigated Crops* produced as a result of the project.

What did we do in the GRDC Optimising Irrigated Grains project?

This GRDC investment Optimising Irrigated Grains (OIG) (FAR1906-003RTX) was set up to identify gaps in our knowledge regarding the true economically attainable yield potential of winter and summer crops grown in south-eastern Australian irrigated farming systems. The focus was on crops where there was less knowledge of upper end yield potential, particularly in light of newer germplasm, management advances and innovations in soil amelioration.

The field research team (FAR Australia and Irrigated Cropping Council (ICC)) was charged with conducting over 60 individual trials per annum, in six crops, over a three-year research period (2020 – 2022). To conduct such a large number of trials, field experiments were consolidated into two major Irrigated Research Centres (IRCs) based at Kerang in Victoria and Finley in southern NSW. Most trials focussed on crop agronomy and were conducted on a grey clay soil at Kerang using predominately surface irrigation (flood), and at Finley on a red duplex using overhead and surface irrigation in collaboration with Southern Growers, NSW DPI and the Maize Association of Australia. Three satellite sites carried a smaller number of trials in the north midlands of Tasmania, south-eastern Australia and Griffiths in NSW in collaboration with Irrigation Research and Extension Committee (IREC), Riverine Plains Inc, Southern Farming Systems, South Australian Research and Development Institute (SARDI) and MacKillop Farm Management Group.

The research programmes were uniquely developed to evaluate crop specific agronomic management practices in irrigated environments in order to ascertain their effects on system productivity and profitability.

Crop specific agronomic practices were focussed on maximising system profitability through:

1. Understanding the yield potential of irrigated crops in the principal environments where research was taking place.
2. Understanding how to consistently optimise yield for the crops where gaps in knowledge were most apparent.
3. Optimising the return on nitrogen through improved nitrogen use efficiency (grain maize, canola, barley and durum).

ACKNOWLEDGEMENTS

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In addition, we would like to acknowledge the collaborative support of our principal trials research partner Irrigated Cropping Council (ICC). We would also like to acknowledge all the OIG partners and collaborators in the project, University of Tasmania, Southern Growers, NSW DPI and the Maize Association of Australia, Irrigation Research and Extension Committee (IREC), Riverine Plains Inc, Southern Farming Systems, South Australian Research and Development Institute (SARDI) and MacKillop Farm Management Group.

BARLEY

Germplasm, Crop structure and Plant population

Key point summary

- ***Irrigated barley benefited from PGR application with greater yield benefits associated with crops that are irrigated earlier in the grain fill period.***
- ***The spring barley RGT Planet (8.13t/ha) was significantly higher yielding than Cassiopee winter barley (7.83t/ha) when averaged over two years (2020 & 2021) and over four treatments in a plant growth regulator trial at the Finley Irrigated Research Centre (IRC).***
- ***Applying a plant growth regulator (PGR), either as a split application (GS31 & GS33) or as a single application (GS31) resulted in a significantly higher yield compared to the untreated crops, averaged over both varieties over two years.***
- ***Weaker strawed cultivars such as Cassiopee were less suited to irrigated farming systems, particularly when soil fertility was higher, however these crops were also in general more responsive to PGR.***
- ***The winter barley Cassiopee experienced significantly more lodging than RGT Planet and was less suitable for irrigated systems. PGR application did reduce lodging, although in Planet differences in lodging were relatively small.***
- ***PGR application and grazing both had a similar reduction (average 7cm) in crop height compared to the untreated plots when measured over both varieties and both years.***
- ***Defoliation of RGT Planet at GS30-31 to simulate grazing generated 722kg DM/ha RGT and 1937 kg DM/ha in Cassiopee, illustrating the longer vegetative growth phase in winter germplasm.***
- ***Valued at 25 cents per kg/dry matter the dry matter was valued at $180/ha and $484/ha respectively for Planet and Cassiopee, which in both cases compensated for the loss of grain yield with defoliation.***
- ***Grazing a late April sown Planet required a minimum 4 cents/kg return on dry matter (DM) to offset the grain loss associated with 722kg DM/ha removal at GS30, whilst with Cassiopee it was 8 cents/kg DM when 1937kg DM/ha was removed at GS30. To grow Cassiopee in place of Planet in order to take advantage of the extra forage required 19 cents/kg DM to counter the loss of $359/ha in grain.***
- ***Over the three years of evaluation (2020 – 2022), there was lower soil N available at sowing (lower fertility) in the later years that has resulted in the weaker strawed crop being easier to manage in terms of lodging control.***
- ***Given lower fertility scenarios under irrigation, optimum nitrogen timings have been centred on two applications split in the period from GS30 – 33. Earlier than this promotes much greater lodging risk, later than this increases protein but not necessarily yield an important consideration in terms of malting barley production.***

Irrigated barley at the Finley IRC has consistently shown yield benefits to the application of Plant Growth Regulators (PGRs) in the OIG project, even though responses have not always been statistically significant (Figure 1).

