



IRRIGATION RESEARCH & EXTENSION COMMITTEE

2008



FOR IRRIGATION CROPPERS

The 5 tonne irrigated canola crop

Paper prepared by

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TAKE HOME MESSAGES

The Vic. DPI achieved record yields above 5 t/ha in their irrigated variety trial at Kerang in 2007 - due to good management and favourable weather conditions at the critical late flowering and pod-fill period.

Growers can aim for the crop to have the optimal conditions to achieve its potential by getting the basics right:

1. Choose a suitable variety.
2. Make sure the crop is in on time – late April to early May.
3. Get the required number of plants established – around 50 plants/m².
4. Control weeds.
5. Use some sort of moisture monitoring to ensure the crop has adequate moisture – ideally an objective method.
6. Windrow on time to minimise shattering losses.

5 T/HA - IS IT POSSIBLE?

To the authors' knowledge there have only been four documented cases of canola crops breaking through the 5 t/ha barrier in Australia – the most recent one a hybrid in a Vic. DPI irrigated trial on beds at Kerang last year.

The highest reported yield of canola in Australia is a commercial dryland crop grown at Lake Bolac in the cooler climate of Victoria's Western District in the late 1990s, reaching 4.9 t/ha. In the irrigation areas, the highest yielding commercial crop reported was at Carrathool at 3.9 t/ha in a year with a particularly cool finish to the season.

But the reality is that most irrigators would be more than happy with a 3 t/ha crop, let alone a 5 t/ha crop. In fact, CropCheck data from 1991 to 2003 showed that the average irrigated canola crop in the dataset from the Riverina and northern Victoria yielded 2.2 t/ha. But the top 20% of these crops yielded an average 3.0 t/ha, while the bottom 20% yielded 1.2 t/ha (Table 1).

Table 1: Median sowing date for 197 irrigated canola crops in the Riverina and northern Victoria from 1991-2003, based on maturity type and data benchmarked for 20% highest yielding crops, average crops, and the lowest 20% yielding crops. Yields (t/ha) are shown and the percentage of crops in each category is in brackets. Data from Finley (127), Coleambally (35), unknown, NSW (13), Yanco (8), Kerang (5), Cobram (3), Deniliquin (2), Griffith (2), Hay (1).

Variety maturity	top 20%		middle 60%		bottom 20%		All crops
	Sowing date	Yield t/ha	Sowing date	Yield t/ha	Sowing date	Yield t/ha	
Early	17 April	3.0 (20%)	24 April	2.4 (5%)	1 May*	1.2(1%)	2.8
Early-mid	na	Na (0%)	16 April	2.4(5%)	18 April	0.9(10%)	2.0
Mid	25 April	3.0(68%)	7 May	2.3(66%)	6 May	1.1(65%)	2.3
Mid-late	22 April	3.0(8%)	28 April	2.2(16%)	20 April	1.4(18%)	2.2
Late	na	na(0%)	20 April*	2.3(1%)	na	na(0%)	2.3
All crops	25 April	3.0 (100%)	5 May	2.2(100%)	4 May (100%)	1.2 (100%)	2 May, 2.3

* indicates small dataset, so view these figures with caution. Note that these data only include irrigated crop. Dryland crops under irrigation layouts were removed from the dataset. Source of raw data: NSW DPI Cropcheck.

HOW THE DPI TEAM DID IT

The team at DPI Kerang has been sowing canola variety trials for many years. 2007 saw the best yields on our records, with one variety averaging over 5 t/ha and the overall trial average was 4.2 t/ha. So why was 2007 such a special year?

This is what we did:

April 2	Pre-irrigated (2 ML/ha) oaten hay stubble.
April 19	Knockdown, Roundup [®] (1.2 L/ha) plus Hammer [®] (50 mL/ha)
April 26	18 varieties were sown at 3 kg/ha with 125 kg/ha DAP, targeting 50 plants/m ² . Establishment was 48 plants/m ² .
June 8	Sertin [®] (1.5 L/ha) plus Lontrel [®] (0.3 L/ha)
July 17	1 st nitrogen (N) topdressing at 55 kg N/ha.
August 31	2 nd N topdressing at 55 kg N/ha. Total N was 240 kg/ha, including soil N, starter and mineralisation through the season, <u>enough for 3t/ha</u> , based on the rule of thumb for nitrogen use in canola.
August 31	1 st spring irrigation (1.25 ML/ha).
September 28	2 nd spring irrigation (1.0 ML/ha). Total irrigation water used was 4.25 ML. Growing season rainfall was 187 mm.
November 1 st	Windrowing.
November 13 th	Harvest.

