



**WESTERN**  
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# **GRDC™** **GROWNOTES™**



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GRAINS RESEARCH  
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CORPORATION

# CANOLA

## SECTION 6

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## WEED CONTROL

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KEY POINTS | IMPROVING THE BEST PRACTICE INTEGRATED WEED  
MANAGEMENT PACKAGE: 2013 TRIAL REPORT | HERBICIDE DAMAGE

## SECTION 6

**FAQ** Weed control

## 6.1 Key points:

- Choose paddocks relatively free of broadleaf weeds, especially charlock, wild turnip, wild radish and other weeds of the Brassica family, because in-crop herbicide options are limited. Grass weeds can be managed in canola by using trifluralin pre sowing. Post-emergent options include Group A grass herbicides; however the level of annual ryegrass resistance to these herbicides has increased dramatically to a point where they are non-effective in many paddocks. The effectiveness of these herbicides in the future is dependent on the use of other non-chemical Integrated Weed Management (IWM) tools to reduce the populations of these resistant weeds. Group A resistant grasses are still of concern.
- Herbicide-resistant varietal systems such as triazine-tolerant (TT), Clearfield® and Roundup Ready® (RR) can be of use in managing weeds in canola, particularly broadleaf weeds. However, careful management is needed to avoid the buildup of resistant weed populations.
- When choosing paddocks for canola be careful with those treated with residual herbicides, especially Group B and triazine herbicides (for conventional varieties); their residues can affect canola. Check labels for re-cropping intervals, some of which are up to 36 months.
- Ensure that all spray equipment is thoroughly decontaminated before using to spray canola. Apply chlorine if the spraying equipment has previously been used to spray sulfonylureas, ammonia for hormone herbicides (salt and amine formulations) such as 2,4-D amine and MCPA, and liquid alkali detergent for Broadstrike™ (flumetsulam) and Eclipse® (metosulam) decontamination. Where possible, use separate spraying equipment for residual herbicides such as the sulfonylureas.
- Imidazolinone-tolerant varieties are marketed as Clearfield® canola. These varieties allow the use of the Group B herbicide Intervix® (imazamox and imazapyr). Clearfield® varieties do not suffer from the yield and oil penalty that the TT varieties exhibit. The use of Clearfield® varieties allows the rotation of herbicide groups and broadens the spectrum of weeds controlled.<sup>1</sup>

### **i** More information

[NSW DPI: Weed control in winter crops 2015](#)

[GRDC: Integrated weed management manual](#)

[GRDC: Soil behaviour of pre-emergent herbicides](#)

[Monsanto: What is Roundup Ready® canola?](#)

[Clearfield stewardship best management practice 2014](#)

[GRDC: Herbicide tolerant canola in farming systems: a guide for growers](#)

<sup>1</sup> L Serafin, J Holland, R Bambach, D McCaffery (2005) Canola: northern NSW planting guide. NSW Department of Primary Industries, [http://www.dpi.nsw.gov.au/\\_data/assets/pdf\\_file/0016/148300/canola-northern-NSW-planting-guide.pdf](http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0016/148300/canola-northern-NSW-planting-guide.pdf)

Weed management is strongly influenced by crop-rotation sequence. Careful planning of a 5-year rotation will enable targeted weed control through both cultural and chemical methods, as well as the ability to plan herbicide rotations. The widespread occurrence of herbicide resistance in Australian weeds puts further emphasis on the need for careful planning and resistance-management strategies such as monitoring, herbicide mode-of-action (MOA) rotation and cultural management techniques.

The area sown to herbicide-tolerant varieties of canola has increased dramatically in recent years; however, widespread use of these varieties without integrated weed-management techniques is likely to accelerate the development of resistance to the herbicides.

The resistance to several of these herbicides that has already occurred in Australian weeds shows that these herbicide-tolerant varieties are not a panacea for herbicide-resistance management, but they will add significantly to the options available to farmers for resistance management.

## More information

[Research paper: Incidence of weeds in canola crops across southern Australia](#)

### 6.1.1 Weed spectrum and herbicide resistance

Large numbers of weed species affect canola production; those that feature consistently in Australia are listed in Table 1. Prior to the introduction of herbicide-resistant varieties, control of key broadleaf weeds was the most important constraint to production of canola throughout Australia.

Table 1: Common weeds of Australian canola crops

\*Weed species that have been particularly important in restricting canola production prior to the introduction of triazine-tolerant varieties

Weed (common name)	Scientific name
Wild radish* (Figure 1)	<i>Raphanus raphanistrum</i>
Indian hedge mustard*	<i>Sisymbrium orientale</i>
Annual ryegrass	<i>Lolium rigidum</i>
Shepherds purse*	<i>Capsella bursa-pastoris</i>
Wild turnip*	<i>Brassica tournefortii</i>
Charlock*	<i>Sinapsis arvensis</i>
Paterson's curse*	<i>Echium plantagineum</i>
Vulpia*	<i>Vulpia spp.</i>
Wireweed	<i>Polygonum aviculare</i>
Toad rush	<i>Juncus bufonius</i>
Wild oats	<i>Avena spp.</i>
Spiny emex	<i>Emex australis</i>
Turnip weed*	<i>Rapistrum rugosum</i>
Fumitory	<i>Fumaria spp.</i>
Buchan weed	<i>Hirschfeldia incana</i>
Cape weed	<i>Arctotheca calendula</i>
Volunteer cereals	

The degree to which such weeds have restricted the canola area is reflected in the rapid adoption of TT varieties across Australia.<sup>2</sup>

<sup>2</sup> S Sutherland. Canola weed management. Australian Oilseeds Federation, [http://www.australianoilseeds.com/\\_data/assets/pdf\\_file/0012/2712/Chapter\\_12\\_-\\_Canola\\_Weed\\_Management.pdf](http://www.australianoilseeds.com/_data/assets/pdf_file/0012/2712/Chapter_12_-_Canola_Weed_Management.pdf)

## More information

[DAFWA: Weeds](#)

[DAFWA: Genetically modified crops and herbicide resistance](#)

[UWA AHRI: Weed control systems in herbicide resistant canola – a resistance reprieve?](#)

[UWA AHRI: Can we make the canola:wheat rotation work?](#)

[UWA AHRI: Burning wet windrows](#)

[CropPro: Wheat and canola tools and resources for agronomists](#)

[Plant Science Consulting: Weed resistance seed test](#)

[GRDC/CropLife: Herbicide resistance mode of action groups](#)

[WeedSmart](#)

[UWA AHRI: Windrow burning – a good place to start](#)

[Nufarm SprayWise decisions](#)

[ISHRW: Three herbicide site of action classification systems](#)

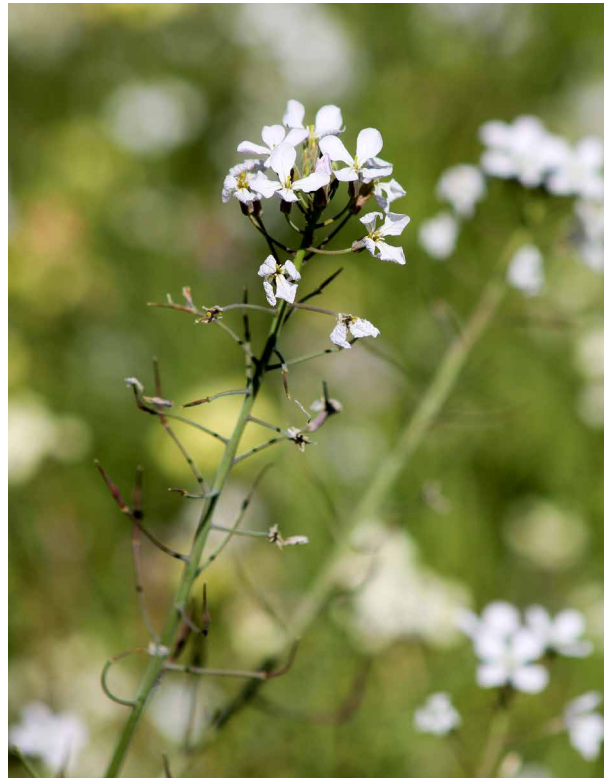


Figure 1: Wild radish is a common weed in canola crops.

## in focus

### 6.2 Improving the best practice integrated weed management package: 2013 trial report

A trial funded by the Grains Research and Development Corporation (GRDC) and conducted by the Department of Agriculture and Food Western Australia (DAFWA) examined the positive impact of crop competition, crop-type rotation and mouldboard ploughing on weed management.

#### 6.2.1 Background and aim

Herbicides continue to be the main means of weed control in WA, despite alarming levels of herbicide resistance. Integrated weed management (IWM) describes the means by which growers use a range of weed-management practices at various times of the growing season to achieve acceptable weed control in the face of populations of herbicide-resistant weeds.

The challenge is to determine how much IWM is necessary to reduce the reliance on herbicides to the point where herbicides become the secondary means of weed control. This trial was set up to achieve this aim by first creating a very low weed seedbank through soil inversion with a mouldboard plough, followed by crop

competition, weed seedset and harvest-weed management treatments to keep the weed seedbank very low.<sup>3</sup>

## 6.2.2 Trial details

This is a long-term trial running over four growing seasons.

In the preceding three seasons, the five IWM treatments were:

1. Control (district practice): no-till, wide row-spacing, plus herbicides (knockdown, trifluralin, wild radish spray), conventional harvest
2. Control + harvest weed-seed management with either a Harrington Seed Destructor or windrow burn
3. Control + harvest management + crop competition (a seeding rate of 120 kg/ha, spread 60 kg seed/ha first with combine, followed by sowing with another 60 kg/ha)
4. Control + harvest management+ competition + mouldboard; plots ploughed in 2010 prior to seeding
5. Control + harvest management + competition + mouldboard + low herbicide (knockdown only) weed-seeker pre-harvest

Each of these treatments was dry-sown to canola variety ATR Snapper and TT canola in 2013.

Atrazine (4 L) was applied in two applications, both post-emergent. In 2013, 500ml/ha of Select® (500 mL, active ingredient clethodim) and 100ml/ha Fusilade® (100 mL, active ingredient fluazifop-p-butyl) were part of the herbicide applications.

## 6.2.3 Results

In 2011 and 2012, brome grass plants were stifling those plots without crop competition or mouldboard tillage (Figure 2).

Numbers of brome grass plants were significantly reduced in 2013 following a controlled burn of all harvest windrows (harvest management) and rotation from wheat to canola, allowing suppression with alternative herbicides. Windrow burning did little to reduce brome grass numbers in previous years because of late harvest and all brome seed being on the ground prior to harvest.

No herbicide for brome grass was applied to mouldboard plots in 2011 or 2012. Therefore, mouldboarding has provided good control, with fewer brome grass plants despite less herbicide.

Crop competition significantly reduced brome numbers.

<sup>3</sup> W Parker (2013) Improving the best practice integrated weed management package 2013 trial report. Department of Agriculture and Food Western Australia. <https://www.agric.wa.gov.au/canola/improving-best-practice-integrated-weed-management-package-2013-trial-report?page=0%2C3>

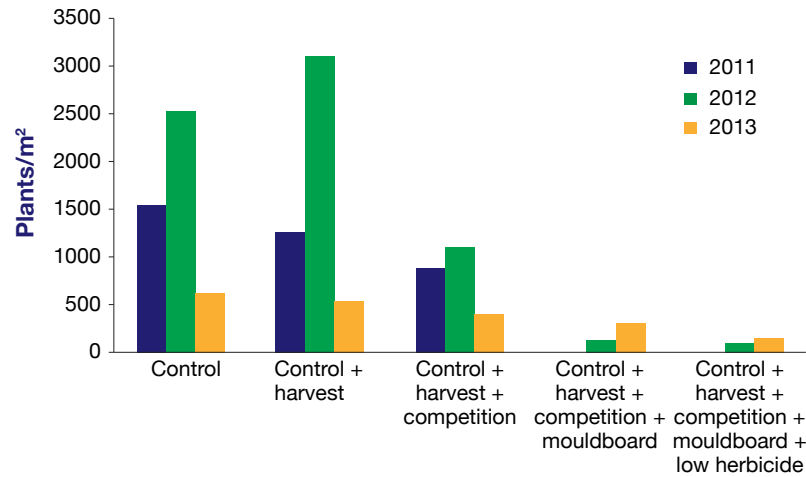


Figure 2: Number of brome grass plants per  $m^2$  in the five treatments over the last three seasons. Mouldboard ploughing was done in 2010. Canola was sown in 2013.

Wild radish numbers increased due to small escapes in previous seasons (Figure 3). Rotating to canola reduced wild radish numbers.

Plant counts were taken before the application of atrazine; only a few late-germinating wild radish plants may have survived the season (these were not counted).

Mouldboard treatment was successful only if there were no wild radish escapes in the season of mouldboarding.

The low-herbicide treatment received wild-radish desiccation spray only at the end of 2010 or 2011.

This result shows that if a grower uses mouldboard ploughing in a paddock and creates a very low weed seedbank, they must keep it low by continuing to achieve high levels of weed control.

By allowing wild radish to set seed in 2011, this paddock has been put back to where it started in terms of wild radish numbers.<sup>4</sup>

<sup>4</sup> W Parker (2013) Improving the best practice integrated weed management package 2013 trial report. Department of Agriculture and Food Western Australia. <https://www.agric.wa.gov.au/canola/improving-best-practice-integrated-weed-management-package-2013-trial-report?page=0%2C3>

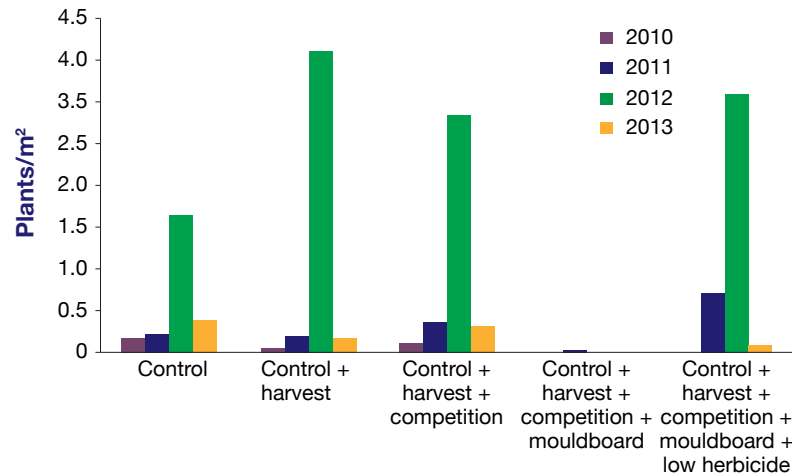


Figure 3: Number of wild radish plants per m<sup>2</sup> in the five treatments from the last four seasons. Mouldboard ploughing was done in 2010. Canola was sown in 2013.

The large variation in yield across replicates destroys any yield comparison from this trial (Table 2).

Table 2: Yield of canola from treatment plots

IWM treatments	Grain yield (t/ha)	Oil percentage
Control)	0.37	50.2
Control + harvest management	0.39	49.9
Control + harvest management + competition	0.40	48.5
Control + harvest management + competition +mouldboard	0.47	46.1
Control + harvest management + competition + mouldboard + low herbicide	0.33	46
I.s.d. ( $P = 0.05$ )	n.s.	1.8

### Conclusion

Herbicides did not keep brome grass numbers in check under continuous wheat. Wild radish patches missed in the early seasons of the trial led to the buildup of unsustainable numbers. This population remains susceptible to atrazine, and so TT canola is a suitable rotation crop.

It was necessary to rotate to canola to provide alternate herbicides and IWM strategies in order to manage the weeds. Canola crops offer the capacity to windrow-burn safely with high heat and good seed kill.

Crop competition reduced buildup of both brome grass and wild radish, and it should be part of a weed-management strategy. Targeting weed patches with higher rates of crop seed at sowing is one way to integrate crop competition into the program.<sup>5</sup>

<sup>5</sup> W Parker (2013) Improving the best practice integrated weed management package 2013 trial report. Department of Agriculture and Food Western Australia. <https://www.agric.wa.gov.au/canola/improving-best-practice-integrated-weed-management-package-2013-trial-report?page=0%2C3>

## 6.2.4 Herbicide resistance in Australian weeds

Australian farmers have moved away from aggressive tillage practices because of the extreme risk of soil erosion and improved soil moisture management. Few farmers use inversion tillage as is practiced in Europe, whereas most use reduced-tillage methods. Significant proportions of the crops are seeded using no-till. Therefore, crop sequences and seeding techniques are highly dependent on herbicides.

Repeated use of herbicides has selected for herbicide-resistant weed biotypes. Herbicide resistance now affects many species of Australian weeds, foremost among them annual ryegrass. Where canola production was restricted by weeds such as wild radish prior to the introduction of TT varieties, it is likely that herbicide-resistant weeds will re-impose restrictions if not carefully managed.

This could be the case with multiple- and/or cross-resistance in single species, as well as mixed populations of resistant weed species.

Canola growers in Australia use a range of herbicides on canola crops from many herbicide groups, and the number of groups will increase with the commercial production of additional herbicide-resistant varieties in the next few years (Table 3).

Table 3: Common herbicides in use in canola crops in Australia

Herbicide Groups	Herbicides
A	Fluazifop, Haloxyfop, Diclofop, Diclofop-methyl, Sethoxydim, Quizalofop, Clethodim
B	Intervix® (Clearfield® varieties)
C	Simazine, Atrazine, Terbutylazine (TT varieties)
D	Trifluralin, Propyzamide
I	Clopyralid
K	Metolachlor
M	Glyphosate (RR varieties)

[www.apvma.gov.au](http://www.apvma.gov.au)

Many populations of annual ryegrass would now be classified as resistant to diclofop-methyl and clethodim and on some farms ryegrass is cross-resistant to Group A and Group B herbicides. There are confirmed cases where annual ryegrass biotypes are resistant to all selective herbicides currently available. For each paddock, monitoring and resistance testing is imperative to understand the control options open to the grower.

Although the major herbicide-resistance problems in Australian weeds are with Groups A and B herbicides, resistance to Groups C, D, F, I, L and M herbicides have also been increasing.

Wild radish has now developed resistance to Group B, Group C, Group F and group I herbicides. Combined with the resistance in ryegrass, this has serious implications for farmers, particularly those wishing to use the imidazolinone-tolerant (IT) and TT varieties.



Farmers across Australia are being encouraged to adopt IWM in order to address the resistance problem. There are two essential components to IWM: the rotation of herbicide groups to avoid repeated use of the same or similar herbicides, and the avoidance of treating large numbers of weeds with a single herbicide. Weed-seed contamination of canola seed in excess of limits will lead to reduced prices. This is especially the case with weeds from the family Brassicaceae, which cause increased erucic acid and glucosinolates and consequent reduction in canola quality. Weed seed and other debris in the canola seed leads to direct penalties, based on the percentage present. Weed competition can affect nutrient uptake by the canola plants and thus affect yield.<sup>6</sup>

### 6.2.5 Weed management in different scenarios

#### *Canola following pasture*

The pasture ley system of farming was developed in Australia to allow crops to make use of nitrogen provided by legume pastures. A cropping phase of a single year to several years follows a period of pasture production. Growing canola in the first year after pasture has been the preferred practice. The system provides fertile, low-weed-density conditions for the crop. A significant bonus is that cereal root diseases are controlled for the following wheat crop, provided grasses are controlled in the pasture. The ley pasture phase provides farmers one or more growing seasons in which weed numbers can be reduced by using non-selective techniques such as grazing, winter cleaning (pasture manipulation), topping, hay-making and silage production. In the spring prior to sowing, the pasture and weeds are killed with glyphosate. In a well-managed ley system, weed numbers are significantly reduced prior to planting the canola.

Invariably, trifluralin is applied prior to sowing, targeting grassy weeds and susceptible broadleaf species. Following a strong pasture phase, subterranean clover (*Trifolium subterraneum*) can often be dense enough to suppress the seedling canola crop, especially if the 4–6 weeks leading up to planting is dry. Other common weeds are annual thistles and cape weed. In these cases, clopyralid is used.

Producers may need to treat late wild oats and other grass weeds that escaped the trifluralin or emerged late. In this case, a Group A herbicide such as Quizalofop is used.

A common practice is to keep the canola crop as clean as possible of weeds, using the techniques outlined. This often allows the following wheat crop to be produced without selective herbicides.

The ley-pasture cropping system has a great deal of merit in terms of IWM. The system is excellent for reducing pressure on herbicides, as well as managing weeds that are already resistant to herbicides. Crop and pasture phases are usually of similar length (1–5 years). Management of herbicide resistance is straightforward in these

<sup>6</sup> S Sutherland. Canola Weed Management. Department of Agriculture and Food Western Australia, [http://www.australianoilseeds.com/\\_data/assets/pdf\\_file/0012/2712/Chapter\\_12\\_-\\_Canola\\_Weed\\_Management.pdf](http://www.australianoilseeds.com/_data/assets/pdf_file/0012/2712/Chapter_12_-_Canola_Weed_Management.pdf)

systems. Unfortunately, the viability of the pasture ley system is closely (although not entirely) linked to livestock product prices.<sup>7</sup>

### *Canola in a continuous cropping sequence*

Weed control in continuous cropping consists of manipulating sowing time, exploiting crop competitive effects and relying heavily on selective herbicides.

Selection pressure for herbicide resistance is often high, especially to the Group A and Group B herbicides, because of the need to use these herbicides in the preceding crops.

Weed numbers tend to be higher because farmers do not have the range of non-selective treatments available in the pasture. This increases the risk of resistant biotypes being present in the crops when the herbicides are applied. Because of herbicide resistance, continuous crop programs may include a forage-fodder or green manure crop so that non-selective weed control can be achieved.

In both the ley system and the continuous cropping system, a significant component of weed management may be achieved through crop competition, although the effectiveness will vary between environments.<sup>8</sup>

### *Triazine-tolerant canola*

In 1999, TT canola accounted for almost 50% of the Australian crop, even though the varieties have a yield penalty relative to non-TT varieties. In most cases, TT canola is chosen because the weeds present cannot be controlled in the conventional varieties. In some situations, TT canola may be chosen as part of a strategy to control annual ryegrass resistant to Group A and Group B herbicides, in order to avoid repetitious use of trifluralin. In addition, the TT varieties were initially grown without an associated best management package, although this has now been rectified. All future herbicide-resistant crops will be introduced with a best management guide.

Some areas have a long history of triazine herbicide use, particularly in lupins. The widespread production of TT canola and use of triazines will certainly lead to an escalation in resistant populations of weeds, particularly annual ryegrass. There is already evidence of triazine resistance in wild radish.<sup>9</sup>

### *Imidazolinone-tolerant canola*

The IT canola varieties offer some significant benefits, but there are important limitations. These varieties are marketed along with an imidazolinone herbicide mix, originally OnDuty®, but this has been replaced with Intervix®. This has a wide

<sup>7</sup> S Sutherland. Canola Weed Management. Department of Agriculture and Food Western Australia, [http://www.australianoilseeds.com/\\_data/assets/pdf\\_file/0012/2712/Chapter\\_12\\_-\\_Canola\\_Weed\\_Management.pdf](http://www.australianoilseeds.com/_data/assets/pdf_file/0012/2712/Chapter_12_-_Canola_Weed_Management.pdf)

<sup>8</sup> S Sutherland. Canola Weed Management. Department of Agriculture and Food Western Australia, [http://www.australianoilseeds.com/\\_data/assets/pdf\\_file/0012/2712/Chapter\\_12\\_-\\_Canola\\_Weed\\_Management.pdf](http://www.australianoilseeds.com/_data/assets/pdf_file/0012/2712/Chapter_12_-_Canola_Weed_Management.pdf)

<sup>9</sup> S Sutherland. Canola weed management. Department of Agriculture and Food Western Australia, [http://www.australianoilseeds.com/\\_data/assets/pdf\\_file/0012/2712/Chapter\\_12\\_-\\_Canola\\_Weed\\_Management.pdf](http://www.australianoilseeds.com/_data/assets/pdf_file/0012/2712/Chapter_12_-_Canola_Weed_Management.pdf)

spectrum of activity and does not suffer from extended plant-back periods on acid soils. Unlike the TT varieties, the IT varieties carry no yield or oil penalties. The introduction of IT varieties has slightly reduced the area of TT canola, which will have herbicide-resistance management and environmental benefits.

Group B herbicides (as used in Intervix®) are 'high risk' in terms of the development of herbicide resistance. Group B herbicides (e.g. chlorsulfuron and triasulfuron) are already used frequently in cropping sequences. Therefore, producers will have to plan carefully how to fit the IT varieties without increasing the frequency of Group B herbicide use. The providers of IT canola are developing best management packages that will help greatly in this regard. The Group B resistance problem is so severe already in some areas (particularly in WA) that the IT varieties may have limited, if any, scope for use.<sup>10</sup>

### *LibertyLink® canola*

LibertyLink® varieties are currently being developed for the Australian market. Presently, there are problems with the efficacy of glufosinate ammonium during the cool growing season, particularly on wild radish and annual ryegrass. This may limit the widespread application of LibertyLink® canola in some areas of southern Australia.

However, when Liberty Link® is combined into hybrids, the additional seedling vigour may enhance competition with weeds.<sup>11</sup>

### *Roundup Ready® canola*

Roundup Ready® canola is available to West Australian producers.

Roundup has a wide spectrum of activity on weeds, has no soil residual problems (in the great majority of situations), and belongs to a low-risk group in terms of herbicide resistance. Given these factors, Roundup Ready® canola was released to offer producers a significant alternative to other varieties, herbicide-resistant or otherwise. The use of Roundup Ready® canola has led to further reductions in the area of TT canola, which may help with management of triazine-resistant weeds and the environment.

A problem that the industry is dealing with is the increasing number of documented cases of glyphosate resistance in annual ryegrass. If glyphosate is the only herbicide used in Roundup Ready® canola, these biotypes will survive unless some other intervention is used, such as cultural methods (weed seed collection and destruction), alternative knockdown and IBS herbicides prior to sowing, cultivation at or prior to planting. There is some level of resistance to all current Group A herbicide options.

<sup>10</sup> S Sutherland. Canola weed management. Department of Agriculture and Food Western Australia, [http://www.australianoilseeds.com/\\_data/assets/pdf\\_file/0012/2712/Chapter\\_12\\_-\\_Canola\\_Weed\\_Management.pdf](http://www.australianoilseeds.com/_data/assets/pdf_file/0012/2712/Chapter_12_-_Canola_Weed_Management.pdf)

<sup>11</sup> S Sutherland. Canola weed management. Department of Agriculture and Food Western Australia, [http://www.australianoilseeds.com/\\_data/assets/pdf\\_file/0012/2712/Chapter\\_12\\_-\\_Canola\\_Weed\\_Management.pdf](http://www.australianoilseeds.com/_data/assets/pdf_file/0012/2712/Chapter_12_-_Canola_Weed_Management.pdf)

Best management packages will need to include recommendations for minimising the risk of increased selection for the glyphosate-resistant biotypes.<sup>12</sup>

### 6.2.6 Future directions

Canola is set to remain a popular crop in Australia providing grain prices remain satisfactory, blackleg is controlled with varietal tolerance and sclerotinia is managed. However, herbicide resistance in weeds may force producers into less intensive rotations in order to manage seedbanks of resistant weeds.

Weed resistance is likely to restrict the useful life of the IT and TT varieties. This is particularly the case with the IT varieties because the associated herbicides are high-risk for resistance development, and because widespread resistance to these herbicides already exists.<sup>13</sup>

## 6.3 Herbicide damage

### 6.3.1 Clethodim

Application of clethodim at the maximum label rate of product as defined for some states (i.e. 500 mL/ha of Select<sup>®</sup>, which contains 240 g clethodim/L) has been reported to cause the following symptoms in canola:

- delayed flowering
- distorted flower buds
- possible yield suppression

Note that for canola in WA, 250 mL/ha is the maximum label rate for Select<sup>®</sup>. For Select<sup>®</sup> Xtra, with 360 g clethodim/L, the maximum label rate for canola in all states is 330 mL/ha.

Recent research in the central west of New South Wales by the Grain Orana Alliance (GOA) had resulted in variable results. Overall damage seemed to be light, and it was difficult to ascertain whether some damage was attributable to frost or to other abnormal conditions. Yield effects were negligible for most sites.

There may be varietal differences in crop damage, although little is known in this regard. However, farmers can control the timing and rate of herbicide application. Spraying earlier may avoid moisture stress issues, particularly in seasons when rainfall is light. Spraying early means late-emerging grass weeds will not be controlled with in-crop sprays but these plants are likely to be suppressed by a rapidly closing canola

<sup>12</sup> S. Sutherland. Canola weed management. Department of Agriculture and Food Western Australia, [http://www.australianoilseeds.com/\\_data/assets/pdf\\_file/0012/2712/Chapter\\_12\\_-\\_Canola\\_Weed\\_Management.pdf](http://www.australianoilseeds.com/_data/assets/pdf_file/0012/2712/Chapter_12_-_Canola_Weed_Management.pdf)

<sup>13</sup> S. Sutherland, Canola Weed Management. Department of Agriculture and Food Western Australia, [http://www.australianoilseeds.com/\\_data/assets/pdf\\_file/0012/2712/Chapter\\_12\\_-\\_Canola\\_Weed\\_Management.pdf](http://www.australianoilseeds.com/_data/assets/pdf_file/0012/2712/Chapter_12_-_Canola_Weed_Management.pdf)

canopy. Seed production from these weeds could still be managed with non-chemical options such as windrow burning.<sup>14</sup>

Clethodim resistance in annual ryegrass is increasing. In the past, this was managed by increasing the rate of clethodim. However, populations of annual ryegrass now exist that are resistant to clethodim at 500 mL/ha, and some will survive when treated with 2 L/ha.

No new post-emergent grass herbicides for canola are in the pipeline, so pre-emergent herbicides will have a greater role in managing ryegrass post-emergence. The ability of some currently registered and potential products for controlling annual ryegrass in canola was assessed in 2012 at Roseworthy, South Australia (Table 4). None of the pre-emergent herbicides was particularly efficacious against clethodim-resistant annual ryegrass and none was better than using clethodim. Currently, the mix of clethodim plus butoxydim (Factor<sup>®</sup>) applied after a pre-emergent herbicide offers the best control, despite continuing to select for clethodim resistance.<sup>15</sup> N.B. The mix does not consistently offer better grass control, only on selected sites.

## More information

[GRDC Update Papers: Maintaining the best options with herbicides](#)

[GRDC Update Papers: Options for using more residual herbicides in northern no-till systems](#)

[GRDC Update Papers: Herbicides and weeds regional issues trials and developments](#)

[GRDC Ground Cover: Revisiting canola management can lift returns](#)

Table 4: Control of clethodim-resistant annual ryegrass in canola at Roseworthy, South Australia, 2012  
IBS, Incorporated by sowing; POST, post-emergence (applied 8 weeks after sowing); CT, crop-topped. Within a column, means followed by the same letter are not significantly different at  $P = 0.05$

Herbicide program	Annual ryegrass plants 8 weeks after sowing (no. per m <sup>2</sup> )	Annual ryegrass spikes at harvest (no. per m <sup>2</sup> )	Crop yield (t/ha)
1.5 kg/ha of atrazine IBS + 500 mL/ha of Select <sup>®</sup> POST	387ab	149cd	1.34a
1.5 kg/ha of atrazine IBS + 250 mL/ha of Select <sup>®</sup> POST	262b	306c	1.13a
1.5 kg/ha of atrazine IBS + 500 mL/ha of Select <sup>®</sup> + 80 g/ha of Factor <sup>®</sup> POST	333b	92d	1.37a
Group K IBS	498a	1105a	0.46d
Group K + 2.0 L/ha of Avadex <sup>®</sup> Xtra IBS	298b	775b	0.76c
Group K + 2.0 L/ha of Avadex <sup>®</sup> Xtra IBS	235b	260cd	0.88bc
Group K + 250 mL/ha of Dual Gold <sup>®</sup> IBS	350ab	802b	0.50cd
Group D IBS	108c	149cd	1.11ab

See the Crop Care Factor technical manual at <http://m.cropcare.com.au/assets/2016/1/BRFactor-2015TechnicalManual.pdf> for details on how to reduce the risk of butoxydim damage in canola.

For more information on weed management in winter crops, see the *GrowNotes* Wheat (Western Region). Section 6. Weed control.

<sup>14</sup> T Cook, G Brooke, M Widderick, M Street (2014) Herbicides and weeds regional issues trials and developments. GRDC Update Papers, 6 March 2014, <https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/03/Herbicides-and-weeds-regional-issues-trials-and-developments>

<sup>15</sup> C Preston, P Boutsalis, S Kleeman, RK Saini, G Gill (2013) Maintaining the best options with herbicides. GRDC Update Papers, 28 March 2013, <http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/08/Maintaining-the-best-options-with-herbicides>