Optimising Irrigated Grains

Optimising Irrigated Grains (FAR1906-003RTX)

A Grains Research & Development Corporation (GRDC) investment

PROVISIONAL HARVEST RESULTS:

Irrigated Canola Trials

Released:24 February 2021

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Finley Irrigated Research Centre NSW

Irrigated trials conducted at the Finley irrigated research centre 2020 were managed by FAR Australia, hosted by Southern Growers.

Trial 1 Optimum Plant Population Under Overhead Irrigation

Project objective: To compare identical plant population x cultivar canola trials under overhead and flood irrigation

Location: Finley IRC

FAR Code: FAR C20-01-1

Sown: 28 April 2020

Cultivar: HyTTec® Trophy and 45Y28 RR

Harvested: 27th November 2020

Rotation position: Wheat (2019), Faba beans (2018), Fallow after rice (2017)

Soil Management: Wheat stubble incorporated with speed disc in Autumn

Irrigation: Overhead lateral irrigation 5 x 25mm in spring. Total applied 125mm

GSR: April-October 244mm. Total water available 369mm

Available Soil N: 129 kg N/ha (0 – 90cm)

Key Messages:

- *Under overhead irrigation there was a significant interaction between plant population and cultivar*
- *With the 45Y28 RR hybrid there was no significant difference in yield (4.05 – 4.27t/ha) between 14 – 36 plants/m^2.*
- *With HyTTec® Trophy a maximum yield of 3.92 t/ha was achieved at the highest plant population achieved (approximately 30 plants/m^2 (sown at 80 seeds/m^2).*
- *There was relatively poor establishment following incorporated wheat stubble with 35-50% establishment in both cultivars.*
- *When both cultivars were averaged there was significant advantage in dry matter (DM) at 20% flowering with plant populations over 15plants/m2.*
- *At harvest the DM content of the 45Y28 RR canopy averaged 14.36t/ha (all populations no significant difference) with a harvest index (%) of 25.6% (range 23.4 – 28.1%) (data not shown only available with 45Y28 RR).*
- *Thinner crops resulting from the lowest plant populations were reflected in lower crop reflectance scores (NDVI measured with a Greenseeker) up until flowering.*
- *The oil content of RR45Y28 RR was significantly higher than HyTTec® Trophy (42.7 v 41.9).*
- *WUE based on average yield of 45Y28 of 4.05t/ha was 15.6.*

The trial establishment was between 35-50% and generated yields of HyTTec® Trophy between 3.18-3.92 t/ha and 45Y28 RR 3.69 – 4.27t/ha (Table 1 & 2). The RR hybrid gave similar yields between 14 – 36 plants/m^2 whilst yields of the TT hybrid were maximised at 30 plants/m^2 (see also Trial 6 where the same hybrid responded to 50 plants/m^2).

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Table 1. Influence of plant population and cultivar on grain yield (t/ha) grown under overhead irrigation.

		Yield t/ha		
Plants/m2 (actual)		**HyTTec® Trophy**	**45Y28 RR**	**Mean**
Trophy	**45Y28**	**(Hybrid TT)**	**(RR Y Series Hybrid)**	**Yield t/ha**
10	10	3.18 e	3.69 cd	**3.44 c**
20	14	3.34 e	4.17 ab	**3.75 b**
18	23	3.63 d	4.27 a	**3.95 a**
29	36	3.92 bc	4.05 ab	**3.99 a**
Mean		**3.52 b**	**4.05 a**	

LSD Seed Rate p = 0.05	0.18 t/ha	**P val**	<0.001
LSD Cultivar p=0.05	0.18 t/ha	**P val**	0.006
LSD Seed Rate x Cultivar.	0.25 t/ha	**P val**	0.023

Table 2. Establishment - Plant population (plants/m^2) established from four seed rates with two different cultivars grown under overhead irrigation.

	Established Population		
Seed Rate	**HyTTec® Trophy**	**45Y28 RR**	**Mean**
	(Hybrid TT)	(RR Y Series Hybrid)	
	Plants/m^2	**Plants/m^2**	**Plants/m^2**
20 seeds/m^2	9.5 -	9.8 -	**9.6 c**
40 seeds/m^2	20.0 -	14.0 -	**17.0 bc**
60 seeds/m^2	17.8 -	23.0 -	**20.4 b**
80 seeds/m^2	29.3 -	35.8 -	**32.5 a**
Mean	**19.1 -**	**20.6 -**	

LSD Seed Rate p = 0.05	8.4	**P val**	<0.001
LSD Cultivar p=0.05	ns	**P val**	0.7993
LSD Seed Rate x Cultivar.	ns	**P val**	0.4103

RR – Roundup Ready Hybrid

Table 3. Influence of plant population and cultivar on seed oil content (%) grown under overhead irrigation.

		Oil content (%)		
Plants/m^2 (actual)		**HyTTec® Trophy**	**45Y28 RR**	**Mean**
Trophy	**45Y28**	(Hybrid TT)	(RR Y Series Hybrid)	**Oil %**
10	10	41.6 c	43.0 a	42.3 -
20	14	42.5 ab	42.7 a	42.6 -
18	23	41.6 c	43.1 a	42.4 -
29	36	42.0 bc	42.0 bc	42.0 -
Mean		**41.9 b**	**42.7 a**	

LSD Plant Population p = 0.05	0.48	**P val**	0.089
LSD Cultivar p=0.05	0.39	**P val**	0.009
LSD Seed Rate x Cultivar.	0.68	**P val**	0.008

Released:24 February 2021

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Table 4. Influence of plant population and cultivar on dry matter (t/ha) at early flowering (GS62) grown under overhead irrigation.

		Dry Matter t/ha at GS62		
Plants/m² (actual)		Plants/m² (actual)	**45Y28 RR**	**Mean**
Trophy	**45Y28**	(Hybrid TT)	(RR Y Series Hybrid)	**t/ha**
10	10	2.87 -	3.43 -	3.15 b
20	14	3.51 -	4.96 -	4.23 a
18	23	4.72 -	4.81 -	4.77 a
29	36	4.48 -	5.68 -	5.08 a
Mean		**3.90 -**	**4.72 -**	

LSD Seed Rate p = 0.05	1.07	**P val**	0.007
LSD Cultivar p=0.05	0.96	**P val**	0.071
LSD Seed Rate x Cultivar	ns	**P val**	0.549

Table 5. Influence of plant population and cultivar on dry matter (t/ha) at harvest grown under overhead irrigation.

		Dry Matter t/ha at harvest	
Seedrate	Plants/m²	**HyTTec® Trophy**	**45Y28 RR**
		(Hybrid TT)	(RR Y Series Hybrid)
20 seeds/m² (10,10)		-	14.53 -
40 seeds/m² (20, 14)		-	15.14 -
60 seeds/m² (18, 23)		13.64 -	13.97 -
80 seeds/m² (29, 36)		-	14.51 -
Mean			**14.36**

LSD Seed Rate p = 0.05	ns	**P val**	0.898

Released:24 February 2021

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Trial 2 Optimum Plant Population Under Flood Irrigation

Project objective: To compare identical plant population x cultivar canola trials under overhead and flood irrigation

Location: Finley IRC
FAR Code: FAR C20-01-2
Sown: 28 April
Cultivar: HyTTec® Trophy and 45Y28 RR
Harvested: 27th November 2020
Rotation position: Wheat (2019), Faba bean (2018) Wheat (2017)
Soil Management: Wheat stubble incorporated with speed disc in Autumn
Irrigation: Flood irrigation 3 x 80mm in spring. Total applied 240mm (2.4 ML/ha)
GSR: April- October 244mm. Total water available 484mm
Available Soil N: 214 kg N/ha (0 – 90cm)

Key Messages:

- *Under flood irrigation and with higher available soil N (214 kg N/ha 0-90cm) seed yields were significantly higher with 45Y28 RR than HyTTec® Trophy with both cultivars maximising yield at higher plant populations tested (45Y28 RR - 4.9t/ha (32plants/m^2),* HyTTec® *Trophy- 4.01 - 4.11t/ha (23-31 plants/m^2)).*
- *At 20% flowering 45Y28 RR was associated with significant higher dry matter production (4.51t/ha compared to 3.3t/ha with the TT hybrid).*
- *Yields cannot be statistically compared in these identical trials on flood and under lateral (Trial 1 & Trial 2) but yields on flood were approximately 0.4 & 0.2t/ha (valued at $240 & $120/ha at $600/t)) higher yielding (depending on hybrid) at equivalent seed rates for the use of 1.15MegaL/ha more water.*
- *Establishment was poor due to heavy rain after sowing with between 30-50% plant establishment.*
- *As yield increased with higher plant population oil content showed a very slight decline (p=0.059) of less than 1%, but there no difference between cultivars.*
- *The highest yielding treatments were associated with the highest dry matter (4.96t/ha) at 20% flowering.*
- *Dry matter assessed at harvest was conducted only at the 60seeds/m^{2}and revealed a harvest dry matter of 13.05t/ha with 45Y28 RR and 12.34t/ha with HyTTec® Trophy, leading to a harvest index of 31% and 30% respectively (data not shown).*
- *WUE based on an average yield of 45Y28 of 4.49t/ha was 12kg/mm.*

Table 1. Influence of plant population and cultivar on grain yield (t/ha) grown with flood irrigation.