Sow on time

The first step was getting the crop in early within the sowing window– the trial was sown on April 26. This is a bit earlier than we would normally sow as we are usually waiting for seed. This year, thanks to the efforts of the Oilseed Breeding Program at DPI Horsham, we had the seed ready in plenty of time. When the weather bureau predicted rain for the 28th, we were able to sow into pre-irrigated ground and let nature supply the moisture to get the trial out of the ground.

Establish recommended plant densities

With the right amount of rain, and with the soil temperatures still warm, the seed had excellent conditions for germination and we achieved close to our target population of 50 plants per square metre from a sowing rate of 3 kg/ha. Improved seeding equipment and good management have allowed some irrigators to sow at 2.5 kg/ha using hybrids.

Control weeds

Weed management was excellent as a result of three major factors:

- good establishment and vigorous crop;
- a hay crop the previous year which reduced the weed seedbank; and
- the technical staff of the cropping team which kept a close eye on the trial and sprayed early to ensure the weeds didn't get a hold.

Objective moisture monitoring

Irrigation management also ensured the crop received minimal stress. Irrigation timing was based on crop stage and objective soil moisture information from the gypsum blocks (Gbugs) we had installed.

Mild spring temperatures can make a huge difference

While we have a certain amount of control over the above, we cannot control the weather and in particular, the temperatures we get in spring. This season saw no extremes during flowering and pod fill. While conditions were a little warmer than average, there was only one brief hot spell in mid October.

A combination of the trial starting earlier and mild weather saw the trial start flowering in late August, approximately two weeks earlier than normal. This was likely to be due to the warmer than average conditions earlier in the season.

Flowering lasted for up to 6 weeks for some varieties and finished about four days later than usual, mostly by 26 September, and the dates for the end of flowering were scattered over a 12 day period for the different varieties.

Most seasons see the flowering of canola cut short by hot windy days in late September or early October, and the different varieties in the trial usually finish flowering over two to three days.

Research in glasshouse trials has shown that sudden high temperatures during flowering can cut yields by as much as half of temperature-sensitive varieties. The yields are less affected if the maximum temperatures increase slowly over a number of days, and some varieties are more tolerant of heat stress than others.

Managing the canopy - holding off with the nitrogen and doing the sums

Nitrogen management follows our recommended practice of sowing with starter N and then topdressing later in the season. Deep soil N tests pre-sowing showed the paddock to have lower than usual N levels of 45 kg N/ha, which was not surprising given the 2006 crop was cut for hay. At sowing, DAP at 125 kg/ha supplied approximately 25 kg N/ha and we would expect the breakdown of organic matter throughout the season to produce another 60 kg N/ha – a total of 130 kg N/ha. With the rough rule of thumb that canola requires around 80 kg N/ha per tonne of grain, our usual target is 3t/ha or needing 240 kg N/ha. This meant we were 110 kg N/ha short.

This shortfall was supplied as a split topdress at mid July and late August. Similar to the cereals, canola has its main requirement for nitrogen at the stem elongation/bolting stage. Our strategy is to manage the canopy by limiting the amount of N early to stop excessive growth and then supply the plant what it needs as it needs it. However this strategy relies on topdressing and moisture to wash the N into the rootzone, not only to minimise N volatilisation when using urea, but to get it to the roots for the crop to use. In 2007, the first topdress in mid July was on time, but we had limited opportunities to supply the rest until we irrigated in late August at early flowering. This N was supplied later than we would have liked. We split our applications due to spreading the urea on the trial plots by hand and we got a more even coverage with the split. On a farm scale, splitting from a coverage perspective is probably less important, but there is a higher risk from spreading then not getting the forecast rain. In the 2007 trial, the amount of N to be topdressed was 110 kg N/ha (or 240 kg urea/ha). Would you be prepared to spread this amount in one hit?

