Australian Government

Grains Research and Development Corporation

RAISING THE BAR WITH BETTER CANOLA AGRONOMY

Canola case studies and demonstration trial activities

SPRING 2008

AOF

better OILSEEDS

GRDC Grains Research & Development Corporation

Compiled by

Steve Marcroft
Grains Innovation Park, Natimuk Rd, Horsham 3400
e: marcroft@bigpond.net.au

Don McCaffery
NSW Department of Primary Industries, Orange, NSW.
e: don.mccaffery@dpi.nsw.gov.au

ISBN: 978-1-875477-82-1

Authors

Information in this document was specifically supplied and compiled by Mark Harris, Don McCaffery, Kate Burke, Patrick Redden (Rural Direction Pty Ltd), Felicity Pritchard, Mark Stanley, Mick Faulkner, Trent Potter, John Duff, Richard Quinlin, Peter Hamblin, Chris Duff.

Acknowledgements

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

We also acknowledge the unpaid efforts of the Better Canola advisory group:

Chris Duff – Delta Agribusiness, Young, NSW.

Don McCaffery – NSW Department of Primary Industries, Orange, NSW.

Mark Harris – Rural Management Strategies Pty Limited, Wagga Wagga, NSW.

Greg Toomey – Landmark, Elmore, Vic.

Kate Bourke – John Stuchbery and Associates, Murtoa, Vic.

Felicity Pritchard – Irrigated Cropping Forum, Horsham, Vic.

Trent Potter – SARDI, Naracoorte, SA.

Tony Craddock – Rural Directions Pty Ltd, Freeling, SA.

Mark Stanley – Port Lincoln, SA.

John Duff – OilseedsWA, Perth, WA.

Tim Scott – Elders, WA.

Grower Involvement

The compilers are also grateful for the invaluable contribution of the following growers who allowed us to publicise their crop production data for the betterment of the canola industry:

Mark & Steven Day, Chris Holland, Andy & Leo Delahunty, David and Tracey Langley, Max Davis, Andrew Parker, Andrew Jaeschke and Brett Fowler.

Copies available from www.australianoilseeds.com.

CONTENTS

INTRODUCTION

Compared to wheat, canola is a relatively new crop to Australian agriculture. Since the commercialisation of cultivars with improved yield, blackleg resistance and oil quality, the industry has grown from a few hectares to an average area exceeding one million hectares per annum.

Canola has been credited with increased cereal yields through rotational disease control and better weed management. In the higher rainfall regions of Australia canola production is secure and is viewed as a vital part of those farming systems. Unfortunately, a decade of lower than average rainfall has seen canola area decline in the medium to lower rainfall regions. However, when asked, most growers in these regions plan to grow canola when the seasons improve.

This publication aims to increase the reliability of canola production by sharing the knowledge and experience of leading canola producers. The publication also contains the results from the Better Canola demonstration trials which are aimed at overcoming specific issues for canola production.

The Better Canola Project

The Better Canola project is jointly funded by the Grains Research and Development Corporation and the Australian Oilseeds Federation. The project provides much needed support for oilseed growers, aiming to lift the productivity of oilseed crops, ensuring critical mass and consistency of production and improving the quality of grain.

Australian oilseed production peaked in 1999, but the peak was less than what many analysts believed was the potential. In recent years, lower rainfall and / or lower prices has resulted in the crop area declining from the 1999 peak and has also contributed to oilseeds disappearing from some farms in traditional growing areas.

This project aims to put aside the weather and price factors and to look at ways to support the industry. The project outcome is for the industry to improve the skill level of advisers and growers enabling them to more reliably produce oilseeds under our current climatic conditions and to be able to take advantage of more favourable seasons when they return.

Specific project aims:

1. *To capture all existing knowledge and place relevant information into an easily accessed website.*
2. *To utilise existing successful growers to share their knowledge with other growers within their region.*
3. *The project will address common problems / issues through demonstration field sites. Issues will be determined through the review process and includes: cost of production; rotational benefits / farming system approach; decision support on when to grow an oilseed given a range of grain prices and dates of the opening rains; disease management etc.*
4. *Regular forums and field days will be used to build capacity of advisers/growers and get them thinking about what the possibilities are for their clients / farms.*
5. *The project will also identify and highlight ways that growers can improve grain quality, making the industry more competitive.*

Better canola demonstration site and case study locations

CANOLA CROP PERFORMANCE, COST OF PRODUCTION AND RISK IN WESTERN VICTORIA

Liam Lenaghan and Kate Burke - John Stuchbery and Associates (JSA), Donald, Victoria

Canola is perceived as a risky crop relative to other crop types. This paper evaluated crop performance and variability on a number of farms across three regions in Western Victoria to evaluate canola performance.

Conclusions

1. *Canola yields were higher and least variable in the Western District, and most variable in the Mallee.*
2. *Canola yield variability can be reduced at the farm level by utilising stored soil water and optimising the use of growing season rainfall through early sowing and good agronomic practices.*
3. *Despite the common perception of high risk, canola did not always have the highest production risk.*
4. *Canola has a high cost of production, and a high profit risk during times of low price and in low rainfall environments.*
5. *It is therefore imperative to minimise yield variability and to have moderate exposure in lower rainfall regions and to manage the cost of production.*
6. *Canola's cost of production (per tonne of grain harvested) relative to lentils is lower in low rainfall environments (<225 mm Growing Season Rainfall [GSR]) and would therefore be a viable alternative to lentils in such environments.*

Data capture and analysis

Ten grain growers from the JSA client base in Western Victoria contributed yearly weighted crop yield averages and rainfall data for the period 1996-2007. Two statistical terms, standard deviation and coefficient of variation, have been used to describe the rainfall and crop performance data. Standard deviation (SD) is a measure of how widely values within a dataset are dispersed from the average (+/- 1 SD will cover 68% of probable outcomes and +/- 2 SD will cover 95% of outcomes); it has been used as a measure of variability of rainfall and crop performance. Coefficient of variation (CV) describes the relative relationship between standard deviation and the average and is expressed as a percentage. It allows the variability of two different datasets to be compared.

Rainfall by region (1996-2007).

		Mallee	Wimmera	Western District
Annual Rainfall	Rainfall (mm)	285	367	527
	SD (mm)	82	80	86
	CV	29%	22%	16%
	*Long term av	346	424	615
Growing Season Rainfall (GSR)	GSR (mm)	182	264	367
	SD (mm)	50	56	78
	CV	28%	21%	22%
	*Long term av	230	297	425

GSR was defined as April to October for Wimmera / Mallee and April to mid November for the Western District.

Canola performance

Canola yield averages of 0.9 t/ha, 1.3 t/ha and 1.8 t/ha were recorded for the Mallee, Wimmera and Western District respectively (Table 2). Western District yields were the least variable with Mallee yields being the most variable.

Canola's water use efficiency was similar for the Mallee (8.3 kg/mm/ha) and Wimmera (8.5 kg/mm/ha) but lower in the Western District (6.8 kg/mm/ha) indicating potential for further yield improvement in the Western District.

Canola performance relative to other crop types

Production (yield) risk was of particular note. Regularly perceived as a high production risk crop, this perception did not hold true for either the Wimmera or Western District but did for the Mallee. In the Wimmera, yield variability of canola as measured by CV, was less than wheat and barley whilst in the Western District it was less variable than barley but more variable than wheat. In the Mallee canola's yield variability was 23% greater than cereals. Canola was much less variable than lentils in both the Wimmera and the Mallee.

Canola crop performance by region (1996-2007).

	Mallee	Wimmera	Western District
Yield (t/ha)	0.90	1.34	1.82
SD (t/ha)	0.56	0.57	0.53
CV (%)	62	43	29
WUE (kg/mm/ha)	8.3	8.5	6.8
SD (kg/mm/ha)	4.4	3.5	2.0
CV (%)	54	41	30

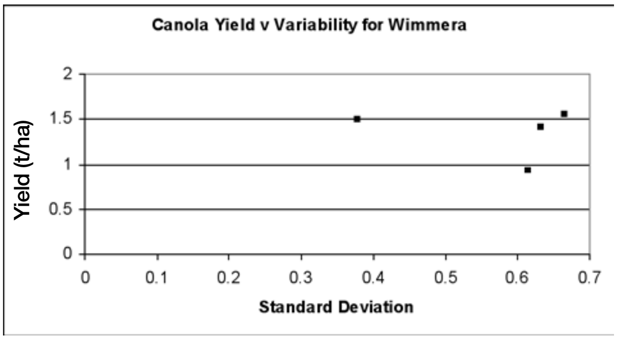
Canola crop performance compared to other crops by region (1996-2007).

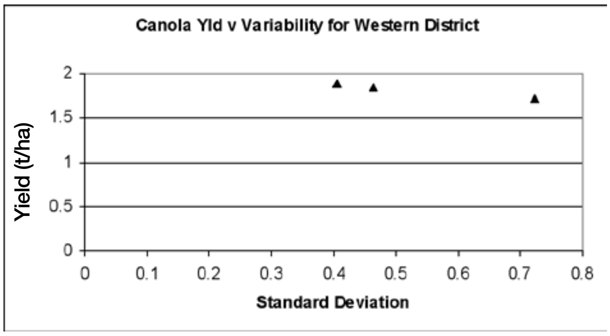
		Mallee	Wimmera	Western Dist
Canola	Yield (t/ha)	0.90	1.34	1.82
	SD (t/ha)	0.56	0.57	0.53
	CV (%)	62	43	29
	WUE (kg/mm/ha)	**8.3**	**8.5**	**6.8**
Wheat	Yield (t/ha)	1.70	2.31	3.61
	SD (t/ha)	0.86	1.23	0.88
	CV (%)	51	53	25
	WUE (kg/mm/ha)	**16.6**	**14.2**	**13.7**
Barley	Yield (t/ha)	1.68	2.68	3.97
	SD (t/ha)	0.84	1.45	1.46
	CV (%)	50	54	37
	WUE (kg/mm/ha)	**14.5**	**14.6**	**13.6**
Lentil	Yield (t/ha)	0.66	1.16	na
	SD (t/ha)	0.63	0.82	na
	CV (%)	95	70	na
	WUE (kg/mm/ha)	**6.4**	**7.9**	**na**

Within region variability

In the Wimmera, there were differences among farms in both average yield and variability. The main cause of high variability for a farm was crop failure in very dry seasons. One Wimmera grower had much less variability while maintaining a yield by growing canola on fallow or on pulse stubbles with >50 mm stored soil water, managing nitrogen inputs and by sowing early and using press wheels to improve establishment. This strategy has reduced crop failures in drought years and resulted in canola being a reliable crop on that farm.

In the Western District, there was little difference in average yields among growers but one grower had a higher level of production risk (variability).





Canola yield variability among Wimmera and Western District growers.

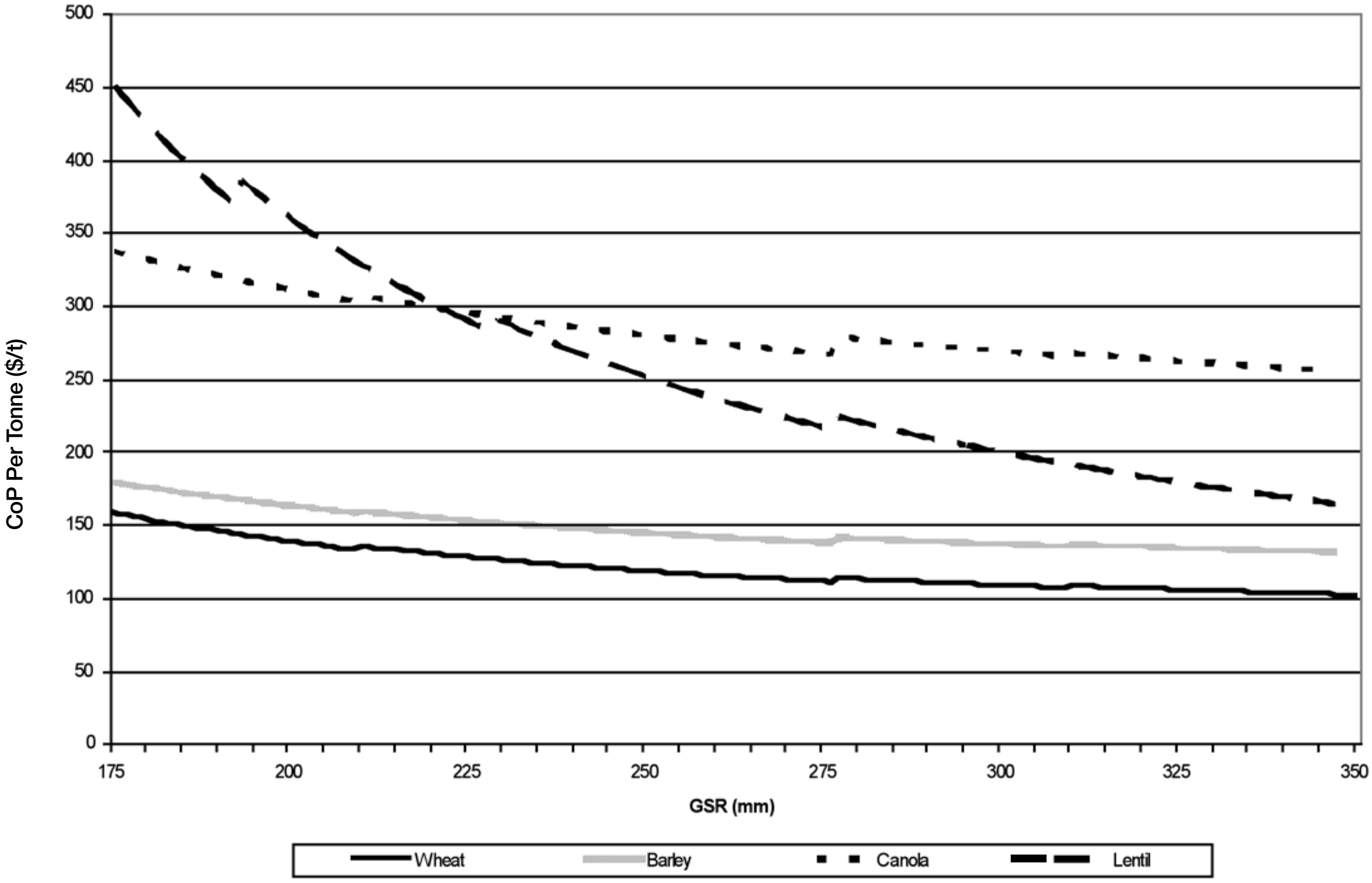
Cost of production

Determining the cost of production for a crop (or whole business) is critical for the purpose of measuring financial performance and risk. A crop production model prepared by Liam Lenaghan was used to model the drivers of production and the relative contributions of the key costs for the 2008 season based on current input prices and a range of price outcomes for a Wimmera scenario.