		Yield t/ha		
Plants/m^2 (actual)		**HyTTec® Trophy**	**45Y28 RR**	**Mean**
Trophy	**45Y28**	(Hybrid TT)	(RR Y Series Hybrid)	**Yield t/ha**
12	11	3.37 -	4.04 -	**3.70 c**
15	21	3.76 -	4.58 -	**4.17 b**
31	18	4.01 -	4.42 -	**4.22 b**
24	32	4.11 -	4.90 -	**4.50 a**
Mean		**3.81 b**	**4.49 a**	

LSD Plant Population p = 0.05	0.24	**P val**	0.003
LSD Cultivar p=0.05	0.18	**P val**	<0.001
LSD Seed Rate x Cultivar.	ns	**P val**	0.433

Released:24 February 2021

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Table 2. Establishment - Plant population (plants/m^2) established from four seed rates with two different cultivars grown under overhead irrigation.

	Established Population		
Seed Rate	**HyTTec® Trophy**	**45Y28 RR**	**Mean**
	Plants/m^2	**Plants/m^2**	**Plants/m^2**
20 seeds/m^2	12.3 de	10.8 e	**11.5 c**
40 seeds/m^2	15.3 cde	20.5 bc	**17.9 b**
60 seeds/m^2	31 a	18.5 bcd	**24.8 a**
80 seeds/m^2	23.5 b	32.3 a	**27.9 a**
Mean	**20.5 -**	**20.5 -**	

LSD Plant Population p = 0.05	5.12	**P val**	<0.001
LSD Cultivar p=0.05	ns	**P val**	1.000
LSD Seed Rate x Cultivar.	7.24	**P val**	0.011

Table 3. Influence of plant population and cultivar on seed oil content (%) grown with flood irrigation.

		Oil content (%)		
Plants/m^2 (actual)		**HyTTec® Trophy**	**45Y28 RR**	**Mean**
Trophy	**45Y28**	(Hybrid TT)	(RR Y Series Hybrid)	**Oil %**
12	11	41.8 -	42.0 -	**41.9 -**
15	21	41.6 -	42.0 -	**41.8 -**
31	18	41.5 -	41.4 -	**41.4 -**
24	32	41.5 -	40.9 -	**41.2 -**
Mean		**41.6 -**	**41.6 -**	

LSD Plant Population p = 0.05	0.51	**P val**	0.059
LSD Cultivar p=0.05	ns	**P val**	0.873
LSD Seed Rate x Cultivar.	ns	**P val**	0.229

Table 4. Influence of plant population and cultivar on dry matter at early flowering (GS62) grown with flood irrigation.

		Dry Matter (t/ha) at GS62		
Plants/m^2 (actual)		**HyTTec® Trophy**	**45Y28 RR**	**Mean**
Trophy	**45Y28**	(Hybrid TT)	(RR Y Series Hybrid)	**t/ha**
12	11	2.64 -	3.85 -	**3.24 -**
15	21	3.11 -	4.90 -	**4.01 -**
31	18	3.77 -	4.32 -	**4.04 -**
24	32	3.67 -	4.96 -	**4.32 -**
Mean		**3.30 b**	**4.51 a**	

LSD Seed Rate p = 0.05	0.77	**P val**	0.051
LSD Cultivar p=0.05	0.54	**P val**	0.006
LSD Seed Rate x Cultivar.	ns	**P val**	0.432

Released:24 February 2021

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Table. 5 Normalised differential vegetation index (NDVI) of two cultivars at 4 seed rates.

	NDVI (0-1)			
Plant Population & Cultivar	**GS16**	**GS50**	**GS52**	**GS66**
HyTTec® Trophy				
12 plants/m^2	0.17 -	0.48 d	0.48 d	0.57 -
15 plants/m^2	0.17 -	0.54 c	0.55 c	0.59 -
31 plants/m^2	0.21 -	0.68 b	0.70 b	0.61 -
24 plants/m^2	0.20 -	0.68 b	0.68 b	0.59 -
45Y28 RR				
11 plants/m^2	0.17 -	0.57 c	0.56 c	0.60 -
21 plants/m^2	0.19 -	0.71 b	0.71 ab	0.59 -
18 plants/m^2	0.20 -	0.73 ab	0.72 ab	0.57 -
32 plants/m^2	0.22 -	0.77 a	0.76 a	0.59 -
Mean	**0.19**	**0.64**	**0.64**	**0.59**
LSD Seed Rate x Cultivar.	ns	0.06	0.05	ns
P val	0.168	0.033	0.009	0.571

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Trial 3 Nitrogen Use Efficiency Trial – Nitrogen Rates

Project Objective: To examine at the nitrogen use efficiency of canola grown under overhead irrigation

Location: Finley IRC
FAR Code: FAR C20-04-1
Sown: 27 April
Cultivar: 45Y28 RR
Harvested: 27th November 2020
Rotation position: Wheat (2019), Faba beans (2018), Fallow after rice (2017)
Soil Management: Wheat stubble incorporated with speed disc in Autumn
Irrigation: Overhead lateral irrigation 6 x 25mm in spring. Total applied 150mm
GSR: April-October 244mm. Total water available 394mm
Available Soil N: 129 kg N/ha (0 – 90cm)

Key Messages:

- *Following wheat, the hybrid 45Y28 RR gave a significant response to applied nitrogen that illustrated an optimum N rate for yield of approximately 160kg N/ha.*
- *There was no significant difference in seed yield between 160 – 320kg N/ha applied in this rotation position with 0.16t/ha covering the difference between the higher N rates.*
- *Differences in oil content were small but significant with a 1.2% oil content decline covering N rates between 80 – 320 N applied.*
- *At early flowering the unfertilised crop canopy had removed 137kg N/ha and had an average dry matter content of 5.5 t/ha compared to just over 300kg N/ha uptake and 7t/ha dry matter where the highest rate of N was applied, however the differences in DM were not significant.*
- *The optimum N rate of 160kg N/ha had removed approximately 238kg N/ha at the 20% flower stage indicating that approximately 110kg N/ha had been utilised if soil N supply (0-90cm) was assumed to be 100% efficient.*
- *At harvest there was no significant difference between dry matter (DM) content with an average DM of 15.5t/ha. Variable plant tissue analysis precluded detailed analysis of N offtake at harvest.*
- *The unfertilised crop removed 123 kg of N/ha at compared up to 310 kg/ha where the highest rate of N was applied.*

Table 1. Influence of applied nitrogen fertiliser rate (split 50:50) at six leaf (6L) & Green bud (GB) on seed yield (t/ha) and oil content (%).

Nitrogen Treatment Rate & Timing		Total Nitrogen N/ha	Grain yield and quality Yield t/ha		Oil %	
1.	0kg N/ha	0	3.91	d	43.0	ab
2.	40kg N/ha@6L & 40kg N/ha@GB	80	4.30	c	43.3	a
3.	60kg N/ha@6L & 60kg N/ha@GB	120	4.41	bc	42.0	d
4.	80kg N/ha@6L & 80kg N/ha@GB	160	4.55	ab	42.4	bcd
5.	100kg N/ha@6L & 100kg N/ha@GB	200	4.59	ab	42.4	bcd
6.	120kg N/ha@6L & 120kg N/ha@GB	240	4.62	a	42.8	a-d
7.	140kg N/ha@6L & 140kg N/ha@GB	280	4.71	a	42.9	abc
8.	160kg N/ha@6L & 160kg N/ha@GB	320	4.71	a	42.1	cd
	Mean		**4.475**		**42.6**	
	LSD		0.19		0.84	
	P val		<0.001		0.032	

N applied as prilled Urea (46% N content)

