14. Dual-Purpose Canola for South Australia's High Rainfall Zone

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KEY MESSAGES

- Second year of a 3-year project funded by SAGIT and managed by SARDI.
- Project aims to evaluate dual-purpose canola varieties, comparing two times of sowing and exploring grazing management options.
- Trial site waterlogging resulted in variable results, interpret results with caution.
- Feed test results appear to vary between varieties and varieties at different times of sowing, indicating the importance of feed tests.
- Conventional canola varieties dry matter (DM) production was greater at time of sowing (TOS) 1 compared to TOS 2. Grain yield differences were not measured between varieties or TOS.
- There was a significant difference in DM production between the Triazine Tolerant varieties and TOS. Average grain yield was greater at TOS 2, than TOS 1.
- Greater DM was removed at TOS 1 compared to TOS 2 for Clearfield canola. Hyola 970 CL showed a significant difference in grain yield between TOS, with TOS 1 having a greater yield compared to TOS 2.

Aim of Trial

The second year of the Southern Australian Grain Industry Trust (SAGIT) funded 'Dual-Purpose Canola for South Australia's High Rainfall Zone' project was sown at Bool Lagoon in 2017. This project aims to evaluate dryland dual-purpose canola varieties in the high rainfall zone (HRZ) (>550 mm) of the south-east of South Australia (SA).

Trial Background

The use of canola as a dual-purpose (grazing canola during the vegetative stage while producing an economic grain yield – graze and grain) option for mixed-farming systems in the HRZ of southern Australia has increased significantly (Kirkegaard et al. 2014) and its popularity in the HRZ of south-east SA is increasing (Christy et al. 2013). Innovative growers are now adopting the graze and grain practice with limited regional research to assist their management decisions.

This project will address this knowledge gap by evaluating dual-purpose canola varieties (both commercial cultivars and experimental lines) in the HRZ of south-east SA, comparing two times of sowing and exploring grazing management options.

Christy B, O'Leary G, Riffkin P, Acuna T, Potter T, Clough A (2013) Long-season canola (Brassica napus L.) cultivars offer potential to substantially increase grain yield production in south-eastern Australia compared with current spring cultivars *Crop & Pasture Science* **64**, 901-913.
Kirkegaard J, Sprague S, Lilley J, Dove H, Bell L, Seymour M, McCormick J, Hunt J, Hamblin P (2014) Recent developments in dual-purpose canola In 'Proceedings of the 18th Australian Research Assembly on Brassicas'. Tanunda, SA. (Eds. AH Ware, T Potter) pp.165-170.

Trial Design

In the second year of trial work, three Conventional, three Triazine Tolerant and three Clearfield canola varieties were evaluated at Bool Lagoon (-37.190067, 140.72932) (Figure 1). There were two times of sowing (TOS), TOS 1 – 17 March and TOS 2 – 12 April. Time of sowing was considerably earlier than evaluated in 2016. The aim of seeding earlier was to provide winter-type canola varieties with the opportunity to reach their full potential of biomass production pre- and post-grazing and to maximise subsequent grain yield.

Prior to TOS 1 the site was irrigated with 8 mm of water. Figure 2 shows the trial site immediately post seeding TOS 1 plots. After sowing 4.7 mm and 40.0 mm of rainfall was received on 20 and 21 March respectively. Rainfall, temperature and soil moisture data are presented in Table 1 and Figure 3. The site experienced waterlogging (Figure 4) with variability across the site so results should be interpreted with caution.

Figure 1. The trial site on the 27 of June 2017.

Figure 2. Trial site post sowing of TOS 1 on 17 March 2017.

Table 1. Monthly rainfall and temperature data for 2017 (accessed via the Dryland Probe Project, an initiative between SARDI, MFMG, Integrated Irrigated and South East NRM Board) and Long Term Rainfall (LTR) (accessed via www.bom.gov.au).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2017 Rainfall (mm)	42.8	5.4	56.6	102.8	98.8	25.0	130.4	136.8	89.2	35.2	79.4	14.6	**817.0**
LTR (mm)	31.0	20.6	28.3	31.9	49.7	66.3	82.7	87.4	56.5	40.5	37.9	35.4	**559.3**
2017 Temp AVG (°C)	19.6	18.4	19.3	15.0	10.7	8.7	9.3	9.3	11.5	13.2	18.5	17.4	**14.3**
2017 Temp MIN (°C)	6.1	1.8	2.8	3.5	-1.3	-3.0	0.2	0.2	1.5	3.4	-0.3	4.4	**-3.0**
2017 Temp MAX (°C)	40.0	40.4	36.8	29.3	21.3	19.0	21.2	19.1	24.8	32.7	37.2	37.4	**40.4**