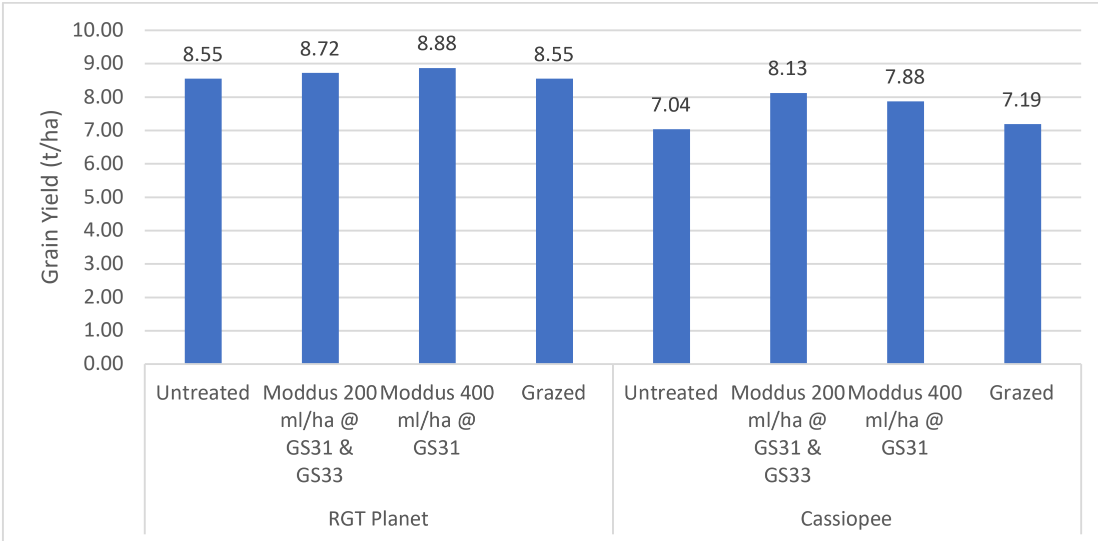

Figure 1. *Influence of plant growth regulator on seed yield (t/ha) using RGT Planet spring barley and Cassiopee winter barley in 2 irrigated trials conducted at Finley – 2020 and 2021.*

These PGRs, either single applications or splits of Moddus Evo (trinexapac ethyl) have been observed to reduce or delay the onset of crop lodging during grain fill. It is this reduction and delay in lodging that is related to the yield increases that have been observed (Figure 2).

