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Grains Research and
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GM CANOLA – PERFORMANCE AND EXPERIENCES IN 2008

Roundup Ready® canola grower case studies
Field trial results and demonstration site activities

AUTUMN 2009



better **canola** through enhanced **productivity**
increasing the **value** of the Australian industry



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ISBN: 978-1-875477-52-4

Published February 2009 - www.agri-mc.com.au

Acknowledgements

We are especially grateful to the Grains Research and Development Corporation and the Australian Oilseeds Federation for funding the Better Oilseeds project.

Grower involvement

The compilers are also grateful for the invaluable contribution of the following growers who allowed us to publicise the Roundup Ready canola experiences:

Chris Sweeney, Rodney and Anthea Wright, Peter and Alison Campbell, Evan, John and Helene Ryan, Andrew and Rachel Broad, Andrew and Julie, Rodney and Andrea Weidemann, Bernie and Sophie Delahunty, John Sheehan, Stephen Heard, Spencer and Dimity Milleer, George Burdett, David and Cameron Gibson and Brian and Alistair Woods.

Copies available from www.australianoilseeds.com or ground-cover-direct@canprint.com.au or free phone 1800 11 00 44.

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CONTENTS

Introduction and summary	4
Roundup Ready canola - an adviser's view	6
National Variety Trials	7
FarmLink canola systems trial	9
Irrigated variety trial	11
Better Canola demonstration	13
Farmer Case Studies	
• Forbes, NSW - Chris Sweeney	16
• Cowra, NSW - Rodney and Anthea Wright	17
• Henty, NSW - Peter and Alison Campbell	18
• Yarrawonga, Vic - Evan, John and Helene Ryan	20
• Bridgewater, Vic - Andrew and Rachel Broad	21
• Rupanyup, Vic - Andrew and Julie Rodney and Andrea Weidemann	22
• Murtoa, Vic - Bernie and Sophie Delahunty	24
• Ballan, Vic - John Sheehan	25
• Willaura, Vic - Stephen Heard	26
• Willaura, Vic - Spencer and Dimity Millear	28
• Wickliffe, Vic - George Burdett	29
• Lismore, Vic - David and Cameron Gibson	30
• Shelford, Vic - Brian and Alistair Woods	31

INTRODUCTION

One of the supporting elements in the canola industry's strategy to improving productivity is innovation and access to technology. One such technology is GM canola.

In 2008, the canola industry planted its first commercial GM canola crop in NSW and Victoria following the lifting of their State-based moratoria. This was five years after two genetically-modified (GM) herbicide tolerant types Roundup Ready® and glufosinate resistant InVigor® hybrids were approved for commercial production by the Federal Regulator - Office of the Gene Technology Regulator.

In supporting the commercial production of GM canola, the industry adopted a position of market choice which frames the development of on-farm and value chain stewardship and coexistence arrangements across the range of products the industry produces.

The management of the grain supply chain to meet end user specifications, for product quality and ensuring that the product is not compromised by the unintended presence of impurities, is built on a platform of product integrity. This is maintained with the use of tools such as standards, identity preservation processes, segregation and traceability.

In response to the approval for commercial production of GM canola in NSW and Victoria, the Australian Oilseeds Federation (AOF) introduced an additional trading standard for non GM canola to accommodate market requirements. The supply chain has implemented appropriate protocols and systems to meet the industry's market choice criteria and customer requirements as defined by the industry standards. The industry adopted a segregated strategy for GM canola in 2008. The Roundup Ready (RR) canola was sold to 2 domestic processors.

In 2008 four RR varieties were available from three seed companies. The InVigor hybrids are not commercially available in Australia at this stage.

Approximately 500 growers, agronomists (the "technology service providers" or TSPs) and industry representatives participated in training and accreditation courses conducted by Monsanto Australia Ltd. More than 300 people also attended industry field days in 2008. There was around 9,600 hectares of GM canola planted by 108 growers. Crop management practices have been conducted in accordance with the Crop Management Plan, developed by Monsanto.

SUMMARY

This book presents 13 case studies of growers, two NVT trials, two other independent trials and one independent Better Canola demonstration of Roundup Ready canola in its inaugural year in Victoria and New South Wales.

Growers' reasons for adopting Roundup Ready canola in 2008

The following case studies show that the primary reason growers planted Roundup Ready canola was for management of herbicide resistant ryegrass. It is seen as "another tool in the toolbox" by a number of growers.

Other reasons includes:

- To try out the new technology.
- Weed management i.e. clean up paddocks.
- Increased flexibility i.e. to dry sow or sow early with minimum tillage.
- Improve yields, in particular, overcome the yield penalty associated with triazine tolerant varieties.
- Herbicide safety i.e. access to a more benign herbicide.

To access the technology, growers were required to pay a stewardship fee per farm and also incurred an end point royalty on grain harvested. Growers worked with their TSP to determine the level of risk of weeds in their paddock developing resistance to glyphosate (using the "PRAMOG®" – Paddock Risk Assessment and Management Option Guide.) The TSPs also monitored the effectiveness of the weed control following herbicide application.

The PRAMOG enables growers to assess the potential risk of weeds developing herbicide resistance by assessing the history of glyphosate use in a particular paddock. The process places a grower into one of three categories which show the management practices which must be implemented in the year following RR canola. In 2008 one-third of paddocks were in category 1, which means that in the year following RR canola growers must undertake one additional, non glyphosate, management practice. Fifty seven per cent were in category 2, requiring two additional management practices and 11% were in the "NG" category, where Monsanto recommends growers do not use glyphosate in the year following RR canola. If the grower and TSP feel the risk of developing glyphosate resistant weeds is too high, they can choose not to grow RR canola.

The 2008 season was a difficult one to test the new varieties due to a dry season in eastern Australia, with Victoria and much of southern New South Wales experiencing decile 1 growing season rainfall. Severe frosts in late October and mid November also reduced canola production in Victoria's major canola growing region of the Western District by about one-third, with many crops not harvested. Only two of the five National Variety Trials (NVT) with Roundup Ready canola were consistent enough for results to be published.

The future

As demonstrated in the following case studies, generally growers who have tried the new technology have been happy with the weed control and the additional tool it provides in fighting herbicide resistant weeds. It is expected that this will lead to an increased area planted to GM canola in 2009 across Victoria and NSW.

Roundup Ready canola will also be trialled in Western Australia in 2009, giving Australia's major canola-growing State the opportunity to test the new technology.

- Herbicide management i.e. to reduce herbicide residue issues after canola.
- Improve profitability.

Positives with Roundup Ready canola in 2008

Growers reported a number of positive features of the technology including:

- Excellent weed control.
- Simple system.
- Opportunity to rest selective herbicide groups.
- Ideal for no-till: ability to sow directly into stubbles and spray post-emergence.
- Cheaper herbicides than the mixes used in triazine tolerant and Clearfield® canola.
- Safer herbicide, and a preference by some for the dry formulation.
- The vigour of the hybrids (this trait is related to the hybrid, rather than the RR trait).
- Higher yields and gross margins than other canola types for some growers.

Issues with Roundup Ready canola in 2008

The case studies showed that growers had few problems with the technology and expected that most of the issues experienced would be ironed out with increased adoption and with the release of newer, more elite varieties.

In addition to agronomic factors raised (see below), there were some issues relating to marketing and delivery. This largely reflected the small scale of production and the supply chain arrangements instituted for 2008 which required growers to deliver to nominated sites and resulted in a narrower choice of marketing options. These issues will be overcome as production expands.

The most common agronomic issues raised were:

- Variety performance – the moratoria meant development of varieties by companies had been either slowed or ceased. In some cases this meant no further development since 2004.
- Sowing delayed due to availability of seed following the lifting of the moratoria.
- Variety characteristics - one hybrid grew very tall, especially in high rainfall areas, similar to the first canola varieties.
- Some growers missed the chance to apply a second Roundup Ready herbicide application by the six-leaf stage (the last opportunity). In some of these cases, the crop required a second post-emergence spray with a selective herbicide (however, some other growers intentionally used a one-spray approach, and most of this group were happy with the result).
- One grower also mentioned the anxiety resulting from pressure groups on growers who chose to adopt the technology, in addition to coping with other drought-related stresses.

Trials

Five National Variety Trials (NVT) were sown in 2008, comparing varieties within and across their herbicide tolerance systems, but only two made it through due to drought and frost. These were at Horsham, Victoria and Forbes, NSW. The method of data analysis removed the effects of herbicide treatments so individual varieties with different herbicide tolerances could be compared.

At both NVT sites, there were no significant differences between the highest yielding varieties of each herbicide tolerant group.

The Forbes site produced an average yield of 1.0 t/ha. Twenty of the 26 varieties produced yields not significantly different from the site mean, one was higher and five were lower. All Roundup Ready canola varieties produced yields not significantly different to the site mean.

The Horsham site was low yielding due to late sowing and a dry spring, favouring the earlier maturing varieties. Average yield was 0.65 t/ha. Mean yields at the Horsham NVT site ranged from 0.52 to 0.82 t/ha. All but five of the 28 varieties produced yields not significantly different from the site mean, including three of the Roundup Ready varieties. Two mid to mid/late maturing varieties (one Roundup Ready and one TT variety) produced yields below the site mean, which is expected for that maturity with a late sowing date and a dry finish.

The Victorian Irrigated Cropping Council and the Victorian Department of Primary Industries conducted an irrigated canola trial at Kerang, comparing 17 varieties but not herbicide systems (that is, all varieties were treated as conventional). The site mean yield was an impressive 3.54 t/ha. The four best performing were conventional varieties AV-Garnet, Hyola 50, the Roundup Ready hybrid Hyola 502RR and the Clearfield variety 44C79. All other varieties followed with no significant differences between them.

FarmLink also conducted a trial near Young in southern NSW with one each of conventional, triazine tolerant, and Clearfield varieties and three Roundup Ready hybrids. The conventional canola variety AV-Garnet and the Roundup Ready hybrid Hyola 502RR topped the yields with all other varieties, which were not significantly different from each other, coming in third.

THE ROUNDUP READY VARIETIES

The commercially available varieties in 2008 and 2009.

Name	Maturity	Blackleg resistance	Pollination system	End Point Royalty
GT61	Early-mid	MR (provisional, P)	Open pollinated	Applies
Hyola 502RR	Early-mid to mid	R (P)	Hybrid	Applies
Hyola 601RR	Mid	R (P)	Hybrid	Applies
46Y20 (RR)	Mid-late	R (P)	Hybrid	Applies



Phil Salisbury (left) and Wayne Burton, Vic. DPI, bred the Roundup Ready canola variety GT61.

ROUNDUP READY CANOLA

An Adviser's View

**JOHN STUCHBERY, JOHN STUCHBERY & ASSOCIATES,
DONALD, Vic.**

Introduction

2008 was the first season for the commercial production of Roundup Ready canola in Victoria and New South Wales. Commercial crops were grown in a range of environments across the cropping areas. This paper summarises the strengths and weaknesses of the Roundup Ready system following a review of the experiences of 2008.

In general, most growers were happy with the technology and the first year's experience did highlight the strengths and weaknesses of the system.

Strengths

Grass control

The Roundup Ready system provided excellent control of grasses and of ryegrass resistant to selective herbicides. In cases where ryegrass was the main weed, two applications of Roundup Ready herbicide were required to maximise weed control.

Broadleaf weed control

In general, Roundup Ready herbicide had good efficacy on most weeds and the two application strategy generally provided the best overall weed control.

Dry sowing

The Roundup Ready system facilitates dry sowing or sowing on the break while still allowing for good in-crop weed control. Dry or early sowing makes the best use of the growing season rainfall and allows the crop to make the best use of the moisture available. These factors have been critical to crop performance in the recent run of dry seasons and contributed to the good performance of the system in 2008.

Tool for integrated weed management

The excellent grass control achieved with the Roundup Ready system means that this system will be a useful tool to incorporate into integrated weed management programs targeting ryegrass that is resistant to selective herbicides. Using the Roundup Ready system in these situations will lead to a large reduction in ryegrass seed banks in one season.

Lack of herbicide residue

Lack of herbicide carryover to provide residual weed control will be an advantage in environments where herbicides applied to canola in the Clearfield and triazine tolerant systems can persist for long periods and damage crops in the following season.

Weaknesses

Timing of applications

The standard recommendation is to apply two applications of Roundup Ready herbicide at least two weeks apart and with the appearance of two new leaves between applications.

Roundup Ready herbicide can be applied up until the six leaf stage of the crop. Our experience was that the hybrids, in particular, reached the six leaf stage quickly and regular monitoring was needed to ensure that the window was not missed. If two applications were planned, the first application had to be applied early so that sufficient time could elapse to apply the second dose while the crop was still at the correct growth stage. There were cases where the first application was delayed and the crop was too advanced for the second application even though it would have been beneficial for weed control. There is also an issue with shading of small weeds if the crop is too advanced when herbicide is applied.

