Variety specific agronomy for southern irrigated cropping systems

Crop	Canola
Irrigation area	South-east South Australia
Location	Bool Lagoon

Key findings

- Growers should utilise the tools, knowledge and rule of thumb guidelines for growing irrigated canola, accessible on the GRDC website.
- The correct variety should be sown at the correct time for maximum yield potential.
- Be prepared to sow early in a suitable paddock, knowing that seasonal conditions can dictate the success of dual purpose crops.
- Recovery and winter growth of canola is slower than cereals.
- Don't graze too early (wait until the 6–8 leaf stage) and lock up before bud elongation is >10 cm.

Introduction

Irrigated canola experiments were conducted at Bool Lagoon in the south-east region of South Australia between 2014 and 2016 as part of the 'Southern irrigated cereal and canola varieties achieving target yields' project (DAN00198). The objective was to improve canola production through identification of varieties and agronomic practices with superior performance under irrigation.

In 2014, the response of spring and winter type triazine tolerant (TT) and Clearfield® (CL) canola varieties to various nutrition regimes and plant growth regulators was evaluated. In 2015 and 2016, experiments focused on irrigated dual purpose canola crops under different management regimes including sowing date, nitrogen rate and grazing intensity. These experiments were undertaken in response to MacKillop Farm Management Group (MFMG) growers highlighting the need to investigate the management of dual purpose canola under irrigation in the south-east region.

Seasonal reviews

The experiment site received its lowest rainfall on record in 2014 and highest rainfall on record in 2016 (Table 1). These extreme rainfall conditions had a strong influence on experiment results. In 2014 there was no significant interaction with grain yield and different nutrition treatments, and in 2016 the very wet conditions resulted in some experiment treatments being abandoned.

NSW GOVERNMENT Department of Primary Industries

GRDC™ GRAINS RESEARCH & DEVELOPMENT CORPORATION

Table 1 Experiment site annual rainfall (mm) (2014–16), long-term average rainfall, lowest annual rainfall recorded and highest annual rainfall recorded (source: www.bom.gov.au Bool Lagoon Station 26103, Lat. 37.13°S and Long 140.73°E).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2014	25.0	6.2	18.0	45.4	33.4	123.6	58.0	27.0	38.2	12.4	16.8	12.6	416.6
2015	48.2	1.4	14.8	24.2	79.2	40.2	64.4	40.0	34.0	1.6	49.0	13.2	410.2
2016	13.6	28.6	22.8	27.2	76.6	91.4	126.9	116.2	103.0	99.0	26.0	42.4	773.7
LT Mean	31.0	20.6	28.3	31.9	47.3	68.8	81.5	87.4	55.4	40.9	35.0	35.4	559.3
Lowest	0.8	1.2	4.2	10.0	10.8	13.0	37.5	25.4	26.2	1.6	8.9	8.0	410.2
Highest	138.4	49.6	73.4	72.2	97.0	146.8	126.9	166.4	103.0	99.0	81.6	116.2	773.7

Centre pivot irrigator over the irrigated canola experiment at Bool Lagoon 20 April 2015.

Experiment site

Table 2 Experiment site details, 2014–16.

Site detail	2014	2015	2016
Soil	Alkaline shallow med-heavy clay over limestone		
Previous crop	Persian clover	Persian clover	Persian clover
Sowing date (SD)	13 June	SD 1: 18 February (winter canola) SD 2: 19 March (winter and spring canola) SD 3: 14 April (winter and spring canola) SD 4: 13 May (spring canola)	SD 1: 14 April (winter canola) SD 2: 2 May (winter canola) SD 3: 19 May (winter and spring canola) SD 4: 1 June (winter and spring canola)
Row spacing	150 mm	150 mm	150 mm
Irrigation	2.0 ML/ha spring irrigation	2.0 ML/ha spring irrigation	None applied