To determine the cost of production, this study has included:

- Input costs: fertiliser, fuel, herbicides, seed etc.
- Machinery costs at contract rates to standardise machinery and labour inputs.
- Land cost: to recognise the opportunity cost of land ownership or access. The land cost has been set at 6% of current market value.

The figure on the following page illustrates a cost of production curve for canola grown in the Wimmera compared to other crops. Canola has a much higher cost of production curve than cereals ($338/t at 175 mm GSR; $268/t at 275 mm GSR; $255/t at 350 mm GSR). Canola's cost of production is slightly more than double wheat owing largely to its inherently lower water use efficiency, higher N requirement and extra machinery costs.



Cost of production versus GSR outcomes for wheat, barley, canola and lentil.

Profit risk

Breakeven matrices for the Wimmera were developed for a range of likely prices (ex-farm basis) and a range of likely costs of production per tonne for typical GSR events and probable yields. These matrices only show circumstances in which the cost of production is surpassed, they do not reflect individual crop profitability. The Canola matrix illustrates that when price is < $400/t, the probability of making a profit is reduced, especially in low rainfall environments. Profit risk (the risk of not making a profit) is high in these situations, whereas when price increases, profit risk decreases. Growing canola successfully must minimise both production risk and profit risk. Profit risk can be minimised by capturing the best possible grain price and minimising cost of production by judicious use of inputs.

Breakeven matrix when cost of production is taken into account against likely yield outcomes resulting from typical GSR ranges and harvest prices for wheat, barley, canola and lentil.

Canola price ex-farm ($/t)	GSR (mm) - April to October					
	125	175	225	275	325	375
300	X	X	?	✓	✓	✓
400	X	✓	✓	✓	✓	✓
500	✓	✓	✓	✓	✓	✓
600	✓	✓	✓	✓	✓	✓
700	✓	✓	✓	✓	✓	✓
800	✓	✓	✓	✓	✓	✓

FARMER CASE STUDY

The value of canola in the rotation

LOCKHART, NSW

Mark & Steven Day

Enterprises:
- Winter cropping 90% (wheat & barley 70%, canola 30%).
- First-cross lamb production.

In recent years the cropping percentage has increased.

Average annual rainfall: 450 mm.

Soil type: Heavy clay, clay loam & lighter red clay soils.

Soil pH_{Ca}: Unlimed 4.5 to 5.0, limed 5.0 to 5.5.

Why grow canola?

To grow higher yielding wheat crops. Canola allows disease and weed control benefits for rotation of herbicides to manage chemical resistance in weeds.

Negative aspects of canola growing

Canola is high risk in dry years and has a high cost of production when calculated alone rather than as part of a production system.

Sowing system

Canola is direct drilled using a Gason Airseeder and Alfarm A660 Condor Cultivator with Maxi-point easy ripper points on 308 mm tyne spacings and Manutec press wheels. Canola sowing commences in late April / early May depending on soil moisture. Dry sowing is undertaken when required.

Paddocks are generally cultivated once when coming out of lucerne into the crop phase.

Harvesting equipment

Canola is windrowed during late October using a 7.6 m MacDon PTO windrower and harvested with a John Deere 9860 header. Harvest usually occurs 10 to 15 days after windrowing.

Role of canola in the system

The primary reason for growing canola is to produce more tonnes of wheat through better disease and weed control.

Canola is routinely grown as the second crop in the rotation and then as a break crop after two consecutive cereals.

Management of canola residue

Traditionally residues have been burnt. More recently crops have been sown into the inter row and stubble has been retained.

Soil amelioration

Lime is applied at 1.0 to 2.5 t/ha where required to target a pH_{Ca} of 5.5. Gypsum is applied at 0.5 to 2.5 t/ha prior to the first canola crop in the rotation. Gypsum provides sulfur as well as soil amelioration benefits. Higher rates are applied on heavier soil types where sodicity is an issue.

Crop nutrition

Canola is sown with MAP at 50 to 100 kg/ha (approximately 11–22 kg/ha phosphorus [P]). The rate is dependent on the measured soil P level, cropping history and recent crop removal.

Urea is applied at 60 to 120 kg/ha (approximately 27 to 55 kg/ha nitrogen [N]) as a split application between sowing and topdressing. Final rate is dependent on soil moisture and seasonal outlook

Gypsum is used as a source of sulfur.

Weed control

Weed control includes a knockdown herbicide prior to sowing, trifluralin incorporated by sowing and simazine/atrazine applied post-sowing, pre-emergence.

An early post-emergence application of Select® or Verdict® is applied where required to control grass weeds and/or volunteer cereals.

Herbicide resistance

The ability to rotate to different modes of herbicide action in canola is critical in controlling resistant annual ryegrass. When appropriate, other means of controlling ryegrass including fallowing, spray topping and winter cleaning pastures are utilised.

Pest management

A bare-earth residual insecticide is applied post-sowing, pre-emergence.

Disease management

Rotation and seed treatments are used to minimise the risk of yield loss from disease.

If using canola varieties with low to moderate blackleg ratings, Jockey® seed treatment is applied.

Gross margin

The gross margin of a single canola crop has little relevance as many of the benefits of growing canola are obtained in the following wheat crop.

Cost of production

The break even price based on full absorption of overhead costs (including interest) using budgeted figures for the 2008/2009 financial year has been calculated at $377/tonne.

The break even price for wheat is $116/tonne. Without canola as part of the cropping rotation it is likely that the cost of growing wheat would be much higher.

Economic benefit from growing canola

Largely indirect but includes weed control and disease control resulting in more profitable cereal crops and better pasture establishment.

Reliability/robustness of canola

Recent dry seasons have resulted in canola being unreliable when considered in isolation. However, the benefits to the following cereal crops have still been realised in these situations.

During the 2006 and 2007 seasons canola produced a large amount of biomass with little viable grain. Hay production has allowed some cost recovery and limited profit.

Early sales of hay at realistic prices has been the key to generating cash flow from canola hay.

Canola compared to other break crops

Canola is far more reliable over a wider range of soil types and seasons when compared to other broadleaf break crops. Being an internationally marketed commodity it has a more reliable and stable market than pulses.

How does canola compare to cereals?

In terms of profitability it does not directly compare to cereals. It is grown as part of a production system.

Fertiliser use efficiency

Canola has a higher nitrogen and sulfur requirement than wheat. Carryover fertiliser is utilised by the following wheat crop.

Canola yield

Average canola grain yield measured from 1995 to 2005 is 1.2 t/ha. In 2006 & 2007 canola crops with lower yield potential and high biomass were cut for hay. This yield equates to 40% of the average wheat yield for the same period.

FARMER CASE STUDY

Canola provides a weed and disease break, as well as spreading out the time of harvest

THUDDUNGRA, NSW

Chris Holland

Enterprises:

- Winter cropping (wheat, canola and triticale).
- Lucerne hay production.
- Self-replacing Merino ewes.

Average annual rainfall: 550 mm.

Soil type: Sandy clay loam.

Soil pH_{Ca}: Limed 5.3 to 6.4, unlimed 4.5.

Why grow canola?

The primary reason for growing canola is to grow better wheat crops.

Canola also provides weed control, disease control, spreads the timing of harvest, and has proven reliable over time.

Negative aspects of canola growing

- Risk of crop failure in dry years.
- Sclerotinia.

Sowing system

Canola is direct drilled using a Flexicoil airseeder, Harrington knife points with 65 mm paired/spread row on 225 mm (9") spacing and Harrington rotary harrows.

Sowing commences in the last week of April to first week of May. Dry sowing has produced good results in the past. If circumstances require canola will be sown as late as mid to late June.

Harvesting equipment

Windrowing and harvest are carried out by a contractor. The contractor uses a self-propelled windrower and either a Case 2388 or 8010 harvester.

Role of canola in the system

Canola provides a weed and disease break, as well as spreading out the time of harvest. Canola is grown in a rotation with wheat. A typical rotation is between 5 and 8 years and includes 2 to 3 canola crops. The final year of the rotation is usually wheat undersown with pasture. A pasture phase is typically 3 years of lucerne/clover pasture.

Management of canola residue

Other than grazing by sheep there is no specific management of canola residue. The following crop is sown directly into the standing stubble.

The use of mulching harrows may be considered in the future if the need arises.

Soil amelioration

Each paddock is soil tested at the beginning of the rotation. Lime applications are based on a long term target pH_{Ca} of 5.5 – 6.5.

Crop nutrition

Canola is sown with MAP fertiliser at around 60 kg/ha (approximately 13 kg/ha P). This is varied slightly depending on paddock soil P levels. Long term applications of chicken manure have contributed to an upward trend in soil P levels.

Nitrogen is applied as topdressed urea. The timing of applications revolves around seasonal conditions. Urea is generally not spread unless there is good soil moisture and a promising seasonal outlook. If required topdressing applications will be split.

Historically gypsum has been applied as the sulfur source for canola. Gypsum has been applied at rates of 0.6 to 1.0 t/ha prior to sowing the first canola crop in the rotation, supplying adequate sulfur for the remainder of the rotation.

Weed control

Weed control is one of the primary reasons for growing canola. Triazine tolerant canola makes up the bulk of the canola grown. Application of trifluralin, atrazine, simazine and a selective grass herbicide are standard. The aim is to achieve maximum control of grass weeds and minimise the requirement for using selective grass herbicides in following wheat crops.

There is a high emphasis on winter cleaning pastures, being a valuable grass weed management tool.

Herbicide resistance

Using break crops (canola) allows rotation of herbicide groups. In addition, pasture manipulation (winter cleaning and cutting hay), are part of the overall program to avoid the build up of resistant weeds. In the past these tools have been used to significantly reduce the impact of resistant wild oats and ryegrass in some paddocks.

Pest management

The first canola crop in the rotation is treated with insecticide as a 'blanket' bare-earth spray. Other crops are monitored and a border spray for earthmite control is applied only where necessary.

Pastures are not sprayed for earthmite.

Disease management

Management of blackleg in canola is primarily through the use of resistant varieties. In high risk situations the use of Jockey® seed treatment or Impact® treated fertiliser provides additional control.

Sclerotinia poses potentially the greatest disease risk to canola yield. Avoiding high plant populations by using low seeding rates is aimed at increasing airflow within the crop canopy thus reducing the impact of Sclerotinia.

Canola is generally sown at 2.5 kg/ha.

Gross margin

Not calculated, many of the variable costs incurred on a canola crop have benefits for following wheat crops.

Cost of production

Cost of production based on full absorption of overhead costs (including interest) and calculated on budgeted figures for 2007/2008 financial year has been calculated at $286/tonne.

Economic benefit from growing canola

The benefits from growing canola flow on to all other crops in the rotation. In wheat these benefits are primarily weed control and a disease break, both of which result in more profitable wheat crops. In addition pasture establishment is better in 'clean' paddocks, therefore pastures are more productive and more competitive against future weed invasions.

Reliability/robustness of canola

This is an issue in dry years, however the success of canola hay in 2002 and 2006 has increased confidence. Canola hay is a good feed source for livestock. As the market develops and techniques are refined the confidence to make early decisions to cut canola for hay will increase. The ability to use canola oil for biodiesel fuel has the potential to put a floor in the canola price. This may remove some price risk.

Canola compared to other break crops

No other break crops can be reliably grown year in year out.

Agronomically lupins and/or peas would also be suitable. However the market for these crops is smaller and more volatile than the canola market over the long term. Small areas of alternative break crops complicate sowing, spraying, harvest, storage and marketing and are unlikely to have a significant impact on the bottom line.

How does canola compare to cereals?

It doesn't – it complements them.

Fertiliser use efficiency

Although canola may be seen as an inefficient user of nutrients, carryover fertility from a canola crop is utilised by the following wheat crop.

Canola yield

Average canola grain yield measured from 1986 to 2005 is 1.7 t/ha. All canola in 2006 and some in 2002 was cut for hay.

This yield equates to 51% of the average wheat yield for the period 1986-2006.

NSW BETTER CANOLA PROJECT REPORT 2007

Don McCaffery, NSW DPI, Orange 2800
Chris Duff, Delta Agribusiness, Young 2594
Mark Harris, Rural Management Strategies, Wagga Wagga 2650

Key messages

- Widening row spacing reduced established plants per area for a given seeding rate.
- The crop architecture trial produced some important information even though the season was disastrous. This trial will be repeated in 2008.

Background

The NSW component of the project focused on two topical farming systems issues. The first trial examined the influence of row spacing and plant population (crop architecture) on yield and oil content of canola, and the second was a revisit of the sulfur recommendations.
The latter trial was harvested but produced no significant interactions or trends, and hence will not be reported on here.

Field experiments over the past few years had investigated wider row spacing with a range of sowing rates and plant populations as a means of reducing the impact from the disease Sclerotinia. Wider row spacing is primarily being driven by stubble conservation and the need for wider row spacing to cope with cereal stubble loads. Any positive or negative effect of row spacing needs to be quantified.

The trial evaluated the effect of row spacing (18, 22 and 30 cm) and plant population (20, 40 and 60 plants/m2) on yield and oil content of a representative Clearfield® and TT variety.

Method

Two representative varieties of the appropriate maturity were used; Bravo TT and the Clearfield® hybrid 45Y77. Seeding rates were calculated based on seed weights and target plant population, ranging from 1.33 – 3.98 kg/ha for Bravo TT and 1.67 – 5.00 kg/ha for 45Y77. Measurements and data were collected as per the trial protocol.