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

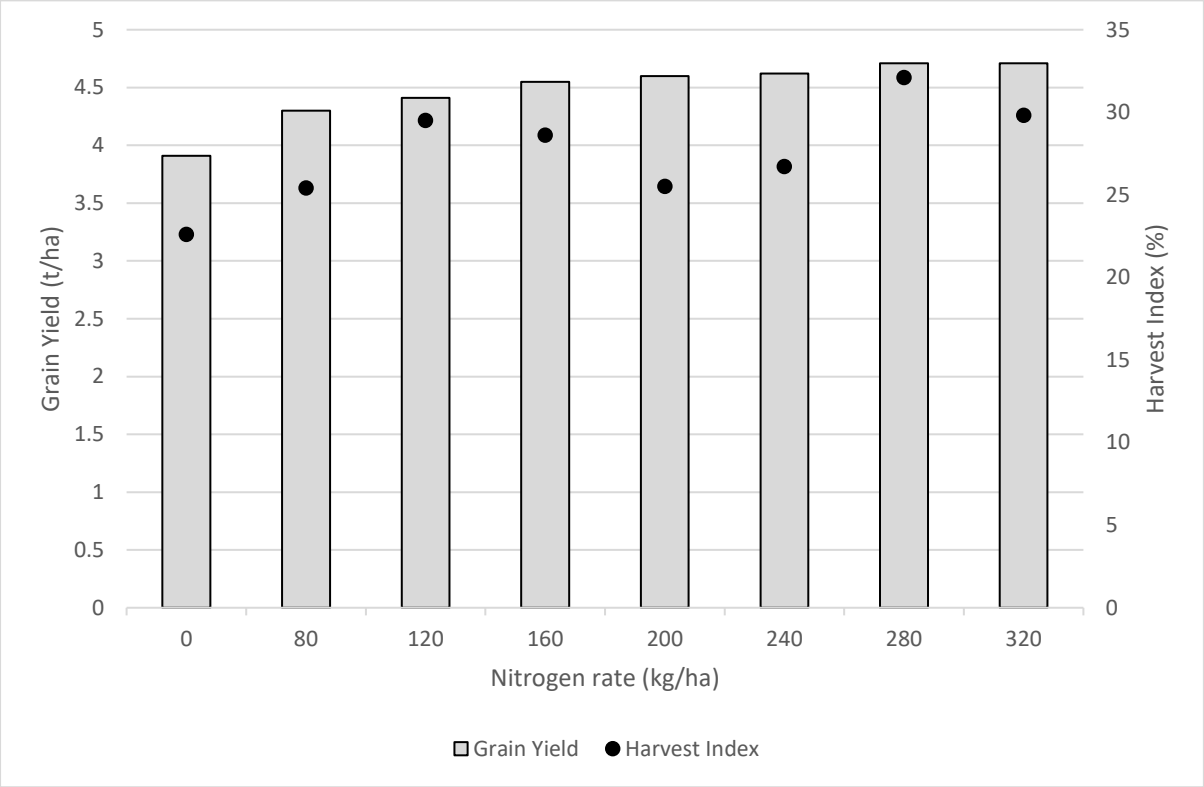

Figure 1. Influence of applied N rate on seed yield (t/ha) and harvest index (%).

Table 2. Influence of applied nitrogen rate at six leaf (6L) & Green bud (GB) on dry matter and N offtake at harvest.

Nitrogen Treatment Rate & Timing		Total Nitrogen N/ha	Dry matter & N offtake Dry Matter Kg/ha		N removed Kg N/ha	
1.	0kg N/ha	0	16.1	-	123	c
2.	40kg N/ha@6L & 40kg N/ha@GB	80	15.8	-	159	c
3.	60kg N/ha@6L & 60kg N/ha@GB	120	14.7	-	153	c
4.	80kg N/ha@6L & 80kg N/ha@GB	160	15.0	-	288	ab
5.	100kg N/ha@6L & 100kg N/ha@GB	200	17.1	-	171	bc
6.	120kg N/ha@6L & 120kg N/ha@GB	240	15.9	-	164	c
7.	140kg N/ha@6L & 140kg N/ha@GB	280	14.7	-	174	bc
8.	160kg N/ha@6L & 160kg N/ha@GB	320	15.0	-	310	a
	Mean		**15.5**		**193**	
	LSD		4.52		123	
	P Val		0.9432		0.041	

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Table 3. Influence of applied nitrogen rate at six leaf (6L) & Green bud (GB) on dry matter offtake at 20% flowering.

Nitrogen Treatment Rate & Timing		Total	Dry matter & N offtake	
		Nitrogen	Dry Matter	N removed
		N/ha	Kg/ha	Kg N/ha
1.	0kg N/ha	0	5.53 -	137 c
2.	40kg N/ha@6L & 40kg N/ha@GB	80	5.98 -	198 bc
3.	60kg N/ha@6L & 60kg N/ha@GB	120	6.53 -	229 b
4.	80kg N/ha@6L & 80kg N/ha@GB	160	6.49 -	238 b
5.	100kg N/ha@6L & 100kg N/ha@GB	200	5.49 -	237 b
6.	120kg N/ha@6L & 120kg N/ha@GB	240	6.41 -	234 b
7.	140kg N/ha@6L & 140kg N/ha@GB	280	6.03 -	260 ab
8.	160kg N/ha@6L & 160kg N/ha@GB	320	7.07 -	304 a
	Mean		**6.19**	**229**
	LSD		ns	65
	P val		0.489	0.002

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Trial 4 Nitrogen Use Efficiency Trial – Nitrogen Timing Trial

Protocol Objective: To assess whether the optimum timing for applied N interacts with N rate under overhead irrigation
Sown: 28 April
Cultivar: Nuseed Diamond
Harvested: 27th November 2020
Rotation position: Wheat (2019), Faba beans (2018), Fallow after rice (2017)
Soil Management: Wheat stubble incorporated with speed disc in Autumn
Irrigation: Overhead lateral irrigation 6 x 25mm in spring. Total applied 150mm
GSR: April-October 244mm. Total water available 394mm
Available Soil N: 126 kg N/ha (0 – 90cm)

Key Messages:

- *Different N timing strategies had no significant effect on seed yield irrespective of N rate applied (120, 240, 360 kg N/ha) cv Nuseed Diamond*
- *Applied N fertiliser significantly increased yield over the unfertilised crop but there was no significant difference between applied N rates of 120 – 360kg N/ha.*
- *Dry matter production at harvest indicated no significant differences due to either N rate or timing.*
- *N offtake at harvest was higher as more N was applied up to 240 Kg N/ha and was significantly greater when N was timed later in the growing season*
- *N offtake was higher when applied at the late timing strategy (green bud & yellow bud) than when applied at the earlier timing strategies*

Table 1. Influence of N rate and timing strategies on seed yield (t/ha) on canola grown under overhead irrigation cv Nuseed Diamond.

	Nitrogen Application Rate			
	0kg/ha N	**120kg/ha N**	**240kg/ha N**	**360kg/ha N**
Nitrogen Timing	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**
PSPE & 6 - Leaf	4.08 -	4.35 -	4.51 -	4.35 -
6-Leaf & Green Bud	4.03 -	4.41 -	4.64 -	4.38 -
Green Bud & Yellow	3.74 -	4.26 -	4.45 -	4.54 -
Mean	**3.95 b**	**4.34 a**	**4.53 a**	**4.43 a**
LSD N Application Timing p = 0.05		ns	**P val**	0.626
LSD N Application Rate p=0.05		0.20	**P val**	<0.001
LSD N Timing. x N Rate. P=0.05		ns	**P val**	0.592

PSPE – Post sow pre-emergence application - broadcast
In addition to N rates specified a standard MAP application meant that all treatments received 12 kg N/ha at sowing.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

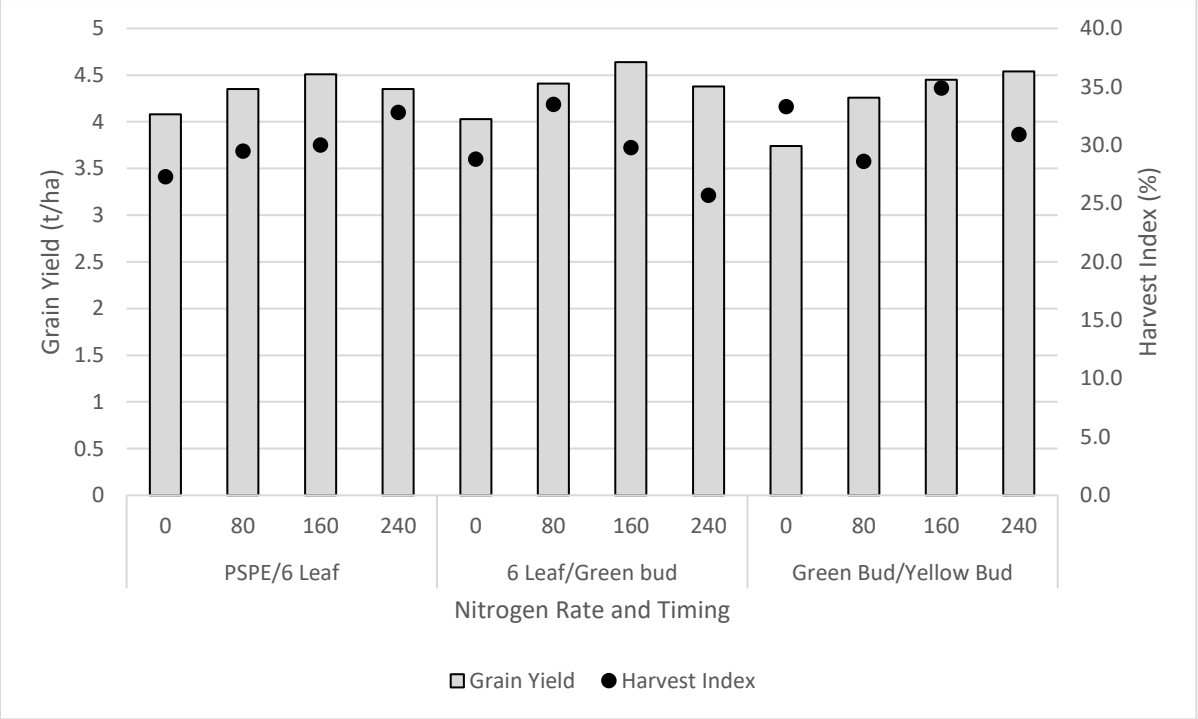

Figure 1. Influence of applied N rate and timing on grain yield (t/ha) and harvest index (%).