Lack of residual weed control

In contrast to the Clearfield and triazine tolerant canola systems, the Roundup Ready system does not provide control of late germinating weeds due to the lack of residual activity from the Roundup Ready herbicide. There were cases of late germinations of wild radish, toad rush, crassula, vetch and hogweed in commercial crops and trial strips.

It can be argued that a vigorous crop will compete with these weeds and that they have little impact on yield. However this is not desirable from a farm hygiene and weed management perspective if weeds such as wild radish and vetch, that can be problematic in other parts of the farming system, are allowed to set seed and populations build up. Also, weeds like hogweed can grow after the crop has matured, utilising moisture and nutrients, and can cause problems with seeding in the following season. A side-benefit of the Clearfield and the triazine tolerant systems is that the chemicals persist and do provide residual control of weeds into summer in some environments.

Tank mixes with Roundup Ready not registered

The lack of registration of tank mixes of other chemicals, such as clopyralid and insecticides with Roundup Ready herbicide means that these products should be applied in a separate operation. This causes logistical difficulties by putting extra demands on labour and the boom spray at a time of peak workload. Research is underway for registration of tank mixes.

Efficacy on weeds

Roundup Ready herbicide worked well on most weeds, but can be weak on some weeds such as marshmallow and erodium. It is essential that these weeds are targeted when they are small or that an alternative system is considered if good control is not possible.

Glyphosate resistance

The incidence of resistance to glyphosate is on the rise and there is no doubt that this will be exacerbated if Roundup Ready technology is misused. It is essential that growers and advisers adhere to the guidelines outlined in the Roundup Ready technical manual and the Paddock Risk Assessment and Management Option Guide (PRAMOG) and adopt integrated weed management practices to minimise this risk.

Summary

Most growers were happy with their first experience with Roundup Ready canola. The system is very effective on grass weeds and can be used as part of an integrated weed management program. The system also facilitates dry and timely sowing, thus maximising yield potential in any given season. Returns are similar to the Clearfield system at equivalent yields. The lack of residual weed control and presence of weeds that are difficult to control with glyphosate will limit the use of this system in some situations. If the system is misused it will increase the risk of developing resistance to glyphosate and it is essential that advisers and growers adhere to management guidelines.



NATIONAL VARIETY TRIALS

Comparisons of Roundup Ready, triazine tolerant and Clearfield varieties within their herbicide system.

Trial location: FORBES, NSW and HORSHAM, Vic.

Trial undertaken by AgriSearch for NVT.

Key messages

All Roundup Ready varieties produced yields not significantly different from the site mean yield.

The highest yielding Roundup Ready varieties were not significantly different from the highest yielding TT and Clearfield varieties.

A number of unreleased breeding lines were included in the trial (data not presented) and results suggest that there are promising breeding lines of Roundup Ready and Clearfield canola hybrids in the pipeline.

Background and aims

To compare yields of newly released and soon-to-be released herbicide tolerant canola varieties treated with herbicides applicable to their herbicide tolerance, as part of the National Variety Trials.

Site details - Forbes

<i>Paddock history:</i>	Pasture 2005, wheat 2006 and 2007.
<i>Sowing date:</i>	21 May 2008.
<i>Plot size:</i>	1.6 m x 10 m.
<i>Pre-sowing herbicide and insecticide:</i>	2.0 L/ha Roundup PowerMAX® as a knockdown on the sowing date, and 1.5 L/ha trifluralin (480 g/L) at sowing.
<i>Fertiliser:</i>	115 kg/ha Granulock 15.
<i>2008 growing season rainfall:</i>	232 mm. (Dry Apr. and May; 93 mm rain Sep.-Oct.).
<i>Harvested:</i>	13 November 2008 (desiccated, not windrowed).

Site details - Horsham

<i>Paddock history:</i>	Wheat 2007, canola 2006.
<i>Sowing date:</i>	2 July 2008.
<i>Plot size:</i>	1.6 m x 10 m.
<i>Pre-sowing herbicide and insecticide:</i>	2.0 L/ha Roundup PowerMAX as a knockdown on the sowing date, and 1.7 L/ha trifluralin (480 g/L) at sowing.
<i>Fertiliser:</i>	120 kg/ha Granulock Supreme Z applied at sowing. 100 kg/ha urea was topdressed on 21 August 2008.
<i>2008 growing season rainfall:</i>	Horsham AWS: 195 mm. (Decile 1). Sep.- Oct. rainfall 27 mm, with no single rainfall event exceeding 5 mm.
<i>Harvested:</i>	10 December 2008.

Method

For details of methods, see www.nvtonline.com.au

Results

Table 1: Predicted yield, quality and height of varieties at Forbes and Horsham NVT canola sites 2008.

Variety	Forbes					Horsham			
	Herbicide tolerance	Yield		Quality	Height (cm)	Yield		Height (cm)	% of plants in flower 16 Sep.
		t/ha	% of site mean	Oil %		t/ha	% of site mean		
44C79	CL	1.26	125	38.1	113	0.71	109	105	73
Rottnest TTC	TT	1.20	119	35.1	87	0.81	124	95	100
Tawriffic TT	TT	1.20	120	39.4	100	0.64	98	72	83
Monola™ 77TT	TT	1.19	119	38.9	97	0.78	119	107	30
ATR-Cobbler	TT	1.18	118	36.6	87	0.69	106	98	100
Bravo TT	TT	1.18	118	36.6	93	0.69	106	98	90
Hyola 502RR	RR	1.15	115	35.9	105	0.73	112	54	93
43C80	CL	1.13	113	35.6	93	0.72	111	108	100
46Y20 (RR) (RR)	RR	1.13	112	36.7	110	0.52	80	87	93
GT61	RR	1.10	110	36.0	97	0.59	90	74	100
44C73	CL	1.06	106	35.9	97	0.82	126	108	97
Hyola 601RR	RR	1.05	105	36.1	103	0.63	97	110	45
ATR-Marlin	TT	1.02	102	36.6	87	0.53	82	105	10
Monola™ 76TT	TT	0.97	97	37.6	80	0.76	117	100	43
CB™ Boomer	TT					0.70	107	103	97
CB™ Tanami	TT					0.70	108	93	100
45Y77	CL	0.91	90	34.2	107	0.62	96	118	47
46Y81	CL	0.91	90	37.8	110	0.67	103	115	47
ATR409	TT	0.90	90	36.1	87	0.65	100	102	33
46Y78	CL	0.90	89	34.1	97	0.54	83	120	63
Tornado TT	TT	0.90	89	35.9	83	0.65	100	93	27
Flinders TTC	TT	0.84	84	36.1	77	0.65	99	69	17
Monola™ 66TT	TT	0.82	82	34.3	90	0.57	87	107	70
CB™ Argyle	TT	0.77	77	36.9	83	0.63	97	83	53
Hyola 571CL	CL	0.77	77	36.6	107	0.61	93	98	77
Thunder TT	TT	0.73	73	36.2	87	0.61	93	97	7
Storm TT	TT	0.65	64	35.7	80	0.61	93	95	30
Hurricane TT	TT	0.61	61	36.5	77	0.68	105	92	73
Site Mean (t/ha)		1.00	100			0.65	100		
LSD (p<0.05)*		0.23	23			0.12	18		
CV (%)		13.7				10.4			

CL = Clearfield TT = triazine tolerant

Note: Variability was high at the Forbes trial site (coefficient of variation, CV, 14%). Oil content data unavailable for Horsham at time of printing.

***NB: The LSD is the least significant difference. Here, when comparing two varieties, the difference between yields needs to be 0.23 t/ha or more to be significant for Forbes or 0.12 t/ha for Horsham. Otherwise, the differences may well be a chance finding.**



FARMLINK CANOLA SYSTEMS TRIAL

Comparisons of Roundup Ready, triazine tolerant, Clearfield and conventional varieties using their relevant herbicide systems.

Trial location: WOMBAT, NSW

Kirrily Condon, FarmLink Research

Key messages

The best performing varieties were AV-Garnet and Hyola 502RR, but there was hardly any difference between the two. All other varieties follow in third place, with no statistical difference between them.

Site details

<i>Paddock history:</i>	Pasture 2007.
<i>Sowing date:</i>	24 May 2008.
<i>Plot size:</i>	10m x 2.2m.
<i>Pre-sowing herbicide:</i>	1.2 L/ha glyphosate; 2.1 L/ha trifluralin incorporated by sowing.
<i>Post-sowing, pre-emergent herbicide and insecticide:</i>	300 mL/ha S-Metolachlor as Dual Gold® + 100 mL/ha alpha-cypermethrin as Fastac®.
<i>Fertiliser:</i>	100 kg/ha MAP + Impact® (with seed), 100 kg/ha Gran-am (below seed).
<i>Plant establishment:</i>	Average 57 plants/m ² .
<i>2008 growing season rainfall:</i>	403 mm (May to Nov.).
<i>Harvested:</i>	27 November 2008 (desiccated 17 November 2008).

Method

Varieties

- Roundup Ready hybrids – Hyola 502RR, Hyola 601RR, 46Y20 (RR).
- Triazine tolerant variety – ATR-Marlin.
- Clearfield hybrid – 46Y78.
- Conventional variety – AV-Garnet.

Post-emergent herbicides (applied 16 July 2008 at approx. 2-4 leaf):

- Roundup Ready – Roundup Ready herbicide 0.9 kg/ha.
- Triazine tolerant – atrazine 2.2 kg/ha + 0.5% Hasten®.
- Clearfield – Intervix® 600 mL/ha + 0.5% Hasten.
- Conventional – Select® 500 mL/ha + Lontrel® 300 mL/ha + 1% Hasten.

Photo by Felicity Pritchard



Results

2008 trial observations:

- Plant vigour (2 Jul.): highest in Hyola 601RR and AV-Garnet, lowest in ATR-Marlin.
- Crop maturity (9 Sep.): Hyola 502RR most advanced, ATR-Marlin and 46Y78 least advanced.
- Weed control (14 Oct., sprayed 16 Jul.):
 - Roundup Ready - traces of vulpia, wireweed and clover.
 - Triazine tolerant- high density of sorrel, traces of skeleton weed and vulpia.
 - Clearfield - low percentage of clover, vulpia and sorrel; traces of skeleton weed and capeweed.
 - Conventional - low percentage of clover, sorrel and annual ryegrass, traces of vulpia and skeleton weed.

Fortunately this trial site was relatively unaffected by the dry season, producing consistent results with a CV of 8.73%.

Table 1: Yield, oil and gross margins at the FarmLink canola systems trial, Wombat 2008.

Variety	Herbicide tolerance	Yield (t/ha)	Oil (%)
AV-Garnet	CON	2.13 ^a	40.4 ^c
Hyola 502RR	RR	1.89 ^b	41.6 ^{bc}
46Y78	CL	1.60 ^c	41.9 ^{abc}
Hyola 601RR	RR	1.66 ^c	42.8 ^a
ATR-Marlin	TT	1.62 ^c	40.9 ^{bc}
46Y20 (RR)	RR	1.60 ^c	41.9 ^{ab}
LSD (p<0.05)		0.23	1.1

CON = Conventional (no herbicide tolerance).

Note: Results followed by the same letter vertically do not significantly differ.

Acknowledgements:

Bruce Smith (co-operator), Tim Condon and Chris Duff (Delta Agribusiness), Paul Breust (FarmLink), AgriTech Pty Ltd and Monsanto. Although funding for trial implementation was provided by Monsanto, the trial was undertaken independently by FarmLink Research (co-ordination, monitoring and communications) and AgriTech Pty Ltd NSW (trial implementation).



Photo by Felicity Pritchard



IRRIGATED VARIETY TRIAL

Herbicide treatments

Trial location: KERANG, Vic.

Damian Jones, Victorian Department of Primary Industries and Victorian Irrigated Cropping Council

Felicity Pritchard, PACE

Key messages

- Site mean yield was 3.54 t/ha.
- The varieties AV-Garnet, Hyola 50, Hyola 502RR and 44C79 topped the trial. All other varieties follow with no statistical differences between them.
- The top performing Clearfield and RR hybrids produced yields not significantly different from the two best conventional varieties. The TT varieties produced yields similar to the site mean, but the highest yielding TT variety yielded less than the two top varieties.

Site details

<i>Paddock history:</i>	2007 wheat crop failed and cut for silage.
<i>Sowing date:</i>	13 May 2008 (sown into marginal moisture and watered up).
<i>Sowing rate:</i>	3.5 kg/ha.
<i>Plant population:</i>	Targeted 50 plants/m ² . Establishment was 38 plants/m ² .
<i>Plot size:</i>	1.42 m x 15 m.
<i>Pre-sowing herbicide and insecticide:</i>	Glyphosate knockdown (0.9 L/ha) and oxyfluorfen (0.075 L/ha) to control annual weeds, mainly ryegrass. 0.1 L/ha omethoate for redlegged earth mite on 5 June 2008. Clopyralid (0.3 L/ha) and haloxyfop (0.075 L/ha) applied post-emergence on 18 June 2008.
<i>Target yield:</i>	Production target of 3.0 t/ha.
<i>Nutrition/fertiliser:</i>	Sown with 125 kg/ha DAP. 110 kg/ha urea topdressed at late cabbage on 31 July 2008 and again at mid bolting (65 kg/ha urea on 21 August 2008), to provide adequate nitrogen for a 3 t/ha crop.
<i>Irrigation:</i>	Pre-irrigated with 1.8 ML/ha, April 9 2008. First spring irrigation on 11 September 2008 and second irrigation on 3 October 2008. Total water use of approximately 4.5 ML/ha.
<i>2008 growing season rainfall:</i>	121.4 mm (exactly half long-term average of 242.8 mm) at Kerang Model Farm.
<i>Windrowed:</i>	3 November 2008.
<i>Harvested:</i>	17 November 2008.