The trial was sown on 8 May 2008 with 100 kg/ha MAP and the fungicide Impact® plus Gran-Am fertiliser at 100 kg/ha in 5 x 10 metre plots into good seedbed moisture but with little subsoil moisture in reserve.

Other crop protection measures were applied to ensure there were no confounding factors affecting the results.

Measurements were taken of crop establishment (plant counts), crop vigour, biomass, canopy height and grain yield.

Results

The trial was affected by drought from mid-August onwards and yielded poorly at 120-230 kg/ha. Target plant population was the only factor affecting grain yields; however grain yields of 200 kg/ha were meaningless in a practical sense in such a drought season. There were no significant interactions between variety, plant population and row spacing. Despite the drought impact, a number of crop measurements were still made. The most important of these measurements is presented in Figure 1.

The interaction between plant population and row spacing for a given seeding rate showed a trend. By widening the row spacing for a given target plant population, the actual established plant population fell as the row spacing was widened from 18 cm to 30 cm. This trend was less evident with the hybrid 45Y77.

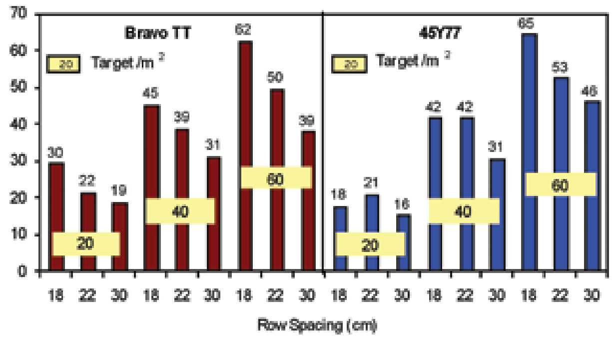


Figure 1. Effect of row spacing on plant establishment at Junee Better Canola site in 2007.

Figure 2. Wider rows reduces plant population for a given seeding rate.

Commercial relevance

The results of the crop architecture trial are consistent with previous findings at Greenethorpe and Grenfell from 2002 to 2006 (Chris Duff and Peter Hamblin pers. com.). If similar results occur with commercial scale seeders then growers need to be aware that seed rates need be increased to get the target plant population on wider row spacing's. The poor season removed any chance of an effect of commercial significance of row spacing and plant population on yield.

Current opinion is that there is an assumed yield penalty by going out to a 30 cm row spacing with canola in the South West Slopes region of NSW. It has also been regularly assumed that plant population, within reason, has little impact on yield. As the trend to wider row spacing and lower seeding rates has continued over the last decade, further trial work is needed to evaluate the impact of this on grain yield and oil content.

Is intra-row competition the main cause of lowered plant populations in wider rows, and how do hybrids differ from open-pollinated varieties in terms of plant vigour, target plant population and optimum row spacing? We seek answers to these questions in 2008.

Acknowledgments

Peter Hamblin, AgriTech Crop Research Pty Ltd, Young
Bernard & Adrian Hart, Hart Bros. Seeds Pty Ltd, Old Junee 2663

Photograph courtesy of GRDC

FARMER CASE STUDY

Changing canola management to improve reliability

MURTOA, VICTORIA

Templemore Partners, Andy and Leo Delahunty

Enterprises:
Grain production (cereal, canola and pulses)
Average annual rainfall: 420mm (Av. last 12 yrs 370 mm)
Average GSR: 290 mm (Av. last 12 yrs 260 mm)
Soil type: Self-mulching and heavier grey clays
Soil pH_{Ca}: 6.0 to 7.5

History

Templemore Partners began growing canola in 1980 with 10 ha after trialling a smaller area in 1979. Since then they have grown canola in every year except 1983. While no-till was introduced on the farm in the mid 1990s, canola paddocks were cultivated when pre-drilling with urea until 2002. Canola has been established using a no-till system since 2002.

Why grow canola?

Canola is grown for broadleaf and grass weed management and a cereal root disease break. The positive effect of canola on the yield of the following cereal crop was immediately noticed in 1981.

Negative aspects of canola growing

- Grain price relative to input costs
- Risk of crop failure in dry years
- High level of inputs required
- Herbicide residues for the following crop
- Reliance on Group B herbicides in a Clearfield® system
- Yield loss from wind damage in windrows

Sowing system

Canola is sown directly into stubble using a Simplicity airseeder, Janke tynes with Janke diamond knife points on 300 mm (12") spacing and press wheels.

Harvesting equipment

Windrowing is carried out by a contractor and harvested with a Case 2388 harvester.

Paddock preparation

Canola is usually grown on chemical fallow commenced in July the previous season using glyphosate and residual herbicides. The stubble from the barley crop prior to the fallow is retained as standing stubble.

Photograph courtesy of GRDC

Sowing and establishment

Canola is sown dry in late April to early May with germination usually by mid to late May. The sowing decision for each canola paddock is based on a minimum 50 mm of available stored soil water.

Canola is sown at 2.5 kg/ha. Good establishment at this rate is achievable with the sowing system. Establishment of dry sown canola has improved since conversion from cultivation to a no-till system.

Varieties

Clearfield® (imidazolinone tolerant) varieties are preferred to triazine tolerant varieties as they have consistently higher oil and yield. Hybrid varieties are also grown when seed is available as are conventional varieties on 'clean' paddocks.

Crop nutrition

Canola is sown with 70 kg/ha MAP fertiliser (14 kg/ha P). Nitrogen was traditionally pre-drilled as urea (usually 120 to 150 kg/ha). From 2002, nitrogen has been applied as topdressed urea. Application is at 3-4 leaf stage, depending on rain fronts. The amount applied depends on soil nitrogen measured to a depth of 60 cm in March and yield potential (based on available soil water and seasonal outlook). Deferring nitrogen to this point is a key part of growing profitable canola in drier seasons. Gypsum was historically applied for soil amelioration and as a sulfur source. Soil structure has improved with no-till and there is less need for gypsum at high rates. It is still applied for sulfur at 600-800 kg/ha in some but not all years, prior to sowing canola.

Weed control

Trifluralin is applied pre-seeding. Lontrel® is used to control vetch and volunteer pulses, thistles and capeweed and a grass selective dim/fop herbicide is used for the control of annual ryegrass, brome grass and volunteer cereals. In the Clearfield® crops, Intervix® is used if required for the control of musk weed and provides some residual control of grass weeds. Spray topping with Gramoxone® after windrowing prevents grass weed seed set and stops canola regrowth. Harvest residue is dumped in rows and burnt the following autumn to destroy weed seeds. The net effect of the weed control program is a reduced weed burden in following cereal crops.

Herbicide resistance

Canola sown on chemical fallow forms the basis of herbicide resistance management. This allows a rotation of herbicide groups, spray topping at windrowing and harvest residue burning. On higher weed burden paddocks it is not the entire answer but very helpful.

Pest management

Gaucho® is used for the control of false wireworm, red-legged earth mite and blue oat mite as it is more user friendly than Lorsban® (for both the operator and for beneficial insects). Post-emergence applications of dimethoate are used to control lucerne flea which is generally more prevalent than mites since the switch to sowing into stubble.

Native budworm is often present in the spring but control is rarely required.

Disease management

Management of blackleg in canola is preferably through the use of resistant varieties with Jockey® though seed treatments are restricted to lower blackleg rated varieties.

Gross margin

The average gross margin from 1996 to 2007 is $243/ha.

Cost of production

The average cost of inputs, machinery and labour from 1996 to 2007 is $260/ha which is $100/ha higher than wheat or barley. 2008 costs are budgeted for $300-$400/ha depending on inputs required, which is a marked increase.

Economic benefit from growing canola

The economic benefits from growing canola flow on to all parts in the rotation in the form of weed and root disease management.

Reliability/robustness of canola

Templemore Partners altered their approach to growing canola in the early 2000s to increase reliability of canola. The approach now involves:

- Well managed chemical fallow to store > 100 mm available water
- Strong emphasis on summer weed control to increase stored soil water
- Canola on pulse stubbles must have at least 50 mm of stored soil water
- Use of climate forecasting tools to regularly monitor seasonal outlook
- Measurement of soil N and soil water to 60 cm
- Early sowing and good establishment with press wheels and stubble retention
- Minimal expenditure on gypsum
- Reducing upfront expenditure on herbicides and nitrogen
- Tailored herbicide rates for each paddock
- Post emergence N application based on soil test + seasonal outlook

Canola compared to other break crops

Canola production has been more consistent than lentils in the drier seasons and provides more weed control options; however, lentils have been more profitable overall. From 1996 to 2001 lentils were far more profitable than canola (lentil $658/ha compared to canola $251/ha). From 2002 to 2007, canola profitability surpassed lentils (lentil $165/ha compared to canola $235/ha).

Canola in the rotation

Canola is grown on the self-mulching clays in paddocks where weed burdens (vetch, musk weed) prevent pulse production. On the heavy clays, canola is the main break crop except for some faba beans depending on seasonal outlook.

Crop intensity

Canola makes up to 10% of the cropping program. Canola will stay at this level while price is high but this may be reduced if grain prices drop. With canola firmly entrenched in the rotation, finding a replacement will be difficult.

How does canola compare to cereals?

Canola yields have been less variable than cereal yields over the past decade due to more stored water under canola than the cereal paddocks. The higher cost of production is a disadvantage especially in years when grain price is low. Cereals have been $50/ha more profitable than canola. Despite the lower margin, canola is required to minimise the risks associated with over exposure to cereals (grass weeds and root disease).

Canola yield

Average canola grain yield measured from 1996 to 2007 is 1.5 t/ha and average water use efficiency based on GSR is 10 kg/ha/mm.

FARMER CASE STUDY

The value of canola in the rotation

WINCHELSEA, Vic

David and Tracey Langley

Enterprises: Grain (cereals & canola), pasture seed and wool production.
Average annual rainfall: 540 mm.
Average GSR: 345 mm
Soil type: Heavy brown clay loam.
Soil pH_{Ca}: Now about 6.0, but was 4.5-5.0.

History

David's grandfather first grew fantastic crops of fodder rape around 1946, but rapeseed for grain was first grown on the property in 1981. Heavy rates of lime were applied annually to overcome soil acidity. Two-metre wide raised beds have been introduced on two-thirds of the farm to overcome drainage problems. In 2006, two unproductive paddocks were laser graded and beds formed and since 2008 David has adopted controlled traffic.

Why grow canola?

Canola has always been a break crop for wheat on David's property. It has high yield potential in the area and provides excellent gross margins. It also spreads the timing of harvest and other operations and allows for better rotation of herbicide groups. David also sees the prospect of being able to bale canola if the season finishes poorly as an enormous benefit. Using guidance systems from 2005 onwards, stubble management is easy as crops can be sown directly into canola stubble between rows.

Negative aspects of canola growing

Gross margins of cereals tend to be higher. Slugs are a major issue, and earwigs and skylarks are also a problem in the region. The input costs are higher for canola than cereals, but some of these costs should really be spread across the whole cropping enterprise as wheat is advantaged from growing canola.

Sowing system

Canola is sown with a home-made airseeder, with narrow points on 250 mm spacings and press wheels.

Harvesting equipment

Windrowing is carried out with their own MacDon self-propelled windrower. David now uses a roller after windrowing to prevent the windrow blowing and reduce shattering of outer pods. Canola is harvested with a John Deere 9750 harvester.

Paddock preparation

Canola is usually grown twice in a 7 year cycle – once following heavy grazing of a seed paddock of perennial ryegrass and also following barley. The stubble from grain crops is retained as spread and standing stubble. Beds are re-formed every 7 years by chisel ploughing and forming beds with a bed-former. Gypsum, lime and poultry manure are applied.

Sowing and establishment

The first week of May is the usual sowing time for David's canola. He hasn't yet had to dry sow.
Canola is usually sown directly into 2 m raised beds at 3.5 kg/ha in an east-west direction and into spread and standing stubble. Establishment on raised beds (which tend to have "loose and fluffy" soil) has improved considerably since the introduction of press wheels. One paddock emerged very successfully when sown at 1.5 kg/ha. Before press wheels, sowing rates as high as 9 kg/ha were needed on beds.

Varieties

David grows triazine tolerant varieties due to the presence of toadrush and silvergrass. He is currently growing ATR-Marlin and ATR-Cobbler.

Crop nutrition

The system is very high-input. Prior to sowing, 1 t/ha gypsum, 2.5 t/ha chicken manure and 2.5 t/ha lime are applied. 120 kg/ha MAP (24 kg/ha P) is applied at sowing. Urea is topdressed at 3-5% flowering at 130 kg/ha.
Since the introduction of liming in 1994, the soil pH_{Ca} has risen from a low of 4.4 to 6.0, with "phenomenal" production gains. Gypsum and the addition of organic matter (stubble retention and manure) ameliorate the soils sodicity, and the gypsum also supplies sulfur for the canola. Stubbles decompose very rapidly with this system, improving soil structure markedly.

Weed control

The main weeds are annual ryegrass, hogweed (wireweed), wild oats, some wild radish, toadrush, canary grass (wild phalaris) and fumitory.
On the non-bedded paddocks, pastures are spray topped in the previous spring. Glyphosate is applied in early May and the crop is direct drilled into the old pasture, using inter-row sowing between grass rows. On raised beds, canola is sown straight into stubble. Traditionally after sowing, the crops have been sprayed with a broadleaf and grass herbicide. A grass selective herbicide and Lontrel® are used post-emergence.

Herbicide resistance

Herbicide resistance is managed by rotating herbicide groups, heavy grazing every 7 years to ensure no seed set and using a knockdown herbicide before sowing.

Pest management

The Langleys are trying to follow integrated pest management strategies, where available. In recent years, virtually no insecticides have been used, allowing for a build-up of beneficial species.
The exception to this is slug bait. This year, David will also use an insecticidal seed dressing which can protect the crop against redlegged earthmite and earwig damage. Slug, earwig and skylark numbers are closely monitored after sowing.

Disease management

Blackleg is managed by using new, resistant varieties. Seed is treated with Jockey® and sown with Impact® applied to the fertiliser. Crops are always sown on the western side of the previous year's canola stubble, as the prevailing winds are westerlies. Yield monitors and fungicide demonstrations indicate that the proximity to the previous year's canola stubble is not important at the property, unless the crop is sown to the east of the stubble.