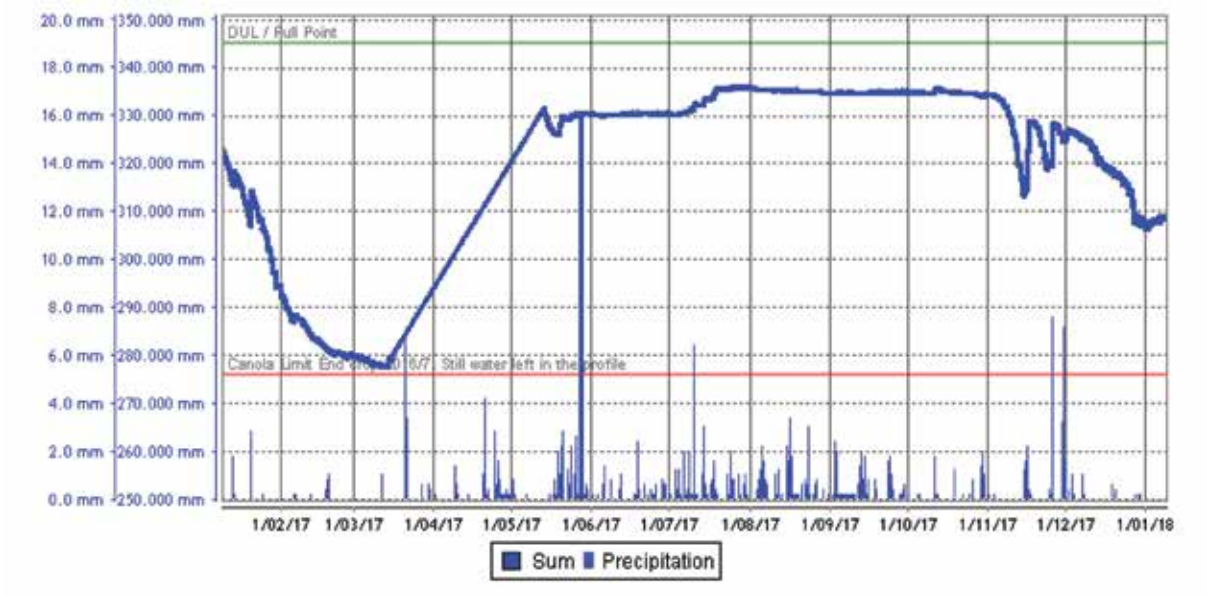

Figure 3. Rainfall and soil moisture, Bool Lagoon (accessed via the Dryland Probe Project an initiative between SARDI, MFMG, Integrated Irrigated and South East NRM Board).

Figure 4. The trial site inundated on September 12 2017.

'Grazing' (simulated by a ride-on-mower) of plots occurred on 15 May for TOS 1 (59 days post seeding) and 26 June for TOS 2 (75 days post seeding). Plants were grazed when anchored and prior to bud elongation beyond 10cm. Plants were grazed down to a height of 5 cm and dry matter (DM) removed was calculated (kg/ha). Grazed plant material was submitted for a feed test. All plots received 75 units of nitrogen post grazing.

Plots were harvested at plant maturity, which occurred from 6 November though to 27 November 2017. Grain quality was measured.

Trial Results

Sowing the 2017 trial earlier resulted in plants reaching growth stage for grazing quicker (59 days TOS 1 and 75 days TOS 2 post seeding) compared to the later sown trial in 2016, where both TOS 1 and TOS 2 were grazed at 101 days post seeding.

In all instances plant establishment was significantly greater at TOS 2 compared to TOS 1.

Feed test results appeared to vary between varieties and varieties at different times of sowing (Table 2 and Table 3). The Feed test results were variable between sowing dates, indicating the importance of checking the feed quality within varieties, between sowing and grazing times.

Table 2. Feed test analysis results for TOS 1 varieties grazed on 15 May 2017 (bulk sample from three replicates).