The trial was sown later than desirable due to delays in obtaining the necessary permission for the trial. Optimum sowing date would be the last week of April.

The site was pre-irrigated but by the time the trial was sown the soil was quite dry. The trial was irrigated shortly after sowing to ensure adequate moisture for germination, but three days after the irrigation the site received 20 mm of rain, which resulted in waterlogged conditions.

Despite the conditions at germination, the overall establishment averaged 38 plants/m², slightly below the target of 50 plants/m².

Crop nitrogen (N) nutrition followed the formula for irrigated crops, i.e. starter N and then topdressed at the beginning of stem elongation. The site was deep soil tested for N before sowing and measured 66 kg/ha available nitrate-N. Overall 240 kg N/ha was available to the crop from all sources.



Damian Jones

Photo by Felicity Pritchard

Results

Table 1: 2008 flowering dates, duration of flowering (days) and height at maturity. Data sorted by flowering date.

Variety	Herbicide tolerance	Started	Finished	Duration of flowering	Height (cm)
GT61 RR	RR	27-Aug	3-Oct	37	130
44C79 CL	CL	29-Aug	6-Oct	38	125
Hyola 571CL	CL	29-Aug	3-Oct	35	135
ATR-Cobbler TT	TT	29-Aug	29-Sep	31	132
Hurricane TT	TT	29-Aug	29-Sep	31	110
Hyola 502RR	RR	29-Aug	6-Oct	38	145
Tawriffic TT	TT	29-Aug	6-Oct	38	130
AV-Garnet	CON	1-Sep	6-Oct	35	140
Hyola 50	CON	3-Sep	6-Oct	33	140
45Y77	CL	5-Sep	6-Oct	31	140
46Y20 (RR)	RR	5-Sep	6-Oct	31	150
AV-Sapphire	CON	5-Sep	6-Oct	31	140
Hyola 601RR	RR	5-Sep	6-Oct	31	140
ATR-Marlin	TT	5-Sep	6-Oct	31	135
Warrior CL	CL	5-Sep	6-Oct	31	137
46Y78 CL	CL	9-Sep	6-Oct	27	145
Rocket CL	CL	9-Sep	6-Oct	27	137

The four best performing entries were AV-Garnet, Hyola 50, Hyola 502RR and 44C79. All other varieties followed with no statistical differences between them (Table 2).

Table 2: Canola variety and yields (t/ha).

Variety	Yield
Clearfield	
44C79	3.93
45Y77	3.20
46Y78	3.09
Hyola 571CL	3.68
Rocket CL	2.87
Warrior CL	3.25
Conventional	
AV-Garnet	4.60
AV-Sapphire	2.92
Hyola 50	4.54
Roundup Ready	
46Y20 (RR)	3.65
GT61	3.43
Hyola 502RR	4.00
Hyola 601RR	3.62
Triazine tolerant	
ATR-Cobbler	3.60
ATR-Marlin	2.99
Hurricane TT	3.36
Tawriffic TT	3.37
Statistics	
LSD* (p<0.001)	0.69
Site mean	3.54
CV%	11.7

***NB: The LSD is the least significant difference. Here, when comparing two varieties, the difference between yields needs to be 0.69 t/ha or more to be significant. Otherwise, the differences may well be a chance finding.**



BETTER CANOLA DEMONSTRATION

Comparison of Roundup Ready canola with triazine tolerant and Clearfield systems as a weed control tool for Victorian cropping systems

Trial location: RUPANYUP, Vic.

Kate Burke, John Stuchbery and Associates and Felicity Pritchard, PACE

Key messages

Roundup Ready canola is a promising new tool for weed management with one open pollinated (OP) variety and three hybrids available to suit a range of growing environments.

Choosing which herbicide tolerance system to use depends on:

- weed spectrum, presence of herbicide resistant weeds, herbicide group rotations, herbicide residue risks.
- variety suitability (maturity, yield, blackleg resistance and oil %).
- cost of production (seed and chemical, other costs).

This report provides information from an unreplicated demonstration. As such yield data should be viewed with caution.

Background and aims

To increase growers' familiarity with all aspects of Roundup Ready canola and compare the commercially-available herbicide tolerant canola production systems. The Better Canola project monitored an existing on-farm demonstration of Roundup Ready, Clearfield and triazine tolerant canola systems.

Site details

A large scale demonstration was established on grey clay soil south west of Rupanyup in the Wimmera region on the property of Andrew and Rodney Weidemann. The canola plots were established and managed by Weidemann Pastoral Company.

<i>Paddock history:</i>	Chemical fallow in 2007.
<i>Sowing date:</i>	9 May 2008.
<i>Plot size:</i>	12 m x 100 m (sown north-south).
<i>Pre-sowing herbicide and insecticide:</i>	Trifluralin as Triflur® 480 at 1.6 L/ha and chlorpyrifos at 1 L/ha were applied prior to sowing and incorporated by sowing.
<i>Fertiliser:</i>	100 kg/ha single superphosphate spread pre-sowing; 40 kg/ha ZincStar at sowing; 100 kg/ha urea spread in late July.
<i>2008 growing season rainfall:</i>	210 mm.
<i>Windrowed:</i>	12 November 2008.
<i>Harvested:</i>	27 November 2008.

Method

Treatments: 3 Clearfield hybrids, 2 TT varieties; 1 RR variety and 3 RR hybrids (Table 1). The TT varieties and Clearfield hybrids were chosen to represent a range of maturities representative of those grown in the Wimmera. Herbicides applied were dependent on herbicide tolerance of the canola.

Design: Nearest neighbour, with RR hybrid 46Y20 (RR) as control, where each herbicide 'system' was adjacent to a control plot. (The large plot size and the need to apply different herbicide groups using a commercial spray rig while minimising the risk of spray drift restricted layout options).

Table 1: Description of varieties in the demonstration

Variety	Comments for Western Victoria
Clearfield	
Hyola 571CL	Hybrid vigour. Yields similar to 45Y77 in Wimmera.
45Y77	Hybrid vigour. Good performer in Wimmera (medium rainfall zone).
46Y78	Hybrid vigour. Slightly later than 45Y77 but has handled dry seasons.
Triazine tolerant	
ATR-Cobbler	Performing well. Replacement for ATR-Stubby but adapted to longer seasons than ATR-Stubby.
Bravo TT	High yielding. Medium rainfall e.g. Northern Wimmera.
Roundup Ready[#]	
GT61	Low to medium rainfall, excellent vigour for an OP. Suits northern Wimmera and southern Mallee.
46Y20 (RR)	Excellent vigour. SW Vic. Could lodge.
Hyola 502RR	Excellent vigour. Suited to medium rainfall e.g. Wimmera.
Hyola 601RR	Excellent vigour. Suited to medium to higher rainfall e.g. Wimmera and SW Vic.

[#] Additional fees apply (\$10.20/t delivered).

Table 2: 2008 herbicide application details

Herbicide system	Spray date	Crop stage	Target weeds and size	Droplet size & water rate	Herbicide mix
Triazine tolerant	6 July	4 leaf	4-6 leaf ARG* 10 cm musk 4 node vetch 4 leaf hogweed	Med-coarse 55 L/ha	Atrazine 1.1 kg/ha + Lontrel 100 mL/ha + Select +500 mL Uptake (spray oil) 1%
Roundup Ready	26 June	3-4 leaf	2-4 leaf ARG 5 cm musk 2 node vetch, 2 leaf hogweed	Coarse 50 L/ha	0.9 kg/ha Roundup Ready herbicide
Clearfield	15 July	6 leaf +	Late tillering ARG 20 cm musk 6-8 node vetch 6 leaf hogweed	Coarse 70 L/ha	Intervix 550 mL/ha + Lontrel 70 mL/ha+ Hasten 0.5%

*ARG = Annual ryegrass

Variety observations

Emergence and establishment

46Y78, 45Y77 and 46Y20 (RR) were the quickest to emerge and Hyola 502RR and Hyola 601RR were the slowest due to poor seed quality which also reduced vigour (Table 3).

Excellent plant establishment was achieved for all varieties. Differences among varieties for plant densities were largely due to seed size and sowing rate, with nominal sowing rates used rather than being adjusted for seed size.

Differences in vigour were as expected with the TT varieties displaying poor vigour compared with the others (the exceptions were the two RR hybrids affected by seed quality). GT61 exhibited good early vigour for an open-pollinated (OP) variety. All varieties compensated for their respective plant populations to achieve good ground cover. 46Y20 (RR) achieved ground cover the quickest.

Table 3: Variety characteristics, sowing rates (kg/ha), density (plants/m²) and vigour (1= poor to 5=very good).

Herbicide system	Variety	Sowing rate	Seed size*	Plant density**	Early vigour
Triazine tolerant	Bravo TT	4.5	M	173±25	2.5
	ATR-Cobbler	4.5	M	156±8	2.5
Roundup Ready	GT61	3.5	L	131± 15	4.0
	46Y20 (RR)	2.7	XL	96±7	4.5
	Hyola 502RR	2.7	XL	47±6 ***	2.5***
	Hyola 601RR	2.7	XL	70±6 ***	3.0***
Clearfield	45Y77	2.7	XL	76 (9)	5.0
	46Y78	2.7	XXL	61(6)	4.0
	Hyola 571CL	2.7	M	122 (10)	4.0

*Based on 1000-seed weight data from Mark Slatter (Nufarm) and historical seed size data. Indicative only.

** Mean and standard error of six observations

***Poor seed quality affected emergence and early vigour

Blackleg

Blackleg infection was low with all cultivars and hybrids having lower infection rates than Bravo TT. Note the ratings for all RR varieties are provisional at this stage.

Flowering and maturity

The flowering and maturity patterns observed in the demonstration differed slightly from the published maturities. This was also observed in other field trials. Of the RR varieties, GT61 was the earliest (between ATR-Cobbler and Bravo TT), followed by Hyola 502RR, Hyola 601RR and 46Y20 (RR) respectively.

Yield

Despite large variation in plant emergence and early vigour, these factors did not appear to significantly influence yield. However, site variability did affect yield. Yields varied from east to west across the site, as illustrated by the variation in control variety, 46Y20 (RR) (Figure 1). Potential reasons for the variation include soil type, elevated yields on the outer plots due to an 'edge effect' (i.e. access to more moisture due to gaps at the edge of the demonstration). Spray drift may have been an issue in a RR control plot adjacent to another herbicide system as buffers were not included. These yield variations indicate the difficulties in obtaining meaningful yield data using large scale demonstration plots. No firm conclusions can be drawn from these yield data.

Quality

Oil content ranged from 35.7 to 38.9 %. The 'edge effect' trend for yield was also evident for oil content with the outside plots being higher. Triazine tolerant varieties tended to produce lower oil content than other canola types. While this was the case at this demonstration, the effects of site variability and variety are difficult to separate.

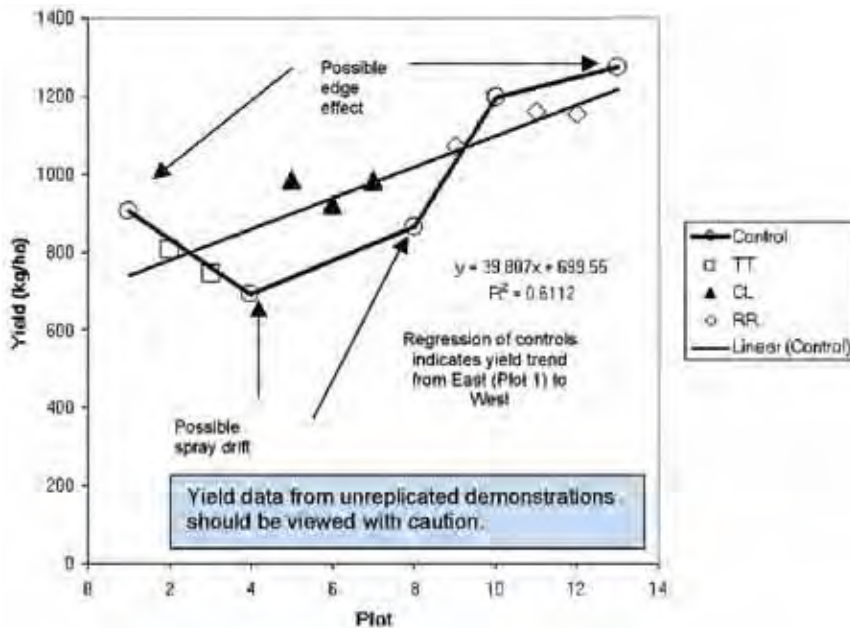


Figure 1: Grain yield from Plot 1 (east) to Plot 14 (west) and the potential causes for variation in the yields of the control variety 46Y20 (RR).