Cost of production

The average cost of inputs, machinery and labour (before 2008) is between $400-$450/ha, using contract rates for sowing and harvest.

Economic benefit from growing canola

Canola has been a consistently profitable crop for the Langleys. The economic benefits from growing canola flow on to subsequent wheat and barley crops through better weed and root disease management. David estimates a 30% yield benefit from canola to the cereals. Even in the 2006 drought when canola yields were disappointing strong prices meant that a profit was still made.

Reliability/robustness of canola

Once established, canola is "exceptionally reliable" on the Langley's property. The long, cool growing season at Winchelsea is ideal for high yields and oil content.

Canola compared to other break crops

Pulses are not used as break crops on the farm as they lack the required yields and gross margins to compare with canola. Pulses also are less competitive with weeds, allowing more to proliferate, whereas the canola smothers many of the weeds.

Canola in the rotation

A 7 year rotation consists of canola-wheat-barley-canola-wheat-perennial ryegrass seed-heavy grazing and then back to canola.

Crop intensity

Canola makes up to 29% of the cropping/grazing program.

How does canola compare to cereals?

In normal years, cereals yield between 6-7 t/ha. Canola yields average exactly half the cereal yields.

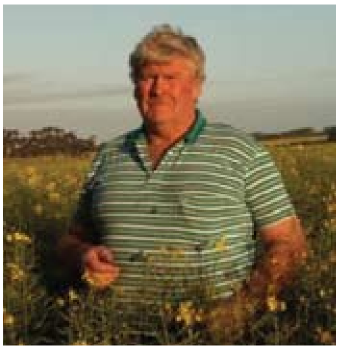
Canola yield

Long-term average canola grain yield is 3.2 t/ha.

FARMER CASE STUDY

Cutting the risks of growing canola

LAKE BOLAC, Vic



Max Davis

Enterprises: Grain and pasture production (cereal, canola, pulses and clover), wool and prime lambs.
Average annual rainfall: 550 mm.
Average GSR: 350 mm (less in the last 7 years).
Soil type: Predominantly grey loam (home farm).
Soil pH_{Ca}: 6.0.

History

Max Davis began growing rapeseed around 1968. In those days, paddocks were cultivated repeatedly for weed control - and the soil structure was ruined. Until 2003, stubbles were burnt. Canola was grown with very high inputs. It is now grown in a minimum till system and inputs have been tailored and timed to reduce risks following 7 years of below-average rainfall. For example, Max has cut about 100 kg/ha of urea from his canola program, as well as lime where it is not needed following a very strong lime history on the paddocks. Max has won the Victorian Crisco Canola Competition three times.

Why grow canola?

Canola is grown as a break crop for cereal root disease and for weed control. Wheat crops following canola on the farm are consistently "magnificent".

Negative aspects of canola growing

Canola has a higher requirement of inputs than wheat in terms of pesticides and fertilisers. Max has overcome some of this by judicious nitrogen management.

Sowing system

Canola is sown directly into stubble or pasture with a RFM airseeder, 700 LB breakout tynes and Sandow knife points and press wheels using 19 cm spacings. Max has good success with his triple disc with press wheels. The next step planned is to sow on 30 cm spacings in a controlled traffic system.

Harvesting equipment

Windrowing is carried out by Max – also contractors - and harvested with a Claas CS116 harvester.

Paddock preparation

Canola usually follows a balansa clover or pulse crop. A 'double knock' herbicide and trifluralin are used and the crop is direct drilled.

Sowing and establishment

Canola is usually sown mid-late May at 4 kg/ha into moisture, but Max has dry sown in the past. Max would be happy reducing this to 3 kg/ha but has concerns of skylark damage. He aims for 75-100 plants/m^2.

Varieties

Clearfield® and triazine tolerant varieties are preferred. In 2007, Max sowed Bravo TT, ATR-Marlin and 46C75.

Crop nutrition

Max has cut back or delayed the application of many inputs in recent below-average rainfall years to reduce up-front costs, and therefore risk. He now applies 100-130 kg/ha MAP (M8 – Hifert with 8% S) with the seed and split topdresses urea instead of pre-drilling, usually applying 80 kg/ha at the rosette stage and again when the first flowers appear. Max stopped pre-drilling urea in 2005 to manage the risk of a dry season. Deep soil tests and nutrient audits are used to tailor fertiliser strategies. In some years in some of the paddocks with lighter soils, copper and zinc have also been applied with the fertiliser during the canola phase. Gypsum has been used in the past. Lime is applied at 1.5-2 t/ha every three to four years.

Weed control

The two major weeds in canola are annual ryegrass, and on some recently acquired and leased land, wild radish. Wild oat populations are also increasing in the district. Max uses two knockdowns – Roundup®, followed by Spray.seed® mixed with a high rate of trifluralin before sowing. For the triazine tolerant varieties, atrazine and Motsa® (a fop and dim herbicide) are applied together post-emergence.

Herbicide resistance

After harvest, Max sprays 0.5 L/ha Roundup® to clean up green weeds or regrowth. He is careful with rotation of chemicals, particularly with Group B herbicides. Spray topping and cutting hay are also used, and a small percentage of stubble is grazed or burnt on the share-farmed property.

Pest management

The main pests are redlegged earth mites and skylarks. Seed is treated with imidacloprid (Gaucho®) for mites. Slugs are baited when present. Endosulfan is applied with Dual Gold® herbicide. Wireworms have not been a problem for the past 10-12 years. Lucerne flea is monitored and controlled as required.

Disease management

Blackleg is a very serious issue in the region. Nearly all seed is treated with Jockey®. In past years Impact® has also been used with fertiliser, although not since 2004. Max was one of the first people to try it. Max also has a blackleg nursery on his property which is used by canola breeders. He is able to observe advanced breeding lines and their ability to withstand extreme blackleg pressure. He always sows canola varieties with a blackleg resistance rating of at least 7.0. Max also tries to sow canola on the west side of the previous year's stubble, although this can sometimes be difficult to arrange.

Gross margin

The long-term average gross margin for Max's canola is around $1000/ha.

Cost of production

The average cost of inputs, machinery and labour only is now $290/ha, using contract rates. Previously, it was $550/ha. However, with the poorer seasons, Max has cut back on inputs including urea, Impact® and lime – the latter of which is no longer needed.

Economic benefit from growing canola

The benefits canola brings in managing weeds and reducing cereal root disease levels has a long-term flow-on effect throughout the rotation, particularly in the cereal phase.

Reliability/robustness of canola

The high rainfall region of the Western District is one of the most reliable in Australia for growing canola with its relatively cool, long growing season promoting high yields and oil content. Prior to the drier seasons, Max had many crops with yields of 4 t/ha, even once achieving a 4.9 t/ha crop using high inputs and with ideal timing of rainfall. In the last 6-7 years, many crops have suffered as moisture has become depleted in October to early November, and in 2006, an extreme frost literally froze most crops in the region. Yields of much of Max's canola have ranged from 2.5-3.0 t/ha. District average was 2.0 t/ha for 2007.

Canola compared to other break crops

Peas yield similar to canola and are also a good break crop. Pea straw is baled and sold to various markets.

Canola in the rotation

Rotations vary, but generally a 3 year rotation is used with canola-wheat-wheat. Max has experimented with pulses and found field peas to be the best. Otherwise he uses balansa clover every 4th year; ie canola-wheat-wheat-legume. Last year he also grew triticale for hay.

Crop intensity

Canola constitutes 25-33% of the cropping program.

How does canola compare to cereals?

Wheat costs for 2008 are $338/ha compared to canola at $500/ha (note that lime at $80/ha is put on the canola costs). Max expects a gross income of $1400/ha for canola and $1600/ha for wheat.

Canola yield

Over the last 3 years canola grain yield has averaged 2 t/ha.
In 2006 canola was cut for hay. Over the last 10 years canola has averaged 3 t/ha.

BETTER CANOLA DEMONSTRATION TRIAL RESULTS

Hybrids versus open pollinated varieties

LONGERENONG, VICTORIA

Kate Burke – John Stuchbery and Associates (JSA)

What happened?

The site at Longerenong was sown very late (June 12) due to the failure of the first sowing attempt. In 2007 the spring was very dry resulting in a short flowering period and low yields.

In this trial two herbicide systems were compared, Clearfield® vs triazine tolerant (TT). It is well documented that triazine tolerance has an approximate yield penalty of 15%, so it is not surprising that the Clearfield® varieties out-yielded the triazines. However, the yield difference was nearly 40% in favour of the Clearfield® hybrid varieties.

Trial site sown June 22, 2007

Rainfall

Average Annual: 414 mm
Average GSR: 284 mm
2007 Total: 372 mm
2007 G.S.R.: 206 mm

Soil type

Grey cracking clay.

Fertiliser

Fertiliser at sowing: Urea 100 kg/ha predrilled, 110 kg/ha SuPreme Z15S

Yield limiting factors

Moisture stress in spring, with an early finish.

Grain yield of four canola varieties at Longerenong 2007.

Measurement	Harvest Date	Clearfield® hybrid		TT		LSD
		45Y77	46Y78	ATR-Barra	Tornado TT	(P<0.05)
Seed Yield (t/ha)	20 Nov 2007	1.10	1.07	0.66	0.66	0.16
Seed Oil (%)		35.5	36.5	37.1	36.1	NS*

*Not significant

BETTER CANOLA DEMONSTRATION TRIAL RESULTS

Canola hay: reducing the risk of canola production

LONGERENONG, VIC

Kate Burke – John Stuchbery and Associates (JSA)

What happened?

Canola can produce excellent quality hay (and silage).

Cutting at late flowering is a good compromise between hay quality and quantity.

Cutting after late flowering reduced hay quality but had little effect on hay quantity.

The hybrid Clearfield® varieties produced higher hay and grain yields than the triazine tolerant varieties.

The option of hay reduces the risk of growing canola and enables the rotational benefits (weed control, disease break) of canola to be achieved at a lower financial risk.

Background

Canola yields have been variable in north central and north western Victoria over the past ten seasons due to below average rainfall and a lack of early sowing opportunities. In some years (2002, 2006, 2007), cutting canola crops for hay has provided an alternative risk management strategy and significantly improved the income compared to grain production.

The demand for hay from the dairy industry and the gradual acceptance of canola hay or silage as a feed source for dairy cows creates a new fallback option for canola. In years where grain yields are likely to be low, hay demand is likely to be strong as was the case in 2007.

This option could encourage growers who have removed canola from the rotation to reintroduce this valuable rotational crop. Canola is an excellent weed and disease management tool.

The value of a canola hay crop is driven by demand, hay quality and dry matter. In order to maximise potential returns, it is essential to understand the management requirements for maximising quality and dry matter. There are several factors that may influence this result.

Trial aims

The aims were to investigate:

- The effect of time of cutting on canola dry matter, quality and profitability
- The effect of variety selection on canola dry matter, quality and profitability
- The profitability of hay compared to grain production

Methods

A variety by time of cutting trial was conducted at Birchip Cropping Group's Wimmera Research and Demonstration site at Longerenong College. In addition, a commercial canola crop at the same location, but sown 6 weeks earlier, was utilised to repeat the time of cutting aspect of the trial.

Trial design

Four varieties (two Clearfield® hybrids and two triazine tolerant varieties) were sown in a fully replicated trial.

Management details

Sowing Date: 22/5/2007 – Re-sown 12/6/2007 due to poor emergence.
Fertiliser: Urea 100 kg/ha pre-drilled, 110 kg/ha supreme Z 15 S. *(Total nutrient application 60 N, 14 P, 14 S, 0.8 Zn).*
Herbicide + Insecticide: 1.2L/ha Trifluralin 480, 0.5 L/ha endosulfan PSPE on all plots. 1 L/ha atrazine 500 + 1 L/ha simazine 500 PSPE on TT plots only.

Grass weeds were removed by hand.
Acknowledgment: Birchip Cropping Group and Longerenong College staff

Time of cutting

In the paddock trial, cutting at mid flowering produced significantly higher quality (higher protein, digestibility and energy and lower fibre) than cutting at late flowering but the earlier cutting time produced significantly less hay yield (Table 1). The hay cut at late flowering produced higher yields and good quality feed, with high energy and protein levels. Cutting at mid pod-fill produced similar dry matter to the late flowering timing but quality had deteriorated significantly. This change in quality is consistent with samples tested in southern NSW.

Table 1. Dry matter and quality of canola hay cut at early and late flowering in the commercial paddock trial.

Time of Cutting	Date	Dry matter (t/ha)	Residual dry matter (%)	Crude protein (%)*	Neutral detergent fibre (%)*	Dry matter digestibility (%)*	Metabolisable energy (MJ/kg)
Mid flowering	6 Sep	3.1	87	28	24	86	13
Late flowering	27 Sep	3.9	91	18	33	74	11
Mid pod-fill	17 Oct	4.0	91	15	38	68	10
LSD (P<0.05)		0.62		2.7	3.43	4.4	0.73

* adjusted to dry matter basis

Variety and time of cutting

The Clearfield® hybrid varieties 45Y77 and 46Y78 produced more hay at both timings than the TT varieties Tornado TT and ATR-Barra (Table 2). The Clearfield® hybrid varieties also produced more grain than the TT varieties but there was no significant difference in oil content. Within each canola type, there was no difference between any of the varieties for biomass at either hay cutting time or for grain yield. 45Y77 and 46Y78 developed more ground cover by late flowering (82 and 85% respectively) than ATR-Barra (66%) and TornadoTT (69%). They were also taller and had greater depth of podding.

Table 2. Hay and grain yield for four canola varieties at Longerenong 2007.

Measurement	Harvest Date	Clearfield® Hybrid		TT		LSD
		45Y77	46Y78	ATR-Barra	Tornado TT	(P<0.05)
Hay						
Late flowering hay (t/ha)	17 Oct 2007	4.4	3.9	3.2	2.9	0.59
Mid pod-fill hay (t/ha)	1 Nov 2007	3.8	3.7	3.1	2.8	0.71
Grain						
Seed yield (t/ha)	20 Nov 2007	1.10	1.07	0.66	0.66	0.16
Seed oil (%)		35.5	36.5	37.1	36.1	NS*

*Not significant

Hay quality was not affected by variety (Table 3) but was affected by time of cutting (Table 4) although there were no significant differences in protein for the two times of cutting. There was no significant interaction between variety and time of cutting, however, 45Y77 displayed poorer quality than the other varieties at the second time of cutting. This was most likely due to its earlier maturity, therefore being closer to ripeness than the other varieties. Table 4 illustrates the drop in quality resulting from the later time of cutting which is consistent with the findings from the commercial paddock trial.