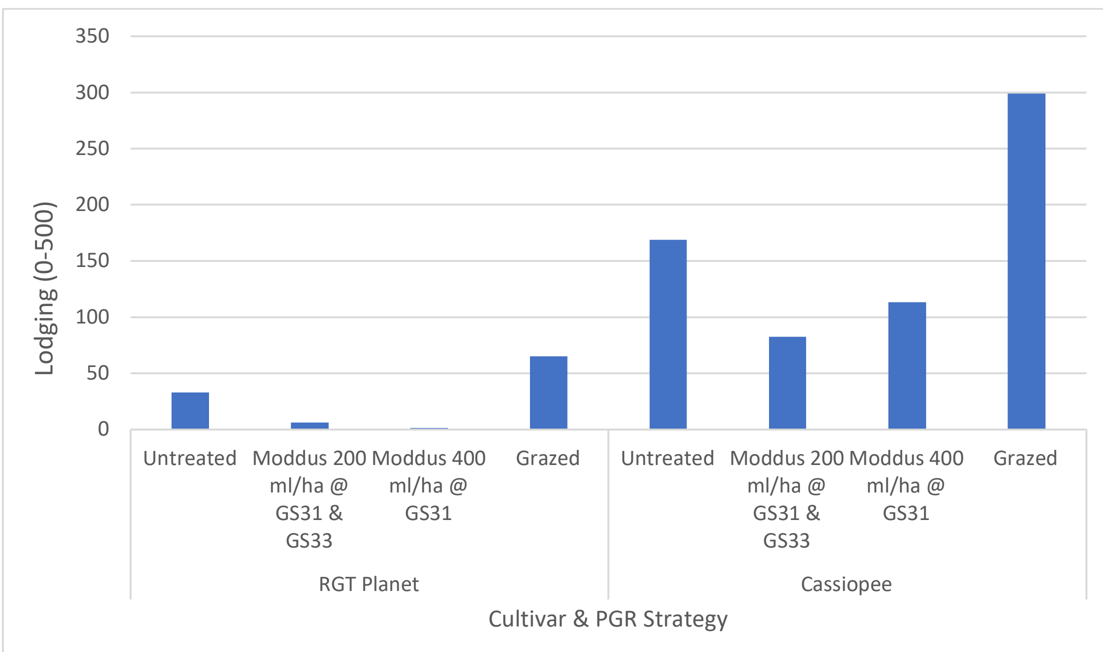

Figure 2. *Influence of plant growth regulator on crop lodging using RGT Planet spring barley and Cassiopee winter barley in 2 irrigated trials conducted at Finley – 2020 and 2021.*

Defoliation of the crop at GS30-31 (start of stem elongation) to mimic the effect of grazing produced significantly more dry matter with the winter barley that reached stem elongation later in the spring cultivar than Planet (Figure 3).

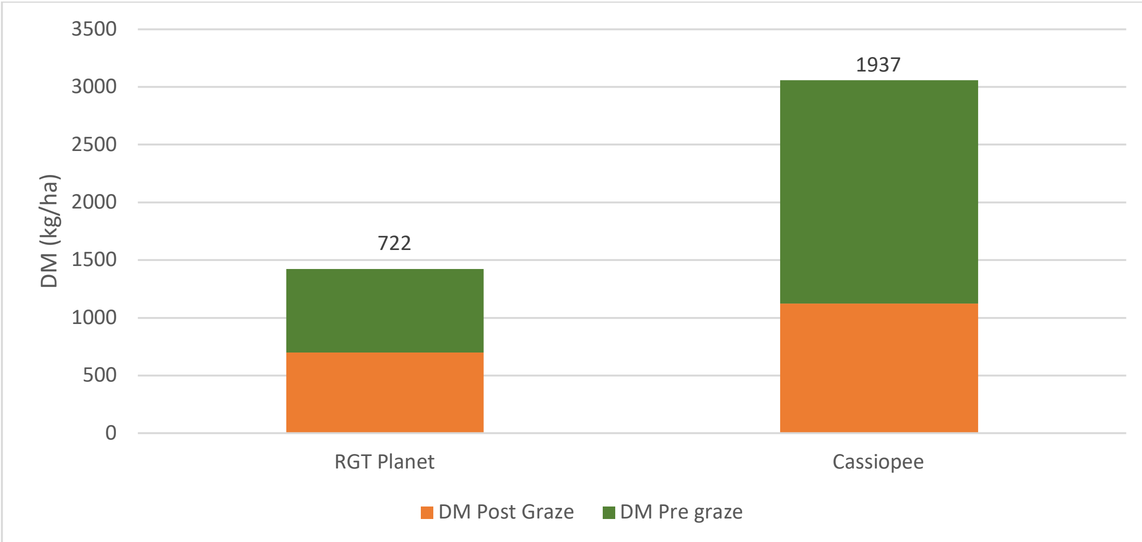

Figure 3. *Influence of cultivar on dry matter (DM) kg/ha harvested by simulated grazing using a lawn mower to remove biomass at GS30-31 in two years of trials at Finley – 2020 and 2021. Figures above bars show the amount of biomass removed by "simulated" grazing.*

The return in $/ha from PGR application with Planet was marginal, since the split application of Moddus (GS31 and GS33) was less cost effective than the untreated, whilst the single application (GS31) was slightly more cost effective. With the weaker strawed winter barley Cassiopee both single and split applications were very cost-effective applications (Table 1).