Table 2. Influence of N timing and rate (kg N/ha) on N removal in the crop canopy at early flowering.

	Nitrogen removed at GS63 (kg N/ha)									
	0kg/ha N		**120kg/ha N**		**240kg/ha N**		**360kg/ha N**		**Mean**	
Nitrogen Timing										
PSPE & 6 - Leaf	118	-	120	-	240	-	132	-	**152**	-
6-Leaf & Green Bud	162	-	174	-	200	-	146	-	**171**	-
Green Bud & Yellow Bud	146	-	153	-	144	-	171	-	**153**	-
Mean	**142**	**b**	**149**	**b**	**194**	**a**	**150**	**b**		
LSD N Application Timing p = 0.05			ns				**P val**		0.284	
LSD N Application Rate p=0.05			36				**P val**		0.071	
LSD N Timing. x N Rate. P=0.05			ns				**P val**		0.136	

Table 3. Influence of N timing and rate (kg N/ha) on N removal in the crop canopy at harvest.

	Nitrogen removed at harvest (kg N/ha)									
	0kg/ha N		**120kg/ha N**		**240kg/ha N**		**360kg/ha N**		**Mean**	
Nitrogen Timing										
PSPE & 6 - Leaf	75	-	151	-	199	-	189	-	**154**	**b**
6-Leaf & Green Bud	96	-	81	-	167	-	149	-	**123**	**b**
Green Bud & Yellow Bud	141	-	260	-	284	-	251	-	**234**	**a**
Mean	**104**	**c**	**164**	**b**	**217**	**a**	**196**	**ab**		
LSD N Application Timing p = 0.05			48				**P val**		0.004	
LSD N Application Rate p=0.05			36				**P val**		<0.001	

Released:24 February 2021

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

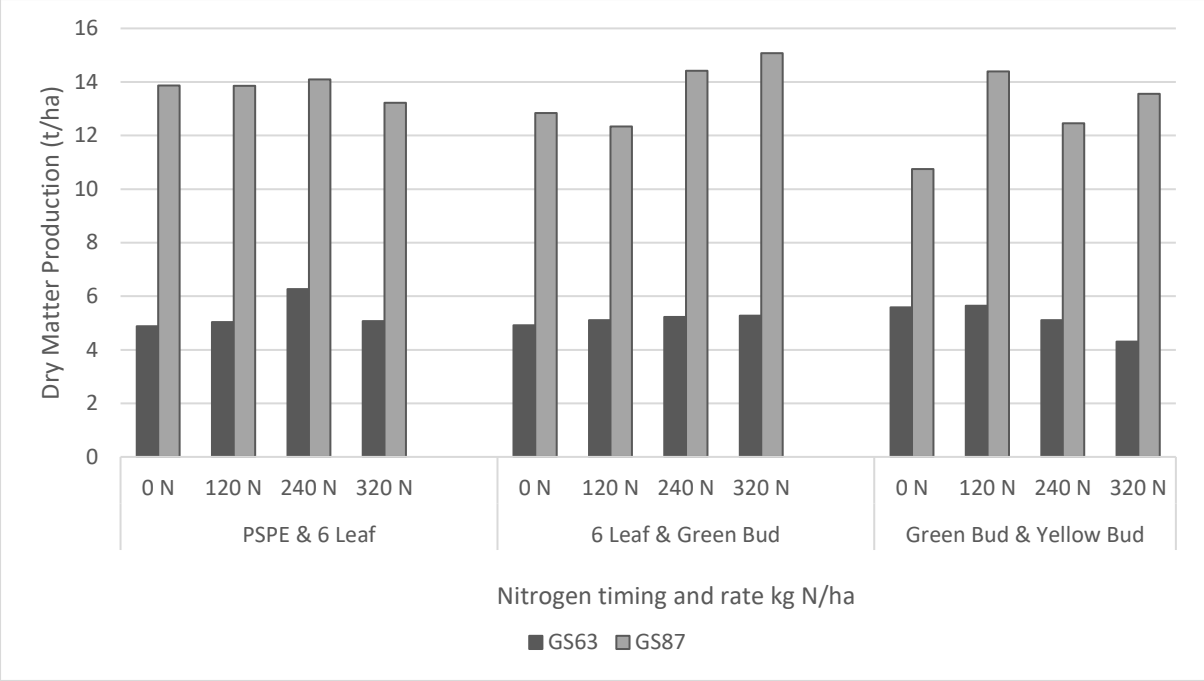

Figure 2. Influence of applied N fertiliser rate and timing on dry matter production at early flowering (GS63) and harvest – assessed 11-Aug and 4-Nov.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Trial 5 Influence of Fungicide Management Strategies on Blackleg and Sclerotinia Infection under Overhead Irrigation

Project objective: To determine the effectiveness of fungicide strategies for a susceptible canola cultivar grown under overhead irrigation

Location: Finley IRC **FAR Code:** C20-08-1

Sown: 28 April **Cultivar:** ATR Bonito

Harvested: 27th November 2020

Rotation position: Wheat (2019), Faba beans (2018), Fallow after rice (2017)

Soil Management: Wheat stubble incorporated with speed disc in Autumn

Irrigation: Overhead lateral irrigation 5 x 25mm in spring. Total applied 125mm

GSR: April-October 244mm. Total water available 369mm

Available Soil N: 129 kg N/ha (0 – 90cm)

Key Messages:

- *The trial grown under overhead irrigation was subject to branch infection of blackleg rather than crown stem canker infections (cv ATR Bonito).*
- *The most effective fungicide applications gave approximately 50-55% control of branch blackleg infection (incidence), with 20-30% flower sprays (applied for sclerotinia) giving 45-50% control of branch blackleg or upper canopy infection (UCI).*
- *No sclerotinia infection was identified in the trial.*
- *Despite visual observations indicating control of blackleg branch infection there were no significant yield responses in this trial to fungicide application (p=0.69).*
- *Control of phoma leaf spot on lower canopy leaves was recorded at approximately 45-60% when assessed at stem elongation and flowering.*

Table 1. Influence of fungicide strategy on canola seed yield (t/ha) grown under overhead irrigation.

Treatment mL/ha				Yield	
	At sowing	4 – 6 leaf	20-30% Flower main raceme	t/ha	
1.	Untreated			3.59	-
2.	ILeVO seed treatment 800 mL/100 kg of seed	----	----	3.64	-
3.	ILeVO & flutriafol (I.F)	----	----	3.64	-
4.	ILeVO (seed trt)	Prosaro 375mL/ha	----	3.57	-
5.	Flutriafol (I.F)	Miravis 450mL/ha	----	3.72	-
6.	----	Miravis 450mL/ha	----	3.49	-
7.	----	Prosaro 375mL/ha	----	3.54	-
8.	----	Miravis 450mL/ha	Prosaro 450mL/ha	3.28	-
9.	----	Prosaro 375mL/ha	Aviator 650mL/ha	3.59	-
10.	----	----	Prosaro 450mL/ha	3.66	-
11.	----	----	Aviator 650mL/ha	3.69	-
12.	ILeVO & flutriafol (I.F)	Prosaro 375mL/ha	Aviator 650mL/ha	3.65	-
13.	Flutriafol (I.F)	Miravis 450mL/ha	Prosaro 450mL/ha	3.36	-
	Mean			**3.57**	
	LSD			0.43	
	P val			0.691	