	TOS 1 - Grazed 15 May 2017								
	SF Brazzil	SF Sensation	Hyola 635 CC	SF Turbine	Hyola 559 TT	Hyola 750 TT	Archer CL	SF Edimax	Hyola 970 CL
Dry Matter (%)	84.8	85.5	87.0	86.6	87.4	86.4	85.6	84.4	84.7
Moisture (%)	15.2	14.5	13.0	13.4	12.6	13.6	14.4	15.6	15.3
Crude Protein (% of DM)	28.8	27.5	33.6	31.3	34.4	35.5	32.0	27.7	28.8
ADF (% of DM)	12.9	14.3	14.4	14.4	13.2	11.8	14.0	11.0	13.1
NDF (% of DM)	20.3	22.6	20.6	19.6	20.2	17.3	19.6	18.5	19.9
DMD (% of DM)	94.7	92.1	94.4	94.2	94.4	98.0	95.0	97.2	95.8
DOMD (Calc) (% of DM)	87.1	84.9	86.8	86.6	86.8	89.9	87.3	89.2	88.0
ME (Calc) MJ/kg DM	14.7	14.2	14.6	14.6	14.6	15.2	14.7	15.1	14.9
Fat (% of DM)	4.6	4.5	4.7	4.7	4.9	4.9	4.6	4.5	4.6
Ash (% of DM)	7.3	11.3	11.7	7.6	11.8	11.8	11.7	5.0	9.7

Table 3. Feed test analysis results for TOS 2 varieties grazed on 26 June 2017 (bulk sample from three replicates).

	TOS 2 - Grazed 26 June 2017								
	SF Brazzil	SF Sensation	Hyola 635 CC	SF Turbine	Hyola 559 TT	Hyola 750 TT	Archer CL	SF Edimax	Hyola 970 CL
Dry Matter (%)	85.3	85.8	83.7	88.2	88.1	87.6	86.7	85.0	87.0
Moisture (%)	14.7	14.2	16.3	11.8	11.9	12.4	13.3	15.0	13.0
Crude Protein (% of DM)	28.1	28.8	26.3	37.7	35.8	33.6	33.4	29.6	35.2
ADF (% of DM)	11.8	12.2	12.9	12.2	13.6	15.8	15.4	13.5	13.7
NDF (% of DM)	19.8	20.0	21.0	18.3	20.4	21.9	23.0	19.5	20.6
DMD (% of DM)	95.0	95.6	94.0	95.3	93.9	92.9	91.9	94.4	94.3
DOMD (Calc) (% of DM)	87.3	87.8	86.4	87.6	86.4	85.5	84.7	86.8	86.7
ME (Calc) MJ/kg DM	14.7	14.8	14.5	14.8	14.5	14.4	14.2	14.6	14.6
Fat (% of DM)	4.6	4.6	4.5	5.1	4.9	4.7	4.7	4.5	4.8
Ash (% of DM)	9.8	5.8	7.2	12.0	11.7	11.8	11.9	6.8	8.7

On average TOS 1 Conventional canola varieties had significantly higher DM removed than from TOS 2 (Table 4). TOS 1 averaged 1021 kg/ha of dry matter in comparison to 751 kg/ha of dry matter at TOS 2. Grain yield did not vary between varieties or time of sowing, with an average yield of 1.34 t/ha (Table 5). The Conventional plots had a higher weed pressure than the herbicide tolerant canola varieties, a problem with a dry early sow and lack of a pre-sow weed kill options.

Table 4. Conventional canola grazed dry matter removed kg/ha and 50 % flowering date.

Variety	Grazed dry matter kg/ha		50 % Flowering	
	TOS 1	TOS 2	TOS 1	TOS 2
SF Brazzil	1082	666	28 Sept	11 Oct
SF Sensation	1072	755	16 Sept	6 Oct
Hyola 635 CC	910	831	17 July	20 Aug
Mean	1021	751		
	P Value	l.s.d		
Variety	0.896	NS		
TOS	0.009	185		
Variety X TOS	0.281	NS		
CV %	7.4			

Table 5. Conventional canola grain yield t/ha and grain quality (bulk sample from three replicates), moisture (%), oil (%) and protein (%). (- not enough seed to conduct analysis)

Variety	Grain Yield t/ha		Grain Quality					
			TOS 1			TOS 2		
	TOS 1	TOS 2	Moisture (%)	Oil (%)	Protein (%)	Moisture (%)	Oil (%)	Protein (%)
SF Brazzil	1.81	1.33	4.9	43.5	22.5	5.5	45.8	19.9
SF Sensation	1.88	1.50	5.2	46.6	20.5	5.2	47.9	17.6
Hyola 635 CC	0.27	1.23	-	-	-	5.8	44.4	20.2
Mean	1.32	1.35						
	P Value	l.s.d						
Variety	0.171	NS						
TOS	0.925	NS						
Variety X TOS	0.275	NS						
CV %	7.4							

There was a significant difference between Triazine Tolerant canola varieties and DM kg/ha production. Hyola 559 TT sown at TOS 2 had the greatest amount of DM removed, 1404 kg/ha (Table 6). The average grain yield was greater at TOS 2, 1.19 t/ha compared to average grain yield at TOS 1, 0.62 t/ha (Table 7).