Table 4: Weed populations (plants/m²) assessed after windrowing (14 November 2008).

	Hogweed	Vetch	ARG	Muskweed	Milk thistle
Triazine tolerant	Nil	Nil	Nil	<1	<1
Roundup Ready	Nil	Nil	Nil	Nil	1
Clearfield	Nil	Nil	3.6	Nil	<1

Triazine tolerant system

Herbicide application was typical of district practice (restricted atrazine rates for soil pH above 6.5 and applied post-emergence). Weed control was acceptable (Table 4) and consistent with industry expectations. The herbicide treatment did not completely control the muskweed which was consistent with previous research (Stuchbery, 2000).

Roundup Ready system

A one-spray approach was used on the RR plots. These were the cleanest plots overall with very good muskweed control and no annual ryegrass detected in the final counts. Time of spraying was ideal in terms of crop and weed size.

Hogweed plants germinated after the spray application and low levels of hogweed and vetch survivors were observed in late winter. Vigorous crop competition and the dry spring assisted control with no survivors detected at harvest (Table 4). Milk thistle populations were higher than the other systems mainly due to the absence of Lontrel, and therefore no residual activity, in the spray mix. A two-spray approach is being advocated by Nufarm to provide better control of later germinating weeds.

Clearfield system

Despite the large weed and crop size at spraying, muskweed control was good, consistent with industry experience and previous research (Stuchbery, 2000). Annual ryegrass control was unsatisfactory due to the late timing of application and large weed size. Ryegrass control would have been assisted by the addition of a 'dim' herbicide such as clethodim (e.g. Select) or tepraloxymid (Aramo) and by spraying earlier. Industry experience suggests that the Clearfield system can provide excellent weed control.

Acknowledgements

Weidemann Pastoral Company, Nufarm (provision of information), Nuseed, Pioneer Seeds, Pacific Seeds (provision of seed for trial), Marcroft Grains Pathology, Ben Jones (yield data interpretation).

For further information

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Post-emergence weed control observations

Post-emergent herbicide application was conducted by the grower and chemical mixes were tailored for each herbicide tolerance system (Table 2). Application dates were influenced by wind direction, particularly when spraying the triazine tolerant and Clearfield plots with RR plots directly adjacent to them. Consequently the triazine tolerant and Clearfield canola was sprayed later than the RR canola, and therefore weeds were larger.

Weed populations observed prior to sowing included hogweed (wireweed) (3 plants/m²), vetch (9 plants/m²), muskweed (5 plants/m²) and very low levels of annual ryegrass (< 1 plant/m²). Other weeds at lower plant densities included prickly lettuce, milk thistle and amsinckia. These populations were considered very low and not yield-limiting.

FARMER CASE STUDY

Having a go at new technology

OVERTON, FORBES, NSW.



Chris Sweeney

Enterprises:	Wheat, barley, oats, canola, field peas, 2500-3000 prime lamb feedlot.
Average Annual Rainfall:	526 mm. (Average annual rainfall since 1995: 439 mm).
Average GSR:	305 mm (Apr.-Oct.). (Average GSR since 1995: 261 mm)
2008 GSR:	232 mm (Apr.-Oct.).
Soil Types:	The canola was grown on a grey self-mulching clay.
Soil pH:	pH _{Ca} 7.5 for canola paddocks.

History

Chris has been farming for around 30 years, and the family have farmed in the district since the 1870s. He has been a no-till farmer since 2003 by gradually changing his equipment and reducing tillage over the preceding 20 years. He has grown canola since the early 1990s.

Typical rotations

Chris has a basic plan for his crop rotations, but these are modified with the help of his agronomist if the seasonal and financial conditions demand it. A rotation may be pasture – canola – wheat – barley – pulse – wheat; or pasture – wheat – canola – wheat – barley – pulse. Canola is not sown if it hasn't rained by the first week of June. Field peas are not sown after the second week of June, and the paddock is instead usually fallowed.

Problem weeds on property

Barley grass, annual ryegrass, wild radish, Paterson's curse, capeweed and saffron thistle.

Herbicide resistance in paddock/farm

Weeds have not been tested for herbicide resistance on the farm. Chris prefers to assume resistance is present when managing for weeds. A neighbouring farm has group A resistant annual ryegrass, so it is likely to be present on Chris' farm too.

Herbicide resistance management strategies used

- Rotating chemical groups as much as possible – not doubling up modes of actions and checking rotation of chemical groups with my agronomist.
- Avoiding the use of group A chemicals where possible through use of trifluralin and Spray.Seed®.
- Running livestock.
- Using pastures which allow the use of different chemical groups.
- Cutting silage and hay.

What did you gain from the RR canola training course?

I thought it was very good. Monsanto gave a lot of information that I'd only heard snippets of before. I think they should provide the course to everyone who is against Roundup Ready canola, so they are informed about the technology and how the system works. It's informative, and it's good to know the science behind it – simple things such as the gene is not found in the canola oil. It comes from the soil and is not created in a lab.

How useful was the PRAMOG?

I thought it was alright. It is more information to help you in your decision making process on what crop to grow or spray.

Why did you choose to grow RR canola?

- It's a new technology that's too important to be dismissed.
- Everyone has been telling us we'll get more money if we stay

non-GM, however no-one has come out and offered more money to stay non-GM. End-users are not prepared to pay for the non-GM product. To me it was a financial decision.

- About 10 years ago, we were involved in trial crops with Pacific Seeds.
- I'd rather spray 2 L Roundup® than 4 L atrazine any day of the week, for both safety reasons and weed control.
- I also run sheep therefore the Roundup Ready herbicide is good because it has no residual activity. I call atrazine "drought in a drum", as there's nothing left on the ground after using it. The atrazine takes out a lot of native pasture species and decimates them. This is good if you're a full-time grain grower, but not for this property – although it is excellent for cleaning up problem weeds on the canola paddocks which are to be followed by wheat.

- The RR canola is another tool in the box for herbicide resistance management.
- It provides an opportunity for earlier sowing. For example, you can sow dry in April or early May into a barley grass pasture and spray the canola as it comes up.

(Note: The other herbicide tolerant canola types can be sown earlier too, but the Roundup Ready canola may allow for this with less herbicides and can avoid the necessity for a group A herbicide).

- Excellent weed control – I did windrowing for some other farmers this year and my Roundup Ready canola was cleaner than any of the TT and Clearfield canola I windrowed. On heavier soils, the OnDuty® looked like it hadn't worked very well.
- Management is simple – when it rains, the canola comes up, then you can spray the Roundup Ready herbicide.

Varieties grown in 2008 and acreage of RR canola

120 hectares of all four Roundup Ready varieties – around 30 ha each, with GT61, 46Y20 (RR) and Hyola 601RR in one paddock, and Hyola 502RR in another.

Sowing system used in RR canola in 2008

Both paddocks were sown with a 11.8 m Flexicoil bar with Simplicity airbox with narrow points. However, seed was broadcast from the last row of tynes and covered with a prickle chain. An estimated 70% of seed ended up in the furrow, and the remainder near the top of the seedbed. All seed was sown at 4 kg/ha, although the aim was 3.5 kg/ha. Seed size varied with variety.

The first paddock on cereal stubble (with the three varieties) was sown dry on 22 May, with slightly staggered germination following a small rainfall event and later follow-up rains.

Chris Sweeney





FARMER CASE STUDY

Simple system for no-till

ROJAHNAH PARK, COWRA, NSW

Rodney and Anthea Wright

The second paddock (Hyola 502RR) was sown into moisture on an old lucerne pasture (sown 2006) around 4 June. Sowing was delayed due to a wait for the seed. Germination was good.

Both paddocks had 80 kg/ha of DAP applied.

Weed control

The first paddock received a summer spray of Roundup, 2,4-D and Garlon® (triclopyr). Volunteer cereals emerged in autumn. No pre-emergent or knockdown was used. Roundup Ready herbicide was applied at the 4-6 leaf stage.

The second paddock had big wild radish plants which were mostly controlled with a knockdown of 1.5 L/ha Roundup. Roundup Ready herbicide was also applied post-emergence at the 4-6 leaf stage. This spray also controlled 45 cm diameter thistles growing in a track intentionally left unsown within the crop. The only weed the herbicide was soft on was trefoil. However, this was not a problem, as it makes good fodder for sheep.

Some positive aspects of RR canola?

- I prefer the dry formulation to the liquid. I have also been told that the dry formulation packs more punch per unit of active ingredient than the liquid formulation.
- Management is simple and the herbicide is easy to use.
- It's good to not have to use harsh chemicals with residues like OnDuty or atrazine. Once Roundup Ready herbicide hits the ground, it's all over (i.e. degraded). I could sow sorghum or lucerne on it today with no worries.
- I like it because it's an extra tool to do the job. I'm careful to manage the herbicide resistance and ensure that the correct crop is sprayed.
- It was a good thing that you had to do a course and sign documents to say that you are prepared to do it all properly. Otherwise it could be a bit dangerous – for example some people may accidentally use the wrong chemical on the wrong crop.
- We also were involved in trials in the control of GM canola in the following crop and pastures.

Issues with RR canola growing in 2008

The lack of promotion of GM crops to the general public. There is a lot of misinformation, perpetuated through some media.

Some things are harder – e.g. cleaning down machinery and monitoring the clean-down site.

Distance to receival site in 2008

80 km to Grenfell silo. The service from Graincorp was excellent.

Grain yield

The crop was entered into a local crop competition, where, after windrowing, the independent judge estimated the yield of the Roundup Ready varieties to be 1.5 t/ha. The later-sown Hyola 502RR in the second paddock was estimated to yield around 1.0 t/ha.

However, a big wind, hail storm and heavy rain wiped out most of the crop, which then yielded around 0.4 t/ha. (Crop insurance covered 12% of the yield loss as only damage by hail was covered).

Gross margin

The gross margin was roughly \$19.20/ha. The contracted price (after EPR) was \$600/t. The return (0.4 t/ha) was \$240. Insurance also covered 12% of the 1.1 t/ha yield loss, equating to 0.132 t/ha or \$79.20/ha. Therefore the gross return was around \$319.20/ha.

Cost of production

Variable costs were around \$300/ha, including freight.

Enterprises:

Wheat, canola, some lupins, 400 crossbred ewes, 70-cow calf operation.

Average Annual Rainfall:

600 mm – very consistent rainfall over the year, about 50 mm per month.

Average GSR:

Approx. 400 mm (Apr. – Oct.).

2008 GSR:

326 mm.

Soil Types:

Red loam.

Soil pH:

pH_{Ca} 5.0-5.2.

History

The family have continuously cropped since the early 1970s. They have been no-till farmers since 1998, and three years ago began running stock on 150 ha of their 1000 ha property to combat herbicide resistant ryegrass and improve their lifestyle. Rodney's father began growing rapeseed in 1968, one of the first three in NSW to grow the crop.

Typical rotations

Wheat-wheat-canola. (Pulses have been tried in the past, but difficult to make a profit from. Faba beans performed well, but marketing was an issue).

Problem weeds on property

Wild radish and herbicide resistant annual ryegrass are the two main weeds. Other weed problems are hogweed (wireweed) and milk thistle, which is becoming an increasing problem.

Herbicide resistance in paddock/farm

Annual ryegrass with resistance to group A and B herbicides.

Herbicide resistance management strategies used

Strategies include:

- Running stock.
- Silage production.
- High rate of trifluralin and atrazine in triazine tolerant (TT) canola. TT canola has helped considerably to clean up herbicide resistant weeds on the property.
- High rates of trifluralin and Logran® in wheat.
- If there is a 'disaster', a hot burn is sometimes used to reduce the weed seedbank, but is avoided if possible.

What did you gain from the RR canola training course?

Not a lot, really. All the management strategies are what we know anyway. It reinforced what we are doing. We understand where we are heading with group A and B resistance. We know we need to use trifluralin and a double knock.

It did make me realise that the Roundup Ready system is more simple than we had thought. Everyone thought that Monsanto would have more control of us than they do, but we actually saw that we are the farmers and still have the control over what we do.

How useful was the PRAMOG?

It was not much use to us. The agronomist and I went through it. I had already put a lot of thought into it. We know that we are not going to blanket the place in Roundup.

I think a lot of the first time growers will be more astute managers and would be fully aware of herbicide resistance management. It will be down the track a bit when it will be helpful to more farmers who may not have the same background in herbicide resistance management.

Why did you choose to grow Roundup Ready canola?

- It's another tool in the toolbox to combat weed resistance to group A and B herbicides.
- More yield, more oil.
- The Roundup Ready system hasn't got the (higher) chemical costs of atrazine and trifluralin like the TT system. And it requires less spray applications.