Released:24 February 2021

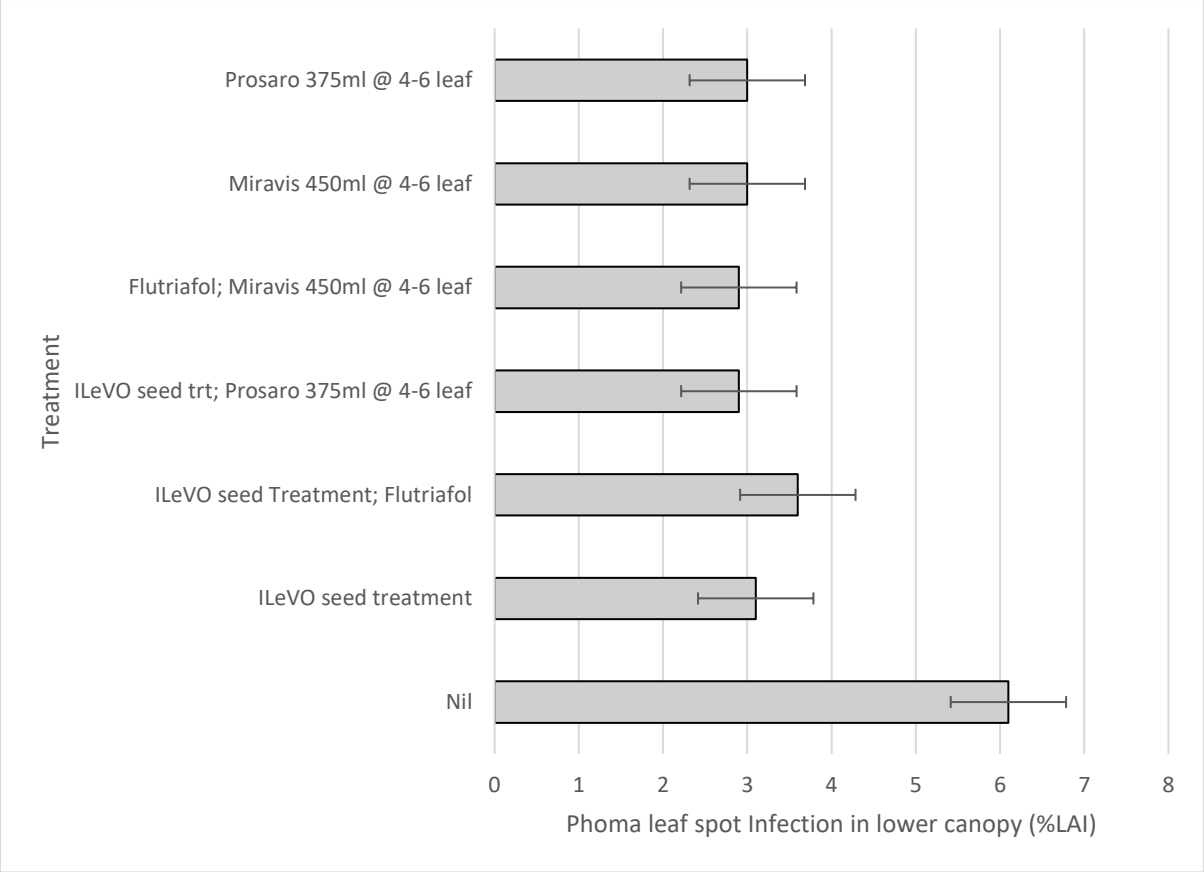

Figure 1. Influence of early season treatments on phoma leaf spot infection at stem elongation (GS50). P value <0.001.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

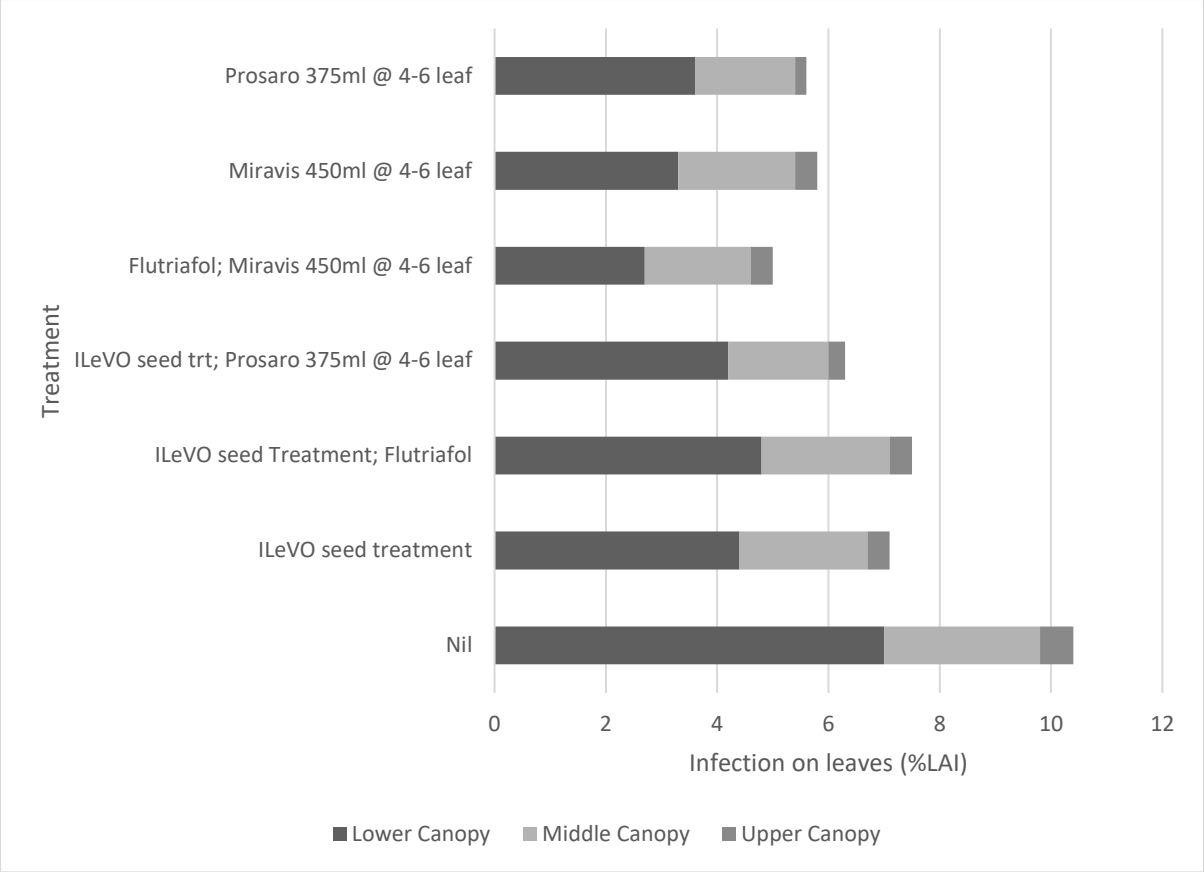

Figure 2. Influence of early season treatments on phoma leaf spot infection in the lower (LSD 1.67, P value 0.002), middle (ns, P value 0.231) and upper canopy (ns, P value 0.213) at flowering (GS67).

Table 2. Influence of different fungicide strategies on branch canker infection (% incidence) at harvest.

Treatment mL/ha				**Branch Canker**	
	At sowing	**4 – 6 leaf**	**20-30% Flower main raceme**	%	
1.	Untreated			55	a
2.	ILeVO seed treatment 800 mL/100 kg of seed	----	----	32.5	bc
3.	ILeVO & flutriafol (I.F)	----	----	36.3	bc
4.	ILeVO (seed trt)	Prosaro 375mL/ha	----	46.3	ab
5.	Flutriafol (I.F)	Miravis 450mL/ha	----	32.5	bc
6.	----	Miravis 450mL/ha	----	25	c
7.	----	Prosaro 375mL/ha	----	45	ab
8.	----	Miravis 450mL/ha	Prosaro 450mL/ha	35	bc
9.	----	Prosaro 375mL/ha	Aviator 650mL/ha	26.3	c
10.	----	----	Prosaro 450mL/ha	30	c
11.	----	----	Aviator 650mL/ha	27.5	c
12.	ILeVO & flutriafol (I.F)	Prosaro 375mL/ha	Aviator 650mL/ha	37.5	bc
13.	Flutriafol (I.F)	Miravis 450mL/ha	Prosaro 450mL/ha	25	c
	Mean			34.9	
	LSD			14.17	
	P val			0.002	

Released:24 February 2021

Trial 6 Influence of Plant Growth Regulation on Canola Yield and Profitability under Irrigation

Project objective: To examine whether experimental PGR (not commercially approved) application has any yield benefit in irrigated canola at different plant populations

Location: Finley IRC
FAR Code: C20-09-1
Sown: 28 April
Cultivar: HyTTec® Trophy
Harvested: 27th November 2020
Rotation position: Wheat (2019), Faba beans (2018), Fallow after rice (2017)
Soil Management: Wheat stubble incorporated with speed disc in Autumn
Irrigation: Overhead lateral irrigation 5 x 25mm in spring. Total applied 125mm
GSR: April-October 244mm. Total water available 369mm
Available Soil N: 129 kg N/ha (0 – 90cm)

Key Messages:

- *Experimental PGR management (based on gibberellin inhibitors) in irrigated canola resulted in significant differences in crop canopy height but no significant effect on seed yield irrespective of plant population.*
- *Reducing plant population did significantly reduce crop height at green bud (GS 51) and yellow bud (GS 59), however there was no difference in crop height at mid pod or harvest due to plant population.*
- *The highest population (48 plants/m^2 - 100seeds/m^2) of the TT hybrid produced significantly higher yields than lower plant populations based 38plants/m^2 - 60seeds/m^2 and 11 plants/m^2-20 seeds/m^2*
- *There was no benefit in harvested seed yield although the canopy was more suitable for direct heading due to its shorter stature at harvest*

Table 1. Influence of PGR application and different plant populations on the seed yield (t/ha) of HyTTec® Trophy.