In paddocks where the N levels were higher, then obviously the required amount of N would be reduced and therefore the risk in a single topdress is reduced.

Although the late application of N may have made the crop N deficient at the late bolting/early flowering stage, it appears to have had little effect on yields. Added to the possible yield penalty is the risk of increased protein and reduced oil content. However the grain quality of ^{AV}Sapphire from the trial was still reasonably good at 41% oil. This may be another risk in years where topdressing is delayed but the crop may be able to cope with this late N if the yield is high enough – that is a dilution factor. We see this effect each year with our barley trials where our final protein levels are in reverse to our yields. If we don't reach our target yield, we tend to get high proteins, and vice versa, where we do exceed our target yield, our proteins are OK.

Variety choice

The best approach for selecting a canola variety is to stick to proven varieties, and try new varieties on a smaller scale. Also consider blackleg resistance rating and whether or not the rating is eroding.

The varieties selected for the Kerang trial were predominantly mid to mid-late maturity varieties. It is also interesting to note that quite a few are no longer available.

A consistent result from the trials over the seasons is the relative poorer performance of the triazine tolerant (TT) lines. TTs should only be used if the TT trait is needed to control weeds as the control comes at a yield penalty.

TT varieties are inherently lower yielding than other varieties (see Table 1). These varieties should only be used when the weed population necessitates their use, or when triazine residues from the previous year (e.g. sometimes after maize) limit the cropping options.

Table 1: Irrigated canola yield data (t/ha), maturity, herbicide tolerance, height (cm) and lodging score (1-9) from Kerang DPI/VICC trials. Note: not all new varieties/hybrids tested.

Variety	Maturity	Herbicide tolerance	Height	Lodging score*** *	2007 yield	5-yr adj. average (t/ha)***	5-yr adj. average (% Pioneer® 46C76)
Hyola75* (hybrid)	Late	Conventional	150	8	5.10	3.70	124
^{AV} Sapphire**	Mid	Conventional	125	8	4.50	3.35	112
Pioneer®44C11	Early	Conventional	150	5	4.20	3.34	112
Pioneer®46C04	Mid	Conventional	130	7	4.76	3.33	112
^{AV} Garnet	Mid	Conventional	165	8	4.15	3.30	111
WarriorCL	Early-mid	Clearfield	165	8	4.41	3.29	110
Skipton	Mid	Conventional	140	7	4.11	3.24	109
^{AG} Spectrum**	Early	Conventional	110	8	4.67	3.21	107
^{AV} Jade	Early-mid	Conventional	130	7	4.07	3.19	107
Pioneer®45Y77 (hybrid)	Early-mid	Clearfield				3.11	104
^{AV} Ruby	Mid	Conventional	130	8	4.14	3.09	103
Rivette	Early	Conventional				3.05	102
MONOLA™75 TT	Mid-late	TT				3.00	101

Pioneer®46C 76	Mid-late	Clearfield	120	6	3.55	2.99	100
Pioneer®45C 75	Early-mid	Clearfield				2.93	98
^{ATR} Cobbler	Early-mid	TT	130	7	3.90	2.92	98
^{ATR} Summitt	Mid-late	TT	155	7	3.91	2.91	98
ThunderTT	Mid-late	TT	155	6	3.76	2.89	97
^{ATR} Marlin	Mid-late	TT				2.88	96
RocketCL	Mid-late	Clearfield	160	7		2.81	94
^{ATR} Signal**	Early-mid	TT	110	9	3.65	2.79	93
Flinders TTC	Mid-late	TT				2.72	91
^{ATR} 409	Mid	TT				2.71	91
BravoTT	Mid	TT				2.70	90
TornadoTT	Mid	TT	160	6	3.70	2.62	88
^{ATR} Beacon**	Early-mid	TT				2.62	88
Average						2.99	100

*Variety withdrawn in 2008 due to difficulties in seed production.