Varieties grown in 2008 and acreage of RR canola

100 ha 46Y20 (RR). In the neighbouring paddock, with identical paddock history, 140 ha of Rottnest TTC was also grown.

Sowing system used in RR canola in 2008

The Roundup Ready and TT crops were sown on 10 May, directly into stubble using a Conserva Pak parallelogram with knife points and press wheels on 60 cm spacings to 1.3 cm depth. Seed was sown at 1.8 kg/ha (both varieties) and 80 kg/ha urea and 80 kg/ha MAP was deep banded in the one pass. The crop established well.

Weed control

A knockdown of Roundup was used to control variegated thistle two weeks before sowing. The crop received a single spray of Roundup Ready herbicide at the six leaf stage. No other herbicides were used.

Some positive aspects of RR canola

- A big plus is that you can sow it directly into stubble and spray it. That's what we've been looking for – sowing into stubble and good weed control.
- Weeds can be sprayed in an economical manner.
- It's another tool for combatting resistance.

Issues with RR canola growing in 2008

- The variety we grew didn't yield well. There weren't many seeds in the pods. It was too tall.
(Note: this did not occur for all growing regions – see other case studies and trial reports. Pioneer has stated that this crop had excessive nutrition causing the crop to grow too tall).
- The varieties need more work. In four years time, we should have varieties more adapted to our environment. (I will still be growing 60 ha of RR canola in 2009. I'll do some research on the performance of the different varieties).

Distance to receival site in 2008

Grenfell, 70 km away (\$20/t freight).

Grain yield

The 46Y20 (RR) yielded 1.5 t/ha. The Rottnest TTC alongside it yielded 2.0 t/ha. Both had an oil content of 39%. The crops experienced a very hot, windy week in the last week of October which significantly reduced their yield potential by an estimated 1.0 t/ha.

Gross margin

The gross return was \$810/ha for the Roundup Ready canola. The variable costs were around \$400/ha (including EPR), giving a gross margin of roughly \$410/ha.

Cost of production

The variable costs were estimated at \$400/ha.

FARMER CASE STUDY

More choice

AVONALE, HENTY, NSW

Peter and Alison Campbell

Enterprises:	Wheat, canola, triticale, lupins, 2800 self-replacing merino ewes, crossbred ewes for lamb production.
Average Annual Rainfall:	550 mm.
Average GSR:	Approx. 350 mm (Apr. – Oct.).
2008 GSR:	202 mm.
Soil Types:	Red brown earths and yellow podsollic soils.
Soil pH:	pH _{Ca} 4.7-5.5.

History

The family have farmed the property for three generations. Peter has been farming since 1980, and started growing canola in the late 1980s, and now practices zero-till farming.

Typical rotations

Cropping phase of 5-7 years, including canola, wheat, triticale, lupins and arrowleaf clover, and a pasture phase of 3-5 years.

Problem weeds on property

Annual ryegrass is the number one weed. Other weed problems are dependent on the year, e.g. capeweed, wild oats.

Herbicide resistance in paddock/farm

Annual ryegrass with resistance to group A and B herbicides, although Select still works.

Herbicide resistance management strategies used

Strategies include:

- Hay cutting.
- Silage production.
- Double knock with disc seeder – i.e. glyphosate before sowing; followed by paraquat as Gramoxone® before emergence, after sowing with a disc seeder.
- Crop topping in lupins.
- Pasture phase.

What did you gain from the RR canola training course?

I thought it was very good. It gave me a greater understanding of the technology and the genetics of resistance to herbicides. The main thing, that may not have been covered in detail in the accreditation course, was that I became more aware that you shouldn't use a Roundup Ready crop where there are high ryegrass numbers in the paddock.

How useful was the PRAMOG?

It was useful. It made sure I thought about the glyphosate resistance and how to tackle it and what extra steps to put in place. My paddocks were intermediate risk for glyphosate resistance.

The PRAMOG stated that we could use Roundup Ready canola if we followed certain procedures, such as extra strategies for keeping ryegrass numbers low. For us, it was using Spray.Seed as the knockdown for two years following the Roundup Ready crop. We could use trifluralin too, but under our zero-till system, it's pretty hard to use trifluralin.

Why did you choose to grow RR canola?

- We've been watching the Canadians and Nuffield scholars have reported that it's a great technology to use.
- It gives us an opportunity to move away from using the residual triazine herbicides.



- The triazine tolerance (TT) trait is associated with low yields. We weren't getting anywhere with the TT varieties, especially in these drier years.
- Conventional varieties are difficult to grow because of a lack of effective weed control options.

Varieties grown in 2008 and acreage of RR canola

380 ha canola, comprising around 250 ha of Roundup Ready canola and 130 ha Clearfield canola. Two varieties of Roundup Ready canola were grown – GT61 and the hybrid 46Y20 (RR) (Clearfield hybrid was 46Y78). The GT61 was grown in four paddocks, and 46Y20 (RR) was grown in four paddocks.

Sowing system used in RR canola in 2008

The paddock histories varied – some paddocks were in lucerne in 2007, causing additional moisture deficit stress at the end of the 2008 season. The better yielding crops were on wheat stubble.

The GT61 was sown on 30 April, the 46Y20 (RR) around 9-12 May (seed arrived late) and the Clearfield 46Y78 was dry sown on 25 April. All crops were sown with a 1590 John Deere disc seeder with press wheels at 2.2 kg/ha. The population of the Roundup Ready crops was around 52 plants/m². (The Clearfield hybrid population was lower at 30 plants/m² due to larger seed size).

The crop was sown with 19 cm row spacing and established well.

Weed control

No knockdowns were used. About half the Roundup Ready canola paddocks had two spray applications – around the 2-leaf and again at the 6-leaf stage. The other paddocks received one application – around the 2-leaf stage.

I think I should have put out a second clean-up spray on all paddocks. The paddocks with only one application did get a second germination of weeds, but this was only small. Those weeds didn't amount to much in the end.

Some positive aspects of RR canola

- The choice to grow it or not.
- You don't have to use atrazine.
- It gives a wider choice – and you can grow the equivalent (yield) of conventional canola, whereas before you couldn't.
- Having to use Select all the time for grass weed control on the Clearfield hybrids creates a potential problem, even though the Intervix or OnDuty is good on wild oats and wild radish.
- I doubt I'd go back to growing anything other than hybrids now.
- It can potentially be grazed because of the small withholding period of Roundup.

Issues with RR canola growing in 2008

- Delivery points – it was a long way to the receival site. The freight cost was higher than normal as the site was on a branch line.
- Not being able to warehouse it, even for a short time. However, these two issues will resolve themselves once more people grow it.
- We need to be very careful to make sure we don't get glyphosate resistant annual ryegrass.
- Upfront costs are higher than the TT varieties, thus exposing us to more financial risk.

Distance to receival site in 2008

Lockhart, 48 km away, on the branch line.

Grain yield

The 46Y20 (RR) yields varied between paddocks from 0.65 t/ha on lucerne to 1.8 t/ha on wheat stubble. The GT61 yielded from 1.2 t/ha on pasture to 1.5 t/ha on wheat stubble. The 46Y78 yielded up to 1.3 t/ha in a dry paddock.

Although I didn't grow a TT variety, none of the TT varieties in the area yielded more than 1 t/ha, even though there were some good crops around.

Gross margin

The gross margin hasn't been worked out yet. The price was contracted as the price on the day of delivery.

Cost of production

The full costs have not yet been determined. A comparison of costs related to each herbicide tolerance system was made. The Clearfield hybrid can equal the RR hybrid in costs under different conditions. The analysis indicated the TTs to be less risky financially to grow, but as the hybrids are expected to yield significantly more, they should be more profitable.



Peter Campbell

Photo by Kellie Penfold, courtesy Coretext Communications

FARMER CASE STUDY

Making more money

CLONTARF, YARRAWONGA, Vic.



Evan, John and Helene Ryan

Enterprises:	Canola, wheat, barley, oaten hay, lucerne seed, trade lambs, contract hay baling, water.
Average Annual Rainfall:	512 mm.
Average GSR:	375 mm (Apr. – Oct.).
2008 GSR:	120 mm.
Soil Types:	Red brown earths.
Soil pH:	pH _{Ca} is now 5.5.

History

The family has farmed the property since the 1860s, and has grown canola for around 20 years. The property includes a water allocation, however the current allocation is too low to irrigate, so water is traded.

Typical rotations

Rotations vary depending on whatever is considered most profitable. Canola is likely to be planted before wheat. A typical rotation may be canola – wheat- triticale or barley-canola, or if the paddock has a weed problem, oaten hay.

Problem weeds on property

Annual ryegrass, wild oats, wild radish, marshmallow.

Herbicide resistance in paddock/farm

Group A and B herbicide resistant ryegrass.

Herbicide resistance management strategies used

- Growing oaten hay.
- Strategic burning.
- Residue baling.
- Hay production.
- Lucerne seed production.
- Rotation of chemical groups.
- Preference for pre-sowing or pre-emergent herbicides - reduced reliance on selective post-emergent herbicides.
- Double knock with Roundup (glyphosate) followed by Gramoxone (paraquat) or Spray.Seed (paraquat/diquat).
- Brown manuring of cereals.
- Strategic crop topping.
- Roundup Ready canola.

What did you gain from the RR canola training course?

It gave me a better understanding of the technology and the science behind it, and also the stewardship requirements.

How useful was the PRAMOG?

It was a good rough tool to determine the risk of glyphosate resistance in a given field. We came up with a low score for the paddocks where Roundup Ready canola was planted.

Why did you choose to grow RR canola?

- To make more money.
- We didn't choose it particularly to address the herbicide resistance, as it is not a problem that we couldn't overcome by other means. It was because the technology gives us more timely and effective weed control. There is no other system that can do it like that.

Varieties grown in 2008 and acreage of RR canola

200 ha of the hybrid 46Y20 (RR), the Clearfield hybrid 46Y78 and the triazine tolerant variety Thunder TT.

Sowing system used in RR canola in 2008

The crop was sown with a no-till system using knife points and press wheels on 30 cm spacings, using a 15 m airseeder built by the Ryans 35 years ago. It was sown 3 cm deep on 25 April.

Establishment was staggered with reduced emergence due to wireworm, beetle larvae and a false break in some paddocks. The worst-affected paddocks had an emergence of 2 plant/m² in parts. One of these paddocks was resown before the end of May.

Weed control

Trifluralin was applied pre-sowing at 2 L/ha. Two Roundup Ready herbicide applications were made - one at the cotyledon stage and then at the 6-leaf stage.

Some positive aspects of RR canola

- Easy to manage. There are not a lot of different chemistries and mixes.
- Glyphosate is safe on the crop.
- The Roundup Ready herbicide gave better weed control than the triazines in the TT varieties.
- No yield penalty; unlike the TT varieties.
- The hybrid vigour was a big asset in the 46Y20 (RR). The benefits came from the hybrid vigour combined with the good weed control in a synergy that improves yield and profit.

Issues with RR canola growing in 2008

- Hard to get seed in a timely manner, because of the timing of when the State Government moratorium was lifted, which was an issue related to the Government not understanding the timelines that growers work under.
- The possibility that the varieties are not the latest and best genetics, again due to the fact that we had the moratorium.
- A lot of hype and negative pressure from uninformed pressure groups. This created a lot of anxiety for growers already working under the pressing issues of drought and financial hardship. This just put more pressure on farmers and highlights the fact these pressure groups have little understanding of the nature and systems which farmers are required to operate with to be viable and sustainable.

Distance to receival site in 2008

Finley, 70 km away.

Grain yield

The Roundup Ready canola yielded the best of all the canola, but only 200 kg/ha due to the drought. The TT variety was not harvested. The Clearfield hybrid in the same paddock yielded 30-40% less than the Roundup Ready hybrid, presumed to be due to the less effective weed control resulting in more competition from weeds for scarce moisture.

Gross margin

The gross margin was negative due to the season.

Cost of production

The Roundup Ready canola was marginally more expensive to grow than the TT or Clearfield canola. However, the upside in yield was more substantial.



Evan Ryan

Photo by Felicity Pritchard

FARMER CASE STUDY

Standing up to the tough season

BRIDGEWATER, Vic.



Andrew and Rachel Broad

Enterprises:	Wheat, canola, barley, vetch/oaten hay, 550 crossbred ewes for lamb production.
Average Annual Rainfall:	450 mm.
Average GSR:	400 mm (Apr. – Oct.).
2008 GSR:	200 mm.
Soil Types:	Red brown earths.
Soil pH:	pH _{ca} of topsoil is above 5.5 overlaying and alkaline subsoil pH _{ca} 7-8.



Andrew Broad

Photo by Felicity Pritchard

History

The family have farmed the property for three generations. Andrew bought their farm in 1998. His father first grew canola in 1997.

Typical rotations

A typical rotation may be canola – wheat - wheat – hay or pasture. However, Andrew does not follow set rotations, and rotations are dependent on the paddock's requirements.

Now that Andrew can grow Roundup Ready canola, he may try growing vetch/oat hay – RR canola – wheat – barley.

Problem weeds on property

Winter weeds include annual ryegrass, wild oats, hogweed (wireweed).