	Seed Rate & Plant population		
	20 seeds/m^2	60 seeds/m^2	100 seeds/m^2
	11 Plants/m2	**38 Plants/m2**	**48 Plants/m2**
	Yield t/ha	**Yield t/ha**	**Yield t/ha**
Untreated	3.18 -	3.86 -	4.09 -
FAR PGR20/2 @ GB	3.17 -	3.84 -	3.88 -
FAR PGR20/1 @ GB FAR PGR20/2 @ YB	3.15 -	3.91 -	4.23 -
Mean	**3.17 c**	**3.87 b**	**4.07 a**
LSD Seed Rate p = 0.05	0.15	**P val**	<0.001
LSD PGR Strategy p=0.05	ns	**P val**	0.399
LSD Seed Rate x PGR P=0.05	ns	**P val**	0.511

Table 2. Influence of PGR application (mean of three plant populations) on crop height (cm) assessed at GS59, GS75 and late seed fill – 10 Aug, 24 Sep & 12 Nov respectively, cv HyTTec® Trophy.

	Crop Height (cm)		
	GS 59	**GS 75**	**GS 86**
Untreated	67.4 a	154.3 a	150.6 a

Released:24 February 2021

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

FAR PGR20/2 @ GB	55.2 c	143.7 b	141.8 b
FAR PGR20/1 @ GB FAR PGR20/2 @ YB	59.1 b	136.9 c	137.8 b
LSD PGR Strategy p=0.05	2.3	5.4	4.7
P val	<0.001	<0.001	0.002

Table 3. Influence of plant population (mean of PGR treatments & untreated) on crop height (cm) assessed at GS59, GS75 and late seed fill – 10-Aug, 24-Sep, and 12-Nov respectively, cv HyTTec® Trophy.

	Crop Height (cm)			
	GS 51	**GS 59**	**GS 75**	**GS 86**
20 seeds/m2	15.5 b	59.3 b	154.5 -	150.5 -
60 seeds/m2	29.3 a	72.3 a	154.5 -	149.5 -
100 seeds/m2	30.8 a	70.8 a	153.8 -	151.8 -
LSD Seed Rate	5.0	5.7	ns	ns
P val	<0.001	0.003	0.857	0.781

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Kerang VIC

Irrigated trials conducted at the Kerang irrigated research centre 2020 were managed by the Irrigated Cropping Council

Trial 1 Optimum Plant Population Under Sprinkler Irrigation

Project objective: To compare identical plant population x cultivar canola trials under overhead and flood irrigation

Location: Kerang, Victoria
Sown: 23 April
Harvested: 18 November 2020
FAR Code: ICC C20-01-3
Cultivar: HyTTec® Trophy and 45Y28 RR
Rotation position: Dryland vetch/brown manure 2019
Soil Type: Neutral medium grey clay
Irrigation: Overhead sprinkler irrigation 4 applications totalling 108mm (1.08 ML/ha)
GSR: April-October 250mm. Total water available 358mm

Key Messages:

- *Establishment rate for the trial averaged 61%.*
- *Seeding population of the Roundup Ready variety 45Y28 RR made no difference to plant biomass by green bud stage. The low population of TT variety Hytec Trophy failed to 'catch up' to the higher population's biomass.*
- *Yield was maximised at the highest seeding rate (50 plants/m^2 - 80 seeds/m^2), but was not significantly different to that of the 40 and 60 seeds/m^2 treatments in both varieties.*
- *40 seeds/m^2 equates to a plant population of approximately 25 plants/m^2.*
- *Oil content was significantly different between varieties but not between seeding rates.*
- *While there was variation in the Harvest Index from 0.24 to 0.30, the differences were not statistically different for either seeding rate or variety.*
- *Water use efficiency was 15.8 kg/mm*

Table 1. Establishment - Plant population (plants/m^2) established from four seed rates with two different cultivars grown under overhead irrigation.

	Established Population		
Seed Rate	**HyTTec® Trophy** (Hybrid TT)	**45Y28 RR** (RR Y Series Hybrid)	**Mean**
	Plants/m^2	**Plants/m^2**	**Plants/m^2**
20 seeds/m^2	12.0 c	13.4 c	**12.7 d**
40 seeds/m^2	19.7 c	31.6 b	**25.7 c**
60 seeds/m^2	30.9 b	41.1 a	**36.0 b**
80 seeds/m^2	42.5 a	49.6 a	**46.1 a**
Mean	**26.3**	**33.9**	
LSD Seed Rate p = 0.05	6.51	**P val**	<0.001
LSD Cultivar p=0.05	4.60	**P val**	0.002
LSD Seed Rate x Cultivar.	9.20	**P val**	0.4103

RR – Roundup Ready Hybrid

Table 2a. Canopy measurements – dry matter (DM t/ha).

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

	Dry matter (t/ha)							
Seeding Rate (seeds/m²)	**20**		**40**		**60**		**80**	
Green Bud								
TT	1.42	d	2.29	cd	2.46	bcd	2.49	bcd
RR	2.87	abc	3.78	ab	3.77	ab	4.17	a
	p_{var} = <0.001, p $_{rate}$ = 0.079, p_{vxr} = 0.983, lsd $_{vxr}$ = 1.35, cv% = 31.5							
Early Flowering								
TT	4.24	b	6.25	a	6.32	a	6.18	a
RR	6.14	a	7.54	a	7.52	a	6.23	a
	p_{var} = <0.001, p $_{rate}$ = 0.007, p_{vxr} = 0.754, lsd $_{vxr}$ = 1.68, cv% = 17.3							
Harvest								
TT	13.08	b	12.56	b	12.07	b	14.18	ab
RR	15.21	ab	13.97	ab	14.07	ab	16.42	a
	p_{var} = 0.018, p $_{rate}$ = 0.178, p_{vxr} = 0.980, lsd $_{vxr}$ = 3.16, cv% = 15.4							

Table 2b. Canopy measurements – accumulated N (kg N/ha).

	Accumulated N (kg N/ha) *							
Seeding Rate (seeds/m²)	**20**		**40**		**60**		**80**	
Green Bud								
TT	75.3	c	113.3	bc	124.8	bc	118.3	bc
RR	156.6	a b	202.6	a	201.7	a	208.2	a
	p_{var} = <0.001, p $_{rate}$ = 0.139, p_{vxr} = 0.989, lsd $_{vxr}$ = 66.64, cv% = 30.2							
Early Flowering								
TT	157.9	b	239.6	a	239.9	a	227.5	a
RR	229.4	a	226.1	a	265.1	a	252.5	a
	p_{var} = 0.075, p $_{rate}$ = 0.0.049, p_{vxr} = 0.254, lsd $_{vxr}$ = 59.9, cv% = 17.7							
Harvest*								
TT	233.5	a	195.0	ab	159.8	b	239.7	a
RR	194.5	a b	184.7	ab	157.2	b	200.7	ab
	p_{var} = 0.181, p $_{rate}$ = 0.059, p_{vxr} = 0.800, lsd $_{vxr}$ = 68.4, cv% = 23.8							

*Accumulated N at harvest data should be viewed with caution as sampling errors resulted in variable nitrogen content depending on the proportion of grain in the sample tested.

The data presented in Tables 1a and 1b should be viewed with caution as there was variability in the data collected, as indicated by the high cv%.
Starting soil N was 215 kg N/ha (0-60cm). By early flowering, another 95 kg N/ha had been applied.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Maximum biomass achieved at harvest was 16.4 t DM/ha by 45Y28 RR at the highest sowing rate, but this was not significantly different to any of the 45Y28 RR seeding rates or the highest rate of the TT variety.

Table 3. Yield and grain quality.

Seeding Rate (seeds/m^2)	**20**		**40**		**60**		**80**	
				Grain Yield (t/ha)				
TT	3.25	c	3.79	b	3.79	b	4.08	ab
RR	3.80	b	4.02	ab	4.30	a	4.34	a
	p_{var} = 0.002, p $_{rate}$ = 0.002, p_{vxr} = 0.624, lsd $_{vxr}$ = 0.47, cv% = 8.0							
				Oil content (%)				
TT	40.6	b	41.1	b	40.4	b	41.1	b
RR	44.7	a	44.2	a	44.1	a	44.1	a
	p_{var} = <0.001, p $_{rate}$ = 0.477, p_{vxr} = 0.258, lsd $_{vxr}$ = 0.87, cv% = 1.4							
				Harvest Index				
TT	0.24		0.30		0.30		0.28	
RR	0.24		0.28		0.29		0.25	
	p_{var} = 0.447, p $_{rate}$ = 0.077, p_{vxr} = 0.914, lsd $_{vxr}$ = NS, cv% = 16.9							

Highest yield grain was from the highest seeding rate (80 seeds/m^2) in both varieties. However the yields from the 40 and 60 seeds/m2 were statistically similar to that of the high seeding rate.

Oil content was only influenced by variety, not seeding rate.

While there were differences in the Harvest Index, these were not statistically significant.

The average yield for the trial was 3.92 t/ha. This represents a WUE of 15.8 kg/mm.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Trial 2 Optimum Plant Population Under Flood Irrigation

Project objective: To compare identical plant population x cultivar canola trials under overhead and flood irrigation.