Table 3. Effect of variety on hay quality (mean of two times of cutting).

Quality measurement	Clearfield® hybrid		TT		LSD
	45Y77	46Y78	ATR-Barra	Tornado TT	(P<0.05)
Crude protein %*	15.0	17.3	16.8	16.6	NS**
Neutral detergent fibre %*	45.0	41.6	41.0	41.0	NS
Dry matter digestibility %*	63.2	66.8	66.5	66.9	NS
Metabolisable energy (MJ/kg dry matter)	9.3	9.8	9.8	9.9	NS

*Dry matter basis; ** Not significant

Table 4. Effect of timing of hay cutting on quality (mean of four varieties).

Timing	Harvest date	Yield (t/ha)	Residual dry matter (%)	Crude protein (%)	Neutral detergent fibre (%)	Dry matter digestibility (%)	Metabolisable energy (MJ/kg)
Late flowering hay	17 Oct 2007	3.6	91.4	17.1	35.8	71.6	10.7
Mid pod-fill hay	1 Nov 2007	3.4	94.6	15.8	48.5	60.10	8.7
	LSD (P<0.05)	NS**	0.54	NS**	3.0	3.8	0.64

*Dry matter basis; ** Not significant

Economic analysis

In the commercial paddock trial, hay production regardless of the time of cutting was more profitable than harvesting the crop for grain. A frost in mid October caused significant damage to seed formation and reduced yield potential. Cutting at late flowering produced a more profitable result than early flowering at a given hay price. Canola cut at early flowering was better quality, but produced lower hay yields, requiring a $60/t premium to compensate for this. Although not presented in Table 5, the gross margin for the mid pod-fill cut was similar to the late flowering cut (as dry matter production was similar) assuming the same price could be achieved for the hay given the drop in quality.

In the variety by timing trial, the profitability of hay compared to grain was dependent on variety and hay price (Table 6). For 45Y77 and 46Y78 hay was more profitable than grain at the higher hay price of $270/t (which was achievable in mid October) but it was not as clear cut at the lower hay price of $200/t. Conversely, for the lower yielding Tornado TT and ATR-Barra, hay was a more profitable option, with the grain yield required to exceed the gross margin from hay being greater than the achieved grain yield for each time of cutting and for both hay prices.

Table 5. Gross margin for grain compared to canola hay cut at early or late flowering using two hay prices.

End Product	Yield (t/ha)	Oil (%)	Commodity Price ($/t)	Gross Income ($/ha)	Total Costs ($/ha)	Gross Margin ($/ha)
Grain	0.4	35.3	535	214	240	-26
Early flowering hay	3.1	*	270	837	362	476
"	"	*	200	620	360	260
Late flowering hay	3.9	*	270	1053	392	661
"	"	*	200	780	390	390

Costs include $162/ha for haymaking at 3.1 t/ha and $192/ha at 3.9 t/ha; $200/ha production costs (no N applied in this paddock due to high stored N) $40/ha harvesting and windrowing costs. Grain price Marma Lake Dec 07.

Table 6. Gross margin for grain compared to canola hay cut late flowering or mid pod-fill using two hay prices for four varieties.

Clearfield® hybrids							
		45Y77			46Y78		
	Price ($/t)	Yield (t/ha)	Gross Margin ($/ha)	Grain yield required to match hay gross margin (t/ha)	Yield (t/ha)	Gross Margin ($/ha)	Grain yield required to match hay gross margin (t/ha)
Grain*	545	1.10	287		1.1	272	
LF hay	200	4.4	391	1.3	3.9	309	1.1
	270	"	696	1.8	"	579	1.6
MP hay	200	3.8	291	1.1	3.7	281	1.1
	270	"	553	1.6	"	538	1.6
Triazine Tolerant							

Table 6. (cont.)

	ATR-Barra				Tornado TT		
	Price ($/t)	Yield (t/ha)	Gross Margin ($/ha)	Grain yield required to match hay gross margin (t/ha)	Yield (t/ha)	Gross Margin ($/ha)	Grain yield required to match hay gross margin (t/ha)
Grain*	545	0.66	70		0.66	70	
LF hay	200	3.2	227	0.9	2.9	181	0.9
	270		452	1.4		385	1.2
MP hay	200	3.1	215	1.0	2.8	158	0.9
	270		433	1.4		353	1.2

Production costs for Clearfiled® hybrids $270/ha, TT $250/ha. Harvest costs $ 40/ha, Hay costs $50/t
Grain price based on 36 % oil mid December Graincorp Marma Lake.

Discussion

Hay production is not without risk (weather damage, volatile markets) but does provide a great salvage option in some seasons as was the case in 2007. Greater nutrient removal from the soil in hay should be considered when planning the following season's crop.

Cutting at late flowering is a good compromise between quality and quantity for maximising hay income; however later salvage cuts at mid pod-fill (e.g. after a frost event) can still prove profitable as was the case in these trials, as long as the reduction in quality does not hinder the sale of the hay.

In these trials, the commercial paddock was clearly better off cut for hay as were the two TT varieties in the variety by time of cutting trial. The decision to cut the Clearfield® hybrids was border line if the price was low but favourable if a price above $200/t was achievable.

This illustrates that cutting crops for hay is a complex decision making process involving seasonal outlook, soil moisture reserves and the likely price for both hay and grain as well as considering the logistics of hay making.

Biomass estimation prior to cutting assists decision making. In the commercial paddock trial, dry matter yields were 18, 23 and 27% of fresh weight at mid flowering, late flowering and mid pod-fill respectively. In the variety trial, dry matter yields were 26% and 36% of fresh weight at late flowering and mid pod-fill respectively. These ratios are useful for assessing potential hay yield without drying down plant material. Suggested rules of thumb for estimating dry matter are 20% of fresh weight for early flowering, 25% fresh weight for late flowering and 30-35% of fresh weight for mid pod-fill.

Paying attention to detail in the hay making process is essential to produce a high quality saleable product. Chemical records and withholding periods of chemical applied in that season should be checked before cutting for hay. Canola hay should be conditioned to reduce curing time and increase palatability. This ensures a higher quality product. The reduction in curing time reduces the chance of weather damage and also reduces the chances of baling hay too wet which can lead to hay shed fires. Patience is indeed a virtue in hay making but is essential to ensure that high moisture hay is not baled prematurely.

Proactive marketing and the use of contracts for hay sales can also reduce some of the uncertainty associated with hay marketing. This trial also illustrates how variable hay quality can be so analysis of hay using FEEDTEST® is suggested to aid in selling canola hay and is required by most dairy farmers.

Wimmera farmers Kevin, Grant and Steve Schultz found canola hay a profitable option after a failed spring.

FARMER CASE STUDY

Canola is used to control ryegrass

OWEN, SA

Andrew Parker

Enterprises:
- Winter cropping (wheat, barley, canola, peas).
- Oaten hay.
- Contract windrowing.

Average annual rainfall: 400 mm.
Soil type: Red-brown earth.
Soil pH_{Ca}: Neutral to slightly alkaline 7.0 - 8.0.

Why grow canola?

Canola is used as a cleaning crop in the rotation to control ryegrass. It is often grown after another 'break' crop (such as oaten hay) to give a 2 year control and reduce the seed bank of ryegrass.

Negative aspects of canola

- High input costs.
- Is not profitable when price is below $400/t.

Sowing system

Canola is sown with an AFM wideline bar with a Simplicity box. The bar is equipped with inverted-T points set on 19 cm row spacings. Paddocks will usually receive one working prior to sowing, during which all of the fertiliser is predrilled to avoid all risk of fertiliser toxicity. The canola is sown preferably in April, generally following the opening rains, at a rate of 4 kg/ha. The points are set so they barely scratch the soil surface, with the seed lightly incorporated by a subsequent pass with a prickle chain. If there are heavy stubble residues present, rolling is carried out to improve seed-soil contact.

Harvesting equipment

Andrew owns a New Holland HW325 self-propelled windrower with a 7.5 m front. The windrower is equipped with spray nozzles to enable spraying of ryegrass with knockdown herbicides during the windrowing operation. Harvest is carried out with a New Holland TR88 open front header. Crop lifters are used to assist in picking up the windrows. The header is equipped with a self-cleaning canola sieve system incorporating small balls between two sieves, which reduces blockages and seed losses.

Role of canola in the system

Canola provides opportunities for ryegrass control in the rotation. It also sets up paddocks for high yielding wheat crops the following year by providing a cereal root disease break.

Management of canola residue

At harvest the spinners are taken off the header to concentrate residue into rows. These are then burnt in autumn as a means of preventing ryegrass from entering the seed bank.

Soil amelioration

None required.

Crop nutrition

Depending on paddock history, gypsum is applied at 600 kg/ha in the year canola is grown, to ensure adequate sulfur for the crop. It is applied approximately once in every 10 years. All fertiliser is predrilled prior to sowing to avoid any risk of fertiliser toxicity. This includes urea and MAP plus zinc. Additional urea is topdressed during the cabbage stage if the season is progressing favourably.

Weed control

In the past few years Andrew has switched from growing conventional canola varieties to Clearfield® varieties, although this is to protect the crop against potential Group B herbicide residues associated with recent dry seasons rather than targeting OnDuty® applications for specific weeds.

A knockdown herbicide plus trifluralin are incorporated through sowing. Generally a tank mix of a 'fop' and a 'dim' Group A selective grass herbicide is applied post-emergence for control of volunteer cereals and ryegrass. Surviving ryegrass is also sprayed with glyphosate during windrowing to prevent seed set of escapes.

Herbicide resistance

The property has populations of ryegrass with varying levels of resistance to Group A herbicides. Growing canola is an opportunity to use alternative techniques to control these populations (burning windrows, spraying under windrower). Oaten hay is also grown to provide control of herbicide resistant ryegrass.

Pest management

An application of endosulfan immediately post seeding protects the crop from early infestations of redlegged earth mite. From flowering onwards regular monitoring is carried out to assess grub and aphid levels, with insecticides applied by aircraft if required.

Disease management

The main disease threat is blackleg. This is managed by growing varieties with good resistance. Jockey® seed dressings are used when canola is grown adjacent to canola stubbles from the previous season to provide additional protection from blackleg.

Gross margin

Canola gross margins vary considerably according to yield and price. Input costs remain relatively constant from year to year. The value of the ryegrass control to the rotation is difficult to quantify but is considered to be substantial.

Cost of production

Cost of production is typically $300/ha to grow the canola crop. This includes machinery operations and inputs.

Economic benefit from growing canola

Canola is a profitable crop in its own right when prices are high and when average yields are achieved. Owning a windrower also leads to contracting work which is an important income source for Andrew's business.

Reliability/robustness of canola

Canola yields can suffer in dry years, with yields of 0.6 t/ha the worst on record. This makes it difficult for the crop to break-even financially in poor seasons. However, the benefits of canola to the farming system, i.e. ryegrass control and providing a disease break for subsequent cereal crops is maintained no matter what the seasonal conditions and justifies canola in the rotation.

Canola compared to other break crops

Compared with field peas, canola has higher input costs, but it also has potential to return higher gross margins. It complements other break crops by providing a 'double hit' on ryegrass in the rotation.

How does canola compare to other cereals

Canola is grown to set paddocks up for cereal crops. It is not competing with cereal crops for a place in the rotation.

Fertiliser use efficiency

Wheat crops following canola tend to require less nitrogen inputs than wheat crops following a cereal. This indicates that there is some residual fertiliser leftover from a canola crop, or higher mineralisation of nitrogen following canola, which is utilised by the following wheat crop.

Canola yield

The long term average over 10 years for the property is approximately 1.0 t/ha.

FARMER CASE STUDY

Canola is grown to provide weed control options and a disease break in the rotation

HILLTOWN, SA

Andrew Jaeschke

Enterprises:
- Winter cropping (wheat, barley, canola, lupins).
- Oaten hay.
- Sheep (prime lambs).

Average annual rainfall: 495 mm.

Soil type: Varies from black cracking clay to red brown earth.

Soil pH_{Ca}: Neutral through to acidic 4.8 – 5.5.

Why grow canola?

Canola is grown to provide weed control options and a disease break in the rotation.

Negative aspects of canola

High input costs and high level of monitoring required.

Sowing system

Fertiliser is pre-drilled with the opening rains, preferably in late April, at the same time incorporating trifluralin. This is followed immediately by 'trickling' the seed onto the soil surface at 4.5 kg/ha through Andrew's Horwood Bagshaw Air-seeder on 18 cm row spacing, with rolling harrows behind the seeder bar used as a covering device. The paddock is then rolled using a rubber tyre roller to improve seed-soil contact.

Harvesting equipment

Swathing is carried out by a contract windrower. The windrower is set up with spray nozzles so that a knockdown herbicide is applied during the swathing operation to prevent regrowth of ryegrass. Windrows are then harvested using a John Deere harvester equipped with a pickup front. Residues are concentrated in a narrow windrow, rather than spread during the harvesting operation to facilitate burning of the residue rows in autumn to eliminate viable ryegrass seeds.

Role of canola in the system

Canola is grown to provide a root disease break for subsequent cereal crops, and to provide alternative options for ryegrass control. It is the only stage in the rotation where strategic burning occurs. Because triazine tolerant varieties are grown this also allows Group A and C herbicides to be used for ryegrass control.

Management of canola residue

At harvest canola residue is concentrated into windrows at the back of the header. Stubbles are lightly grazed, and windrows are burnt in autumn as a further ryegrass control strategy. The following crop is direct drilled into standing stubble.

Soil amelioration

Soil testing is done on a 'as needs' basis and is used to refine the fertiliser program. Lime applications are targeted on paddocks with pH_{Ca} of less than 5.0.

Crop nutrition

A mixture of urea and sulfate of ammonia is pre-drilled prior to sowing, and DAP is sown with the seed. A further application of urea is topdressed at bolting if the seasonal outlook is favourable and subsoil moisture levels are good.

Weed control

Ryegrass and wild radish are the main weeds on the property. A mix of trifluralin and glyphosate is applied pre-seeding, followed by an application of simazine post-sowing/pre-emergence. A 'dim' herbicide is used post-emergence to control ryegrass. If the paddock has a high density of wild radish, atrazine is included with the post-emergence selective grass herbicide.

Herbicide resistance

Oaten hay is a regular component of the rotation on the property and this has helped to delay the onset of herbicide resistance in ryegrass. Pastures are also used to control ryegrass. Despite this, there is a level of ryegrass resistance to Group A herbicides. Canola is used to provide alternative control options for resistant ryegrass. Non-selective herbicides are sprayed when windrowing, and windrows are burnt post harvest. These approaches provide diversity in ryegrass management and help to slow the development of herbicide resistance.

Pest management

A broad spectrum residual insecticide is included with the post-sowing/pre-emergence simazine application. This aims to control redlegged earth mite and other insect pests during the establishment phase of the crop. Regular monitoring from podding onwards determines the need for additional insecticides. When populations of budworm and/or diamondback moth reach threshold levels, insecticides are applied by aircraft.

Disease management

Blackleg is the main disease threat. Canola is not grown in the same paddock within 4 years to minimise disease risk. Blackleg resistance is also a criterion when selecting a variety, and Jockey® seed dressings are used to enhance resistance if the variety has a rating of less than 7.0.

Gross margin

High prices combined with good yields in 2007 resulted in a gross margin of approximately $640/ha.

Cost of production

Cost of production varies depending on fertiliser applications, and is typically between $300 and $350/ha, including machinery costs.

Economic benefit from growing canola

Canola is a profitable crop in its own right in good years, and also provides an economic benefit by reducing the need to use expensive post-emergence selective grass herbicides in subsequent cereal crops.

Reliability/robustness of canola

Canola performs well in 'good' seasons although it can perform poorly in drier years. It was not grown on the property for 3 years due to a run of poor results.

Canola compared to other break crops

Lupins, hay and pasture are the other break crops grown on the property. Canola provides alternative options for ryegrass control such as strategic burning and spraying under the windrower. It is used in conjunction with these other break crops to control ryegrass.

How does canola compare to cereals

Canola is not viewed as a "competing" crop with cereals, but rather a "complementary" crop to the cereal enterprises on the property. Canola complements cereal production by spreading the time of sowing and harvest, providing ryegrass control and controlling cereal root diseases.

Fertiliser use efficiency

Canola is recognised as having a high nutrient requirement, especially for nitrogen. To maximise fertiliser efficiency, in-crop applications of urea are targeted prior to substantial rainfall events with rates adjusted according to how the season is developing.

Canola yield

Yields on the property have varied over the years, with 0.9 t/ha being the lowest. In the 2007 season, despite being a drier year, canola averaged 1.8 t/ha and 43.5% oil.

BETTER CANOLA DEMONSTRATION TRIAL RESULTS

Nitrogen rates & management

FRANCES and CUMMINS, SA

Trent Potter, SARDI and McKillop Cropping Group
Jim Egan, Joanne Crouch, Kieran Wauchhope and the LEADA group

What happened?

Frances

Although late sown, late spring rains resulted in good growing conditions.

At each nitrogen rate, the highest grain yield was produced by the earlier application timings.

Grain yield increased in response to higher rates of nitrogen.

Cummins

Despite the good start to the season and timely sowing, there was moisture stress from August through to crop maturity.

The average yield in this trial was 1.04 t/ha.

The N management treatments produced no yield response, with the basal fertiliser (control) treatments yielding just as well as treatments supplying up to 100 kg N/ha. Additional sulfur did not increase yield.

The trial site had high levels of available (mineral) soil N at the start of the season, estimated at 417 kg N/ha, which was more than adequate for the low yields obtained, hence the lack of response to additional N is not surprising.

Frances sown June 14
Cummins sown May 24

Rainfall

Frances:

Average annual: 580 mm
Average GSR: 450 mm
2007 Total: 503 mm
2007 GSR: 315 mm

Cummins:

Average annual: 425 mm
Average GSR: 344 mm
2007 Total: 327 mm
2007 GSR: 223 mm

Paddock history

Year	Cummins
2004	Wheat
2005	Canola
2006	Pasture

Soil type

Frances: Black cracking clay over limestone.
Cummins: Grey cracking clay.

Yield limiting factors:

Frances: Trial sown late due to wet May, some waterlogging early.
Cummins: Moisture stress in spring with an early finish.

Fertiliser

Frances: Fertiliser at sowing 18:13:0:10 Zn 1% @ 120 kg/ha, drilled below seed.
Cummins: Fertiliser at sowing 18:13:0:10 Zn 1% @ 120 kg/ha, drilled below seed.

Figure 1. Frances - Yield response to nitrogen applied at 25 kg/ha at various timings

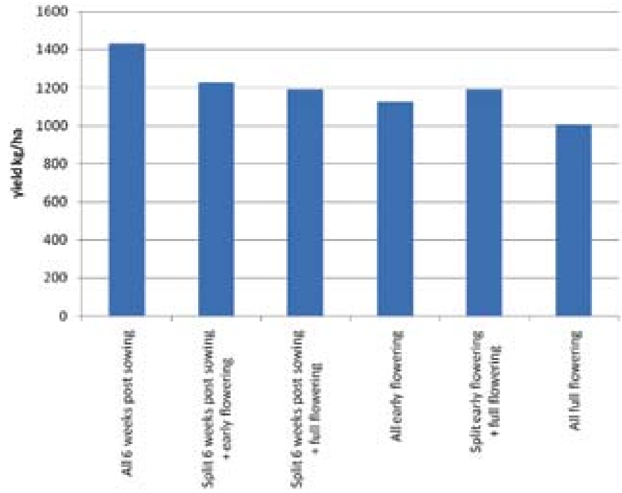


Figure 2. Frances - Yield response to nitrogen applied at 75 kg/ha at various timings

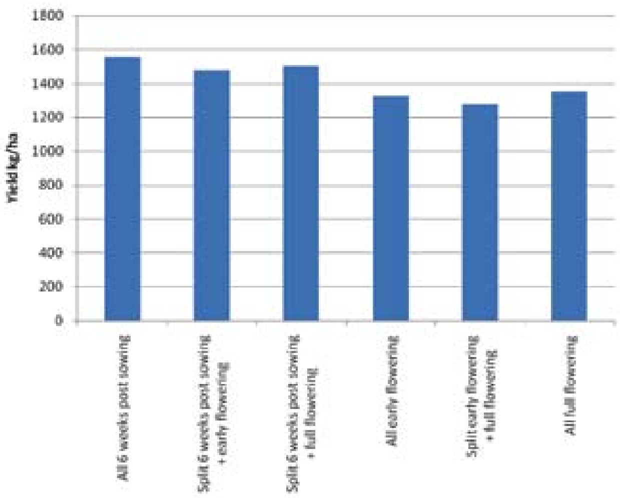


Figure 3. Frances - Yield response to nitrogen applied at

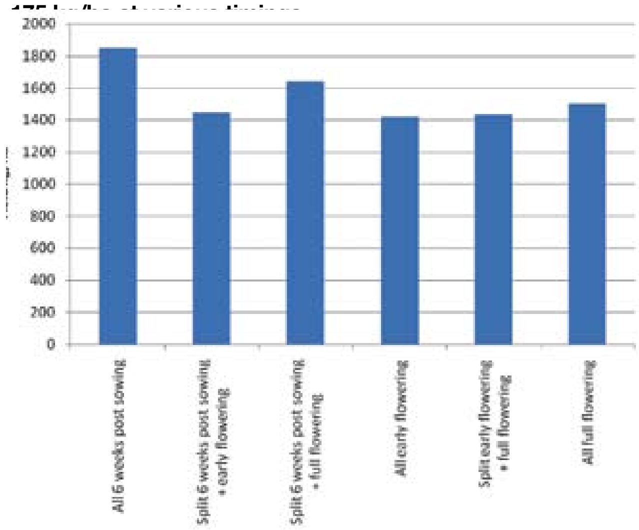


Figure 4. Frances - Yield response to various rates of nitrogen applied 6 weeks after sowing

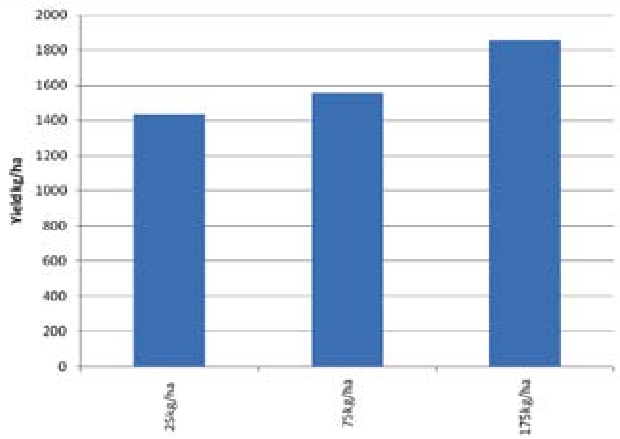


Table 1. Effect of rate and timing of nitrogen and sulfur on grain yield at Cummins, 2007.

TREATMENT	DESCRIPTION	NITROGEN APPLICATION (kg N/ha)					GRAIN YIELD (t/ha)
		Basal at seeding	Extra at seeding	Mid Veg.	Budd ing	TOTAL	
1	Basal (Control) - 19:13:0:9 @150 kg/ha at seeding, and no extra N	28	0	0	0	28	1.02
2	Extra 22 units N at seeding	28	22	0	0	50	1.03
3	50:50 split N app. - seeding + mid-veg	28	6	33	0	67	0.98
4	50:50 split N app. - seeding + budding	28	6	0	33	67	1.03
5	Extra 72 units N at seeding	28	72	0	0	100	1.03
6	50:50 split N application - seeding + mid-veg	28	22	50	0	100	0.99
7	50:50 split N application - seeding + budding	28	22	0	50	100	1.23
8	33:33:33 split N app. - seeding + mid-veg + budding	28	6	33	33	100	1.07
9	Extra S - same as Treat. 6, but sulfate of ammonia at mid-veg	28	22	50 (AS)	0	100 + S	1.04
10	Max + S - same as Treat. 8, but AS for both in-crop applications	28	6	33 (AS)	33 (AS)	100 + S	0.97
Mean yield across all treatments							**1.04**

No fertiliser treatments had a statistically significant response.

Discussion

There is a great deal of knowledge on canola grain yield response to nitrogen. However, in recent dry seasons and in response to increased fertiliser costs growers have been advised to delay timing of nitrogen application. This enables growers to spend their nitrogen dollars later in the season when they have a better idea on how the season is progressing. This demonstration site showed that nitrogen rates are more important than timing. However, growers should still apply their nitrogen as soon as they are confident in the season as long delays may reduce yields.

BETTER CANOLA DEMONSTRATION TRIAL RESULTS

Effect of seeding rate on hybrid and open pollinated varieties

NARACOORTE, LAMEROO and CUMMINS, SA

Trent Potter, SARDI and McKillop Cropping Group
Jim Egan, Joanne Crouch, Kieran Wauchhope and the LEADA group

What happened?

- Three trials were undertaken in South Australia to compare the effects of sowing rate on grain yield of conventional open-pollinated canola varieties and a hybrid.
- Sowing rate had little effect on the yields of canola in the trials. The only exception was the higher sowing rates of 5 and 7.5 kg/ha, which reduced yields at the low rainfall site of Lameroo.
- Canola is a crop that generally compensates well for plant densities outside the optimal range.
- These results suggest that in some cases, yields may be reduced in low rainfall environments by sowing canola too heavily, while low plant numbers may reduce yields in high rainfall environments.

Trial site sowing date: Naracoorte, May 26, Lameroo May 15

Rainfall

Naracoorte:
Average annual: 578 mm
Average GSR: 439 mm
2007 Total: 600 mm
2007 GSR: 407 mm

Lameroo:
Average annual: 384 mm
Average GSR: 273 mm
2007 Total: 363 mm
2007 GSR: 184 mm

Cummins:
Average annual: 425 mm
Average GSR: 344 mm
2007 Total: 327 mm
2007 GSR: 223 mm

Paddock history

Year	Naracoorte	Lameroo	Cummins
2004	-	-	Wheat
2005	-	-	Canola
2006	Wheat	Wheat	Pasture

Soil type

Lameroo: Loam.
Naracoorte: Black cracking clay over limestone.
Cummins: Grey cracking clay.

Yield limiting factors

Lameroo: Moisture stress from early August with hot winds just after flowering started. Little rain in spring.
Naracoorte: Some moisture stress in spring, but very good late rain in early November.
Cummins: Moisture stress in spring with an early finish.

Nutrition

Lameroo: Fertiliser at sowing was 120 kg/ha N:P:K:S 18:13:0:10 plus 1% Zn, drilled below seed. Urea and sulfate of ammonia at a total of 50 kg/ha N was applied on 26 July.
Naracoorte: Fertiliser at sowing was 120 kg/ha N:P:K:S 18:13:0:10 plus 1% Zn, drilled below seed. Urea and sulfate of ammonia applied at 50 kg/ha total N was applied on 13 August.
Cummins: Fertiliser at sowing was 19:13:0:9 (Croplift 19) at 150 kg/ha, drilled below seed.

Pest control

Lameroo: Trifluralin applied prior to sowing and clethodim plus clopyralid applied on 25 July.
Naracoorte: Trifluralin applied prior to sowing and clethodim plus clopyralid applied on 19 July. The TT sowing rate trial had simazine applied at sowing and atrazine applied on 13 August.

Cummins: Herbicides & insecticides: Knockdown spray of Roundup @ 1.2 L/ha, Simazine@ 2 L/ha and Lorsban @ 250 ml/ha. In-crop sprays of Fastac @ 250 ml/ha, Chlorpyrifos @ 500 ml/ha, Piramol @ 18 ml/ha, Aramo @ 4 ml/ha, Lontrel @ 200 ml/ha, Karate @ 40 ml/ha.

Background

As canola is now sown across a larger range of environments and with the introduction of hybrids there is a need to revisit early research on optimal plant populations.

Trial aims

- To determine optimal sowing rates for a range of environments.
- To determine if hybrid sowing rates can be reduced.

Results

At the low rainfall site of Lameroo, plots sown at the two highest sowing rates (5 and 7.5 kg/ha) reduced yield, compared with the lowest sowing rates (1 and 2 kg/ha) (Table 1).

The variety AG-Muster yielded the highest in the dry season, followed by Tarcoola and then AV-Jade.

All varieties responded in a similar way to sowing rate, i.e. no significant interaction was observed.

Table 1. Yield of the triazine tolerant canola variety Bravo TT over a range of sowing rates (kg/ha) at MacKillop Farm Management Group site, Naracoorte.

Sowing rate (kg/ha)	Grain yield (t/ha) Bravo TT
1	1.74
2	1.80
3	1.78
4	1.86
5	1.78
6	1.86
7.5	1.68
Site mean	1.79
LSD (p<0.05)	ns
CV%	4.87

There were no significant difference between treatments.

Table 2. Yield of three conventional canola varieties over a range of sowing rates (kg/ha)at Lameroo.

Sowing rate	Yield (t/ha)			
(kg/ha)	AG-Muster	Tarcoola	AV-Jade	Mean
1	0.66	0.59	0.43	0.56
2	0.69	0.55	0.45	0.56
3	0.75	0.55	0.42	0.57
4	0.61	0.60	0.35	0.52
5	0.66	0.47	0.31	0.48
7.5	0.59	0.47	0.28	0.44
Mean	0.66	0.54	0.37	0.52
LSD (variety) (p)	0.11 (0.005)			
LSD (sowing rate)				0.08 (0.007)
CV%	15.75			

At the high rainfall site of Naracoorte there was no significant difference (p>0.05) between cultivars, sowing rates or the interaction between cultivar and sowing rate (Table 2). Therefore plant populations of 20 to 150 plants/m^2 had no effect on yield.

Table 3. Yield of canola 45C75 variety and 45Y77 hybrid over a range of plant populations at Cummins LEADA site, 2007.

	Yield (t/ha)	
Plant population (plants/m^2)	**45C75**	**45Y77 hybrid**
20	1.09	0.94
40	1.12	1.07
60	0.98	1.16
80	0.81	1.08
100	1.01	1.04
150	0.90	1.01
Variety mean	**0.99**	**1.05**
LSD (p<0.05)	**ns**	**ns**

There were no significant difference between any of the treatments.

Table 4. Yield (t/ha) of Clearfield® canola 45C75 variety and 45Y77 hybrid over a range of plant populations (plants/ m^2) at MacKillop Farm Management Group site, Naracoorte.

	Yield (t/ha)		
Plant population	**45C75**	**45Y77 hybrid**	**Mean**
20	2.33	2.18	2.26
40	2.46	2.58	2.52
60	2.40	2.56	2.48
80	2.44	2.43	2.44
100	2.43	2.70	2.57
150	2.43	2.60	2.52
Mean	**2.42**	**2.51**	**2.46**
LSD (variety)	**nsd**		
LSD (sowing rate)			**nsd**
LSD (var x sowing rate)	**nsd**		
CV%	**8.34**		

The triazine tolerant canola variety Bravo TT gave no significant yield response to sowing rate even at rates as low as 1 kg/ha (Table 3).

Commercial practice

Low sowing rates can be used for open-pollinated and hybrid cultivars of canola provided good control of insect pests and weeds is undertaken. In low rainfall environments care should be taken to keep sowing rates lower rather than higher to avoid yield loss due to drought stress.

BETTER CANOLA DEMONSTRATION TRIAL RESULTS

Time of sowing / nitrogen rates and timing

RIVERTON, SA

Mick Faulkner and Geoff Braun, Agrilink Agricultural Consultants

Nitrogen application of 100 kg N /ha either at seeding or bolting gave significant yield increases. Early sowing produced a significantly higher yield for variety 46C76, but significantly lower yield for both Thunder TT and 46Y78 hybrid. This is most likely due to the vigorous growth exhibited by these varieties, which resulted in excessive soil moisture use and lower yield given the poor spring conditions. A similar result occurred where delayed nitrogen applications produced slightly higher yields in these varieties as opposed to sowing nitrogen. This could be associated with the deferred water use from winter to spring.

Trial sown: May 24

Rainfall

Average annual: 520mm
Average GSR: 400mm
2007 Total: 400mm
2007 GSR: 313mm

Yield limiting factors

Moisture stress in spring, with an early finish.

Effect of nitrogen rate and timing on canola yield.

	Yield (t/ha)
Nil N	1.40
50N Seeding	1.54
100N Seeding	1.73
100N Bolting	1.92
LSD (0.05)	0.20

Effect of time of sowing (TOS) on canola yield of three varieties.

	Yield (t/ha)		
	46C76	Thunder TT	46Y78
TOS 1	1.60	1.74	1.69
TOS 2	1.92	1.41	2.02
LSD (0.05)	0.24		

Effect of nitrogen rate and timing on canola yield of three varieties.

	Yield (t/ha)		
	46C76	Thunder TT	46Y78
Nil N	1.40	1.33	1.48
50N Seeding	1.16	1.66	1.80
100N Seeding	1.72	1.58	1.89
100N Bolting	1.76	1.74	2.26
LSD (0.05)	*Not Significant*		

FARMER CASE STUDY

Canola enables us to use herbicides with different modes of action and is the most profitable break crop WILLIAMS, WA

Brett Fowler

Enterprises:
Cropping, export hay, canola, barley, sheep merino/dohne cross
Average rainfall: 550mm
Soil type: Gravelly loam
Soil pH_{Ca}: 4.8 to 5.2

Why grow canola?

Triazine tolerant canola is part of our program for rotational options. It is the best financial return of the break crop options we have available (particularly recently and looking forward to 2008). It gives us the ability to use different herbicide groups other than those we would use in the cereal phase, i.e. rotate for resistance purposes. As an enterprise it spreads our risk as part of the cropping program and also spreads the workload with other crops, i.e. hay, livestock etc. It is a crop which is easily stored on farm in terms of tonnages.

Negative aspects of growing canola

Management at seeding and early post-emergence is more demanding than cereals particularly insect control such as bryobia mite and vegetable weevil.

Seeding system

Gason 9.6 m bar with knifepoints on 20 cm row spacing and a dragging boot configuration. Gason 1830 triple box.
Canola seeding commences at the earliest around 20 April and the latest 25 June. Canola is sown at 4 kg/ha.

Harvesting equipment

New Holland CX 780, with Rollerdown Phillips Pick up front.

Management of canola residue

Stubbles are grazed over summer and then remaining residue is rolled with a chain during summer to break it up and improve seeder trafficability.

Soil amelioration

Much of Western Australia's soil is acidic and canola particularly is sensitive to lower pH hence paddocks are limed to achieve a target pH_{Ca} of over 5.0.

Nutrition

We use 100-110 kg/ha of Macro Pro Boost at seeding which is a compound N, P, K, S product. Macro Pro Boost has only been used in the last two years in an attempt to improve potassium (K) uptake early, particularly when drier starts to the season may mean topdressed K isn't immediately available.
Canola responds well to high sulfur (S) rates particularly on the lighter WA soils.
The standard regime is approximately 60 kg/ha of sulfate of ammonia (SOA), which combined with the S supplied in Macro Pro Boost provides around 20 kg/ha of S.
Total N application including that supplied from Macro Pro Boost and SOA is around 70-90 kg/ha when aiming for 2 t/ha yields.
Cereals following canola are generally more P and K responsive than cereals following cereals. Therefore attention to P and K nutrition in the following cereal crop is important.

Weed control and herbicide resistance

The weed control aspect of growing canola is certainly a significant benefit but non-wetting gravels provide issues with several germinations of ryegrass and radish and tend to produce more inconsistent results with triazines.
The ability to use Group C and Group A in that part of the rotation assists in slowing the onset of resistance to any one group.
Sprayseed® is generally used as the knockdown where possible in the canola phase as an alternative option to glyphosate which is used in the remainder of the cropping program.
Canola is generally grown one in every three years hence there is good rotation of herbicide chemistry groups. Triazines and clethodim are used in canola, followed by metalochlor in export hay, trifluralin in barley and then back to canola.

Yr 1	Canola
Yr 2	Export hay (K) cutting
Yr 3	Barley
Yr 4	Canola

Pest management

Canola receives a 'blanket' application of Talstar® and chlorpyrifos spray post-sowing / pre-emergence for red-legged earth mite, bryobia mites and vegetable weevil. If required omethoate (Lemat®) will be added to the first atrazine top up. Aphids, native budworm and diamondback moth are rarely an issue.

Disease management

As canola rotations have become tighter Jockey® has been introduced into the program and more recently Maxim XL® and varieties generally have a minimum rating of 6.5 for blackleg (i.e. Bravo TT and CBTMTanami).

Gross margin:

Equivalent to cereals in the rotation.

Cost of production

Canola is similar to other crops in the rotation as the price of selective herbicides and insecticides have fallen in recent times.

Economic benefit from growing canola

Financially in the year of production canola's gross margin is equivalent to other cereals in the rotation. Following canola some of the best hay and barley yields are grown given the paddocks are generally weed and disease free.

Reliability and robustness of canola

The 2006 season gave a good indication of the reliability of canola in the rotation. In one of the poorest seasons in the history of the area it still yielded 1.2 t/ha. Hence many growers now have the confidence to plant canola later into the year assuming the prices are there to offset lower yields.

Canola compared to other break crops

Canola is by far the most profitable break crop available in the rotation currently. Newer varieties of lupins and better radish control options for field peas may change that into the future but with current pricing canola is well in front.

Fertiliser use efficiency

Canola itself is a good scavenger for phosphorus on high phosphorus binding soil types such as the forest gravels on the property.
Nutrition of cereals following canola needs to be managed differently to cereals following cereals. Trials have indicated strong responses to both phosphorus and potassium following canola.

Canola yield

Average canola yield over the last 10 years has been 1.9 t/ha, with a low of 1.2 t/ha and high of 2.3 t/ha.

BETTER CANOLA DEMONSTRATION TRIAL RESULTS

Sclerotinia control

WILLIAMS, WA

Richard Quinlan – Agronomist Planfarm Agronomy Pty Ltd, OilseedsWA

What happened?

Rainfall received in 2007 was well below the long term average for the district. The trial was significantly influenced by the dry season and consequent lack of expression of the Sclerotinia fungus at the trial site.

It is necessary to continue this research in a normal rainfall season year where the disease is more prevalent. CBTMTanami was the highest yielding variety. It significantly out-yielded all other varieties in the trial.

Aim

To compare canola varieties for yield and quality and their relative response to Rovral® (250g/L iprodione) and Amistar (250 g/L azoxystrobin) for Sclerotinia control.

Background

In some countries sclerotinia is the most important disease of canola. Sclerotinia is a broadacre cropping disease found throughout the wheatbelt of Western Australia especially in higher rainfall coastal regions. Sclerotinia infects broadleaf crops such as lupins, canola, faba beans, chickpeas and lentils as well as some broadleaf weeds such as capeweed. Usually the stalk rots just above soil level, causing the plant to wilt and ripen prematurely. Severely attacked plants often lodge.

Sclerotinia control trials have been conducted in southern NSW. Work conducted by "Best Bet Canola Management 2001" clearly demonstrated that controlling Sclerotinia will give significant yield responses. With 2-3 applications of fungicide, these responses ranged from 7-34% depending on sowing date, variety and season. The range of stem infection in unsprayed plots was from 4-26%. Stem infections higher than 26% were recorded in farmers paddocks in 2001.

2001 Sites	% Stems infected (Unsprayed)	Yield response (t/ha)	% Yield response
Wallendbeen NSW	6-26%	0.47-0.91	17-34
Galong NSW	4-12	0.14-0.43	7-18

Current research in NSW suggests the optimum time to spray is between 20-50% flowering, and just prior to rain. 20% flowering is the time when the crop has just covered in yellow and when 90-100% of plants have at least one fully opened flower. Whilst the decision to spray in NSW is made in September, the weather conditions that cause the losses can occur both before and after that time. The decision to spray therefore is not straightforward, as the disease is highly weather dependent and the cost of application is high ($65-80/ha). Further work needs to be undertaken to confirm the appropriate spray timing, and establish the reliability of fungicide responses, and the conditions that promote the development of the disease after petal infection.

Local Western Australian Observations

Currently Sclerotinia is not viewed as a significant disease in Western Australia. However, in the 2003, 2004 and 2005 seasons several crops were observed by the author to have stem infection levels of 30-35% at the pod-fill stage with significant lodging at harvest. Yield reductions were not measured but were likely to be significant. In comparison to blackleg, Sclerotinia is more prevalent in the coastal fringe of the Northern Agricultural Region.

Products Registered

There are currently two fungacides registered for Sclerodinia control in Australia.

Trial Details:

Location:	Appa Springs (Treasure Family), Moonyoonooka, Geraldton.
Soil type:	Red loam.
Rotation:	2006-wheat, 2005-lupins, 2004-wheat, 2003-canola.
Trial sown:	11 May 2007
Fertiliser rate:	Pre-sowing: 65 kg/ha urea/SOA 5:1 (topdressed); at sowing: 65 kg/ha MAP (banded).
Post-sowing (fertiliser & timing):	70 kg/ha urea/SOA 5:1 (topdressed).

Fungicides (timing & rate)

CBTMTanami, ATR-Stubby and Bravo TT - Rovral® fungicide applied 9 August 2007.
ATR-Stubby + Amistar® applied 9 August 2007
Tornado TT + Rovral® and ATR-Banjo + Rovral® treatments applied 16 August 2007.
See Table 2 for crop growth stage at fungicide application.

Hybrids are a first cross generation, with good seedling vigour and higher yield potential.

Table 1. Rainfall (mm) data for trial site 2008.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOT	GSR
2007	0	0	0	6	31	24	62	46	35	18	0	19	239	222
Long Term Average	5	12	17	25	72	106	94	66	32	20	10	5	464	415

The trial was rated for stem infection of Sclerotinia per 3 metres of row for each plot. There was no sign of Sclerotinia (stem infection or sclerotes) in the trial.

Table 2. Relative flowering times, yield and oil contents for the various treatments.

Variety	% Flowering (9 August)	% Flowering (16 August)	% Oil	Yield kg/ha
ATR-Stubby	20	80	41.9	879
ATR-Stubby + Rovral®	20	80	41.4	948
CB™ Tanami	50	100	41.5	1058
CB™ Tanami + Rovral®	50	100	41.7	1140
Bravo TT	15	60	41.7	953
Bravo TT + Rovral®	15	60	41.1	936
Tornado TT	5	20	42.8	771
Tornado TT + Rovral®	5	20	43.2	797
ATR-Banjo	5	30	40.3	664
ATR-Banjo + Rovral®	5	30	41.6	619
ATR-Stubby + Amistar®	20	80	41.4	951
LSD (5%)			1.14	102

Rovral® = 2.0 L/ha Rovral® (250 g/L iprodione).

Amistar® = 1.0 L/ha Amistar® (250 g/L azoxystrobin).

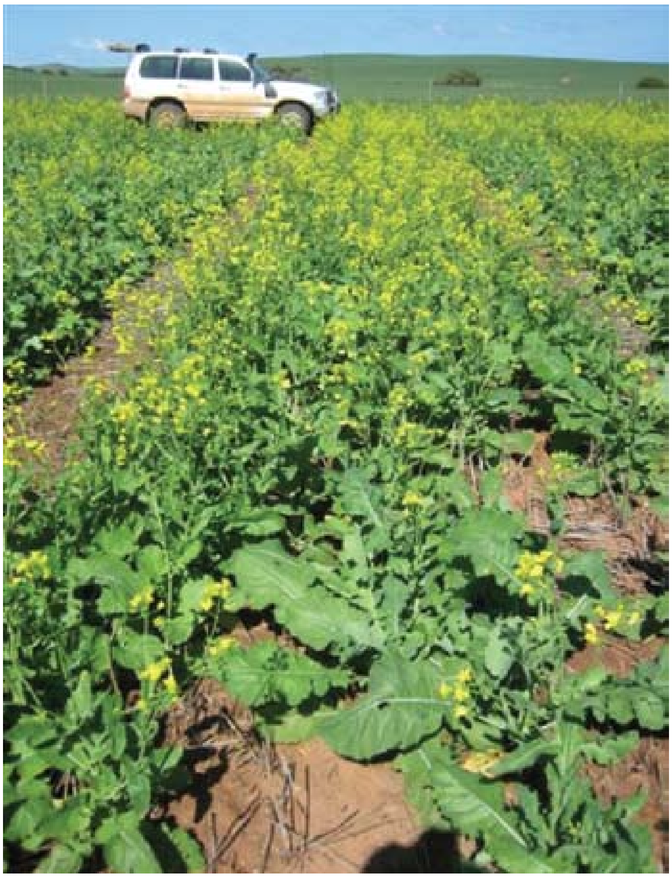


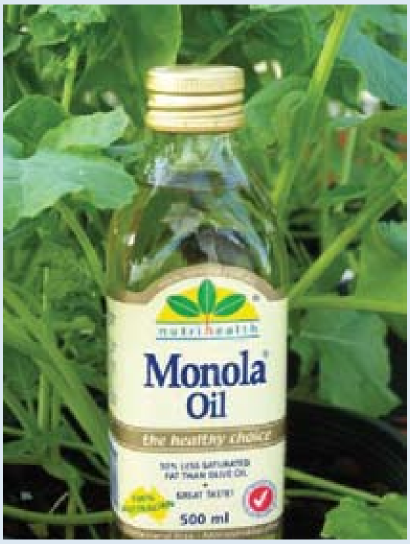
Figure 1. CB™Tanami at time of spraying (9th August) 50% flower.

NEW CANOLA TECHNOLOGY

High stability canola oil

Advantages

1. High stability canola oil is stable and well suited to deep frying applications.
2. Expanded range of healthier food products.
3. Rapid growth in demand.
4. An import replacement for palm oil and animal fats, which are high in saturated fats.
5. Triazine tolerant varieties are also available.



Canola varieties with high stability oil have been bred to produce a healthier, more stable cooking oil compared with normal canola.

Nelson Gororo, breeder of canola varieties with high stability oil.

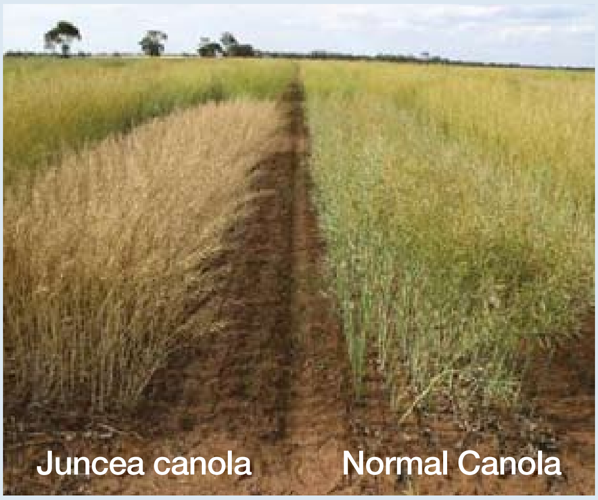
Key points

- High stability canola oil varieties are normally grown under a 'closed loop' growing and marketing arrangement.
- Consult NVT trial results and other trial data to determine if the price premium is sufficient to warrant growing these varieties.

Juncea canola

Advantages

- Heat / drought tolerance.
- May yield better or more reliably than canola in environments where target yields are less than 1.5 t/ha.
- May be a better option for late sowing in high rainfall regions.
- Can be direct headed, no need for windrowing saving $25-30 per hectare.
- Excellent early vigour.
- Excellent blackleg resistance.
- Has a yellow seed coat which is more nutritious as a stock feed and gives higher oil percent.
- Cereal disease break for lower rainfall regions.
- Herbicide tolerant types will be available soon.



Juncea canola *(Brassica juncea)* has been bred to have the same oil as normal canola *(Brassica napus)*

Wayne Burton, Juncea canola breeder

Key points

Determine likely yields and reduced cost of production to calculate gross margins.

Hybrid canola

Advantages

- Stronger seedlings with better establishment and better competition with weeds.
- Sowing rates can be lower.
- Hybrids are generally higher yielding, check local NVT trial results.

Greg Buzza, world-first hybrid canola breeder.

Key points

- Seed is expensive and labour intensive to produce.
- Benefits are NOT maintained if seed is retained past the first year.
- Calculate gross margin comparisons between conventional varieties and hybrids.

2008 CAA BLACKLEG RESISTANCE RATINGS

Variety	Blackleg resistance rating	Comment
Conventional Varieties		
Hyola 50	R	
Hyola 76	R	Provisional rating
AV-Jade	MR	
AV-Garnet	MR	
AV-Opal		MR
AV-Sapphire	MR-MS	
46C04	MR-MS	
Hyola 61	MR-MS	
AG-Spectrum	MS Reduced resistance	
Skipton	MS	
Tarcoola	MS	
AG-Muster	MS-S	
Rivette	MS-S	
Triazine Tolerant Varieties		
ATR-409	R-MR	
Tornado	TT	MR
Hurricane TT	MR	Provisional rating
ATR-Marlin	MR	
Rottnest TTC	MR	
CB™ Argyle	MR	Provisional rating
Thunder TT	MR-MS	Reduced resistance
Tawriffic TT	MR-MS	Provisional rating
ATR-Barra	MR-MS	
Storm TT	MR-MS	Provisional rating
ATR-Banjo	MR-MS	Reduced resistance
Flinders TTC	MR-MS	Reduced resistance
ATR-Cobbler	MS	
Bravo TT	MS	Reduced resistance
ATR-Summitt	MS	
CB™ Tanami	MS	
CB™ Trilogy	MS-S	
CB™ Boomer	MS-S	
ATR-Beacon	MS-S	
ATR-Stubby	S	Reduced resistance
CB™ Trigold	S-VS	
Clearfield System Varieties		
46Y81 (CL) hybrid	MR	
46Y78 (CL) hybrid	MR	
Rocket CL	MR	
45Y77 (CL) hybrid	MR	
Warrior CL	MS	
45C75 (CL)	MS	
46C76 (CL)	MS	Reduced resistance
44C73 (CL)	S	Reduced resistance
Conventional High Stability Oil Varieties		
Monola NMC131	R	Provisional rating
Monola NMC130	R-MR	Reduced resistance
Cargill 102	R-MR	
Cargill 103	MR	
Triazine Tolerant High Stability Oil Varieties		
Monola 75TT	R-MR	Provisional rating
Conventional Juncea Canola Varieties		
Dune	R	Provisional rating

Canola Association Of Australia

CAA 2008 Blackleg Resistance Ratings

Supported by GRDC Grains Research & Development Corporation

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

Provisional rating - There is insufficient data to meet National Blackleg Rating protocols. Growers should be cautious until sufficient data is available.
Varieties in the same Blackleg Resistance Rating group are listed in descending resistance order.

Note:

- The Blackleg resistance rating for a variety is based on the average square root percentage survival for the variety in trials conducted during the previous three years. These trials are held in disease nurseries (very high blackleg pressure) located in Vic, NSW, SA & WA. Data is supplied by Department of Primary Industries Victoria, New South Wales Department of Primary Industries, South Australian Research and Development Institute, Department of Agriculture Western Australia, Nuseed, Bayer CropScience, Pacific Seeds, Pioneer Hi-Bred and Canola Breeders Western Australia Pty. Ltd.
- Under severe blackleg pressure varieties which are rated highly may still suffer yield loss.

This publication is endorsed by all canola breeding programs in Australia, both public and private.

Disclaimer

This rating system is published by the Canola Association of Australia, the Grains Research & Development Corporation (GRDC) and Agriculture Departments from NSW, Vic & SA on the basis of the best information available at the time of publication. However, nursery and grower experience has shown that severity may vary between locations and from year to year depending on seasonal conditions and possible changes in the fungus for reasons which are not currently understood. Therefore growers may sometimes experience significant variability from the averages shown by these ratings.

2008 CAA BLACKLEG RESISTANCE RATINGS DESCRIPTIONS

Rating	What do you see?	What do you do?
Resistant (R)	• Some lesions on cotyledons and leaves. • Some internal infection at the base of the plant when cut near maturity.	Do not sow into canola stubble from the previous year. Separate your crop by 500m from the previous year's stubble. Fungicide use is unlikely to be economic.
Resistant to Moderately Resistant (R-MR)	• Lesions on cotyledons and leaves. • Some internal infection at the base of the plant when cut near maturity. • Some external cankering.	Do not sow into canola stubble from the previous year. Separate your crop by 500m from the previous year's stubble. Fungicide use is unlikely to be economic.
Moderately Resistant (MR)	• Lesions on cotyledons and leaves. • Internal infection at the base of the plant when cut near maturity. • Some external cankering. • Some plant death in high disease pressure situations.	Do not sow into canola stubble from the previous year. Separate your crop by 500m from the previous year's stubble. In high disease risk situations fungicide use may be of economic benefit.
Moderately Resistant to Moderately Susceptible (MR-MS)	• Lesions on cotyledons and leaves. • Internal infection at the base of the plant when cut near maturity. • External cankering. • Plant death will be easily found in high disease pressure situations.	Do not sow into canola stubble from the previous year. Separate your crop by 500m from the previous year's stubble. In moderate to high disease risk situations fungicide use may be of economic benefit.
Moderately Susceptible (MS)	• Lesions on cotyledons and leaves. • Internal infection at the base of the plant when cut near maturity. • External cankering. • Plant death will be easily found in moderate to high disease pressure situations.	Avoid high disease pressure. Do not sow into canola stubble from the previous year. Separate your crop by 500m from the previous year's stubble. In moderate disease risk situations fungicide use is likely to be of economic benefit.
Moderately Susceptible to Susceptible (MS-S)	• In low disease pressure situations some lesions on cotyledons and leaves may be found. > Low levels of internal infection. > Low levels of external canker. > Occasional plant death. • If sown in moderate disease pressure situations plant death is likely to be severe.	Recommended for low disease pressure regions only (i.e. low rainfall areas). Do not sow into canola stubble from the previous year. Separate your crop by 500m from the previous year's stubble. In moderate disease risk situations fungicide use may be of economic benefit.
Susceptible (S)	• In low disease pressure situations some lesions on cotyledons and leaves may be found. > Low levels of internal infection. > Low levels of external canker. > Occasional plant death. • If sown in moderate disease pressure situations plant death is likely to be severe.	Recommended for low disease pressure regions only (i.e. low rainfall areas). Do not sow into canola stubble from the previous year. Separate your crop by 500m from the previous year's stubble. Fungicide use is unlikely to be economic at high or low disease risk situations. If blackleg is causing yield loss consider a more resistant variety in future years.
Susceptible to Very Susceptible (S-VS)	• In low disease pressure situations some lesions on cotyledons and leaves may be found. > Low levels of internal infection. > Low levels of external canker. > Occasional plant death. • If sown in moderate disease pressure situations plant death is likely to be very severe.	Recommended for low disease pressure regions only (i.e. low rainfall areas). Do not sow into canola stubble from the previous year. Separate your crop by 500m from the previous year's stubble. Fungicide use is unlikely to be economic at high or low disease risk situations. If blackleg is causing yield loss consider a more resistant variety in future years.
Very Susceptible (VS)	• In low disease pressure situations some lesions on cotyledons and leaves may be found. > Low levels of internal infection. > Low levels of external canker. > Occasional plant death. • If sown in moderate disease pressure situations plant death is likely to be extremely severe.	Recommended for low disease pressure regions only (i.e. low rainfall areas). Do not sow into canola stubble from the previous year. Separate your crop by 500m from the previous year's stubble. Fungicide use is unlikely to be economic at high or low disease risk situations. If blackleg is causing yield loss consider a more resistant variety in future years.

AOF

better OILSEEDS

GRDC
Grains
Research &
Development
Corporation