In some paddocks, there is some wild radish, and some brome grass, which is being closely monitored.

Herbicide resistance in paddock/farm

No herbicide resistant weed populations found.

Herbicide resistance management strategies used

Andrew feels that recent management practices may be increasing the chance of weeds developing herbicide resistance. This is due to dry sowing in seasons with late autumn breaks, increasing the reliance of in-crop selective herbicides applications. The herbicide resistance management options are also somewhat restricted as pulses are not grown in the rotation.

However, strategies to reduce the risk include:

- Cutting hay crops (mechanically removing weed seeds).
- Roundup Ready canola after hay crops, resulting in two years without the use of a group A or group B herbicides.
- Rotation of chemical groups.
- Sheep play a role.
- Occasional tillage, used if sheep have been on a paddock for a few years (one working).

What did you gain from the RR canola training course?

Personally, nothing as I was fairly exposed to the concept. (Andrew was a Nuffield scholar in recent years and studied GM canola adoption in North America and Europe).

How useful was the PRAMOG?

It's useful for people getting their heads around the technology. It's a good visual chart for farmers to get a grasp of it. I had been advocating for a stewardship program to accompany the technology, so I am supportive of it.

Why did you choose to grow RR canola?

- To put up or shut up.
- There has been a lot of talk and we needed to see how it performed under Australian conditions. It will either prove itself or not, and it will take a few years to do so.
- A philosophical argument: it's technology in agriculture that creates an opportunity for wealth for rural Australia. If we stagnate, rural areas will be completely under-populated.
- I'm not afraid to stick my neck out and do it. I'm fairly thick-skinned.
- I believe different farming systems can co-exist (e.g. with organic grower neighbour). It provides for stronger and more diverse agriculture across the country. That's a way people can learn from each other.

Varieties grown in 2008 and acreage of RR canola

32 ha of the open pollinated variety GT61 and two paddocks of the triazine tolerant variety ATR-Summitt.

Sowing system used in RR canola in 2008

- The crop was sown on a vetch/oat hay paddock. It was compacted, and as Andrew had no experience with no-till canola, he worked the paddock twice with a chisel plough. The paddock was sprayed with 1 L/ha trifluralin and 0.5 L/ha endosulfan on bare earth. The trifluralin was incorporated by sowing with the airseeder.
- In the first week of May, the canola seed was dry-sown 8 mm deep at 4 kg/ha with 100 kg/ha MAP using a 11m (37-foot) AFM airseeder with Simplicity box and trailing harrows, pulled by a Steiger tractor.

(Andrew has recently bought press wheels to improve the seed-soil contact). No additional fertiliser was applied.

- The crop emerged well. Andrew was very impressed with the “outstanding” vigour of the GT61, relative to the TT variety.

Weed Control

Trifluralin was applied pre-sowing at 1 L/ha. Roundup Ready herbicide was applied once at the 4-leaf stage. Andrew let the canola emerge with the weeds and sprayed the weeds out post-emergent.

Some positive aspects of RR canola

- Its vigour compared with the TT variety.
- Weed control was much cheaper and substantially better than the triazines. The paddock was fairly dirty, i.e. had capeweed, annual ryegrass, wild oats, wild radish, Patterson’s curse. The weed control was fantastic.
- The price was exactly the same as the non-GM canola.
- The Roundup Ready crop kept trying to do something (fill grain) in the dry spring, whereas the TT variety didn’t produce anything. It was a disaster. We won’t be growing TT canola again. The yields were low for both canola types, but the GT61 was tough, and kept trying.

Issues with RR canola growing in 2008

- We didn’t really have any problems, except the distance to the receival site was a bit far. This would not have been a problem if the Raywood site had been open. I would still grow the RR canola, despite that.
- None of the issues that had been raised (during the moratorium) had stacked up. It was a bit like the millennium bug – all hype and a big fizzle.

Distance to receival site in 2008

Lubeck, about 170 km away.

Grain yield

The RR crop yielded 0.6 t/ha, whereas the TT variety in the neighbouring paddock with similar history, sown a day apart, yielded 0.2 t/ha. In the other TT paddock, about 10 km away, we took 6 tonnes off 60 ha (0.1 t/ha).

Gross margin

The gross margin was \$57.20/ha for the RR canola.

The gross return for the RR canola was \$520/t x 0.6 t/ha = \$312/ha.

The gross margin for the TT canola was negative – both due to lower yields (0.1 and 0.2 t/ha) and much higher costs of herbicides (simazine, atrazine, clopyralid as Lontrel and clethodim as Select used on the TT variety).

Cost of production

Variable cost	\$/ha
Seed, licence costs	\$15.60*
Herbicide and insecticide	\$39.20
Fertiliser	\$90.00
Machinery operation (assume contractor rates)	\$110.00**
Total cost	\$254.80

*Seed actually supplied by seed company – originally intended for seed crop. Add roughly extra \$28/ha to include untreated seed.

**Actual costs lower, as own cultivation, sowing, spraying, windrowing and harvesting equipment used.

FARMER CASE STUDY

More flexibility in rotations

SUNNYDALE, RUPANYUP, Vic.

Andrew and Julie, Rodney and Andrea Weidemann

Enterprises:	Canola, wheat, barley, faba bean, chickpeas, lentils, oaten hay, approx. 600 prime lambs and white Suffolk stud.
Average Annual Rainfall:	414 mm (Longerenong College).
Average GSR:	300 mm (Sunnydale home block).
2008 GSR:	210 mm (near canola paddock).
Soil Types:	95% grey self-mulching cracking clay (SMCC), remainder timber belts on sandy loams and grey SMCC.
Soil pH:	pH 7.6-8.4.

History

- The Weidemanns have been growing canola every year since 1984. In 1990, the family began direct drilling and stubble retention. In 1996, they moved to yield mapping and more intensive soil testing of paddocks.
- Evaluation of yield data and soil types has been enhanced through a range of new technologies like EM38 soil surveying, trialing the HYDRO N Sensor measuring biomass on the move through the use of NDVI sensors, and more recently the introduction of satellite photo imagery. The Weidemanns also rely on guidance systems for a range of machinery, enabling them to improve efficiencies in a number of areas on the farm. They are now primarily no-till farmers, but have about 10% of their farm under fallow each year. Until this year it has been part chemical fallow and part mechanical, but from hereon where practical will be all chemical fallow.

Typical rotations

Fallow - canola – wheat – pulse – barley – pulse – cereal or hay and fallow. The rotation can vary a bit, and depends on factors including paddock history, weeds and available soil moisture at sowing.

Problem weeds on property

Annual ryegrass is becoming a greater problem particularly on new properties as well as wild vetch and muskweed.

Herbicide resistance in paddock/farm

Some annual ryegrass resistant to group A and B herbicides.

Herbicide resistance management strategies used

The three main strategies, in addition to herbicide group rotation, are:

- Using a double knock.
- Cutting oaten hay.
- Until now, some cultivation in the fallow phase.

Other strategies used are:

- Wick-wiping muskweed and escapes of annual ryegrass in lentil crops.
- Late season spray of gramoxone in lentils.
- Mixes of trifluralin and AvadexBW® pre sowing with AI nozzles.

What did you gain from the RR canola training course?

I guess the main thing was the scoring mechanism through the PRAMOG. It also gave us information on where to deliver the grain to and the contractual things that were involved in regards to seed licensing and the collection of end point royalties by the marketers.

How useful was the PRAMOG?

It was good. I think every grower should do it, regardless of whether they grow Roundup Ready canola or not. We got a score of 18, which meant we had to implement one extra herbicide resistance management strategy.



We have other paddocks which we will now also consider as high risk and limit the usage of glyphosate on these and implement other strategies as described earlier.

Why did you choose to grow RR canola?

- It was based on the paddock situation. If we were going to continue growing canola, we weren't going to grow a TT, they're traditionally lower yielding and have lower oil content in our area.
- We want to get away from residual chemicals. The Roundup Ready herbicide has no residues, which gives us a lot more flexibility for our next crop.
- We are trying to get away from the group B herbicides which can be used on the Clearfield canola. We have a high reliance already on group B herbicides and we are seeing some Group B resistant weeds on our property.

Varieties grown in 2008 and acreage of RR canola

90 ha 46Y20 (RR). We also grew the Clearfield hybrid 46Y78 in a neighbouring paddock and the Clearfield variety Rocket CL at another property at Wal Wal.

Sowing system used in RR canola in 2008

The paddock was chemical fallowed in 2007. Sown on 9 May with an 11.75 m AFM bar with Janke knife points. No press wheels were used. 100 kg/ha single superphosphate was spread pre-sowing. A Morris harrow/packer bar was used pre-sowing (on other crops it follows the seeder. For the canola, it provides a firm, even seedbed on the fallow and greatly improve canola emergence due to even sowing depth). 40 kg/ha ZincStar was applied at sowing (100 kg/ha urea was spread in late July).

Weed control

Trifluralin as Triflur 480 at 1.6 L/ha was applied prior to sowing and incorporated by sowing. Roundup Ready herbicide at 0.9 kg/ha was applied at the 3-4 leaf stage.

Some positive aspects of RR canola

- I believe in the science. It allows plant breeders to introduce traits more quickly into the crop plant. I hope better water use efficiency and frost and drought tolerance will come in the future.
- A big advantage is that we can sow on time. We can dry sow and get good weed control and eliminate the need for an

extra spray. We can dry sow the other types, like the TTs too, but there's not the power in the weed control. We would still need to come back again with 1-2 extra sprays, often with a group A.

- It opens a lot more ways we can use glyphosate in the farming system. In no-till, we can't get the best value out of trifluralin due to the stubble, and we don't want to use excessive rates of trifluralin to combat annual ryegrass.
- It will reduce our reliance on residual chemicals. We could even grow crops like lentils after Roundup Ready canola, which do well sown inter-row on canola stubble.
- Plant vigour of current varieties look very good and will help cover ground quickly.

Issues with RR canola growing in 2008

The potential for off-target loss of Roundup Ready herbicide needs to be considered at the time of spraying. We need to be mindful of other crops.

Distance to receival site in 2008

Lubeck, about 6 km.

Grain yield

The 46Y20 (RR) yielded 1.2 t/ha. The neighbouring 46Y78 didn't yield as well – I think that paddock had too much nutrition (hayed off).

Gross margin

On-farm price \$580/t (after freight and other deductions). Variable costs (not including insurance) \$278/ha = gross margin \$620/ha.

Cost of production**

Input	\$/ha
Seed	\$56.70
Herbicides and insecticides	\$36.95
Fertiliser	\$127.00
Machinery operations*	\$60.44
Total cost	\$281.09

*Using actual costs, not contractor rates.

** Crop insurance not included in the costs.



Andrew Weidemann

Photo courtesy of the Weekly Times

FARMER CASE STUDY

Safer chemical use

ROSSCRAE PASTORAL CO., MURTOA, Vic.



Bernie and Sophie Delahunty

Enterprises:	Pasture and grain production: barley, wheat, canola, lentils, chickpeas, oaten hay; 800 merinos in a self-replacing flock.
Average Annual Rainfall:	av. since 1889: 414 mm (av. 1 Dec 1996 - 1 Dec 2008: 326 mm).
Average GSR:	285 mm.
2008 GSR:	183 mm.
Soil Types:	Alkaline self-mulching grey cracking clays to red loam.
Soil pH:	Variable, depending on soil.

History

Bernie has been farming for 17 years. His father was one of the first adopters of rapeseed, growing the variety Tatyoon about 25 years ago. They stopped growing canola for a few years, but Bernie has re-introduced it into the rotation and grows it most years.

Typical rotations

Chemical fallow – canola – wheat – barley – lentils – barley – sometimes a second barley crop. Oaten hay is grown on some paddocks.

Problem weeds on property

Wild radish on some paddocks, annual ryegrass.

Herbicide resistance in paddock/farm

Group A herbicide resistant ryegrass on some paddocks.

Herbicide resistance management strategies used

For annual ryegrass in particular, the rotation of chemical fallow followed by a herbicide tolerant canola variety reduces the seedbank of a range of weed populations. Bernie uses no-till and keeps stock off the paddocks, reducing the spread of weed seeds and cultivation of weed seedbanks. He rotates herbicide resistance groups, desiccates lentils and grows oaten hay in problem paddocks following a pulse crop with minimal stubble cover (eg lentils).

What did you gain from the RR canola training course?

Lots of things. I thought it was very informative. I'm now a little more aware of the correct use of glyphosate. The main thing I gained was to be aware of how much glyphosate we put on the particular paddock and the need to break it up with Spray.Seed or different herbicide groups.

How useful was the PRAMOG?

We did it with the agronomist (TSP). I can't really remember the details of it. My agronomist went through it and we were aware in 2007 where we would put the RR canola in 2008. We planned ahead to limit our glyphosate use in the paddock in 2007.

Why did you choose to grow RR canola?

We used to grow triazine tolerant (TT) canola, but the crops just weren't performing, and the yields were ordinary. We had a new block of land, and thought it would be a good one to try it in, so we went for it. I would give up on the TTs unless something good came out. I was really pleased with the Roundup Ready canola.

