Optimising Irrigated Grains

DURUM

GOOD MANAGEMENT GUIDELINES for Irrigated Crops:

2020 to 2022

GRDC Grains Research & Development Corporation
FAR Australia
Irrigated Cropping Council
Promoting irrigated agriculture
SFS
Southern Growers
MAA
tia
MFMG
Irrigation Research & Extension Committee
Riverine Plains

SOWING THE SEED FOR A BRIGHTER FUTURE

Introduction

Good management guidelines for irrigated durum

This good management guidelines summary for durum 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.

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Nitrogen (N) strategy for yield and quality

Key point summary

- ***The ability to use irrigation to improve the efficiency of later N timings is ideal for producing a crop that requires high protein levels to achieve the grade required.***
- ***Results illustrated that later N timings of main N doses in durum maintain yield potential whilst at the same time giving high proteins.***
- ***The ability to delay all of the N until GS32 (second node) and GS37 (flag leaf just visible) will need to be considered in the light of available soil N in the profile at late tillering and GS30.***
- ***Very low levels of soil N available at GS30 may require a small late tillering dose in order to feed the crop (40N). With high levels of available soil N this can be delayed until GS32.***
- ***In 2020 at Finley, high soil fertility (232kg N/ha in the 0-90cm soil profile at sowing) resulted in no response to applied N fertiliser, with no significant difference in grain yield between 28-378kg N/ha applied.***
- ***In a scenario of lower soil fertility in 2021 (measured 47kg N/ha in the soil, 0-90cm, 23rd August), increasing applied N rates (Urea 46% N) from 0-350kg N/ha had no significant effect on grain yield above 100kg N/ha, but to be certain of having 13% grain protein for DR1, N levels had to be increased to 200kg N/ha since 150kg N/ha achieved only 12.5% grain protein.***
- ***A separate adjacent nitrogen timing trial demonstrated that protein above 13% could be achieved with 100kg N/ha by delaying the timing to GS32 and GS37 (Table 1).***
- ***The same trials at Kerang (2020 & 2021), with starting soil N 77-130 kg N/ha, showed that maximum yield was achieved with N rates of 100-200kg N/ha and 13% protein could be achieved with no more than 200kg N/ha if timing was delayed to GS32 & GS37.***

Durum has been an important crop in the OIG research programme over the three years of the project. The research covered all aspects of agronomy, but nutrition was a key component of the work. How can we reliably achieve 7t/ha plus with protein levels that meet the 13% level? Work was centred on N rates and N timing. In 2020 high residual soil N (232N-0-90cm profile) built up from the drier previous seasons resulted in no yield response for N applied above starter N (28N). In 2021 soil available N was much lower at the start of spring (47N 0-90cm) and there were yield responses up to 100kg N/ha with 13% grain protein achieved at 200kg N/ha applied (Figure 1). A separate adjacent nitrogen timing trial demonstrated that protein above 13% could be achieved with 100kg N/ha by delaying the timing to GS32 and GS37 without sacrificing yield. (Table 1). At both Kerang and Finley similar findings were identified with regards to later N timings under surface and overhead irrigation whereby later N timings gave the optimum combinations of yield and grain protein.

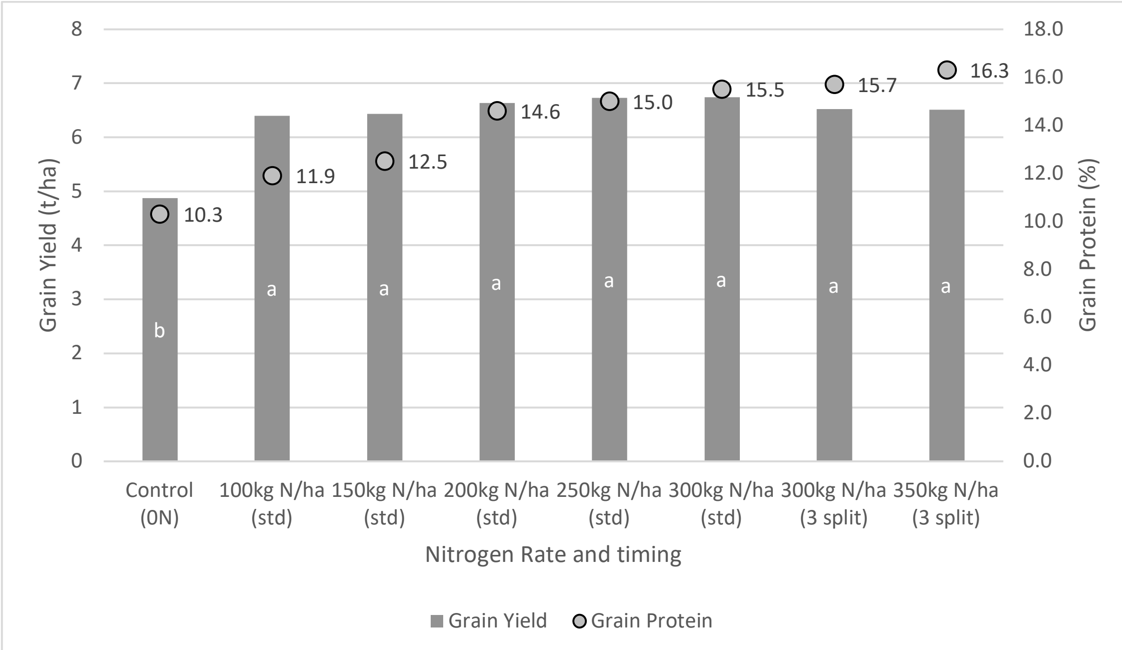

Figure 1. *Influence of applied nitrogen at stem elongation on grain yield (t/ha) and protein content (%). – Finley 2021 Notes. Std – nitrogen split 50:50 between GS30 and GS32. 3 split – 100kg of nitrogen withheld until GS39 with the remainder split 50:50 between GS30 and GS32. Yield bars with different letters are considered statistically different.*

Table 1. *Influence of N rate and timing strategies on grain protein (%) based on split application rates (0-300kg N/ha).*

	Nitrogen Application Rate									
	0kg/ha N		**100kg/ha N**		**200kg/ha N**		**300kg/ha N**		**Mean**	
Nitrogen Timing	**Protein %**		**Protein %**		**Protein %**		**Protein%**		**Protein%**	
PSPE & GS30	10.9	-	12.4	-	13.8	-	15.0	-	**13.0**	**b**
GS30 & GS32	10.6	-	12.5	-	13.7	-	15.0	-	**13.0**	**b**
GS32 & GS37	10.9	-	13.4	-	15.3	-	16.4	-	**14.0**	**a**
Mean	**10.8**	**d**	**12.8**	**c**	**14.3**	**b**	**15.5**	**a**		
N Timing		LSD		0.4			**P val**		<0.001	
N Rate		LSD		0.5			**P val**		<0.001	
N Timing x N		LSD		ns			**P val**		**0.235**	

Soil N available – 47kg N/ha 0-90cm

Crop lodging control and use of PGRs

Key Points:

- ***Aurora durum is prone to greater lodging problems during grain fill than Vittaroi.***
- ***PGR applications at Finley and Kerang in 2020 and 2021 in Aurora consistently resulted in a reduction in both crop height and lodging during grain fill.***
- ***At Kerang in 2021, treatments where Moddus at 200ml/ha and Errex at 1.3l/ha were applied at various timings gave an average yield increase of 1.97t/ha over the untreated control plots (Table 1).***

Four trials were conducted at two sites (Finley and Kerang) over two years (2020 and 2021). Moddus Evo mixed with Errex and an unregistered experimental product were used at various rates and timings. A grazing treatment was added where plots were mowed (mechanical defoliation) twice (GS22 and GS30) to simulate grazing. Responses to plant growth regulator (PGR) chemicals resulted in a reduction in crop height and reduced lodging. The yield results varied from 0-2.04t/ha. In most cases grazing led to a reduction in lodging, however it almost always led to a reduction in yield compared to the highest yielding plots in each trial. Table 1 illustrates the trial where the biggest penalty to not using a PGR occurred.

Table 1. *Influence of PGR strategy on Grain yield (t/ha) and crop height - Kerang 2020 cv Aurora.*

PGR Treatment			**Grain yield and quality**			
			Yield		**Plant Height**	
No.	**Product and Rate**	**Timing**	**t/ha**		**cm**	
1.	Untreated		7.61	d	100	a
2.	Moddus Evo 200mL/ha + Errex 1.3L/ha	GS31-32	9.49	ab	83	ef
3.	Moddus Evo 100mL/ha + Errex 0.65L/ha Moddus Evo 100mL/ha + Errex 0.65L/ha	GS30 GS32	9.59	ab	81	f
4.	Errex 1.3L/ha Moddus Evo 200mL/ha	GS30 GS32	9.65	a	86	de
5.	Errex 0.65L/ha Moddus Evo 100mL/ha	GS30 GS32	8.17	cd	98	ab
6.	Moddus Evo 200mL/ha + Errex 1.3L/ha FAR PGR 20/01 0.75 L/ha	GS31-32 GS39	9.64	a	81	f
7.	Moddus Evo 100mL/ha + Errex 0.65L/ha Moddus Evo 100mL/ha + Errex 0.65L/ha FAR PGR 20/01 0.75 L/ha	GS30 GS32 GS37	8.95	abc	84	ef
8.	FAR PGR 20/01 0.75 L/ha	GS39	7.81	d	98	ab
9.	Grazing (twice GS22 & GS30)	GS22 & GS30	8.61	abcd	91	cd
10.	FAR PGR 20/01 0.75 L/ha + Errex 1.3 L/ha	GS32	8.53	bcd	95	bc
	Mean		**8.81**		**89.7**	
	LSD		1.08		4.52	
	P val		0.001		<0.001	

Disease management in durum

Key point summary

- ***Over three years of trials stripe rust caused by the pathogen Puccinia striiformis has been a key aspect of growing DBA Vittaroi and flutriafol used upfront in furrow has been an effective starting point for growing a disease-free crop.***
- ***Key foliar fungicide follow-ups to flutriafol applied GS39 (flag leaf fully emerged) have frequently been the most profitable way to manage stripe rust in a susceptible durum crop.***
- ***If the period from flag leaf to head emergence is wetter than normal for your region, consider an extra foliar spray at head emergence to the protect the head and "top up" disease control in the upper leaves.***

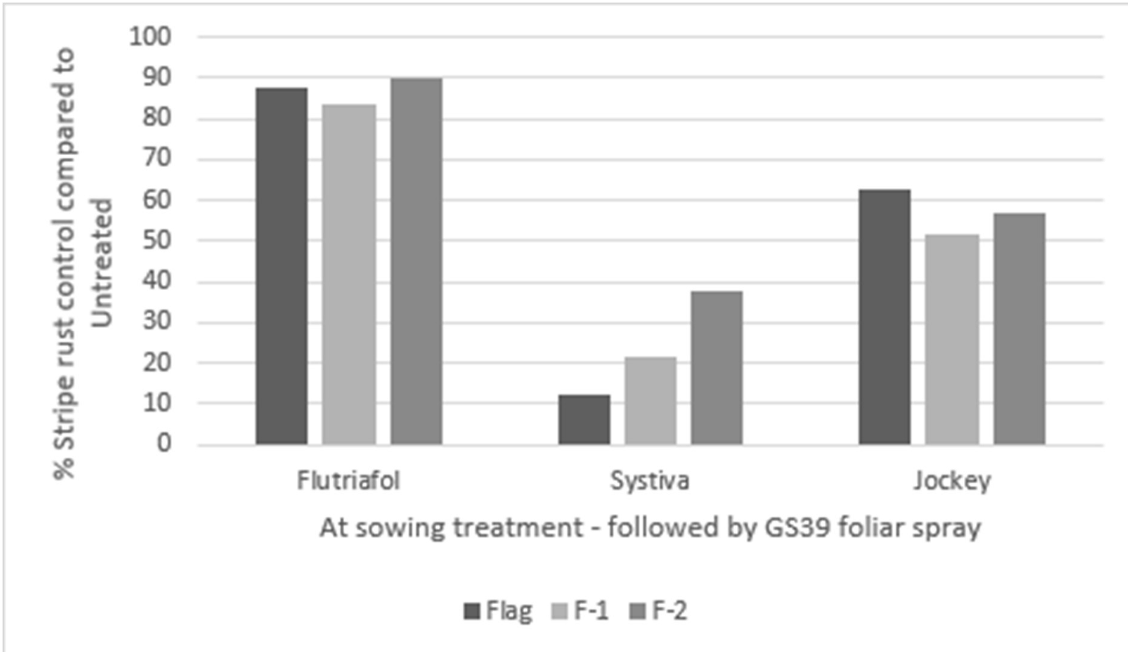

Figure 2. *Influence of "at sowing" seed treatment and in furrow fungicides for stripe rust control compared to control – assessed 23 September at GS49. Prosaro 300ml/ha applied at GS39 across all treatments.*

NOTES

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