Site detail	2014	2015	2016
Starter fertiliser	DAP/SOA blend (19:13:0:9 of N:P:K:S) 140 kg/ha Impact® 400 mL/ha	DAP/SOA blend (19:13:0:9 of N:P:K:S) 140 kg/ha Impact® 400 mL/ha	DAP/SOA blend (19:13:0:9 of N:P:K:S) 140 kg/ha Impact® 400 mL/ha
Herbicides, fungicides and insecticides	RoundUp® 2 L/ha TriflurX™ 1.8 L/ha Avadex® Xtra 1.6 L/ha Lorsban™ 1 L/ha 250 mL/ha Dual Gold® MouseOff® 1 kg/ha Snail bait 5 kg/ha CL experiments only – Intervix® 760 mL/ha Supercharge® 500 mL/ha TT experiments only – Gesaprim® 1.7 L/ha Adigor® 500 mL/ha Suprathion® 200 mL/ha Select® 500 mL/ha Lontrel™ Advanced 150 mL/ha Hasten® 1 L/ha CL experiments only – Intervix® 760 mL/ha Supercharge® 500 mL/ha Suprathion® 1 L/ha Karate® 40 mL/ha	RoundUp® 2 L/ha TriflurX™ 1.8 L/ha Goal™ 75 mL/ha Lorsban™ 1 L/ha MouseOff® 1 kg/ha Snail bait 5 kg/ha Intervix® 760 mL/ha Supercharge® 500 mL/ha Select® 500 mL/ha Lontrel™ Advanced 150 mL/ha Hasten® 1 L/ha OnDuty® 55 g/ha Hasten 500 mL/ha	RoundUp® 2 L/ha Goal™ 75 mL/ha Lontrel™ Advanced 75 mL/ha WetterXT™ 200 mL/ha TriflurX™ 1.6 L/ha Avadex® Xtra 1.6 L/ha Lorsban™ 1 L/ha Axe® 200 mL/ha Alpha Forte® 100 mL/ha MouseOff® 1 kg/ha Snail bait 5 kg/ha Intervix® 760 mL/ha Supercharge® 500 mL/ha Havoc® 500 mL/ha Lontrel™ Advanced 150 mL/ha Factor® 80 g/ha Supercharge® 1 L/ha Prosaro® 450 mL/ha BS1000® 500 mL/ha
Harvest date	19 December 2014	Spring canola SD 2 and SD 3: 19 November 2015 Winter canola SD 1 and SD 2 + Spring canola SD 4: 10 December 2015 Winter canola SD 3: 23 December 2015	SD 1: 23 December 2016 SD 2, 3, 4: 4 January 2017

Treatments

In 2014, the nutrition experiment evaluated three nutrition treatments (Table 3) and the plant growth regulator (PGR) experiment evaluated five PGR treatments (Table 4). Two TT and three CL varieties with varying maturities were used in the experiments: Hyola® 656TT, Hyola® 750TT, Hyola® 575CL, Hyola® 971CL and Pioneer® 45Y88 (CL). The plant growth regulator experiment had an additional 140 kg SOA/ha and 70 kg N/ha applied on 9 September 2014.

Table 3 Nutrition rates and canola growth stage of application.

Treatment	Nutrition treatments	Growth stage applied
1	100 kg SOA/ha; 130 kg N/ha	8-leaf; stem elongation
2	100 kg SOA/ha + 130 kg N/ha	Stem elongation
3	100 kg SOA/ha + 80 kg N/ha; 100 kg N/ha	8-leaf; stem elongation

Table 4 Plant growth regulator (PGR) treatments and canola growth stage of application.

Treatment	PGR treatment	Growth stage applied
1	Product A	8-leaf
2	Product A, Product A	8-leaf, stem elongation
3	Product B	Stem extension
4	Simulated grazing	Prior to bud elongation
5	Nil	Nil

In 2015 and 2016, two varieties — Hyola® 575CL (spring type) and Hyola® 970CL (winter type) — were sown at four different sowing dates (Table 2). Plots were either grazed (simulated with a mower) or un-grazed and in 2015 a heavy graze and light graze were compared (Figure 1). Grazing was targeted for when plants were well anchored, at the 6-8 leaf stage and to allow lock up prior to bud elongation greater than 10 cm. In 2015, a post grazing application of either 300 kg N/ha (High N) or 150 kg N/ha (Low N) was applied, and in 2016 either 75 kg N/ha (High N) or 40 kg N/ha (Low N) was applied.

Figure 1 A heavily grazed plot (left) compared to a lightly grazed plot (right) in 2015.