Also, I really don't like handling simazine and atrazine. I'd rather not use it if I can. The new Roundup Ready herbicide seems to make less dust. There was not much dust at all. It's one of the safest chemicals to use too. With simazine, the dust hangs around, even with a mask, it seems to get into it.

Variety grown in 2008 and acreage of RR canola

77 ha of Hyola 502RR.

Sowing system used in RR canola in 2008

Sown with a Horwood Bagshaw airseeder with press wheels, on 14 inch spacings, sown at 2.4 kg/ha to about 1.5 cm on 10 May. The crop came up really well with excellent vigour. Followed chemical (long) fallow in 2007.

Weed control

An early knockdown of Spray.Seed was applied. Trifluralin was not used. Two sprays of Roundup Ready herbicide were applied – the first at the two true leaf stage, and the second was three weeks later, just before the 6-leaf stage (about two weeks before it would have been too late).

Some positive aspects of RR canola

- I was really happy with the weed control.
- The early vigour of the hybrid plants was excellent.
- It was fantastic to use the Roundup Ready herbicide. There was no dust, and I think it worked better than the Roundup that we normally use. It caned the annual ryegrass and the hoary cress in the paddock.

Issues with RR canola growing in 2008

- No major issues.
- A lack of flexibility in marketing arrangements earlier in the season was a bit difficult, limiting your options. The grain has to be delivered to the site within three weeks. You can't warehouse it and need to either forward contract it or take the price on the day.

Distance to receival site in 2008

6 km to Lubeck silo.

Grain yield

1.50 t/ha. May have been frost damaged; on chemical fallow.

Gross margin

The canola has not been sold at this stage. If an on-farm price of \$550/t is assumed, the gross margin would be \$422/ha.

Cost of Production

Variable cost*	\$/ha
Seed, licence costs	\$56.49
Herbicide and insecticide	\$51.45
Fertiliser	\$158.65
Machinery operation (assume contractor rates)	\$141.01
Total cost	\$407.61

*The above does not include crop insurance. Gypsum costs are averaged over 5 years. End point royalty is not included here, but will be taken from the on-farm grain price. The above costs also do not factor in the 2007 chemical fallow.



Photo by Felicity Pritchard

FARMER CASE STUDY

Weapon against ryegrass

YALOAK ESTATE, BALLAN, Vic.



Farm Manager: John Sheehan

Enterprises:	Wheat, barley, canola and prime lambs.
Average Annual Rainfall:	483 mm, Sheoaks 1991-2008.
Average GSR:	355 mm, Sheoaks 1991-2008.
2008 GSR:	260 mm, Inverleigh 2008.
Soil Types:	Chocolate clay loam.
Soil pH:	pH _{Ca} 5.3.

History

Up until 10 years ago, the property was very much a grazing enterprise. Raised beds were introduced by Southern Farming Systems in 1998 with 400 ha planted to crop. The business now crops more than 2800 ha across southwest Victoria, including more than 1000 ha of canola in 2008.

Typical rotations

Wheat – canola – barley; or canola – winter wheat – spring wheat – canola.

Problem weeds on property

Annual ryegrass.

Herbicide resistance in paddock/farm

Group A and B resistant annual ryegrass.

Herbicide resistance management strategies used

Crop rotations and deferred sowing where possible, high use of pre-emergence herbicides.

What did you gain from the RR canola training course?

The need to be more aware of using alternative knockdowns.

How useful was the PRAMOG?

Completed by agronomist. It allowed us to grow the crop.

Why did you choose to grow RR canola?

Ryegrass management.

Varieties grown in 2008 and acreage of RR canola

51ha of 46Y20 (RR), and three triazine tolerant varieties: 560ha of Thunder TT, 200 ha ATR-Marlin and 200 ha of ATR409.

Sowing system used in RR canola in 2008

Sown with airseeder using direct drill points, sown to a depth of 5 mm in the first week of June. Very good establishment and vigour. Sown at 4 kg/ha, giving a population of 80 - 120 plants/m².

Weed control

SpraySeed at 2.0 L/ha as a knockdown, then Roundup Ready herbicide at 0.9 kg/ha at four leaf stage.

Some positive aspects of RR canola

- Ease of management; not too many options to get wrong.
- Offers a real weapon against ryegrass.

Issues with RR canola growing in 2008

A small amount of drift (5-6 m) of glyphosate into neighbouring lucerne field (on the same farm). Spray drift with all chemicals is a potential issue, but when using a knockdown herbicide when crops have emerged, growers need to be very conscious of the possibility of drift.

Distance to receival site in 2008

Tatyon North is about 120km away.

Grain yield

Roundup Ready hybrid 46Y20 (RR) yielded 1.5 t/ha, 44% oil. The ATR409 in the adjacent paddock produced a similar yield, but lower oil content (42%). The TT variety ATR409 was the second crop out of paddock, while the 46Y20 (RR) the tenth crop since pasture. The other two TT varieties did not yield as well (about 1.2 t/ha), but this was put down to a heavier soil type which was a disadvantage in the dry spring.

Gross margin

1.5 t/ha x \$590/t = \$885/ha gross income. \$885/ha - \$396/ha = \$489/ha gross margin.

Cost of production

\$396/ha.

John Sheehan



Photo by Brad Collis courtesy of Coretext Communications

FARMER CASE STUDY

Accessing the new technology

BRENLEY, WILLAURA, Vic.



Stephen Heard

Enterprises:	5000 merino sheep, canola, wheat, barley.
Average Annual Rainfall:	500 mm.
Average GSR:	358 mm (Apr.-Oct.) or 400 mm (Apr.-Nov.).
2008 GSR:	243 mm (Apr.-Oct.) (Decile 1).
Soil Types:	Red clay loam on the 2008 Roundup Ready canola paddock.
Soil pH:	pH _{Ca} above 5.5.

History

Stephen has farmed the property since 1978. He sowed his first canola crop in 1983 with the variety Marnoo.

Typical rotations

Canola-wheat-barley. Stubbles are grazed.

Problem weeds on property

Annual ryegrass, wild oats are becoming an increasing issue, a little bit of brome grass, wild radish.

Herbicide resistance in paddock/farm

Group A herbicide resistance to annual ryegrass.

Herbicide resistance management strategies used

- Rotating chemical groups as much as possible.
- Pre-emergent sprays – trifluralin mixes in front of seeder.
- Spraying glyphosate at windrowing (boom on windrower).
- Trying to crop top barley with Reglone®.
- If stubbles are too heavy, they are burnt.
- He plans to get rid of the sheep which spread weed seeds.

What did you gain from the RR canola training course?

I felt that I had heard most of it before, but did get a little bit out of it. We have been using glyphosate for years. Some new things were the dry formulation of Roundup Ready herbicide, and I will be using Alliance® (amitrole/ paraquat) as a knockdown next year.

How useful was the PRAMOG?

I have used glyphosate for 15 out of 20 years and have kept detailed spray records. The paddock came under the second PRAMOG group.

Why did you choose to grow RR canola?

- Stephen's partner, Louise, is a research fellow of the Institute of Public Affairs and the national webmistress for the Producer's Forum and feels strongly that Australian growers should have access to the technology.
- Stephen wanted to grow RR canola "to be controversial".

Variety grown in 2008 and acreage of RR canola

70 hectares of 46Y20 (RR).

Sowing system used in RR canola in 2008

Sown with a Conserva Pak parallelogram with knife points and press wheels on 30 cm spacings, just under the surface (5 mm) on 20 May. The crop was sown at 2.9 kg/ha with 90 kg/ha MAP and 60 kg/ha urea. (The crop was topdressed with 110 kg/ha urea and again with 50 kg/ha urea).

Germination was staggered, although this was the same for all my canola crops in 2008, which included a conventional, a triazine tolerant and two Clearfield varieties.

Weed control

On 20 May, 1.6 L/ha paraquat (as Gramoxone) and a high rate of trifluralin were applied as a tank mix in front of the seeder. One spray of Roundup Ready herbicide was applied at the 4-leaf stage.

Some positive aspects of RR canola

- Opportunity to sow early and dry sow for both maximum potential yields and convenience (gets the job out of the way and allows for extra time if something goes wrong).
- The TT varieties have lost the plot a bit. They are slowly going backwards.
- The current hybrids always look good.
- The GM crops are the way of the future, but breeding for the Roundup Ready crops has lost some pace (due to the moratoria), so the currently available varieties aren't quite there yet. If we hadn't lost five years breeding, we would be.

Issues with RR canola growing in 2008

- People driving me mad. Every man and his dog ringing me up.
- It can't be warehoused – it has to be contracted or sold for cash. It has to be sold on the day it's delivered. I don't know what that's about.
- It would be good if you could put out a second Roundup Ready spray later on (after the 6-leaf stage).
- Following a dry spell after sowing, the crop had poor germination, but with follow-up rains, everything came up – so there was staggered emergence of all the canola (not just Roundup Ready). This limited the chance for a second spray application.
- Shading from the canola leaves over the ryegrass plant which was shooting at the base of the canola plants (in the press wheel furrow) meant that it was difficult to get good spray coverage. This was the biggest dilemma I had with growing it.

Distance to receival site in 2008

About 50 km to Tatyoon silo.

Grain yield

The Roundup Ready canola yielded 1.73 t/ha, with 41.5% oil content. I was lucky the crop was on an elevated paddock and had only minimal frost damage. If it had been at the other end of the farm, it would have been more severely frosted.

Gross margin

The gross margin has not been determined, as the grain is being sold under a Cargill open price contract and a price is yet to be locked in.

Cost of production

Stephen and Louise have calculated the variable costs in detail and worked out a break-even price. Fertiliser rates were high, but would be appropriate for an average growing season at Willaura.



Stephen Heard

Table 1: Summary of variable costs of producing Roundup Ready, TT and Clearfield canola for Stephen Heard (exc. GST) in 2008.

Variable cost	Roundup Ready hybrid	TT open pollinated	Clearfield open pollinated
RR licence	\$7.14	\$0.00	\$0.00
RR End Point Royalty	\$17.65	\$0.00	\$0.00
Seed*	\$60.90	\$21.75	\$22.00
Additional seed treatment	\$2.80	\$9.82	\$9.82
Lime, freight & spread	\$21.00	\$21.00	\$21.00
Fertiliser	\$230.30	\$230.30	\$230.30
Chemicals	\$37.53	\$56.78	\$79.64
Machinery Operations	\$169.86	\$184.86	\$177.36
Freight	\$25.95	\$17.30	\$17.30
Agronomic advice	\$7.50	\$7.50	\$7.50
Crop Insurance	\$14.01	\$14.01	\$14.01
Total cost	\$594.63	\$563.31	\$578.92

The above rates for machinery operation use contractor rates for harvesting and windrowing.

*Sowing rates for TT and Clearfield canola 2.5 kg/ha; RR canola, 2.9 kg/ha. TT and Clearfield open pollinated varieties, therefore lower seed costs than the RR hybrid seed.

Table 2: Details of variable costs of producing Roundup Ready canola for Stephen Heard in 2008, and calculation of break-even price.

Input	\$		\$		times	cost/ha
Agronomic advice			7.5			\$7.50
RR Licence	\$500	per farm	70	ha		\$7.14
End Point Royalty			10.2	per t	1.73	\$17.65
Treated RR seed	2.9	kg/ha	21	per kg		\$60.90
Additional seed treatment			0.965	per kg seed		\$2.80
Lime	2.47	t/ha	15.5	per t	0.2	\$7.66
DAP	93	kg/ha	1100	per t		\$102.30
Urea	200	kg/ha	640	per t		\$128.00
Trifluralin	2.0	L/ha	5	per L		\$10.00
Gramoxone	1.4	L/ha	7.2	per L		\$10.08
RR herbicide	0.9	kg/ha	19.39	per kg		\$17.45
Spraying			7.5	per ha	2	\$15.00
Sowing			50	per ha	1	\$50.00
Topdressing urea			5.5	per ha	2	\$11.00
Lime spreading			19.76	per ha	0.2	\$3.95
Windrowing			32.11	per ha	1	\$32.11
Fuel windrower			2.47	per ha	1	\$2.47
Harvest			54.34	per ha	1	\$54.34
Fuel harvest			4.94	per ha	1	\$4.94
Freight lime			19	per t	0.2	\$9.39
Freight Tatyoon			15	per t	1.73	\$25.95
Crop Insurance			14.01	per ha		\$14.01
Total variable cost/ha (Exc. GST)						\$594.63
Total variable cost (70 ha)			\$41,624.34			
Total tonnes produced			121.10			
Break even price/t			\$343.72			

*Cost of lime calculated over five years.

FARMER CASE STUDY

Prolonging the cropping rotation

EASTLEIGH, WILLAURA, Vic.