Table 1. *Net income ($/ha) after PGR treatment, exclusive of grazing income and other input costs.*

Cultivar	Treatment	Yield (t/ha)	Gross Income[1] ($/ha)	PGR cost[2] ($/ha)	Net Income[3] after PGR ($/ha)
RGT Planet	Untreated	8.55	2052	-	$ 2,052
	Moddus Split GS31 & GS33	8.72	2092	61.72	$ 2,030
	Moddus @ GS31	8.88	2130	46.72	$ 2,083
	Grazed	8.55	2052	-	$ 2,052
Cassiopee	Untreated	7.04	1688	-	$ 1,688
	Moddus Split GS31 & GS33	8.13	1950	61.72	$ 1,888
	Moddus @ GS31	7.88	1890	46.72	$ 1,843
	Grazed	7.19	1724	-	$ 1,724

[1]Gross income based on $240/t for feed barley delivered Finley, (protein was above 12% for all treatments in these trials and therefore unable to achieve malt quality). [2]PGR cost based on Moddus Evo at $79.30/L and application cost of $15/ha. [3]Net income has no other costs of production included only the PGR costs and its application cost.

Table 1 does not include the value of dry matter grazed at GS30-31. In Table 2 the value of the reduction in grain yield equates to a value for DM to justify grazing. In RGT Planet only 4 cents/kg DM was required to offset grain loss associated with removal of 722kg DM at GS30. With Cassiopee where defoliation produced nearly 2t/ha DM the grain loss at harvest was greater (0.94t/ha compared to

PGR treated) and 8 cents/kg DM was required to offset grain loss compared to the most effective PGR treatment or to warrant growing Cassiopee instead of RGT Planet 19 cents/kg DM.

Table 2. *Grazing value ($/ha) required to ensure same income as ungrazed, PGR treated plots grain yields.*

			Penalty for grazing cf. highest net income ($/ha)		**c/kg required from GS30 DM to offset grain loss**	
Cultivar (Grazed)	Net Income ($/ha)	Grazed DM (kg/ha)	cf. Planet ($2083/ha)[1]	cf. Cassiopee ($1888/ha)[2]	$2083/ha	$1888/ha
RGT Planet	$ 2,052	722	-31		$ 0.04	
Cassiopee	$ 1,724	1937	- 359	-164	$ 0.19	$ 0.08

[1]Gross income achieved with RGT Planet and single PGR application. [2]Gross income achieved with Cassiopee and split PGR application.
cf. Compared to

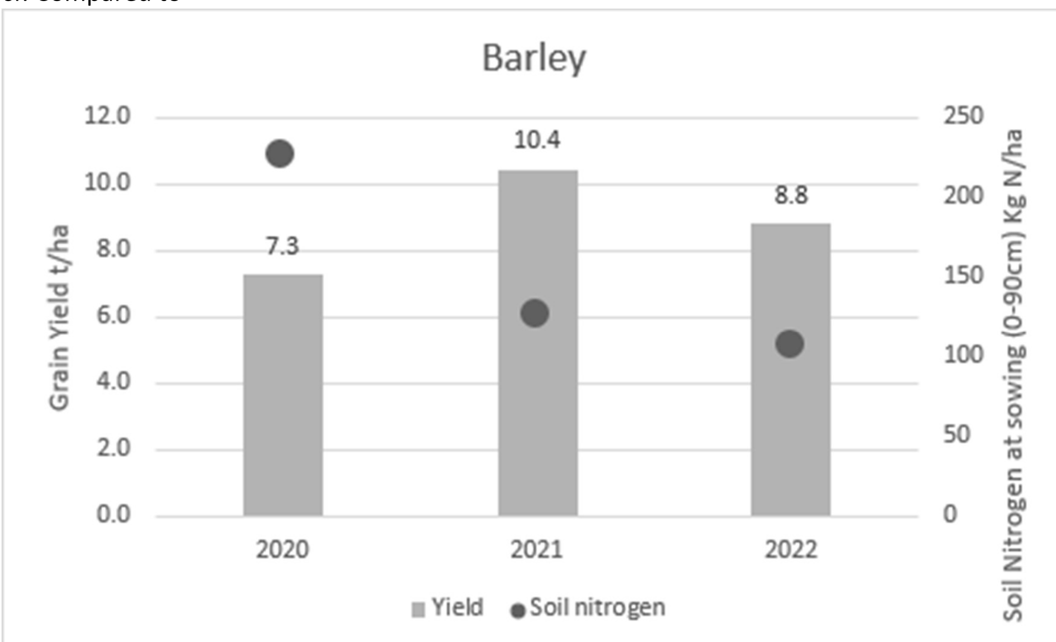

Figure 4. *Highest yields of barley in the OIG project and the relationship to soil nitrogen available in the soil in the autumn of growing those crops – Finley, NSW.*

NOTES

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