Results and discussion

In 2014, plant establishment counts, days to first flower, normalised difference vegetation index (NDVI), plant height, shoot and root biomass, grain yield and grain quality were recorded.

No significant differences were observed in grain yield or grain quality with different nutrition treatments. There was a significant varietal difference observed in both the TT and CL canola types (tables 5 and 6).

Applying a plant growth regulator treatment did not significantly reduce plant height compared to the nil treatment. Treatment 4 in the PGR experiment (simulated grazing) significantly reduced grain yield of the TT varieties by 0.46 t/ha compared with the nil treatment. No other interactions were observed between variety grain yield and treatment applied. However, there were significant grain yield differences between varieties (tables 5 and 6).

Table 5 Triazine tolerant canola variety grain yield (t/ha) in the nutrition and plant growth regulator experiments, 2014.

Canola variety	Grain yield (t/ha)	
	Nutrition experiment	Plant growth regulator experiment
Hyola® 656TT	2.62	2.35
Hyola® 750TT	3.13	2.92
Mean	2.88	2.63
P value (0.05)	0.014	<0.001
l.s.d.	0.31	0.18

Table 6 Clearfield® canola variety grain yield (t/ha) in the nutrition and plant growth regulator experiments, 2014.

Canola variety	Grain yield (t/ha)	
	Nutrition experiment	Plant growth regulator experiment
Hyola® 575CL	2.64	2.64
Hyola® 971CL	3.95	4.00
Pioneer® 45Y88 (CL)	2.89	2.89
Mean	3.16	3.17
P value (0.05)	<0.001	<0.001
l.s.d.	0.48	0.48

In summary, the 2014 experiment showed grain yield difference between varieties. The exceptionally dry weather conditions were not conducive to nutrition or plant growth regulator experiments. The experiment shows the suitability of the late maturity spring and winter canola varieties under irrigation in this region, particularly when compared with the shorter spring types.

In 2015 and 2016, plant establishment counts, NDVI, dry matter production pre and post grazing, feed test analysis of dry matter, biomass at flowering, grain yield and grain quality were recorded in both experiments.

Hyola® 970CL had the greatest amount of dry matter removed at SD 1 heavy graze (5.12 t/ha), which was significantly greater than the amounts removed at the other sowing dates (Figure 2). Hyola® 575CL had the greatest amount of dry matter removed at SD 4 (2.06 t/ha).

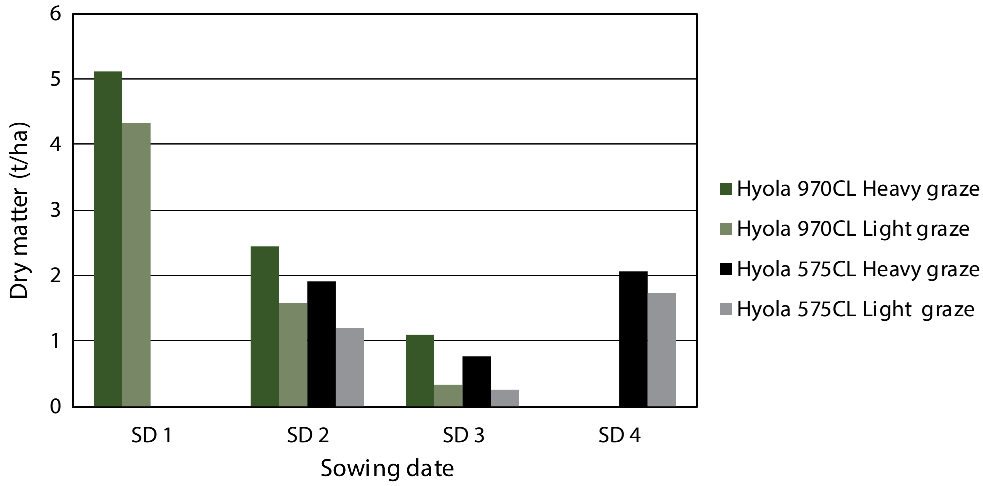

Figure 2 Dry matter removed from the grazing treatments (t/ha).

