2-2001

Profitable canola production in the great southern and lakes district

Paul Carmody

Ashley Herbert

Bulletin No. 4411
February 2001
Agdex 144/00
2nd Edition

PROFITABLE CANOLA PRODUCTION IN

THE GREAT SOUTHERN AND LAKES DISTRICT

Compiled by: Paul Carmody, Agriculture Western Australia
Centre Cropping Systems, Northam

Ashley Herbert Agricultural Consulting
Katanning

Profitable canola production in the Great Southern and Lakes Districts

CONTENTS

Acknowledgment

The Editor; Paul Carmody, Oilseed Industry Development Officer, AGWEST would like to thank the following Katanning Agronomists for their valuable contributions to the Canola Regional Package: Brent Prichard from Elders, Steve Tunbridge from Wesfarmers, Daniel Hester from IAMA, and Ashley Herbert, a private consultant.

The contributions of Ross Brennan and Graham Walton, Research Officers; Agriculture Western Australia and Parmjit Singh, Landcare Extension Officer,

Andrew Simon, formerly Canola Development Officer, AGWEST for compiling much of the information in the package.

The Canola Agronomy Package for the Great Southern and Lakes District is the outcome of a five year project; ‘Integrated approach to oilseed industry development within WA’, funded by GRDC with AGWEST (DAW 504).

A special thanks to Carol Day and Chiquita Bulter who assisted me in formatting the layout of this document under tight deadlines.

Introduction

The Canola industry has rapidly grown with a 10 fold increase in area sown in Western Australia over the four years from 1996-99.

The driving force behind this increase in area can be attributed to the successful adoption of weed control technology in Triazine Tolerant Canola.

By knowing the model of the limiting factors, which are usually; weed control, fertiliser practices, blackleg management, variety selection, seeding dates, seeding depths, insect control and swathing, we can make the right decisions and achieve the targeted profit.

To produce yield to potential, all factors need to be optimised, otherwise yields will be decreased by the lowest factor.

These production factors are interdependent. If one factor is changed, the other factors will be affected. For example, when introducing the early sowing, in the case of TT canola, we have found that it has triggered many changes in our growing practice.

The purpose of the Regional Canola Manual is to demonstrate this interdependence, and show how the grower can make the most of it. The aim of launching this Agronomy Package is to provide the growers with the latest information and help them to achieve a profitable high standard of canola.

Great Southern and Lake District, for the purpose of this package consist of the Shires of Kojonup, Katanning, Arthur River, Wagin, Darkin, Cranbrook, Tambellup, Dumbleyung, Gnowangerup, Lake Grace, Kulin, Narrogin, Williams, Boddington and Boyup Brook.

Growth stages of the canola plant

A grower who has an understanding of how a canola plant grows and how its pattern of growth can be affected, can make more effective management decisions

The growth and development of canola can be divided into recognisable growth stages. The length of each stage is greatly influenced by temperature, moisture, light, nutrition and variety. The vegetative stages, or days from seeding to first flower, depend on crop variety, date of seeding and growing conditions.

GERMINATION AND EMERGENCE

Germination involves water absorption, swelling, splitting of the seed coat and emergence of root tip. The new stem begins growing, pushing two heart shaped leaf-like organs called cotyledons up through the soil. The seed leaves or cotyledons provide nourishment to the growing plant. Because the seed is small the plant is very dependent on sunlight and available nutrients when the seedling first emerges. Unlike cereal seedlings the growing point of canola is above the soil between the two cotyledons. This exposed growing tip makes canola seedlings susceptible to sand blasting and insect attack.

LEAF PRODUCTION

The seedling develops its first true leaves four to eight days after emergence. The plant quickly establishes a rosette with larger, older leaves at the base and younger leaves in the centre. Rapid leaf development is important for the early and full use of sunlight. The larger the leaf area index, the more dry matter and higher crop yield it can produce. As a general rule of thumb, canola will develop one full mature leaf every ten days in the eastern grainbelt.

STEM EXTENSIONS

Stem extension has begun when the distance between two leaves on the stem is greater than the width of the stem itself. The tall varieties will have a longer internode length than short varieties. It is during this stage that the plant demand for nutrients begin to increase dramatically in particular for Calcium and Potash which are involve in cell wall structures.

BUD INITIATION

Long days and rising air temperatures trigger bud formation. A cluster of flower buds appears in the centre of the rosette. Between 30 and 60 per cent of the plant's total dry matter production will have occurred by this time. Maximum leaf area is usually reached near the start of flowering and then begins to decline with the loss of bottom leaves. The leaves, especially the upper ones, are the major source of food for the rapid development and growth of a large leaf area. A larger leaf area after flowering increases pod set and seed growth and oil content.

FLOWERING

Flowering begins with the opening of the lowest bud on the main stem and continues upward. Pollen is shed and dispersed by both wind and insects, even though canola is about 70 to 80% self-pollinated. The young pod becomes visible in the centre of the flower a day after the petals' drop. During flowering, branches continue to grow longer as buds open into flowers and as flowers develop into pods. In this way the first buds to open become the pods lowest on the main stem or secondary branches. Canola plants initiate more buds than can develop into productive pods.

The abortion of pods is a natural occurrence. If unfavourable growing conditions, or damage at early flowers causes abortion, the plant can recover by development of those buds which otherwise would have been aborted. By mid-flower, when lower pods have started elongating, the stem has become the major source of food for plant growth (with a reduced amount from the declining leave area). There is a competition between flowers and pods for food supply. The earliest developed pods have a

competitive advantage over the later formed ones. A decrease in food supply during pod development results in fewer flowers and fewer pods retained to maturity. Pods will be smaller with fewer, lighter seeds, especially in the later secondary branches and tops of branches.

POD DEVELOPMENT

In the first phase of seed development, the seed coat expands until the seed is almost full size. The seed at this stage resembles a 'water filled' balloon. The seed's embryo grows rapidly to fill the space previously occupied by fluid. Seed weight increases as proteins and carbohydrates are laid down in the seed it that order. Immature seeds, when filled, contain about 40 per cent moisture. Seed filling is followed by a maturing or ripening stage characterised by seed coat colour changes. Ripening begins with petals falling from the last formed flower on the main stem.

SEED DEVELOPMENT

At this stage the older pods at base of the flowering branches are well formed with firm seeds in many of the pods. When 30 to 40 per cent of the seeds on a plant have begun to show seed colour changes to black to yellow, seeds in the last formed pods are all in the last stages of filling, and the average seed moisture is about 30 to 35 per cent. In canola, the seed accounts for about 15 to 35 per cent of the total dry matter produced. It has a lower harvest index than cereals where the seed can account for 40% of the total dry matter. Mature pods are easily split along the centre membrane and the seed lost.

REGIONAL PRACTICALITIES - GREAT SOUTHERN AND LAKES DISTRICT

- Sow canola early to achieve higher yields and oil content. Sow by the end of May in the Lakes area and the middle of June in the high rainfall area.
- Shallow seeding depth (< 2 cm) is crititical to maintaining seedling vigor and achieving target plant density.
- Effective early insect control is essential to successful establishment. Because the growing point of canola is above the ground it is extremely susceptible to insect attack as a seedling.
- Use fertilisers in time, as dry matter production and pod setting are determined well beyond start of flowering.
- Spreading out the sowing time of canola is less effective tool than in case of cereals to minimise the frost risk.
- Canola can effectively compensate for aphid damage, especially in good growing conditions. This is why it is difficult to determine the economical threshold for spraying.
- Swathing canola at average seed moisture of 30 to 35 per cent is a viable (and economical) way to prevent significant loss of seed from shattering. Swathing rather than direct harvesting is recommended in most situations.

Canola varieties

BACKGROUND

The word **'canola'** comes from the words **Can**ada and **ol**eic fatty **a**cid.

Canola has good yield and quality oil (less than 2% erucic acid content), compared to *Brassica rapa*/Polish rapeseed with 23.5% erucic acid content and to *Brassica napus*/Argentine rapeseed with 40% erucic acid content. Canola varieties contain less than 30 micromoles of glucosinolates per gram of air-dried oil-free meal.

Most plants of the Cruciferae/mustard family contain glucosinolates, which are responsible for odour or sometimes palatability problems. **Glucosinolate content is high in the weed species of the Cruciferae family like wild turnip, wild radish**. Apart from being highly competitive weeds in canola these weeds are also serious contaminants of the harvested seed.

PLANT BREEDERS RIGHTS (PBR)

All recently released canola varieties are subject to plant breeder's rights. This means that growers are not allowed to trade the seed for sowing but are allowed to keep seed for their own purposes (exception being those under a seed and chemical contract, e.g. CLEARFIELD™ Canola). Farmer to farmer trade of seed without authorisation from the variety owner will make the farmers liable to prosecution and court action. Royalties collected are used by the breeders to develop new and improved varieties.

BLACKLEG TOLERANCE

Resistance to blackleg (a fungal disease) is a most serious disease and is a prime selection criteria for new varieties released in Western Australia. The scale (1-9) is based upon a combination of the level of stem canker infection and severity in the adult plants and plant survival counts. Note that the ranking scale is different to the Eastern States system, which is based on a percentage plant survival. A new national ranking system has recently been release by ACAR which is also base on a combination of the two methods.

WA Blackleg Resistance Ratings Scale 0-9

Use the following Index for the new WA Blackleg Resistance Ratings (2001) in the Varieties Description Tables. Blackleg ratings are in brackets.

0-2 = highly susceptible

3-4 = moderately susceptible

5-6 = moderately resistant

7-8 = resistant

8+ = highly resistant

Varietal tolerance is the most important component of the blackleg control program. Always select a variety with the highest disease tolerance.

See the section on Disease management in Grwoing Golden Canola Manual and new Farmnote *WA Blackleg Resistance Ratings on Canola Varieites for 2001*.

SEED FOR SOWING

Seed that gives poor germination and establishment is considered the most expensive seed. Agriculture Western Australia advises you to sow quality assured seed. If you plan to retain your own seed, then grow it from new seed each year and have this seed tested for vigour and germination prior to sowing. In some seasons seed which is retain in the harsh environment of the eastern grainbelt may not be very suitable seed for planting. Research in Canada has shown that seed size has an significant effect on the vigour and germination of canola, seed size should be greater that 1.7 mm in size. There fore when retaining seed, grade it heavily to maintain good seed size. Canola does

outcross to a small extent and the longer seed is retain the more variation in maturity and in quality are likely to occur.

Table 1. Sowing guide for canola varieties in Great Southern and Lakes District

Rainfall zone	Current varieties		New varieties	
	Conventional	Herbicide tolerant	Conventional	Herbicide tolerant
Low > 325 mm	Monty	*Karoo* ♦ *Drum*♦	Outback	*Hyden*♦ *Surpass 402CL**
Med 325-450 mm	Monty Hyola 42 Rainbow Mystic Emblem Ripper Insignia	*Karoo*♦ *Clancy*♦ *Pinnacle*♦ *Pioneer 44C71**	Georgie Surpass 400 Outback	*Hyden*♦ *Surpass 300TT*♦ *Surpass 501TT*♦ *Beacon ATR* *Pioneer 44C73** *Pioneer 46C74** *Surpass 402CL**
High 450 <	Oscar Dunkeld Grouse Scoop Purler Emblem Ripper Trooper Insignia	*Pinnacle*♦ *Clancy*♦ *Pioneer 46C72**	Charlton Georgie Judge	*Surpass 501TT*♦ *Surpass 402CL** *Pioneer 46C74** *Surpass 603CL**

♦ Triazine Tolerant varieties.

* Imidazolinone Tolerant or IT canola.

POPULARITY OF TRIAZINE TOLERANT CANOLA VARIETIES

Due to weed management issues more than 90% of canola grown in the Great Southern and The Lakes, are currently triazine tolerant (TT) varieties. While TT varieties do have a 10-15% lower yield potential than conventional varieties sown at the same time in a weed free situation, the flexibility they provide to the crop program more than compensates for any potential yield penalty.

Weed control is simple, broad spectrum and cost effective. Because of this TT varieties can be sown very soon after opening rains or even dry without compromising weed control.

VARIETIES DESCRIPTION TABLES

Table 2. Triazine Tolerant (TT canola) Varieties (WA Blackleg Resistance Rating in brackets)

Beacon	A very promising mid season line from the Agriculture Victoria breeding program which performed very well in the CVT trials in 2000. Good oil oil content and blackleg resistance. Not available in 2001. (4P*)
Bugle	A medium-maturity triazine tolerant variety from Ag-Seed Research. Higher oil content than Clancy and Drum. Suited to medium or medium-high rainfall zones, and has higher blackleg resistance than Karoo. May be phased out in favour of Hyden. (6)
Clancy	A mid-late season variety with improved blackleg resistance and yield over Drum but lower than Pinnacle. (6)
Drum	Medium/early maturing variety with higher blackleg resistance than Karoo. (6)
ATR Hyden*	High yielding medium-early maturity triazine tolerant variety from AgSeed Research. Flowers about 5 days later then Karoo, with higher blackleg resistance than Hylite 200TT and Karoo, and higher average oil content than Karoo. Suited to medium to low rainfall areas, but performed very well in medium to high rainfall zones in 2000 CVT trials. (5P*)
Hylite 200TT	A very early maturing variety from Pacific Seeds, with apetalous flowers. Higher oil and protein than Karoo. Likely to be replaced by Surpass 300TT. (2)
Karoo	Early maturing variety that performs well in the low-medium rainfall zones in Western Australia and has moderate blackleg resistance. (4)
TI1 Pinnacle	Medium-late maturing variety with high yields and high-level blackleg resistance. Suited to the medium-high rainfall areas. (6)
Surpass 300TT*	An early maturing TT canola by Pacific Seeds, first tested in WA this season. Good oil content. Yielded well in low rainfall sites in 2000 CVT trials, but more prone to Blackleg than other Surpass lines. (N/A)
Surpass 501TT*	A mid to early variety from Pacific Seeds. Good oil content. Flowers about a week later than Karoo, but was about 7% higher yielding in the medium rainfall sites of the 2000 CVT trials. (N/A)
Surpass 600TT	Mid/late maturity triazine tolerant variety from Pacific Seeds, with high yield and oil content potential. Better blackleg resistance than Karoo. (5)
ATR Grace	A new variety developed by Ag Seeds. Is a late maturing variety which could have higher yield potential than Pinnacle if sown early in southern districts. (N/A)
TM 8	Medium-late maturity triazine tolerant variety from Agriculture Victoria. Similar maturity to Clancy, with higher blackleg resistance than Hylite 200TT and Karoo. Suited to medium to high rainfall areas - particularly in Northern areas. (5P*)

* New varieties 2001.

Table 3. Imidazolinone Tolerant (CLEARFIELD™) Varieties

Pioneer 44C71	Medium maturity CLEARFIELD™ variety from Pioneer Seeds, available from CLEARFIELD™ accredited outlets. Medium blackleg resistance, and suited to areas where Karoo or Monty has been grown. Similar oil content to Monty. (4)
Pioneer 44C73*	Early/medium maturity CLEARFIELD™ variety from Pioneer Seeds, available from CLEARFIELD™ accredited outlets. Medium blackleg resistance, and suited to areas where Karoo or Monty has been grown. Similar oil content to Monty. (N/A)
Pioneer 46C72	Late maturity CLEARFIELD™ variety from Pioneer Seeds, available from CLEARFIELD accredited outlets. Moderate blackleg resistance, suited to medium to high rainfall areas. Higher oil content than Oscar. (4)
Pioneer 46C74*	Medium/late maturity CLEARFIELD™ variety from Pioneer Seeds, available from CLEARFIELD accredited outlets. Moderate blackleg resistance, suited to medium to high rainfall areas. Similar maturity and higher oil content than Pinnacle. (N/A)
Surpass 402CL*	Early-midseason maturity CLEARFIELD™ variety from Pacific Seeds, available from CLEARFIELD™ accredited outlets. High blackleg resistance, suited to medium to low rainfall areas. Higher oil content than Karoo or Mystic. (8+)
Surpass 603CL*	Mid-late maturity CLEARFIELD™ variety from Pacific Seeds, available from CLEARFIELD™ accredited outlets. High blackleg resistance, and suited to areas where Pinnacle has been grown. Higher oil content than Pinnacle or Oscar. (8+)

* New varieties 2001.

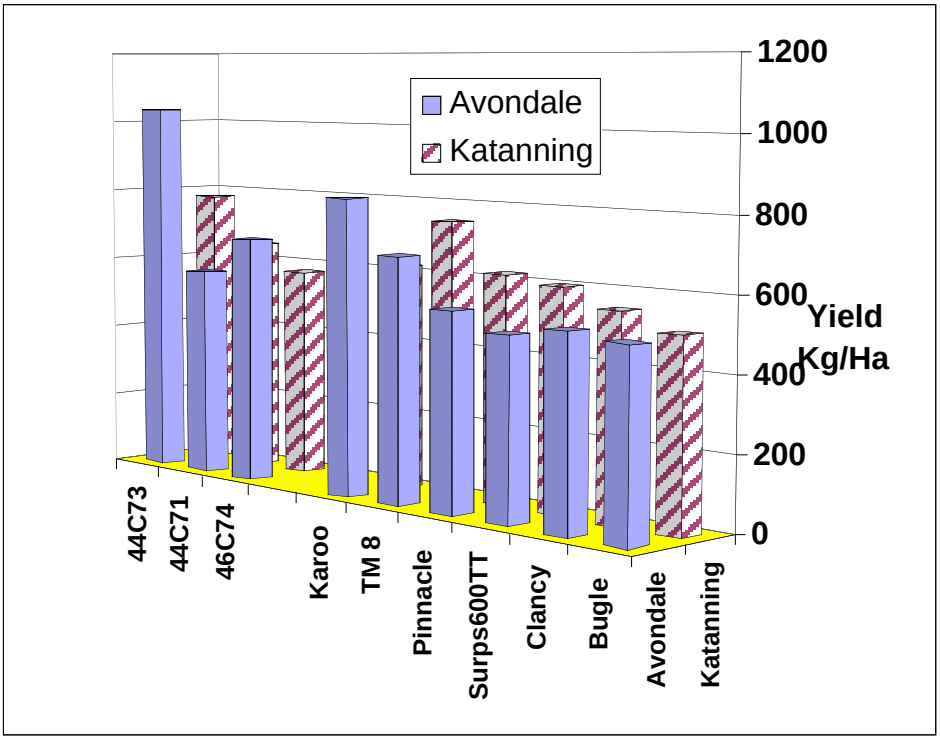


Chart 1. The results of package comparison trials in 2000 between TT and CLEARFIELD varieties at west Katanning and Avondale research station. Katanning trial (00GS73) was sown on the 6 June and Avondale (00AD43) sown on 6 July where Karoo had a grain yield of 579 kg/ha and 647 kg/ha respectively. Only Pioneer lines were tested.

Table 4. Varieties Description Tables cont'd, Conventional varieties

Charlton*	Medium/late variety from Agriculture Victoria. Moderate blackleg resistance and suited to medium-high to high rainfall zones. (6)
Emblem	Medium/early season variety from Ag-Seed Research, with higher blackleg resistance than Mystic and Monty. Excellent early seed vigour and suited to medium to medium-high rainfall areas. (7)
Georgie*	Early/medium maturity variety from NSW Department of Agriculture, with moderate blackleg resistance and suited to medium to medium-high rainfall zones. Higher oil content than Monty or Rainbow. (4P*)
Grouse	Mid maturity variety with good blackleg resistance and higher oil content than Oscar. (7)
Insignia	High yielding medium/late maturity variety from Ag-Seed Research. Good blackleg resistance and suited to medium-high to high rainfall zones. Very good early vigour, excellent stem strength and lodging resistance. (6P*)
Judge*	Late maturing variety from AgSeed Research. Flowers a little earlier than Charlton, with similar oil content and good blackleg resistance. (N/A)
Monty	Early maturity, moderate resistance to blackleg with good yield and oil content. (5)
Mystic	Mid to early maturity, good southern region variety, earlier than Rainbow. (5)
Oscar	Mid - late maturing variety with moderate resistance to blackleg. (6)
AG-Outback*	Early maturity line from AgSeed Research. Flowers a few days later than Monty. Oil content similar to Monty. Good seedling vigour and good blackleg resistance. (4P*)
Pioneer 46C01	Medium/late season variety from Pioneer Seeds, suited to medium rainfall zones. Moderate blackleg resistance and good seedling vigour. (5)
Pioneer 46C03	Medium season variety from Pioneer Seeds, suited to medium rainfall zones. Moderate blackleg resistance and good seedling vigour and oil content. (N/A)
Pioneer 47C02	Late maturity variety from Pioneer Seeds, suited to higher rainfall zones. Moderate blackleg resistance. (5)
Purler	Medium -late maturity variety with very high oil content from NSW Agriculture. Similar blackleg resistance to Dunkeld and Charlton. Suited to the higher rainfall regions. (7)
Rainbow	Mid maturity, good blackleg resistance. (6)
Ripper	Late season variety from NSW Agriculture with high blackleg resistance. Higher oil content than Oscar. Distributed by SGB. (6P*)
Scoop	Early/mid maturity, good blackleg resistance. (6)
Surpass 400*	Early maturity variety bred by Pacific Seeds. Excellent blackleg resistance. Oil content 2-3% higher than Monty. (8+)
Surpass 600	Mid maturity variety bred by Pacific Seeds. Excellent blackleg resistance, and oil content with good seedling vigour. (8+)
Trooper	Medium/late maturity from Ag-Seed Research, with good early seeding vigour and higher oil content than 47C02, 46C01, Grouse and Oscar. Excellent blackleg resistance and suited to medium to very high rainfall zones. (5)

- New varieties 2001.

Use the following Index for the new WA Blackleg Resistance Ratings in the Varieties Description Tables. Blackleg ratings are in brackets.

† N/A.: Not sufficient WA data upon which to rank these varieties.

* The varieties with less than two years or four sites data have been given a provisional rating and a letter P follows the scores for these. This means their rating could change based upon their performance for blackleg resistance in trials in 2001.

0 - 2 = highly susceptible 3 - 4 = moderately susceptible

5 - 6 = moderately resistant 7 - 8 = resistant

8+ = highly resistant

Canola establishment

The seeding rate, germination percentage and the depth of seeding determines the plant density.

Early plant establishment is greatly influenced by firmness, moisture and temperature of seedbed, soil texture, depth of seeding, seed source and germination, fertiliser placement with respect to seed, chemical seed treatment, insects and diseases at the time of seeding.

Agronomic factors such as: seed quality, seedbed, time of seeding, depth of seeding and seeding rate are essential in establishing a uniform plant stand with high yield potential.

Modifying these particular production practices has relatively **little effect on input costs but can have a large effect on yield and in turn, the income from the crop.**

SEED QUALITY

Purchasing canola seed from seed companies ensures that the seed meets the standard requirements, i.e. it comes from controlled and inspected paddocks and also been tested for germination, weeds and other foreign seeds.

The current canola varieties are large seeded with a range of about 250,000 to 320,000 seeds/kg. 5 kg/ha canola will give 140-160 seeds per square metre.

IDEAL SEEDBED

Canola seed sown to a depth of 12-25 mm into a firm, moist seedbed germinates rapidly with a high percentage of emergence. On sandy soils or in environments where the topsoil dries quickly, planting should be slightly deeper.

Deep sowing is one of the major causes of crop establishment failure in the Great Southern. Local and Canadian studies point out that increasing seeding to 50-75 mm resulted in poor emergence; reduced root, seedling and plant growth; seedling disease; and reduced yields. Canola seeds do not have sufficient stored energy to push their cotyledons to the surface from depth at which cereals are normally sown. At the end of the day all of these together do reduce yields and most importantly profits. Canola must be seeded shallow (< 25 mm). If sufficient moisture is not available at the 50 mm depth, may be best to shallow seed and wait for rain.

SEEDING AND PLANTING EQUIPMENT

Canola can be seeded satisfactorily with a range of equipment. The seeder must do the following:

- Open a furrow into sufficient moisture.
- Place the seed at a uniform shallow depth onto a firm seedbed.
- Accurately meter the seed in each run/furrow.
- Cover the seed with soil.
- Pack the soil around the seeds.

The ‘knife point press wheel’ machine fulfills the above requirements whereas the ‘full cut finger harrow’ combine rarely meets all of them.

The ‘full cut’ technology could provide a fairly good establishment when the soil moisture is not critical (e.g. in June) but loses the advantage of early sowing.

Note: It is important to achieve a good seed soil contact to maximise germination, this can be attained through several methods. A home made leveling bar would do and in case of stubble use tyre rollers. These methods prevent slicing of the soil and cloddiness on heavier soil. This can also be beneficial in weed control in the case of either pre and post emergent herbicides.

TIME OF SEEDING

Date of sowing or more accurately, the date of emergence correlates with canola yield and oil content. We can not expect a quick and even emergence unless we conserve the soil moisture and compact the seedbed using press wheel, leveling bar or roller in case of early sowing.

Table 5. Effect of sowing date on TT Canola oil percentage

	30 April	21 May	11 June	2 July
Clancy	43.3	41.4	38.6	40.2
Drum	43.3	41.0	38.8	40.4
Karoo	43.8	39.1	37.7	40.8
Pinnacle	43.7	42.2	39.2	38.2

(Data from the Southern Coastal Canola Package.)

Table 6. Effect of different sowing date on yield and oil %. Agronomy trial - Katanning, Andrew. Simon, 98GS23

	30 April		9 June	
	Yield t/ha	Oil %	Yield t/ha	Oil %
Karoo	1.85	45.5	0.82	41.4
Monty	*		1.80	45.9

* Monty could not be sown early but after a second knock down against radish.

SEEDING RATE

Canola is a very flexible crop, in that the variation in population over relatively wide ranges normally have little effect on the final yield.

Local and Canadian studies demonstrate that populations ranging from 60 to 200 plants per square meter resulted in similar yields. It is not worth increasing the density above 60, however moderate to high plant population in the early growth stages can be beneficial as it can buffer the loss due to mites and insects.

Calculating with an average field germination of 60%, and with the recommended **seeding rate of 5 kg/ha** you should be on the right track.

Rule of thumb:
A canola population between 50-70 plants/m^2 (assessing 40 days after emergence) in an even distribution will result in a maximum yield.

If the target density is not reached it will be more efficient to rectify the problem rather than increasing the seeding rate.

PLANT DISTRIBUTION/TYNE WIDTH

Even seed distribution and therefore plant distribution will help to optimise yield with the added benefit of better weed competition. This is particularly true in short growing seasons. Wider row spacing is important for trash clearance and trash is important for moisture conservation and soil stabilisation. Design your seeder to give it maximum trash clearance but with minimum row spacing adjustment.

Canola seed yields are reduced by increased row spacing; for every inch increase above 7 inches the yield can decline by up to 2 per cent. A compromise will need to be reached between the value of wider row spacings and the very real cost of reduced yields every year.

Nutrient management of canola

COMPARED TO WHEAT

As is the case with all crops the key to making the most of your fertiliser dollar lies in identifying the most limiting nutrients in each situation. The required rates and the likely response to applied nutrients will be greatly influenced by achievable yield potential of the crop.

AGWEST research has shown that we can use our experience with wheat nutrition to help make effective canola fertiliser decisions. From this research the following rules of thumb can be used when comparing canola to wheat:

- Where nitrogen is non limiting canola will yield approximately half that of wheat.
- Canola requires 1.5 times the nitrogen for optimum yields.
- Canola requires 50-70% less applied Phosphate than wheat.
- Canola is more sensitive to low pH.
- Canola is at least as responsive and maybe less responsive to Potassium than wheat.
- Canola is less responsive to trace elements.
- Canola has a much higher requirement for sulfur.

FERTILISER PRIORITIES AND STRATEGIES FOR CANOLA

While there will be some exceptions the nutrients to be applied to a canola crop in most situations can be prioritised as in the list below. This is the order in which you will get best value for money.

1. Nitrogen, Sulfur
2. Phosphate
3. Lime, Potassium
4. Trace elements

In practice Nitrogen and Sulfur deficiencies represent the vast majority of nutritional problems encountered in canola each year, throughout the Great Southern and Lake Districts.

Points to consider

1. Excessive nitrogen can reduce oil content. This is most likely to occur when nitrogen supply is excess to requirements for the actual yield achieved. This can occur if simply too much nitrogen is available to the crop (e.g. high rate of urea on a long term clover pasture) or some other factor has limited the yield (e.g. late sowing, sulfur deficiency, insect damage).

2. In most situations time of sowing has a greater impact on oil than nitrogen.

Excess rates of other nutrients do not appear to reduce oil content.

While it is a little simplistic to give a blanket recommendation the following table provides an indication of a likely fertiliser program for a canola crop in the Great Southern. It relates to a crop with an achievable yield potential of 1.8 t/ha on a pasture stubble with an average clover content.

Table 7. Suggested fertiliser strategies for canola in Great Southern and Lake Districts

Nutrient	Application range (kg/ha)	Best bet applications (kg/ha)
P	10-15	12
N	40-100	70
S	16-25	20
K	Soil Test	20 kg if < 50 ppm in top 10 cm
Lime	Soil Test	1.0 t/ha if pH < 4.7
Trace elements	Unlikely	Apply Cu, Zn, Mo once every four years across the program, or As for wheat.

Points to consider:

1. Apply nitrogen within 8 weeks of seeding. For maximum effect nitrogen needs to be available to the canola plant at the beginning of stem elongation. There is no consistent benefit to delaying Nitrogen application. Therefore it is a realistic option to apply all nitrogen at seeding if this is an easier strategy.

2. The only requirement of the Sulfur source is that it is in a form that is readily available to the plant. Common sources are compound fertilisers high in sulfur (e.g. Agras and Cropras), Sulfate of Ammonia products and gypsum. Elemental sulfur is only effective when it is in the powdered form.

3. Fertiliser toxicity is a very real risk when high rates of nitrogen are drilled close to the seed. The risks increase when seeding with knife points, sowing into dry soil and increased row spacing. In practice 20-25 kg N/ha with the seed is safe when sowing into moist soil with full cut points. For knife points on 180 mm spacings 15 kg N/ha is the limit. Less if the soil is dry or at wider row spacings.

4. Regular soil testing is strongly recommended to further refine the decision for individual situations.

Factors influencing plant response to fertilisers

LIME AND SOIL ACIDITY

The term pH means hydrogen ion concentration in a solution. On strongly acid soils (on soils with low pH) plant root growth may be affected directly by the toxicity of the hydrogen ions. Root growth may be reduced by high levels of aluminium, which becomes increasingly soluble pH's below 4.5.

Canola has a similar tolerance to acidity as barley and a range of tolerances has been observed in breeding material. Canola's preferred pH range is **above 4.5** but reasonable crops are being grown on soils with lower pH levels; for example, 4.3 in 0-10 cm and 3.9 in the 10-20 cm, measured in calcium chloride ($CaCl_2$). Canola will tolerate soils with a pH of up to 8.3 before yield reductions are serious.

Soil tests for pH are recommended before growing canola and can be taken in late summer with the soil fertility test. Surface soil samples (0-10 cm) should be taken as well as at depth (10-20 cm, and 20-30 cm) to check for sub-soil acidity.

Results from two trials sown in the Lakes area in 1997 have shown consistent positive yield responses to lime application. More promising is that canola responded to lime only one year after application at two sites, whereas responses in wheat yield can often take two to three or more years depending on the conditions.

Table 8. Narrogin (96NA3) liming trial result in 1997 showing dramatic yield responses to lime applied in 1996

Lime (t/ha) spread 1996	Yield (t/ha) 1997	PH 1997 $CaCl_2$ @ 0-10 cm	PH 1997 $CaCl_2$ @ 10-20 cm
0	1.32 a	4.75	4.66
1.0	1.46 b	5.25	4.80
2.0	1.60 c	5.75	4.97

Numbers with the same letter are not significantly different ($p < 0.05$).

Growers should have a good idea of their soil pH values and should be considering liming (apply 1-2 t lime/ha) if the pH is below 4.5, particularly if canola is part of the rotation.

SALINITY

The presence of excess soluble salts is harmful to plants. Soils high in soluble salts are called 'saline'. The term 'alkali' is often incorrectly used to refer to saline soilsThe degree of salinity or total soluble salt concentration in a soil can be measured with conductivity. If the soil analysis rates the soil at 0-2 conductivity, the soil is slightly saline, at 5-10 conductivity the soil is moderately saline, at 11-16 very saline, and over 16 extremely saline. Canola is considered moderately tolerant and can tolerant salinity up to levels of 5-6 conductivity. Farmers often comment that Canola will grow in similar conditions to that of barley.

Table 9. Nutritient content of 1 tonne of Wheat and Canola grain and stubble

	Nitrogen kg/ha		Phosphate kg/ha		Potassium kg/ha		Sulfur kg/ha	
	Seed	**Straw**	**Seed**	**Straw**	**Seed**	**Straw**	**Seed**	**Straw**
Wheat	17-23	4-6	2-4	0.5-1.0	4-6	10-14	1.5-3	1-1.8
Canola	15-41	4-10	4-7	2-4	8-10	25-31	2-10	3-12

SOIL NUTRIENT CONTENT AND SOIL TESTING

The most commonly deficient nutrients in Western Australian soils are nitrogen and phosphorus. Potassium deficiencies likely occur on sandy soils and possibly on some duplex soils of the Great Southern where wheat has shown responses.

Calcium and magnesium are generally not in short supply for crop growth in Western Australia. The micronutrients requirement of canola with marginal fertility soils in Western Australia needs further investigation, although to data no symptoms or problems with micronutrients have been observed. This of course does not preclude any possible problems that may arise in the future.

Variations in soil nutrient levels occur from year to year and may also vary within paddocks, even those areas which appear to be a uniform soil. Paddocks should be regularly soil test to give an appreciation of its general nutrient status.

PLANT TISSUE ANALYSIS

Plant tissue analysis does not in any way diminish the importance of soil testing. Plant tissue analysis allows a producer to evaluate the effectiveness of fertiliser recommendations provided by a soil testing laboratory. Plant tissue analysis maybe a 'post-mortem' analysis if not done at the correct time to allow the farmer to apply the essential nutrient before growth has been affected. Results may only be

useful in determining management strategies to rescue a crop or to avoid problems in a subsequent crop.

NITROGEN FERTILISER PLACEMENT AND TIME OF APPLICATION

Nitrogen's ability to increase canola yields can be significantly affected by method of placement and time of its application.

Canola is extremely sensitive to nitrogen fertilisers placed with the seed, especially when soil moisture is low at seeding. Rates of nitrogen that would normally cause little or no damage to wheat or barley can cause severe reduction in germination and emergence of canola when placed with the seed. Urea based fertilisers are more damaging to emergence due to ammonia toxicity and should not placed with the seed. Urea should never be placed with canola seed.

However, compound fertilisers used for canola contain both phosphorus and nitrogen are placed with the seed. Generally, it is recommended that rate of nitrogen not exceed about 15 kilograms per hectare.

Side-band placement is the best method of applying nitrogen in paddocks with little risk of leaching. Leaching losses could be particularly severe if the nitrogen applied in nitrate form. The ammonium form of nitrogen is more stable as it binds to the soil colloids unlike the anionic nitrate. Applying phosphorus fertiliser in the same operation will reduce the cost. However, at high rates of nitrogen, a 2.5 centimetres separation of seed and fertiliser bands may not sufficient to prevent harmful effects.

TIMING OF NITROGEN APPLICATION

The yield potential for canola is established during stem elongation and the budding stage, so all nitrogen should be applied before this stage of growth (8 to 10 weeks).

Application options:

- In most soils all nitrogen can be applied at seeding. Further N could be applied if the season becomes favourable and yield potential is higher.

- On deeper sandy soil it would be better to split the application with 60% of N at seeding, then broadcasting the balance four to six weeks after emergence, before stem elongation.

- In the lower rainfall areas more nitrogen can be added if the crop looks likely to have a high yield potential.

Canola seed is very sensitive to nitrogen fertiliser toxicity. **Do not exceed 15 kg N/ha with seed. Under dry or drying conditions toxicity increases.** Note that 100 kg/ha of Agras or Agstar or equivalent exceeds the 15 kg/ha of nitrogen with the seed.

Good rainfall immediately after broadcasting will incorporate the nitrogen and will move the fertiliser into the soil. Urea is more subject to volatile losses under high temperatures, high soil pH, low organic matter and intermediate humidity.

Canola plants take up a large proportion of their nitrogen in the growth stages before flowering. This helps establish the number of branches, flowers and eventually pods. Nitrogen must be available early when it is needed most. Broadcasting granular fertiliser after the crop has emerged may cause damage if the foliage is wet.

Application range of nitrogen can vary between 40-68 kg/ha in the Great Southern. It relates to a crop with an achievable yield potential of 1.8 t/ha on a pasture stubble with an average clover content.

It needs further investigation to see whether the top up nitrogen, which at present is mostly urea, is worth replacing for the more expensive but less volatile nitrate form of nitrogen.

PHOSPHORUS

Phosphorus plays an important part in energy store and use. Lack of available phosphorus restricts root growth. This results in poorly developed root systems; spindly, thin stems with few branches and small narrow leaves. A severe phosphorus deficiency may cause a dark bluish coloration of leaves, often accompanied with purple or reddish coloration as well.

Soil phosphorus occurs in both organic and inorganic forms. Canola roots absorb only that phosphorus which is present in the soil solution. The release of the bounded form of phosphorus is influenced by many factors including the pH. Phosphorus should be placed close to the seed to obtain a starter effect. Canola has the ability to start absorbing banded fertiliser phosphorus in large amounts from early stage, and generally absorbs more total phosphorus than cereals.

Canadian researchers found out that the response of canola to both nitrogen and phosphorus fertiliser was nearly double the response of canola to nitrogen alone and eleven times that phosphorus alone.

In case of nutrient imbalance where both nitrogen and phosphorus are deficient in a soil, both nutrients must be added in order to maximise yields.

SULPHUR

Sulphur, while not a constituent of chlorophyll, is needed in the formation of chlorophyll for the photosynthesis process. Sulphur plays role in vegetative growth and total dry matter production. The protein contains Sulphur and canola has higher protein content than cereals canola has higher requirement for Sulphur. Sulphur deficient symptoms can be detected at all stages of growth. Unlike nitrogen and phosphorus Sulphur is not mobile in the plant. Therefore the new leaves flowers and pods at the top of the branches are likely to be deficient in Sulphur than older leaves.

During the cool wet months of July and August, sulphur mineralisation is low (due to low soil micro-organism activity) and root exploration of the soil volume is low. This can result in the plants trying to grow but being unable to get sufficient sulphur initially, resulting in a temporary deficiency symptoms showing in patches. Later when the soil warms up there is sufficient sulphur mineralisation to provide enough of the mineral to the growing plant.

If sulphur deficiency persists then apply sulphur in the sulphate form, at about 10 kg S/ha.

Sulphur deficiency in canola crops is more common on sandplain soils and where leaching has moved residual sulphur from the root zone. Paddocks with a history of low sulphur fertiliser usage are also at risk.

Increasing soil disturbance during cropping helps make sulphur more available as organic matter breaks down and releases useable sulphate. A trend towards direct drill and no-till may explain why there is increasing occurrence of sulphur deficiency in canola in some districts.

Apply at least 15 kg S/ha for medium to low regions. Two common sources of sulphur are gypsum and ammonium sulphate. Gypsum is a good source of sulphur (16-18% S) because unlike sulphate of ammonia it does not cause acidification of the soil.

Maximum responses to Sulphur fertiliser occurred at rates of 10 to 20 kg/ha on soils which were very deficient in Sulphur. Higher rates of Sulphur may reduce oil content and increase glucosinolate content.

POTASSIUM

Adequate supply of potassium provides plants with increased disease, frost and drought resistance, and increased starch production. Canola crops take up large amounts of potassium (K) during growth, but only a small proportion of this is removed in the seed. Few responses to potassium fertiliser in seed or oil yield have been recorded. Deficiencies are more likely to occur in the high rainfall areas on sandy surfaced soils where the depth to gravel or clay is more than 40-50 cm and the soil potassium

test is below 50 ppm (data from Brennan and Edward, Agriculture Western Australia). Refer to the Growing Golden Canola manual for more information on addressing nutrient deficiencies in canola.

MICRONUTRIENTS

Canola requires a supply of all the essential micronutrients, however, micronutrient deficiencies are not common in canola in Western Australia. However, boron application is being researched in Western Australia.

Micronutrient or trace element deficiencies may be found in sandy soils or soils that are intensively cropped. Foliar sprays may be very effective for quickly correcting confirmed micronutrient deficiencies.

> Trace element responses in canola are rare. Confirm any suspected deficiencies with a tissue test before spending money on foliar trace element sprays.

Calculating your canola nitrogen input according to yield potential and oil content

When planning your inputs to a canola crop, none are more critical that Nitrogen both in terms of the impact it can have on yield but also the impact it can have on your profits. Over fertilising or under fertilising is second to time of sowing in terms of the effect it has on final yield. The canola yields, which growers actually achieve, are directly related to the potential yield (nitrogen non-limited) and the availability of soil and fertiliser nitrogen. On the other hand, oil percentage is proportional to the yield potential of the crop but is often inversely proportional to its nitrogen status.

The tables below allow a farmer to read off the expected yield and oil% for any canola crop, given an estimate of the yield potential and soil nitrogen status. Changes in yield and oil% when different levels of nitrogen fertiliser are applied, can also be determined.

Guidelines are needed for the choice of an appropriate yield potential which is a function of the time of sowing, variety choice, soil type, level of other nutrients location and, of course, the seasonal conditions. The tables can be used to see the impact of changing any of these variables on the yield and oil% of canola.

The nitrogen status is best determined from existing nitrogen calculators, but some rough estimates for rainfall zones and cropping history categories are given in the table below.

The tables of predicted yield and oil% are gross first approximations of expected outcomes but are one step in the evolution of both an electronic and a wheel version of a canola nitrogen calculator.

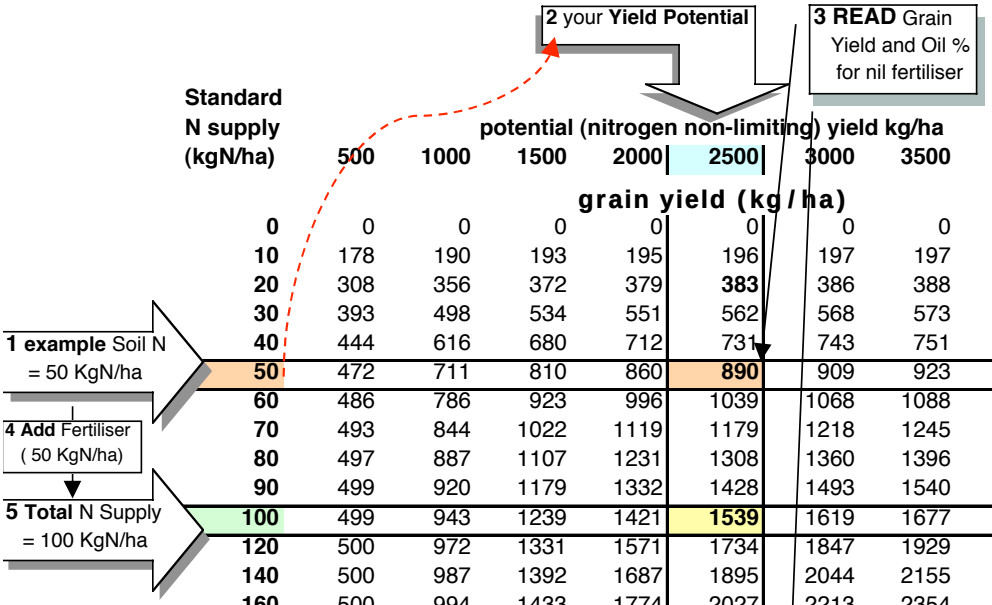
The steps to follow:

1. Using your rainfall zone and cropping history, read off the estimated nitrogen supply from soil plus crop residues.
2. Estimate the nitrogen non-limiting yield potential from PYCAL, the TopCrop handbook or else use your target yield multiplied by 1.2.
3. At the intersection of nitrogen supply and potential yield, read off grain yield from the upper table and oil % from the lower table on the next page. If you know your region has cool and or mild finishes to the season, then increase the oil% by 2 units.
4. Now add some units of fertiliser nitrogen (standard efficiency) to your original N supply.
5. Read off the grain yield and oil % for that level of nitrogen application.

Table 10. Nitrogen supply from soil and residues

Crop history		Rainfall zone		
Last year	**Year before**	**(< 350 mm) Low**	**(350-450 mm) Medium kg nitrogen/ha**	**(> 450 mm) High**
Non legume	Non legume	30	40	80
Non legume	Legume	40	50	100
Legume	Non legume	70	100	160
Legume	Legume	90	140	200

Table 11.



Standard N supply (kgN/ha)	potential (nitrogen non-limiting) yield kg/ha									
	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
	grain yield (kg / ha)									
0	0	0	0	0	0	0	0	0	0	0
10	178	190	193	195	196	197	197	198	198	198
20	308	356	372	379	**383**	386	388	390	391	392
30	393	498	534	551	562	568	573	577	579	582
40	444	616	680	712	731	743	751	758	763	767
50	472	711	810	860	**890**	909	923	933	941	947
60	486	786	923	996	1039	1068	1088	1103	1114	1123
70	493	844	1022	1119	1179	1218	1245	1266	1282	1294
80	497	887	1107	1231	1308	1360	1396	1423	1444	1461
90	499	920	1179	1332	1428	1493	1540	1575	1601	1622
100	499	943	1239	1421	**1539**	1619	1677	1720	1753	1779
120	500	972	1331	1571	1734	1847	1929	1991	2039	2078
140	500	987	1392	1687	1895	2044	2155	2239	2304	2357
160	500	994	1433	1774	2027	2213	2354	2462	2548	2616
180	500	997	1459	1839	2133	2357	2529	2663	2770	2856
200	500	999	1475	1886	2218	2478	2682	2843	2972	3078
220	500	999	1485	1920	2285	2578	2813	3002	3155	3281
240	500	1000	1491	1945	2337	2661	2927	3143	3320	3467
260	500	1000	1495	1962	2377	2729	3023	3266	3468	3636
280	500	1000	1497	1974	2407	2785	3105	3374	3600	3790
300	500	1000	1498	1982	2431	2830	3174	3468	3717	3928

Standard N supply (kgN/ha)	potential (nitrogen non-limiting) yield kg/ha									
	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
	oil %									
0	44.2	44.2	44.2	44.2	44.2	44.2	44.2	44.2	44.2	44.2
10	43.5	43.9	44.0	44.0	44.1	44.1	44.1	44.1	44.1	44.1
20	42.6	43.5	43.8	43.9	**44.0**	44.0	44.0	44.0	44.1	44.1
30	41.4	43.1	43.5	43.7	43.8	43.9	43.9	44.0	44.0	44.0
40	40.3	42.6	43.2	43.5	43.7	43.8	43.8	43.9	43.9	44.0
50	39.2	42.0	42.9	43.3	**43.5**	43.6	43.7	43.8	43.8	43.9
60	38.2	41.4	42.6	43.1	43.3	43.5	43.6	43.7	43.8	43.8
70	37.5	40.9	42.2	42.8	43.2	43.4	43.5	43.6	43.7	43.7
80	36.9	40.3	41.8	42.6	43.0	43.2	43.4	43.5	43.6	43.7
90	36.4	39.7	41.4	42.3	42.8	43.1	43.3	43.4	43.5	43.6
100	36.1	39.2	41.1	42.0	**42.6**	42.9	43.1	43.3	43.4	43.5
120	35.7	38.2	40.3	41.4	42.1	42.6	42.9	43.1	43.2	43.3
140	35.6	37.5	39.5	40.9	41.7	42.2	42.6	42.8	43.0	43.2
160	35.5	36.9	38.8	40.3	41.2	41.8	42.3	42.6	42.8	43.0
180	35.5	36.4	38.2	39.7	40.7	41.4	41.9	42.3	42.6	42.8
200	35.4	36.1	37.7	39.2	40.3	41.1	41.6	42.0	42.3	42.6
220	35.4	35.9	37.2	38.7	39.8	40.7	41.3	41.7	42.1	42.3
240	35.4	35.7	36.9	38.2	39.4	40.3	40.9	41.4	41.8	42.1
260	35.4	35.6	36.6	37.8	39.0	39.9	40.6	41.2	41.6	41.9
280	35.4	35.6	36.3	37.5	38.6	39.5	40.3	40.9	41.3	41.7
300	35.4	35.5	36.1	37.1	38.2	39.2	40.0	40.6	41.1	41.4

Add 2% oil if season has a very early start and/or a mild (long, cool) finish

Weed management in canola

Weeds in canola depress yields in the same way as they do in cereal crops. Early weed control is essential for high yields. Traditionally, one of the main reasons for growing canola is as a break crop. The control of all weeds at knockdown time is essential for the establishment of conventional canola varieties and with early April rains and an autumn tickle two knockdowns can be possible in many districts. Where tank mixes are used plant back periods must be taken into account as some incur longer seeding delays than others (e.g. 2,4 D Ester mixed with a knockdown). Transplants are the most expensive weeds to control, in terms of herbicide costs and yield loss. Growing conventional canola faces many problem weeds, which are either difficult to control or unable to be controlled with current herbicides. For example; silvergrass, radish and turnip devastat many early sown conventional canola crops. The only herbicides registered for conventional canola are the grass selective ones and Lontrel for limited broadleaf control.

Where possible, the choice of a conventional variety is preferred over TT variety in the Great Southern and Lakes District because of their high disease resistance, better oil contents and higher yield in low weed situations.

WEED CONTROL IN TRIAZINE TOLERANT CANOLA

The impetus behind the progress of canola in Western Australia has been the quick adoption of triazine tolerant (TT) weed control technology by growers. Although the triazine tolerant varieties may be less efficient compared to conventional varieties, farmer experience has shown that better weed control and earlier sowing do compensate for the lower yield potential of TT canola.

The Triazines are the herbicides Atrazine and Simazine which require good soil moisture to be activated. Where time of sowing is critical, TT canola gives growers the very real flexibility to sow on opening rains without compromising weed control.

The TT canola is the only crop grown in Western Australia that can tolerate high levels of atrazine applied at the seedling stage. The herbicide simazine has very limited foliar activity. The germinating weeds absorb the herbicide through their root systems. Atrazine on the other hand has root and leaf uptake on weeds, and can be used as a knockdown on small weeds.

Lack of adequate soil moisture is often a source of poor weed control in the eastern grainbelt. The benefit of atrazine application is that it can be used after the emergence of TT canola without causing any damage. Atrazine absorbed through the foliage of the germinating weeds provides an effective weed control.

The weed control in TT canola is entirely different to weed control in crops like lupins, field peas, etc., as the application of atrazine or simazine is restricted to pre-emergent use only. TT canola has the benefit of pre and post-emergent applications.

EARLY PLANNING FOR WEED CONTROL

Grow TT canola in paddocks where the weed burden is too great for standard canola.

Atrazine will control all the common weeds in Western Australia except old man Dock and Sorrel. It is particularly effective on Doublegee and Silver Grass, and will do a good job on the Brassicas and other broad-leaved weeds and grasses. Do not rely upon atrazine only for weed control in TT canola crops. You should also implement good knockdown chemical control whenever the season allows.

Pre-seeding strategies for controlling emerged weeds before a canola crop (using knockdown herbicides) are similar to those for most other crops. In very weedy paddocks, delay seeding until at least one germintion of weeds has been controlled by a knockdown. This may require the use of an earlier maturing variety. In medium to low rainfall areas, weeds can have a far greater impact on canola yield than delayed sowing.

Pre-seeding weed control is especially important in paddocks with a heavy burden of resistant ryegrass. Aim to reduce ryegrass numbers as much as possible before they are exposed to atrazine.

There will then be a much lower chance of atrazine-resistant individuals being present and beginning to contaminate the paddock. Annual Ryegrass can develop triazine resistance, as has happened along railway lines near Northam.

Knockdown control is also important in seasons when summer or autumn weeds germinate. Although atrazine is a very effective herbicide, do not expect it to control large transplants, especially transplants that are stressed by low moisture or from cultivation disturbance. Treat such plants with an adequate rate of glyphosate before seeding.

TIMING OF ATRAZINE FOR OPTIMUM WEED CONTROL

Triazines work most effectively when weeds are small, before they have developed extensive root systems. Control at this stage can result in the greatest yield benefit. Thus the herbicide should be applied just before or just after seeding.

If soil conditions allow a full cultivation, apply 2 L/ha just before seeding. Atrazine will then be incorporated by the seeder, however a rolling harrow will ensure more uniform incorporation. For zero tillage operations, apply the same rate immediately after seeding. This chemical will remain on the surface until sufficient rain falls to leach it into the root zone. In most situations it will be slightly less effective than if it were incorporated.

If a knockdown herbicide application has left the paddock essentially weed-free at seeding, delay the atrazine application until the first weed seedlings appear. This will be three to four weeks after seeding. Applied post-emergent, with oil, this atrazine application should be particularly effective.

Make a second application of atrazine (plus oil) six to eight weeks after the first application if a second flush of weeds emerges. The paddock should remain free of weeds as the canola canopies over and smothers any further germinations.

HANDY HINT

If considering DRY SOWING canola in the Great Southern and Lake District (only when the opening rains fail to come before mid May) then attempt to apply atrazine on or immediately after the opening rains.

New Triazine label for canola

The National Registration Authority (NRA) is constantly reviewing the use of atrazine in Australian farming systems. This year the industry begins to operate under a full label issued by the NRA to the Canola Association of Australia and Syngenta (formerly Novartis). For the industry to retain the use of atrazine it must abide by the strict guidelines for the continued use of it in WA farming systems.

TRIAZINES MUST NOT BE USED ON THE SAME AREA OF LAND IN CONSECUTIVE YEARS.

> If you simizine or atrazine on canola in the first year then you should not use them in the same paddock the following year on a lupin crop for example.

TRY TO USE ATRAZINE EITHER AS A PRE-EMERGENCE OR POST-EMERGENCE SINGLE APPLICATION.

> Pre-emergence applications work more effectively here ryegrass is the main weed problem.
>
> Post emergent applications are very effective on broadleaf weeds.

Table 12. Directions for use - triazine tolerant canola only (label)

Situation	Weeds	Rate
Single Application Pre-emergence: Atrazine or simazine or combination of both	Annual Ryegrass, Barley Grass, Capeweed, Charlock, Corn Cromwell, Doublegee, Fumitories, Geraniums, Ivy-leaf Speedwell, London Rocket, Mustards, Oats, Paterson's Curse, Shepherd's Purse, Soursob, Turnip Weed, Wild Radish, Wild Turnip, Winter Grass	1-2 kg active/ha
Single Application Post-emergence: Atrazine only (up to 4-6 leaf crop stage, i.e. within 4-5 weeks of crop emergence)		500 g - 1 kg active/ha
Split Application: Pre-emergence - atrazine or simazine or combination of both PLUS Post-emergence - atrazine only (up to 4-6 leaf crop stage, i.e. within 4-5 weeks of crop emergence)	 Suppression of: Clovers, Medics, Wireweed And Annual Grasses	500 g - 1 kg active/ha (pre-emergence) PLUS 500 g - 1 kg active/ha (post-emergence)

The **maximum** amount of active (atrazine, simazine or combination of both) to be applied to any one crop during its growing season is 2 kg per ha.

Warning. This use may promote the development of herbicide resistance in weed populations. Persons must, when using chemical(s) in a manner covered by this label follow the guidelines and principles outlined in the Generic Integrated Weed Management Strategy for Triazine Tolerant Canola. This strategy was developed with the assistance of the Canola Association of Australia who also have copies of the strategy available.

Full details of the label can be obtain from the Syngenta (formerly Novartis) web site **www.syngenta.com.au.**

RATES OF ATRAZINE FOR WEED CONTROL

A rate of 2 L/ha of flowable product (500 gai/L) should control most weeds when they are small. For post-emergent applications, the addition of 1 per cent spraying oil will greatly improve leaf penetration and efficacy.

Table 13. Example product rates

Product type	500 g - 1 kg active/ha rate	1-2 kg grams active/ha rate
500 g/L active Gesaprim 500 SC Gesatop 500 SC	1-2 litres product per ha	2-4 litres product per ha
900 g/kg active Gesaprim Granules 900WG Gesatop Granules 900WG	555 g - 11 kg of product/ha	1.1-2.2 kg product per ha

Do not exceed the maximum rate of 2.0 kg/ha active ingredient.

By limiting the amount that is applied in anyone one season also helps delay the onset of resistance in weeds.

The triazine resistance management strategy for TT Canola is a part of the Integrated Weed Management Strategy.

Triazines belong to the Group C family of herbicide.

INDUSTRY STEWARDSHIP

Growers who apply triazines in excess of the above label requirement will risk legal action by the NRA and put at risk future availability of triazine herbicides for us in Australia agriculture because of environmental consideration. Practice good herbicide stewardship and don't exceed label rates list in the table above. For further information on the permit, contact the Canola Association of Australia or your nearest Syngenta reseller.

Where the use of triazines have been extensive in the farm system, growers are advised to rotate their atrazine use with trifluralin and grass selective to minimise split applications of atrazine in the one season.

PRACTICALITIES

- We can forget simazine in our weed control technology for TT canola. Atrazine has the same weed control range as simazine when they are applied at the pre-emergent stage and in addition, atrazine has a unique attribute that it can also be used as a foliar herbicide.

- When you seed with a 'full cut', spray 1 kg of atrazine (active ingredient) per hectare before sowing to incorporate the herbicide. At this time the atrazine can be tank mixed with knock down herbicides.

- Spray atrazine after seeding in the case of knife point seeding. Spraying atrazine immediately after seeding utilises the soil moisture of the soil particles that have been turned onto the surface. Spray the atrazine onto a smooth soil surface.

- Postpone post-sowing atrazine application until the soil surface becomes wet or spray just before a rain.

- Use a mineral-based oil additive of 1% if some weeds have already emerged on the paddock. The advantage of the post-sowing application is the even cover of herbicide with no gaps due to the tynes.

- Soils with low pH alter the residual effect of triazines. The lower the soil pH the shorter the life span and consequently the poorer the performance of triazines.

- Apply atrazine at a rate of 1 kg per hectare with oil additives in the sensitive stages of the weeds (up to 2-4 leaf stages of broad leaf weeds and up to the height of 1-1.5 cm or 1-2 leaf stage of grass weeds.)

- Use a high water volume with a minimum of 50 L/ha. Use an additive with a wetter when you mix grass selectives with atrazine according to the label recommendations of the grass selective.

- The smooth soil surface and the compact seedbed make the germination of both the canola and the weeds even and allow us to choose the proper timing.

- Time is crucial in the case of post-emergent application of atrazine. Ryegrass needs to be sprayed at no later than the 2 leaf stage for effective kill using atrazine.

Warning:

If rainfall is low, triazine residue carryover can reduce yields of cereal crops.
Do not use any more than two applications in any season and restrict the total triazine application to 4 L/ha.

CONVENTIONAL CANOLA

Conventional canola relies on traditional grass selective herbicides (group A) and the broad leaf herbicide, Lontrel (group I, the only broad leaf herbicide that can be used in conventional canola). Weed control is based on pre-sowing knock down treatments combined with grass selectives in the

crop. Trifluralin is well tolerated by canola and is now used widely as a pre-plant herbicide. The biggest threats to conventional canola are radish, turnip, silvergrass, water weeds and herbicide resistant rye grass.

Water weeds now have a registered product for control in canola; Dual Gold. This will control toad rush very effectively and give adequate suppression of other water weeds. Application is post-seeding, pre-emergent and it can be tank mixed with Talstar for ease of use.

CLEARFIELD CANOLA

This is a new herbicide tolerant canola production system for the year 2000. Canola varieties have been bred conventionally to be tolerant to Imidazolinone herbicide. This herbicide is part of the Group B herbicides. The system is marketed as a whole package with seed, herbicide and agronomy service being all part of the cost.

The herbicide, On Duty, is used post-emergent. The best weed control is achieved by early post-emergent application to weeds in the 2-4 leaf stage.

ADJUVANTS

Adjuvants are very important in increasing the efficacy of post-emergent herbicides. When using tank mixes it is important to use the correct adjuvant. The use of large volume herbicides such as glyphosate and atrazine together with insecticides and spray oils leaves little space for water when spray volumes are 30 L/ha or less. Higher volumes of 50 L/ha are needed and will also generally increase efficacy of the herbicides used.

BOOM HYGIENE

SU (Logran, Glean, Ally, Broadstrike, etc.) contamination of tanks is a potential problem, extremely low rates (20 mg/ha Logran) can devastate plants per square meter and yield. Booms, tanks and lines need to be cleaned and soaked overnight with chlorine after using the above herbicides. Some booms are more difficult to clear down that others, check with your reseller as to which booms are the best for avoiding these problems.

Further reading & Web sites

http://www.agric.wa.gov.au/progserv/plant/weeds

AVCARE: http://wwww.avcare.org.au/top.htm

Western Australian Herbicide resistance Initiative: http://wahri.agric.uwa.edu.au

Weed management section: Growing Golden Canola (www.agric.wa.gov.au/canola/ggc).

Stewartship Program for Triazine Management in Canola (Syngenta Crop Protection).

Weed control in triazine-tolerant canola - Farmnote - 013/2001.

Insect management in canola

Canola is very susceptible to insect attack in the first 6-8 weeks after sowing. The main insect problems in the Great Southern District are Red Legged Earth Mite (RLEM), Lucerne Flea, Vegetable Weevil, Bryobia Mite, Aphids and False Wire-worm.

With the increase in area of canola, the principles of crop protection have changed. Previously the emphasis was based on monitoring. However, a grower with an area larger than about 50 ha can't monitor the paddocks effectively. The motto emphasises now prevention or planning. If you know the paddock history you know, not only the problem weeds, but the problem pests as well.

Control of RLEM is essential in canola, as it is more sensitive than cereals. RLEM is responsible for the largest production losses out of all the insects. Under high pressure (uncontrolled pasture) a long term residual product like Talstar is a must. You can spray Talstar in tank mix with atrazine immediately after sowing. The miticide with residual activity should be sprayed before emergence as the mite can attack the stems of the seedlings before they reach the soil surface. Canola, following a pasture in rotation, is prone to being attacked by high population of mites. The eggs of RLEM survive the summer in a capsule, which is actually the dead body of a female. The eggs hatch with the rain and the drop in temperature. They move only a few centimetres.

In the case of early sowing Bryobia Mite can be a problem as these mites favour higher temperatures. Lemat as a tank mix with the knockdown has been effective and it is the only registered produced for post-emergence control.

Table 14. Insecticide recommendations for Red Legged Earth Mite

Pest	Chemical	Trade name	Rate mL/ha	Note
RLEM	Dimethoate	Rogor	55-85	Contact effect
	Omethoate	Le Mat	100	Contact effect
	Chlorpyryrifos	Lorsban	140	Contact effect + Some residual effect
	Bitentrin	Talstar	50-100	Residual effect
	Alpha-Cypermethryn	Dominex/Fastac	50	Contact + Some residual effect

Vegetable Weevil can invade the canola paddock from the edges of areas with Capeweed intensity such as sheep camps. Border spraying with Dominex or Fastac can be adequate at times.

Aphids can be a problem in medium and low rainfall areas prior to the flowering of the canola. Thresholds levels in WA are still under investigation. As a guideline, some control strategy should be implemented if every flowering head becomes infected with aphids who colonies on that head exceed 7 mms in length. Perimeter spraying can sometimes reduce the rate at which aphids progress into the crop. Pirimor is effective against aphids whilst still being safe for bees.

Slugs become active with the break of the season. Slugs surviving from the previous season do most damage, and eat two or three times their weight daily. The paddocks after pasture in a high rainfall zone are prone to slug damage. Monitoring is highly recommended as well as spreading Mesurol granules (containing Methiocarb) in the front lines of the enlarging circles in order to stop any damage occurring. Granules work best on a smooth flat surface with low stubble residue.

HELIOTHIS AND DIAMONDBACK MOTH

In years when large Heliothis larvae are present as the crop is maturing, serious damage may occur. Larvae over 15 mm may enter pods and consume the seed. It is essential to sample crops using a sweep net to determine grub numbers because in a dense canola crop the grubs are very difficult to detect. Take care not to confuse diamondback cabbage moth (DBM)with Heliothis which has clear stripes along its body and can grow up to three times the size of DBM. Thresholds for heliothis are also lower than those for DBM, see table 10.

DBM is a major vegetable pest over the warmer months and is difficult to control as it breeds prolifically and develops resistant to insecticides quickly. It is not usually a major problem in the eastern grainbelt with the exception of those years when abundant early rains and mild winters allow then to breed up on volunteer canola plants. Chemical control in canola is usually not warranted unless numbers exceed 5 to 10 grubs per plant as the plant approaches mid flowering.

Table 15. Economic spray thresholds for the major caterpillar pests of canola during flowering to maturity in Western Australia

Canola plant stage	*Thresholds for Heliothis*	*Threshold for DBM*
Foliage to mid-flowering	N/A	5 or more grubs/plant
Mid to late flowering	N/A	7 or more grubs/plant
Pod maturation	20 or more grubs/plant	10 or more grubs/plant

N/A. Not applicable or unlikely to occur.

NOTE: Sample several areas in a crop and spray if you get the following average number of caterpillars. Thresholds are based on aerial application of insecticide at a total cost of $12 per hectare.

Disease management

BLACKLEG DISEASE

Blackleg is the most prevalent disease of canola in Western Australia. The loss due to blackleg over the last few years is estimated to be higher than $20 million per annum in Western Australia. The fungus can invade the plant in each growing phase. Lesions occur on leaves and pods but the most serious symptom is found on the crown of the stem, called a stem canker. Badly affected plants are ring barked at ground level by cankers causing plants to lodge, hence the name blackleg. Less severely affected plants remain standing, but pods fail to fill because their sap flow is restricted and seed is pinched. This results in reduced yield, oil percentage and higher admixture.

There are four main management practices for control of Blackleg.

1. Select the variety with the highest resistance for your district.
2. Four year rotation minimum.
3. Burn or bury canola residues in the vicinity of the current canola paddock.
4. Use Impact in furrow in the vicinity of the previous year's canola paddock. When growing Karoo in low yield potential areas at least a 200-300 m buffer treatment can be taken into consideration.

When using Impact in furrow fertiliser should be placed in furrow and within 2 cm of the seed. Top-dressing of Impact treated fertiliser is not recommended. Early sowing (mid-April - mid-May) may reduce blackleg infection as the plants can reach the adult tolerant stage in a relatively dry environment. Contact your local agronomist or consultant to decide on the most economical use of Impact.

SCLEROTINA STEM ROT

Is not a prevalent disease of canola in the region but it could become more significant with increasing levels of canola and lupin trash being carried over. Sclerotina is a fungal disease of canola that infects the plant during flowering through the dead flower petal falling on the leaves. It invades the stem through the leaf and creates an infection in the lower stem. Sclerotina spores are carried over in the soil and can infect pulse crops also. Capeweed could be a primary carrier of the disease throughout the grainbelt.

At present it is considered uneconomic to directly control the disease with fungicides. Capeweed control, rotation and trash management are currently the best strategies for its control in the region.

Note: Further information about canola diseases is available in ‘Diseases of Canola’, Bulletin No. 4406; and ‘Managing Blackleg’, Bulletin No. 4480.

VIRUSES IN CANOLA

Two viruses, Beet Western Yellows (BWY) and cauliflower mosaic virus are insidious diseases of canola crops in Western Australia. They are spread by aphids from infected weeds or plants to healthy plants. Beet western yellows is a luteovirus typified by being persistently aphid-transmitted. The Cauliflower virus is non-persistently aphid-transmitted. Seed transmission in canola has not been investigated and is possible for cauliflower virus.

The symptoms of Beet western yellows virus is difficult to see in infected canola plants in the paddock. Mild plant dwarfing, leaf distortion and reddening or pallor of lower leaves are some of the symptoms. These mild symptoms are easily confused with those of nutritional disorders. Research is still been conducted to determine the effect of these viruses on the yield of canola in WA, however European work has found seed yield losses of 10-15% associated with this virus disease in canola.

Harvest management

SWATHING

For most growers with large crop areas and high yields (1.0 t/ha) are better managed by swathing before harvest. The crop will dry more evenly allowing earlier harvesting, and reduce harvest losses from shattering. When canola has reached physiological maturity, it is ready to swath. That is when either the seed moisture content is between 30-35 per cent or the seed colour change has reached 60-70 per cent. Swathing at too high a moisture content, when the seed is immature, will adversely affect seed size, oil content and yield. For the eastern grainbelt in most seasons the crop will be ready to swath within 14 to 21 days from the end of flowering.

For more information on swath timing, view *Reaping the Good Oil* video is available from the Rural Connect Free call 1 800 11 00 44.

DIRECT HARVESTING

Direct harvesting canola is an option for growers with belt fronts or those who only have a small area in canola (< 200 ha). Through the low rainfall districts where the crop may dry out unevenly, the denser area on the valley floors for example could be swathed while the remainder of the crop on the hilltops could be direct headed.

Direct heading is certainly an option for salvaging small uneven areas or where are not enough plants established to support the swathes off the ground. The decision to direct harvests depends on the total area sown and whether relying upon a contractor or not.

Areas under 200 hectares crops close to the breakeven or less should be directed harvested to reduce further expenditure, but the header must be ready to go once the crop has reached 8.5 per cent moisture in the seed.

The crop will be ready when the majority of pods are dry and rattle when shaken. Always test a small amount and have the moisture read at the local CBH sidings.

THE MAJORITY OF ALL CANOLA CROPS IN THE GREAT SOUTHERN AND LAKE DISTIRCT SHOULD BE SWATH TO MINIMISE LOSSES AND MOISTURE PROBLEMS AT HARVEST.

CROP TOPPING OR DESICCATION

Generally this method of harvest preparation is not favoured due to knockdown herbicides needing to be sprayed on by air. Farmer experience has shown that use of Reglone® will kill all green material within two to three days, but the seed will not dry out very well in the pods resulting in high moisture seed if attempts to harvest too early. Glyphosate kills the plant slowly and may result in more damage from strong winds. Plants left standing are prone to damage from strong hot winds in October and November and considerable loss of seed can occur even though the crop has been desiccated.

As a general rule of thumb for most canola crops growing in the eastern grainbelt desiccation cannot be justified unless it is for the control of a serious herbicide resistant problem, but even then swathing can achieve this without the risk of seed loss through shattering.

HARVEST TIMING

Ensure moisture meter is calibrated.

Harvest when moisture content is below **8.5 per cent**. Harvest begins approximately 10 to 20 days after swathing and if you are direct harvesting it canola up to 30 day from the time the crop would have been ready to swath. You may spend more time harvesting canola compared to a cereal crop, but it is worth the effort. Moisture levels in canola are lower after mid morning and remain so well into the evening.

Seed can be graded to remove weed seed such as ryegrass and radish in the harvest sample.

Oil content bonus or discount system of 1.5% for each one percent clean seed basis below or above 42% oil will apply to all canola delivered to the Grain Pool of WA. Canola with oil content below 30% oil will be classed as undergrade.

Admixture penalties are applied for 0.0% to 3.0% at 1% pro rata basis, plus $2 per tonne for each 0.1% admixture above 2% and up to 3% (2.5% = $10.00/ tonne, 3.0% = $20.00)

Canola with over 2.0% admixture may be received as CS2, and any canola > 3.0% admixture is considered undergrade. Refer to the Grain Pool of Western Australia website for details **www.gpwa.com.au**

HARVEST LOSSES

Harvest losses can be significant in canola if harvesting is not carefully monitored. Patience is important to minimise losses and because of canola small seed losses are easily over looked. Previous surveys have should harvest losses to be anywhere between 150 kg to 40 kg/ha when a loss of 20 to 30 kg/ha would be considered acceptable. Losses can be minimised by:

- correctly setting up sieves;
- slowing harvesting speed;
- harvesting early in the morning and at night, especially when direct harvesting.

Refer the Farmnote 24/99; ‘Measuring Harvest Losses’.

STORAGE

Quality canola stores well if its moisture and temperature are properly maintained. Storage of canola on-farm should only be for a maximum period of up to two months before being marketed. Storage of retained seed should be in bags where plenty of air can circulate around the bags.

Further reading and research

‘Growing Golden Canola’ Manual	(Available through Rural Connect 1 800 11 00 44 or AGWEST, Information Services)

Some useful Internet sites on canola are:

AGWEST:	**www.agric.wa.gov.au**
SARDI	**www.sardi.sa.gov.au/crops/oilseeds/canola.html**
Canola Council of Canada site:	**www.canola_council.org**
Alberta Agriculture:	**www.agric.gov.ab.ca/crops/canola/harvest1.html**

Farmnotes: 139/2000	‘Blackleg canker rating on canola varieties for 2001’.
12/2001	‘Canola varieties - 2001’.
013/2001	‘Weed control in triazine tolerant canola’.

Canola benchmarks - Great Southern

These benchmarks endeavour to provide growers with a guide to their own canola production against district averages. They are the first step in developing district **best practices** and target benchmarks for canola production in the Lakes and Great Southern.

Table 17. Summary of production benchmarks for canola in the Great Southern and Lakes districts

	*Lakes District	#Great Southern
Yield (t/ha)	Top: 1.6 Average: 1.0	Top: 2.6 Average: 1.6
Oil content (%)	Range: 38-42 Average: 41	Range: 38-46 Average: 43
Variable Costs ($/ha) (includes depreciation)	Range: 180-280 Average: 220	Range: 180-341 Average: 261
Gross margin ($/ha)	Top: 225 Average: 70	Top: 650 Average: 266
Variety (most common)	Pinnacle	Pinnacle
Seeding rate (kg/ha)	Range: 3.0- 6.0 Average: 5.0	Range: 3.0-8.0 Average: 4.8
Fertiliser costs ($/ha)	Range: $50-85 Average: $65	Range: $45-95 Average: $75
Average fertiliser units (/ha)	Following cereal: N - 50 units P - 10 units S - 12 units Following pasture: N - 40 units P - 12 units S - 12 units	Following cereal: N - 80 units P - 11.5-16 units S - 20 units Following pasture: N - 60 units P - 11.5-16 units S - 20 units
Herbicide costs ($/ha)	Range: $25-55 Average: $30	Range: $18-$58 Average: $33
Insecticide costs ($/ha)	Range: $2-$20 Average: $5	Range: $2-$25 Average: $9

* Data supplied by Steve Curtin of ConsultAg.

\# Benchmarks derived from client surveys (Ashley Herbert Agricultural Consulting and Kojonup Sheep Production Group) in Katanning - Kojonup and surrounding areas for the years 1994-1999.

Case study 1

Ed Naisbitt - **Tarin Rock.**

Time growing canola: Since 1992

Average yield: 1.2 t/ha (> 40% oil)

Best-Worst (paddock) 1.5 t/ha - 0.23 t/ha (2000)

Best-Worst (program) 1.4 t/ha - 0.2 t/ha (2000)

Variety: Karoo

Area sown: 150-250 ha

Seeding date: Earliest 26 April - Latest 19 May. Seed canola first.

Seeding rate: 5 kg/ha

Herbicides:

- Atrazine plus knockdowns pre-seeding.
- Atrazine plus oil post emergent. Sometimes tank mix Sertin if ryegrass is particularly thick or past the two leaf stage.

Major weeds:

Ryegrass, wild oats and wild radish.

Insecticides:

Talstare 50 mL/ha immediately post seeding. In the past have had a wait and see approach which has not always been effective.

Blackleg control:

We have never used Impact in Furrow. The three year break between crops seems to be doing the job.

Major insect threat: Red-Legged earth mite.

Swathing

We will swath canola if yields are expected to be better than 0.7 t/ha. Didn't swath in

Rotation:

With 60-70% of the farm area cropped canola mostly follows a wheat crop with at least a three year break between canola crops.

Reasons for growing canola:

- Effective break crop
- Use another group of herbicides to control radish and ryegrass.
- Very effective silver grasss control
- Can clean up a grassy pasture without severe pasture manipulation.

Paddock preparation:

Direct drill into all paddocks Retaining stubble where possible.

Fertiliser:

P 10.5-14 kg/ha

N 55 kg/ha

S 15 kg/ha

In the past have used a range of fertilisers (blends of Agras and Agflow, Agrich and sulfate of ammonia). More recently we use Agflow and NS 51 todressed. Fertilser rates are determined on a paddock by paddock basis depending on soil test information. All paddocks are soil tested every 3-4 years.

Seeding:

Seed with our own design knife points on a J.D. 1010 bar at 9 in spacings with rolling chain harrows. Seed is sown as shallow as possible with the points just scratching the surface, fertiliser and seed are sown together.

Break out on tynes is low which sometimes limits seeding opportunites.

It will grow well on all but the very poor sandy soils.

TT canola is very effective at cleaning up silver grass in the rotation.

2000. We do our own swathing with a Mac Don header front. **Harvest:** Axial Flow Case 2166 - no canola sieves. With a few adjustments we can get a good sample.	

Critical comments: Early time of sowing is essential to a profitable canola crop. Ideally before late May-June is definitely marginal.

Case studies developed by Ashley Herbert Agricultural Consulting, January 2000.

Case Study 2

Angus and Adrienne Woithe, **Broomehill**.

Time growing: Since 1993.

Average yield: 1.55 t/ha (> 42% oil).

Best-worst (paddock): 2.3/ha - 0.3 t/ha (2000, previously worst 1.2 t/Ha).

Best-worst (program): 1.9 t/ha - 0.5 t/ha (2000 previous worst 1.3 t/Ha).

Variety: Pinnacle.

Area sown: 250-340 ha.

Seeding date:

Earliest 6 May - Latest 16 June (2000, previous latest was 1st week of June) Seed canola first in the program.

Seeding rate: 5 kg/ha.

Paddock preparation: Direct drill.

Fertiliser:

P 14-18 kg/ha

N 70 kg/ha

S 20 kg/ha

Use DAP, Urea and sulfate of ammonia**.**

Major weeds:

Ryegrass and wild radish.

Seeding:

Seed with a Shearer combine with full cut points on 7 inches spacings with finger harrows.

Swathing:

Swath our own canola always.

Harvest:

Gleaner.

Rotation:

We crop between 40-50% of our cleared area in short rotation with pasture. Generally canola is sown onto a 2 year pasture and followed with wheat. Paddocks are generally cropped 2 or three years before returning to pasture for 2 to 3 years.

This allows us to maintain a three year break between canola crops.

Reasons for growing canola:

- A very profitable and effective break crop.
- Can use another group of herbicides to control radish and ryegrass.
- Very effective silver grass control. Following wheat and barley yield significantly higher.
- With the TT varieties we can be seeding a cash crop either dry or immediately after opening rains while we are waiting for weeds to germinate on cereal paddocks. This also means that our last sown paddocks can be sown earlier.

Herbicides:

Knockdowns pre-seeding. Atrazine + Talstar PSPE.

Atrazine plus oil post emergent. Have tank mixed grass selective herbicides occasionally in the past when grasses are beyond the two leaf stage.

Always apply 2nd application of atriazine well before two leaf stage of grasses.

Major Insect threat:

Red Legged Earthmite and vegetable weevil

Insecticides:

Talstar 100 mL/ha immediately post seeding. This has been very successful in controlling all insects and grubs (except Byrobia mite).

Blackleg control:

Rely on varietal tolerance of Pinnacle and maintaining at least a three year break between crops. Blackleg - not an issue for us with this approach.

Critical Comments: Sow early. Maintain good agronomic management. Monitor regularly through the season. At weekly early post seeding and monthly there after.

Case studies developed by Ashley Herbert Agricultural Consulting, January 2000.