Table 6. Triazine tolerant canola grazed dry matter removed kg/ha and 50 % flowering date.

Variety	Grazed dry matter kg/ha			50 % Flowering	
	TOS 1	TOS 2	Mean	TOS 1	TOS 2
SF Turbine TT	1041	624	833	13-Jul	14-Aug
Hyola 559 TT	918	1404	1161	2-Jul	17-Aug
Hyola 750 TT	809	564	686	23-Jul	23-Aug
Mean	923	864			
	P Value	l.s.d			
Variety	<.001	166			
TOS	0.338	NS			
Variety X TOS	<.001	234			
CV %	8.8				

Table 7. Triazine tolerant canola grain yield t/ha and grain quality (bulk sample from three replicates), moisture (%), oil (%) and protein (%).

	Grain Yield t/ha		Grain Quality					
			TOS 1			TOS 2		
Variety	TOS 1	TOS 2	Moisture (%)	Oil (%)	Protein (%)	Moisture (%)	Oil (%)	Protein (%)
SF Turbine TT	0.56	1.38	5.8	42.7	23.4	5.7	44.2	21.3
Hyola 559 TT	0.46	1.29	5.8	41.4	24.1	5.7	44.3	22.2
Hyola 750 TT	0.83	0.90	6.3	42.2	22.1	6.3	42.6	21.6
Mean	0.62	1.19						
	P Value	l.s.d						
Variety	0.804	NS						
TOS	0.003	0.32						
Variety X TOS	0.089	NS						
CV %	7.2							

There was a significant difference between TOS for DM, with more DM removed at TOS 1, 1124 kg/ha compared to TOS 2, 729 kg/ha for Clearfield Canola (Table 8).

Only Hyola 970 CL showed a significant difference in grain yield between TOS, with TOS 1 having a yield of 2.37 t/ha compared to 1.39 t/ha for TOS 2 (Table 9).

Table 8. Clearfield canola grazed dry matter removed kg/ha and 50 % flowering date.

	Grazed dry matter kg/ha		50 % Flowering	
Variety	TOS 1	TOS 2	TOS 1	TOS 2
Archer CL	974	535	23-Jul	23-Aug
SF Edimax	1311	659	29-Jul	1-Sep
Hyola 970 CL	1088	994	27-Jul	30-Aug
Mean	1124	729		
	P Value	l.s.d		
Variety	0.119	NS		
TOS	0.004	240		
Variety X TOS	0.153	NS		
CV %	9.4			

Table 9. Clearfield canola grain yield t/ha and grain quality (bulk sample from three replicates), moisture (%), oil (%) and protein (%). (%).

	Grain Yield t/ha			Grain Quality					
				TOS 1			TOS 2		
Variety	TOS 1	TOS 2	Mean	Moisture (%)	Oil (%)	Protein (%)	Moisture (%)	Oil (%)	Protein (%)
Archer CL	0.87	0.61	0.74	5.4	43.4	22.2	5.3	43.8	20.3
SF Edimax CL	1.68	1.59	1.64	5.2	45.1	21.0	5.2	45.3	20.7
Hyola 970 CL	2.37	1.39	1.38	4.9	46.5	20.8	5.5	45.0	21.0
Mean	1.64	1.20							
	P Value	l.s.d							
Variety	<.001	0.26							
TOS	0.001	0.21							
Variety X TOS	0.009	0.37							
CV %	10.4								

Trial Conclusions and Plans for 2018

Overall canola yields were low, but were reflective of the season. Dry matter production was much lower than anticipated and recorded in previous research.

The waterlogging experienced and high variability of the site have confounded results, with varieties not reaching their full potential in DM production and grain yield. Interpret results with caution.

The trial will continue at Bool Lagoon in 2018. Site selection has started for a trial area with a lower waterlogging risk and weed pressure. The trial will evaluate the same cohort as in 2017. Trial seeding times, measurements and data collection in 2018 will remain similar to 2017.

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