Grain yields tended to be greater when plots were subjected to light grazing compared with heavy graze averaging 2.95 t/ha and 2.41 t/ha respectively. Increasing the nitrogen rate from 150 kg N/ha to 300 kg N/ha post grazing significantly increased spring canola yields from 2.31 t/ha to 2.52 t/ha. Growers would need to consider the economic viability of increasing nitrogen input compared to grain yield increases. Hyola® 970CL produced its greatest grain yield from SD 2 (3.71 t/ha) and Hyola® 575CL at SD 3 (3.01t/ha). The grain yield of Hyola® 575CL at SD 4 was only 1.17 t/ha, a consequence of it being grazed too late and too hard (bud elongation was nearly 10 cm and simulated grazing removed this) and the crop not having enough time to recover and express its full yield potential.

The high growing season rainfall experienced in 2016 resulted in the experiments being exceptionally wet from June onwards, experiencing variable and lengthy waterlogging. No SD 4 treatments were grazed as they had low dry matter levels and grazing would have adversely affected the plots. These plots still received the allocated nitrogen treatment. Ultimately, 30% of plots were not harvestable and as a consequence, the experiment was highly variable and results must be interpreted with caution.

Early sowing of the winter variety Hyola® 970CL produced the greatest amount of dry matter (2.13 t/ha). The other two Hyola® 970CL treatments only averaged 0.29 t/ha dry matter. Hyola® 575CL at SD 3 had greater dry matter compared with Hyola® 970CL at the same time.

Grain yield averaged 0.4 t/ha across the experiment site. Increasing nitrogen did not result in increased grain yield in 2016. Grazing Hyola® 970CL tended to reduce grain yield, a result of the seasonal conditions and prolonged waterlogging, reducing the time Hyola® 970CL had to recover from grazing and as a consequence not having enough biomass prior to the onset of winter.

Irrigated canola experiment at Bool Lagoon showing varietal differences in flowering date, 3 November 2014.

The project

This variety specific agronomy package (VSAP) is an output of the 'Southern irrigated cereal and canola varieties achieving target yields' project (DAN00198; 2014–17). It summarises the research outcomes from experiments that were conducted in this research node on this crop type.

The objective of the project was to demonstrate an increase in irrigated cereal and canola production, and ultimately water use efficiency, through improvement of grower and adviser knowledge of high yielding cereal and canola varieties and specific agronomy management that will increase production and improve profitability under irrigation.

The project area extended from the Lachlan Valley in NSW to Victoria, Tasmania and across to south-eastern South Australia. The project comprised a series of research experiments to identify the optimum cereal and canola varieties and agronomic management practices for irrigated cereal and canola production in south-eastern Australia. Specific research questions were tailored to the geographic area, or research node.

Organisations that have contributed to the project by conducting research experiments and the location of their research node are NSW DPI (Murrumbidgee Valley, NSW; Murray Valley, NSW), Victorian Irrigated Cropping Council (Northern Victoria), Southern Farming Systems (Tasmania), MacKillop Farm Management Group (south-east South Australia), Central West Farming Systems (Lachlan Valley, NSW) and AgGrow Agronomy & Research (Lachlan Valley, NSW).

In addition to the VSAPs, the project also produced an irrigated wheat production manual and an irrigated canola production manual (available by contacting the author) and an extensive database of experiment results.

The project has joint investment by NSW Department of Primary Industries (NSW DPI) and the Grains Research and Development Corporation (GRDC).

Acknowledgements

This research is part of the 'Southern irrigated cereal and canola varieties achieving target yields' project (DAN00198; 2014–17) which has joint investment by NSW Department of Primary Industries (NSW DPI) and the Grains Research and Development Corporation (GRDC).

We would like to thank the co-operating grower, Bruce McLean, for allowing us to conduct the experiment on his property. We also gratefully acknowledge the assistance provided by SARDI Technical Officers Ian Ludwig, Matthew Hoskings and Carolyne Hilton, and Felicity Turner, Krysteen McElory and Charlie Crozier from MacKillop Farm Management Group.

Further information

Amanda Pearce
SARDI
PO Box 618, Naracoorte SA 5271
(08) 8762 9105
amanda.pearce@sa.gov.au

ISBN: 978-1-76058-087-2 (print)