Location: Kerang, Victoria
Sown: 23 April
Harvested: 18 November 2020
FAR Code: ICC C20-01-4
Cultivar: HyTTec® Trophy and 45Y28 RR
Rotation position: Dryland vetch/brown manure 2019
Soil Type: Neutral medium grey clay
Irrigation: Flood irrigation 3 applications totalling 300mm (3.0 ML/ha)
GSR: April-October 250mm. Total water available 550mm

Key Messages:

- *Establishment rate for the trial averaged 69%.*
- *There were differences in biomass at green bud, with the trend to lower biomass at lower seeding rates.*
- *There was no difference in biomass at early flowering or harvest from any of the treatments.*
- *Yield was not influenced by sowing rate in either variety.*
- *The lowest sowing rate of 20 seeds/m^2 equates to a plant population of approximately 14 plants/m^2.*
- *Oil content was significantly different between varieties but not between seeding rates.*
- *While there was variation in the Harvest Index from 0.18 to 0.25, the trend being to lower HI at the lower rates, and vice versa.*
- *Water use efficiency was 8.8 kg/mm*

Table 1. Establishment - Plant population (plants/m^2) established from four seed rates with two different cultivars grown under overhead irrigation.

	Established Population		
Seed Rate	**HyTTec® Trophy** (Hybrid TT)	**45Y28 RR** (RR Y Series Hybrid)	**Mean**
	Plants/m^2	**Plants/m^2**	**Plants/m^2**
20 seeds/m^2	16.9 d	17.6 d	**17.2 c**
40 seeds/m^2	26.4 cd	30.9 c	**28.7 b**
60 seeds/m^2	35.1 bc	35.9 bc	**35.5 b**
80 seeds/m^2	44.6 ab	46.8 a	**45.7 a**
Mean			
LSD Seed Rate p = 0.05	7.46	**P val**	<0.001
LSD Cultivar p=0.05	NS	**P val**	0.429
LSD Seed Rate x Cultivar.	10.55	**P val**	0.941

RR – Roundup Ready Hybrid

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Table 2a. Canopy measurements – dry matter (DM t/ha).

Dry matter (t/ha)								
Seeding Rate (seeds/m²)	20		40		60		80	
Green Bud								
TT	2.43	bc	3.00	bc	3.88	ab	4.24	a
RR	2.98	bc	4.79	a	4.27	a	4.08	a
	p_{var} = 0.068, p_{rate} = <0.001, p_{vxr} = 0.387, lsd $_{vxr}$ = 0.954, cv% = 17.0							
Early Flowering								
TT	6.38		7.27		8.61		7.44	
RR	6.61		7.76		7.29		8.55	
	p_{var} = 0.784, p_{rate} = 0.103, p_{vxr} = 0.306, lsd $_{vxr}$ = NS, cv% = 17.2							
Harvest								
TT	16.85		17.26		16.14		15.23	
RR	18.25		16.56		17.43		15.59	
	p_{var} = 0.389, p_{rate} = 0.177, p_{vxr} = 0.665, lsd $_{vxr}$ = NS, cv% = 11.4							

Table 2b. Canopy measurements – accumulated N (kg N/ha).

Accumulated N ((kg N/ha)								
Sowing Rate (seeds/m²)	20		40		60		80	
Green Bud								
TT	110.1	c	159.4	abc	184.8	ab	199.3	a
RR	134.6	bc	201.3	a	204.3	a	181.7	ab
	p_{var} = 0.068, p_{rate} = <0.001, p_{vxr} = 0.387, lsd $_{vxr}$ = 40.9, cv% = 16.2							
Early Flowering								
TT	253		236		244		239	
RR	202		267		236		271	
	p_{var} = 0.964, p_{rate} = 0.808, p_{vxr} = 0.495, lsd $_{vxr}$ = NS, cv% = 25.1							
Harvest*								
TT	298.8	a	267.6	a	216.7	b	257.2	ab
RR	231.9	ab	219.2	b	193.4	b	189.9	b
	p_{var} = 0.008, p_{rate} = 0.125, p_{vxr} = 0.795, lsd $_{vxr}$ = 73.7, cv% = 21.4							

*Accumulated N at harvest data should be viewed with caution as sampling errors resulted in variable nitrogen content depending on the proportion of grain in the sample tested.

The data presented in Tables 1a and 1b should be viewed with caution as there was variability in the data collected, as indicated by the high cv%.
Starting soil N was 158 kg N/ha (0-60cm). By early flowering, another 135 kg N/ha had been applied. There were differences in biomass measured at green bud, with the low seeding rate TT treatment having the lowest biomass, but not significantly different to either the low RR or 40 seeds/m² TT treatments.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Maximum biomass achieved at harvest was 18.25 t DM/ha by 45Y28 RR at the lowest seeding rate, but this was not significantly different to that of any other treatment.

Table 3. Yield and grain quality.

Grain Yield (t/ha)				
Sowing Rate (seeds/m^2)	20	40	60	80
TT	3.36	3.96	3.93	3.98
RR	3.65	4.07	4.01	4.10
	p_{var} = 0.340, p $_{rate}$ = 0.075, p_{vxr} = 0.958, lsd $_{vxr}$ = NS, cv% = 11.3			
Oil content (%)				
TT	42.5 b	42.1 b	42.4 b	42.9 b
RR	45.5 a	45.3 a	45.4 a	45.3 a
	p_{var} = <0.001, p $_{rate}$ = 0.243, p_{vxr} = 0.218, lsd $_{vxr}$ = 0.64, cv% = 1.0			
Harvest Index				
TT	0.18 c	0.22 abc	0.23 abc	0.24 ab
RR	0.19 bc	0.23 abc	0.22 abc	0.25 a
	p_{var} = 0.733, p $_{rate}$ = 0.023, p_{vxr} = 0.883, lsd $_{vxr}$ = 0.053, cv% = 16.2			

Highest yield grain was from the highest rate (80 seeds/m^2) in both varieties. However the yields of all treatments were not statistically different i.e. variety or seeding rate did not affect yield.

Oil content was only influenced by variety, not sowing rate.

Harvest Index was influenced by sowing rate, with the high sowing rate of 80 seeds/m2 having the highest index of 0.25, although the results should be viewed with caution due to the high cv%.

The average yield for the trial was 3.88 t/ha. This represents a WUE of 8.8 kg/mm.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Trial 3 Nitrogen Use Efficiency Trial – Nitrogen Rates

Project Objective: To examine at the nitrogen use efficiency of canola grown under overhead irrigation

Location: Kerang, Victoria
FAR Code: ICC C20-03-2
Sown: 23 April
Cultivar: 45Y28 RR
Harvested: 18 November 2020
Rotation position: Dryland vetch/brown manure 2019
Soil Type: Neutral medium grey clay
Irrigation: Flood irrigation 3 applications totalling 300mm (3.0 ML/ha)
GSR: April-October 250mm. Total water available 550mm

Key Messages:

- *Relatively high starting N at sowing (158kg N/ha 0-60cm) saw little difference in the treatment canopies as measured by NDVI despite the wide range of N application rates.*
- *Plant biomass was similar across all treatments at early flowering, and had produced an average of 8.2 t DM/ha.*
- *Plant biomass at harvest averaged 13.8 t/ha across all treatments, with the highest N rates having the highest crop biomass.*
- *However, grain yield was not significantly different across all treatments excluding the '0 kg N/ha' treatment.*
- *While there was variation in the Harvest Index from 0.26 to 0.20, the differences were not statistically different.*
- *Allowing for soil N at sowing and starter N there was evidence of 60 kg N/ha mineralisation at this site.*

Table 1. Canopy measurements – NDVI, dry matter and accumulated plant N.

Treatments						
	15 June	15 July	Early Flowering		Harvest*	
Rate of Applied N	NDVI	NDVI	DM (t/ha)	Accumulated N (kg N/ha)	DM (t/ha)	
0 kg N/ha	0.70	0.85	7.64	250.9	11.19	a
80 kg N/ha	0.67	0.86	9.11	286.0	13.03	ab
120 kg N/ha	0.68	0.86	8.64	306.8	13.53	ab
160 kg N/ha	0.68	0.85	7.67	259.2	13.59	ab
200 kg N/ha	0.65	0.85	8.36	285.4	12.73	ab
240 kg N/ha	0.66	0.86	8.50	306.1	13.74	ab
280 kg N/ha	0.68	0.86	7.48	251.9	15.47	bc
320 kg N/ha	0.69	0.86	8.01	286.4	17.08	c
P val	0.773	0.042	0.352	0.592	0.013	
LSD	NS	0.006	NS	NS	2.82	
cv%	6.1	0.5	12.8	18.0	13.8	

* Accumulated N at harvest data is not presented as sampling errors resulted in variable data that averaged half that of the N accumulated at early flowering.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Early season soil N was 158 kg N/ha (0-60cm) from cores taken 14 days after the trial was irrigated up. This appears to have been sufficient N to allow even canopy development until at least early flowering as indicated by the lack of difference in the NDVI measurements of the canopy, the biomass dry matter figures and the accumulated N. Although the '0 kg N/ha' treatment had the lowest early flowering biomass and accumulated N, neither were statistically different to the treatments where N was applied.
All treatments exceeded the 7 t DM/ha biomass target at early flowering, with a grand mean of 8.18 t/ha.
The '280 kg N/ha' and '320 kg N/ha' treatments were the only the only treatments to have higher biomass than that of the '0' treatment.