**Considered outclassed, only limited seed available in 2008.

***These yields are estimated by the statistical analysis of the long term data and are adjusted for missing seasons.

****Lodging Score: 9 is vertical (no lodging) and 0 is horizontal.

Mid-season varieties are generally the best option in a normal year in northern Victoria. In regions which experience more hot days post-flowering (e.g. Murrumbidgee Valley), early and mid-season varieties are normally preferred. In low allocation years, early maturing varieties may be a better option in lower rainfall areas (<350 mm), possibly with some yield sacrificed to save water.

In commercial dryland crops, the actual yield difference between the TTs and conventional varieties is less apparent, as TT varieties may allow growers to sow earlier, and use herbicide which may offset some of the yield penalty, rather than waiting for a weed germination and then sowing a conventional variety. In a normal year, irrigated croppers have the opportunity to sow on time and may see real benefits in choosing a non-TT variety.

Hybrids, on the other hand, have the benefit of a trait known as 'hybrid vigour' and tend towards higher yields (Table 1). Canola hybrids have been in Australia since the early 1990s, but it is only in recent years that they have shown their potential.

Some varieties are more prone to lodging under irrigation than others. Lodging is also influenced by sowing date, establishment rate and the up-front nitrogen levels. High populations, sown early with lots of nitrogen result in huge biomass, often leading to lodging.

Table 2: Canola blackleg resistance rating for 2008. New ratings released June 2008.

Conventional varieties and hybrids			Conventional specialty varieties		
Variety	Rating	Comment	Variety	Rating	Comment
Hyola 50	R		Monola™ 130	R-MR	
Hyola 76	R	Provisional rating*			
^{ATR} Signal	MR				
^{AV} Jade	MR				
^{AV} Garnet	MR				
^{AV} Sapphire	MR-MS				
Pioneer® 46C04	MR-MS				
^{AG} Spectrum	MS	Reduced resistance**			
Skipton	MS				
Tarcoola	MS				
^{AG} Muster	MS-S				
Rivette	MS-S				
Triazine tolerant varieties			Triazine tolerant specialty varieties		
^{ATR} 409	R-MR		Monola™ 75TT	R-MR	Provisional rating
Tornado TT	MR				
Hurricane TT	MR	Provisional rating			
^{ATR} Marlin	MR				
Rottnest TTC	MR				
CB™ Argyle	MR	Provisional rating			
Thunder TT	MR-MS	Reduced resistance			
Tawriffic TT	MR-MS	Provisional rating			
^{ATR} Barra	MR-MS				
Storm TT	MR-MS	Provisional rating			
^{ATR} Banjo	MR-MS	Reduced resistance			
Flinders TTC	MR-MS	Reduced resistance			

^{ATR} Cobbler	MS				
Bravo TT	MS	Reduced resistance			
^{ATR} Summitt	MS				
^{ATR} Beacon	MS-S				
Clearfield varieties and hybrids			Conventional juncea canola varieties		
Pioneer® 46Y78	MR		Dune	R	Provisional rating
Rocket CL	MR				
Pioneer® 45Y77	MR				
Warrior CL	MS				
Pioneer® 45C75	MS				
Pioneer® 46C76	MS	Reduced resistance			
Pioneer® 44C73	S	Reduced resistance			

*Provisional rating: There is insufficient data to meet National Blackleg Rating protocols.

Growers should be cautious until sufficient data are available.

Varieties in the same Blackleg Resistance Rating group are listed in descending resistance order.

**Reduced resistance: At one or more sites this variety had lower resistance than previously reported.

SUMMARY

Very high yielding irrigated canola crops are possible with good variety selection, timely sowing, optimal plant populations, good weed control, close monitoring and careful management of inputs including irrigation water and nitrogen. Mild conditions during flowering and pod-filling also help canola crops reach their potential.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the contribution of Kathryn Bechaz (Fox), of Yanco Agricultural Institute, NSW DPI for provision of raw data for Cropcheck benchmarking, and Chris Lisle, Wagga Wagga Agricultural Institute, NSW DPI, for biometrical analysis of variety trials. Coordination of seed for trial undertaken by Dave Robson and Steve Barnes, DPI Horsham.