Spencer & Dimity Millear

Enterprises:	Wheat, barley, canola and merino sheep.
Average Annual Rainfall:	547 mm Willaura, 1902-2008.
Average GSR:	356 mm (Apr. - Oct.) or 404 mm (Apr. - Nov.) Willaura, 1902-2008.
2008 GSR:	234 mm (Apr. - Oct.) Willaura.
Soil Types:	Clay loam.
Soil pH:	mildly acid, pH _{water} 5.9.

History

Millears have been farming in the district since the Western District was opened up to agriculture. They have been growing canola for about 20 years with variable yields ranging from nearly 3 t/ha, down to only a few hundred kilograms when frosted a few years ago.

Typical rotations

Canola – wheat – barley.

Problem weeds on property

Annual ryegrass.

Herbicide resistance in paddock/farm

Group A (fops).

Herbicide resistance management strategies used

A combination of pre-emergence, sheep, spray-topping pastures and deferred sowing for double knockdowns.

What did you gain from the RR canola training course?

Learnt about the right stages to spray the Roundup Ready herbicide and protocols and procedures for growing the crop, including the need for exclusion zones.

How useful was the PRAMOG?

Fairly useful, common sense, gets you thinking.

Why did you choose to grow RR canola?

To control annual ryegrass, to prolong the cropping rotation, reducing the need to go back into pasture.

Varieties grown in 2008 and acreage of RR canola

65 ha of 46Y20 (RR) and 115 ha of the conventional Hyola 50 and 115 ha of the high stability oil Monola™ varieties.

Sowing system used in RR canola in 2008

Sown with airseeder at 300 mm row spacings and presswheels, sown at 1 cm depth on May 10 to 15 into marginal moisture with a Simplicity aircart and Janke tines. The emergence was brilliant due to the hybrid vigour and good seeding system.

Weed control

1.5 L/ha Spray.Seed and a high rate of Triflur incorporated by sowing, Roundup Ready herbicide at 0.9 kg/ha at cotyledon stage and 400 mL/ha Select at early crop extension. It was too late for a second spray of Roundup Ready herbicide. There were a few ryegrass plants left after the canola reached the 6-leaf stage possibly due to some shading by the crop. I just saw the need to apply Select for a clean-up. There wasn't a full emergence of annual ryegrass.

Some positive aspects of RR canola

- Very happy with the weed control.
- Good vigour.
- Prolongs cropping rotation.
- Rests other herbicide groups.

Issues with RR canola growing in 2008

None really, besides frost and lack of rainfall. Only had a small issue with a windrowing contractor not wanting to windrow due to potential movement of the grain to other clients. I also had some RR canola (grain) with stones in it. One contractor didn't want to clean it, so I found another who was happy to do it. It wasn't a huge issue but it was an issue.

Distance to receival site in 2008

Tatyoon North – 70km.

Grain yield

1 t/ha, with some of the crop frosted badly. Some yielded more than 1 t/ha. Other parts yielded 100 to 200 kg/ha.

Gross margin

\$520 income - \$404 costs = \$116/ha.

Cost of production

\$404/ha.



Spencer Millear

FARMER CASE STUDY

Future in GM

RIVERBEND, WICKLIFFE, Vic.



George Burdett

Enterprises:	Canola, wheat, barley, oaten hay, faba beans, 250 merino ewes.
Average Annual Rainfall:	550 mm.
Average GSR:	403 mm (Apr. – Nov.).
2008 GSR:	285 mm (Apr. – Nov.). (Decile 1). The sixth lowest GSR since records began in 1880.
Soil Types:	Clay loams, some sandy loams.
Soil pH:	pH _{Ca} is now 5.5, following 2-3 applications of lime.

History

George has farmed since 1966, and grown canola since 1972. He has been a no-tiller since the mid 1980s. The paddock on which he grew Roundup Ready canola in 2008 has been continuously cropped since 1972.

Typical rotations

Canola-wheat-barley-canola or faba beans or oaten hay.

Problem weeds on property

Annual ryegrass, wild oats, wild radish, brome grass, some bedstraw.

Herbicide resistance in paddock/farm

Group A, B and D herbicide resistant ryegrass on some paddocks.

Herbicide resistance management strategies used

- Growing oaten hay.
- Rotation of chemical groups.
- Spraying glyphosate while windrowing canola.
- Spraytopping legumes with paraquat and barley with diquat.
- George does not graze stubbles to leave weed seeds undisturbed.

What did you gain from the RR canola training course?

I was already aware of much of the information from the course. It ensured everyone knew what we had to do to grow the Roundup Ready canola and to deliver it etc. I had heard about managing for herbicide resistance before, but it is fair enough for the people who hadn't.

How useful was the PRAMOG?

My paddock was in the highest risk bracket, which meant I had to use a different type of knockdown to glyphosate (Spray.Seed) and to use a double knock on nearly all my paddocks.

Why did you choose to grow RR canola?

- I had herbicide resistant annual ryegrass.
- I believe in the science of it. This is only the start of GM crops. I think the GM future will be fantastic for the industry.
- To clean up weeds from my paddock.
- It also gives me the possibility of dry sowing if necessary – although this year the seed was not available until after I was ready to sow.

Variety grown in 2008 and acreage of RR canola

50 hectares of Hyola 601 RR.

Sowing system used in RR canola in 2008

Inter-row sown into barley stubble with a Janke parallelogram bar 10 m wide with a Simplicity box, with knife points and press wheels on 30 cm spacings, sown at 2.4 kg/ha on 23 May. He was satisfied with the crop's emergence, but some emergence was staggered, which George put down to moisture availability.

Weed control

An early (summer) knockdown of 1.2 L/ha of 2,4-D as Surpass® 300 was applied on 7 February 2008, with and 1.5 L/ha Glyphosate 450 (and 0.8 kg/ha ammonium sulphate).

At sowing, a broadleaf herbicide was applied at 1.5 kg/ha, as an alternative to trifluralin. No autumn knockdown was used.

Two sprays of Roundup Ready herbicide were applied – the first at the cotyledon to two true leaf stage, and the second at the 6-leaf stage.

Some positive aspects of RR canola

- I really believe in the science of it.
- The fact that in the future we won't have to use atrazine is positive.
- Next year I will drop the triazine tolerant varieties from my farm.
- I have been concerned about the atrazine use in a high rainfall area.
- It gives me the opportunity to dry sow, or to sow early if longer season varieties become available. In 2008 there was still moisture in the soil when the crop was ready to harvest.

Issues with RR canola growing in 2008

None, except for doing surveys for Pacific Seeds, Monsanto and now Better Oilseeds!

Distance to receival site in 2008

About 50 km to Tatyoon silo (45 minutes).

Grain yield

The crop yielded 1.59 t/ha, oil content 39.1%.

This year, there were two frosts, one on 23 October, where the temperature was below zero between 10 pm and 6 am, and it got to minus 4.5 degrees in the paddock. A second frost occurred on 17 November, which did more damage.

Gross margin

Gross margin of \$244.50/ha.

Gross return \$528.95/t (on-farm) x 1.59 t/ha = \$841/ha.

Cost of production

Variable cost	\$/ha
Seed and licence costs	\$69.47
Herbicide and insecticide	\$117.51
Fertiliser	\$235.55
Machinery operation	\$174.00*
Total cost	\$596.53

*Actual rates for machinery operation, rather than contractor.



George Burdett

Photo by Felicity Pritchard

FARMER CASE STUDY

Less reliance on selective herbicides

STRUAN PARTNERSHIP, LISMORE, Vic.



David and Cameron Gibson

Enterprises:	Cropping component includes canola, wheat, barley, oats and field peas. Livestock component of 2500 sheep, including wool and prime lambs.
Average Annual Rainfall:	620 mm Lismore PO 1919-2008.
Average GSR:	463 mm Lismore PO 1919-2008.
2008 GSR:	336 mm Lismore PO 2008.
Soil Types:	Red and grey loams.
Soil pH:	pH _{Ca} 5.5.

History

David has been at home on the farm since the early 1960s when they were growing rape. Market price dropped and weed problems increased into the 1970s so they stopped growing rape. Started growing canola again in 2001 and have been growing it since.

Typical rotations

Canola – wheat – barley – barley – canola. Oats or field peas sometimes grown in replacement for the second barley crop.

Problem weeds on property

Annual phalaris (canary grass) and annual ryegrass.

Herbicide resistance in paddock/farm

Group A and B resistance.

Herbicide resistance management strategies used

Typically try to sow a late crop of barley or field peas to get a couple of knockdowns.

What did you gain from the RR canola training course?

Got an update on growing canola and what RR canola can offer the farming system.

How useful was the PRAMOG?

Completed by agronomist.

Why did you choose to grow RR canola?

- To try on my own farm to see how it performs against TTs.
- To use as an alternative management option for group A and B herbicide resistant ryegrass to keep the paddock in crop production.

Varieties grown in 2008 and acreage of RR canola

20 ha 46Y20 (RR) and three triazine tolerant varieties: 33 ha of Tornado TT, 56 ha of Thunder TT and 80 ha ATR-Marlin.

Sowing system used in RR canola in 2008

John Deere 1920 10 m bar and air cart, sown 21 May at 1 cm depth with spear points and press-wheels. The 46Y20 (RR) had fair establishment compared with ATR-Marlin, but caught up and had more cabbage.

Weed control

Roundup PowerMAX at 1.5 L/ha as a knockdown, 0.9 kg/ha of Roundup Ready herbicide at cotyledon stage; 500 mL/ha Select at cabbage for ryegrass.

Some positive aspects of RR canola

More economical, less selective herbicides needed. The RR canola only needs two applications and that's it. With the others you need to put more spray on. Will certainly grow RR canola again.

Issues with RR canola growing in 2008

Missed application timing of second spray due to rain, and had to use Select, which did not give a great result.

Distance to receival site in 2008

75km to Tatyoon North receival centre.

Grain yield

1.0 t/ha for 46Y20 (RR). The ATR-Marlin gave slightly higher yields. The Tornado TT and Thunder TT produced yields similar to the 46Y20 (RR).

Gross margin

\$512/t income - \$426 costs= \$86/ha.

Cost of production

\$426/ha.



Photo by Felicity Pritchard

FARMER CASE STUDY

Earlier sowing an option

CRAIGWOOD PTY. LTD., SHELFORD, Vic.



Brian and Alistair Woods

Enterprises:	Canola, wheat, barley, linseed and merino sheep.
Average Annual Rainfall:	483 mm Sheoaks 1991-2008.
Average GSR:	356 mm Sheoaks 1991-2008.
2008 GSR:	260 mm Inverleigh 2008.
Soil Types:	Basalt clay.
Soil pH:	Mildly acid, pH _{water} 5.9.

History

Brian has been farming in the Shelford district for the last 33 years. He has been growing canola for the last 10 years and believes that management is the key to growing a successful oilseed crop. He has spread large amounts of chicken litter across his farm as both a soil amendment and top-up of nutrients.

Typical rotations

Canola – wheat – barley. Brian also grows field peas and is beginning to embark on a lucerne phase within his cropping rotation to reduce the use of in-crop selective herbicides.

Problem weeds on property

Annual phalaris (canary grass), annual ryegrass and wild radish.

Herbicide resistance in paddock/farm

Possibly, but nothing confirmed from testing.

Herbicide resistance management strategies used

A combination of:

- Monitoring herbicide use in each paddock.
- Using break crops.
- 4 year phases of lucerne to reduce continued use of group A herbicides used in each paddock for a prolonged period of time.

What did you gain from the RR canola training course?

Learnt all the information necessary, especially the timings of application, with the need to get this done before 6-leaf stage. The training meant you did not have to chase down the details; they were all listed in one folder.

How useful was the PRAMOG?

Basic guide; already doing that kind of stuff in my head, but good to have it on paper.

Why did you choose to grow RR canola?

Was asked to grow it by the local agronomist and agreed to give it a try.

Varieties grown in 2008 and acreage of RR canola

50 ha 46Y20 (RR), 100 ha of the triazine tolerant (TT) Tornado TT and 80 ha of the Clearfield hybrid 45Y77.

Sowing system used in RR canola in 2008

Sown with airseeder and direct drilled at 2.7 kg/ha, sown to a depth no more than 1 cm. Almost perfect germination, bounced out of the ground almost 4 days earlier than the TT variety.

Weed control

1.2 L/ha Roundup PowerMAX knockdown. Roundup Ready herbicide at 900g/ha at 6-leaf stage.

Some positive aspects of RR canola

Two spray options and early sowing option to really clean up the paddock.

It was a very good crop. The 46Y20 (RR) would have yielded 3 t/ha if it had rained.

Issues with RR canola growing in 2008

The 46Y20 (RR) hybrid grows too tall; hard to windrow properly.

Distance to receival site in 2008

Tatyon Nth – 95km.

Grain yield

The 46Y20 (RR) yielded 1.7 t/ha, with some of the crop slightly frosted. The Tornado TT in the neighbouring paddock on the same soil type and sown the day before yielded a fraction less. The 45Y77 was grown 20 km to the east, and it was severely frosted and yielded 0.70 t/ha.

Gross margin

\$863 gross income - \$406 variable costs = \$459/ha.

Cost of production

\$406/ha (variable costs).



Photo by Felicity Pritchard



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