Table 2. Yield and grain quality.

Treatment	Yield (t/ha)	Oil (%)	Test Weight (kg/hl)	Harvest Index
0 kg N/ha	3.00 a	45.0	64.8	0.26
80 kg N/ha	3.24 ab	44.7	65.1	0.24
120 kg N/ha	3.51 b	45.0	64.5	0.24
160 kg N/ha	3.49 b	44.9	64.8	0.24
200 kg N/ha	3.58 b	44.6	64.4	0.26
240 kg N/ha	3.57 b	44.5	64.7	0.24
280 kg N/ha	3.63 b	44.5	64.0	0.23
320 kg N/ha	3.63 b	44.2	63.9	0.20
P val	0.038	0.003	0.172	0.400
LSD	0.397	7.783	NS	NS
cv%	7.8	6.3	1.0	15.9

Highest yield grain was from the two highest N rates, but these were not significantly different from the '80 kg N/ha' treatment yield.

Trial mean yield was 3.46 t/ha. WUE was 6.3 kg/mm.

While there were differences in the Harvest Index, these were not statistically significant.

Higher N application did not result in differences in grain quality.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Trial 4 Nitrogen Use Efficiency Trial – Nitrogen Timing Trial

Project Objective: To examine at the nitrogen use efficiency of canola grown under overhead irrigation

Location: Kerang, Victoria
FAR Code: ICC C20-04-2
Sown: 23 April
Cultivar: 45Y28 RR
Harvested: 18 November 2020
Rotation position: Dryland vetch/brown manure 2019
Soil Type: Neutral medium grey clay
Irrigation: Flood irrigation 3 applications totalling 300mm (3.0 ML/ha)
GSR: April-October 250mm. Total water available 550mm

Key Messages:

- *Accumulated N at early flowering was 190kg N/ha from the treatments with no applied N, which represented the amount of N supplied by the soil.*
- *The crop responded to increasing N rate and later application.*
- *Higher N rate produced a decrease in oil content.*
- *The mean Harvest Index was 0.27, with no statistical difference between treatments.*

Table 1: Treatment Summary – N application rates (kg N/ha) and timing (Growth Stage).

Treatments					
Intended N application	Sowing	6 leaf	Green Bud	Early Flower	
Date	29 May	8 September	18 September	4 October	Total N applied
Treatment 1	0	0	0		0
Treatment 2	40	40			80
Treatment 3	80	80			160
Treatment 4	120	120	0		240
Treatment 5		0	0		0
Treatment 6		40	40		80
Treatment 7		80	80		160
Treatment 8		120	120		240
Treatment 9			0	0	0
Treatment 10			40	40	80
Treatment 11			80	80	160
Treatment 12			120	120	240

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Table 2. Canopy measurements – NDVI, dry matter and accumulated plant N.

Treatments										
		15 June	15 July		Early Flowering				Harvest*	
Treatment		NDVI	NDVI		DM (t/ha)		Accumulated N (kg N/ha)		DM (t/ha)	
00-6l	0	0.51	0.84	ab	7.52	abc	193.4	d	11.09	
00-6l	80	0.47	0.84	ab	7.01	abc	238.9	abcd	12.28	
00-6l	160	0.52	0.85	a	8.25	a	292.7	a	14.91	
00-6l	240	0.50	0.85	a	8.03	a	291.8	a	14.25	
6l-GB	0	0.43	0.82	b	7.14	abc	225.1	abcd	9.92	
6l-GB	80	0.49	0.82	b	6.63	c	216.2	bcd	15.05	
6l-GB	160	0.45	0.83	ab	7.25	abc	267.6	abc	12.35	
6l-GB	240	0.48	0.83	ab	6.88	abc	281.3	ab	14.57	
GB-EF	0	0.45	0.83	ab	6.43	c	212.6	cd	11.41	
GB-EF	80	0.46	0.83	ab	7.17	abc	200.5	cd	12.53	
GB-EF	160	0.47	0.84	ab	6.57	bc	226.0	abcd	14.27	
GB-EF	240	0.46	0.84	ab	6.78	abc	204.5	cd	14.12	
	p timing	0.110	0.004		0.042		0.033		^	
	p N rate	0.869	0.582		0.770		0.019			
	lsd txr	NS	0.023		1.54		69.14			
	cv%	12.0	2.0		15.0		20.20		11.5	

* Accumulated N at harvest data is not presented as sampling errors resulted in variable data that averaged half that of the N accumulated at early flowering.
^ There was significant interaction between timing and rate $p_{txr} = 0.026$

There was some variation in the data from the initial NDVI assessment taken on June 15, probably due to slightly uneven establishment. By July 15, the analysis of the NDVI readings suggested some treatment differences but it would be difficult to attribute these to the treatments given the relatively low range of treatment means and the use of a hand held greenseeker to obtain the data.

Accumulated N at early flowering saw the average for the '0 kg N/ha' treatments being 210 kg N/ha. After subtracting the starter N, this leaves approximately 190 kg N/ha being supplied by the soil.

The trend in biomass at early flowering was for greater biomass where N had been applied earlier and at a greater rate. The trial mean for biomass at early flowering was 7.1 t/ha.
Final biomass at harvest had interaction between the treatments ($p_{txr} = 0.026$) and so only the treatment means are presented. As a general observation, the higher the N rate, the more biomass, with little difference between the timings.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Table 3a. Influence of N timing on yield and grain quality.

Timing	Grain Yield (t/ha)		Oil (%)	Test Weight (kg/hl)	Harvest Index
Sowing/6 leaf	3.47	c	45.8	63.4	0.25
6 leaf/Green Bud	3.73	b	45.9	64.5	0.27
Green Bud/Early Flower	4.02	a	45.9	64.3	0.29
P val	<0.001		0.687	0.136	0.087
LSD	0.238		NS	NS	NS
cv%	8.8		1.3	1.3	16.3

Analysis of the yield data focussing on the timing of N application shows a positive response to later N application, with no response in oil content, test weight or harvest index.

Table 3b. Influence of N rate on yield and grain quality.

N rate (kg N/ha)	Grain Yield (t/ha)		Oil (%)		Test Weight (kg/hl)	Harvest Index
0	3.39	b	46.7	a	64.2	0.29
80	3.57	b	46.0	b	64.1	0.25
160	3.99	a	45.5	c	64.0	0.27
240	4.02	a	45.1	c	64.6	0.27
P val	<0.001		<0.001		0.283	0.305
LSD	0.274		0.491		NS	NS
cv%	8.8		1.3		1.3	16.3

Analysis of the yield data focussing on the rate of N application shows a positive response to the 160 kg N/ha rate, with no further increase at 240 kg N/ha. Higher rate of N application was a negative response in oil content, with no response in test weight or harvest index.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

Table 4. Rate by Timing results for grain yield and oil content.

Yield (t/ha)				
	0 kg N/ha	80 kg N/ha	160 kg N/ha	240 kg N/ha
Sowing/6 leaf	3.41 e	3.37 e	3.53 de	3.56 de
6 leaf/Green Bud	3.23 e	3.64 de	3.95 bcd	4.12 abc
Green Bud/Early Flower	3.52 de	3.70 cde	4.49 a	4.37 ab
p_{timing} = <0.001, p_{rate} = <0.001, p_{txr} = 0.117, lsd_{txr} = 0.475, cv% = 8.8				
Oil (%)				
	0 kg N/ha	80 kg N/ha	160 kg N/ha	240 kg N/ha
Sowing/6 leaf	46.7 a	45.9 bc	45.2 de	45.2 de
6 leaf/Green Bud	46.7 ab	46.1 abc	45.6 cde	45.3 de
Green Bud/Early Flower	46.8 a	46.3 abc	45.8 cd	44.8 e
p_{timing} = 0.687, p_{rate} = <0.001, p_{txr} = <0.001, lsd_{txr} = 0.850, cv% = 1.3				

Highest yield was 4.49 t/ha where 160 kg N/ha was split between green bud and early flowering application. This treatment was not significantly different to the 240 kg N/ha applied at either the same stages or the 6 leaf/green bud treatments.

While there was a range of 0.22 to 0.30 in the Harvest Index, there were no statistical differences and the trial mean was 0.27.

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners:

SOWING THE SEED FOR A BRIGHTER FUTURE

Field Applied Research (FAR) Australia

HEAD OFFICE: Shed 2/ 63 Holder Road
Bannockburn
VIC 3331
Ph: +61 3 5265 1290

97-103 Melbourne Street
Mulwala
NSW 2647
Ph: 03 5744 0516

9 Currong Street
Esperance
WA 6450
Ph: 0437 712 011

Email: faraustralia@faraustralia.com.au
Web: www.faraustralia.com.au

Released:24 February 2021

The GRDC Optimising Irrigated Grains Project is a collaborative project including the following project partners: