

Roundup Ready® canola Crop Management Plan (CMP)



Objective

The Roundup Ready canola Crop Management Plan details strategies that can be implemented on-farm to manage risks to the integrity of grain supply-chains and the sustainability of agricultural production.

Coexistence

Coexistence in agricultural production systems and supply chains is well established and well understood. Standards and best practices for coexistence were established decades ago and have continually evolved to deliver high purity seed and grain to support production, distribution and trade of products from different agricultural systems. For example, the successful coexistence of oilseed rape varieties with low erucic acid content for food use and high erucic acid content for industrial uses has occurred for many years.

The introduction of biotech crops generated renewed discussion focused on coexistence of biotech cropping systems with conventional cropping systems and organic production. These discussions have primarily focused on the potential marketing impact of the introduction of biotech products on other systems. The health and safety of biotech products are not an issue because their food, feed and environmental safety are demonstrated before they enter the agricultural production system and supply chain.

The coexistence of conventional, organic and biotech crops has been the subject of several studies and reports. These reports conclude that coexistence among biotech and non-biotech crops is not only possible but is occurring. They recommend that coexistence strategies be developed on a case-by-case basis considering the diversity of products currently in the market and under development, the agronomic and biological differences in the crops themselves and variations in regional farming practices and infrastructure. Furthermore, coexistence strategies are driven by market needs and should be developed using current science-based industry standards and management practices.

Successful coexistence of all agricultural systems is achievable and depends on communication, cooperation, flexibility and mutual respect for each system among growers. The responsibility for implementing practices to satisfy specific marketing standards or certification lies with that grower who is growing a crop to satisfy a particular market. This is true whether the goal is high oleic, low linolenic canola, non GM canola or organically produced crops. In each case, the grower is seeking to produce a crop that is supported by a market price and consequently that grower assumes responsibility for satisfying reasonable market specifications. That said, the grower needs to be aware of the planting intentions of his/her neighbor in order to gauge the need for appropriate management practices.

Identity Preserved production

Some growers may choose to preserve the identity of their crops to meet specific markets. Examples of Identity Preserved (IP) crops include specialty oil canola, food grade crops and any other crop that meets specialty needs, including organic and non-genetically enhanced specifications. Growers of these crops assume the responsibility and receive the benefit for ensuring that their crop meets mutually agreed-upon contract specifications. Based on historical experience with a broad range of IP crops, the industry has developed generally accepted IP agricultural practices. These practices are intended to manage IP production to meet quality specifications, and are established for a broad range of IP needs. The accepted practice with IP crops is that each IP grower has the responsibility to implement any necessary processes. These processes may include sourcing seed appropriate for IP specifications, field management practices such as adequate isolation distances, buffers between crops, border rows, planned differences in maturity between adjacent fields that might cross-pollinate and harvest and handling practices designed to prevent mixing and to maintain product integrity and quality.

General instructions for management of mechanical mixing and pollen flow

For all canola crops that they wish to identity preserve, or otherwise keep separated, growers should take steps to prevent mechanical mixing. Growers should make sure all seed storage areas, transportation vehicles and seeders are cleaned thoroughly both prior to and subsequent to the storage, transportation or planting of the crop. Growers should also make sure all planting equipment, harvesters and transportation vehicles used at harvest are cleaned thoroughly



both prior to and subsequent to their use in connection with the harvest of the grain produced from the crop. Growers should also make sure all harvested grain is stored in clean storage areas where the identity of the grain can be preserved.

It is recognised in the industry that a certain amount of incidental, trace level pollen movement occurs, and it is not possible to achieve 100% purity of seed or grain in any crop production system. A number of factors can influence the occurrence and extent of pollen movement. As stewards of technology, growers are expected to consider these factors and talk with their neighbours about their cropping intentions. Growers should take into account the following factors that can affect the occurrence and extent of cross-pollination to or from other fields.¹

Cross-pollination canola to canola. The rate of cross-pollination between two adjacent canola fields is generally low and this declines with distance (leptokurtic response). An Australian study by Rieger et al. (2002) showed that in the great majority of cases, even adjacent canola paddocks in Australia had pollen flow in a range of 0.00 to 0.07%. Whilst in a total of 197 individual samples of paddocks in a range of 0-5 km away from each other pollen flow from paddock to paddock was always less than 0.25%, with no outcrossing detected at 69% of sites.¹

Based on extensive review of scientific studies, GM canola may be grown in proximity of non-GM, with little risk that the non-GM canola will exceed the 0.9% adventitious presence industry threshold level (refer to table below).

RECOMMENDED SEPARATION DISTANCES FOR GROWING ROUNDUP READY CANOLA NEAR OTHER CANOLA IN AUSTRALIA

MINIMUM DISTANCES FOR MANAGING ADVENTITIOUS PRESENCE OF GM GRAIN TO BE LESS THAN 0.9%, BETWEEN GM CANOLA AND:	GRAIN PRODUCTION	SEED PRODUCTION
	Non-GM canola & all other canola	Foundation Seed canola (or farmer saved seed)
	5 metres	400 metres

Pollen movement between canola crops will always occur. Although the risk is very low, the development of canola plants tolerant to more than one herbicide could occur through cross-pollination between crop varieties. The above separation distances are recommended to minimize this potential.

Pollen movement – canola to weedy species. Canola is largely (~70%) self pollinating. However, it can be cross-pollinated (by insects and wind) with other varieties of canola, and to a lesser extent, with other close relatives. Studies have shown that there is the potential for naturally occurring hybrids to form between canola and wild radish, buchan weed or charlock. These events are extremely rare and often result in infertile hybrids. Attempts to transfer Herbicide Tolerance (HT) genes from canola into wild radish, buchan weed or charlock populations by backcrossing the hybrids to the weedy parent species have failed (ie no introgression of HT traits has been possible). Good agricultural practice will ensure these weeds are controlled in crop and non-crop situations, thus, there will be minimal opportunity for Roundup Ready canola to form hybrids with them.

B. rapa and *B. juncea* are crops/weeds that are very closely related to canola, and have the potential to hybridise with canola. Introgression of HT traits is possible but unlikely to occur naturally, and would not confer increased fitness or spread as a weed, relative to conventional *B. rapa* and *B. juncea*. In areas where *B. rapa* or *B. juncea* occur within or adjacent to Roundup Ready canola paddocks, they should be managed similarly to volunteer Roundup Ready canola (ie they should be controlled with other herbicides or cultural techniques).

Management of outcrossing events. Multiple herbicide tolerant canola volunteers and herbicide tolerant weed hybrids could occur at very low to extremely low levels, respectively. These plants can be controlled by an integrated weed management program, including the use of other herbicides and cultural methods.



Management of volunteer canola

Volunteer canola is a weed of crop and non-crop situations throughout Southern Australia. The majority of Australia's canola crop is herbicide tolerant so most growers are already familiar with managing herbicide tolerant canola volunteers. Many options currently exist for the control of volunteer canola. All these options except Roundup (or glyphosate) continue exist for the control of Roundup Ready canola.

It is essential to monitor and manage the appearance of volunteer canola in both crop and non-crop situations. Volunteers are likely to be found for three years after growing the crop and should be controlled prior to flowering. The following situations must be assessed for the presence of volunteers:

- In a paddock, where Roundup Ready canola has been grown
- In a paddock immediately adjacent to where Roundup Ready canola has been grown
- In areas where there has been seed or grain spillage during transport (eg roadsides)
- In any area where ineffective machinery clean down may deposit viable seed
- In areas where grazing animals excrete for 7 to 10 days after digesting seed
- Any areas where physical movement of seed may result in volunteers

Burial of canola seed to a depth greater than 5cm is not recommended as this can substantially delay the emergence of volunteers (secondary dormancy can be induced). Inspection regimes for identifying volunteers should take tillage practices into consideration.

Any plants present in a paddock that may be suspected to be Roundup Ready canola should be controlled as outlined below:

- Prior to crop establishment: through the use of a knockdown herbicide (with an appropriate tank-mix partner if using glyphosate based products) and/or cultivation
- In-crop: through the use of an appropriate registered herbicide for the crop being grown
- In non-crop situations: through the use of grazing, mowing, grading or herbicide application as appropriate for the situation to prevent the canola reaching maturity

When making spray decisions to control volunteer canola, growers should be aware of previous herbicide tolerant canola cropping both on their farm and that of their neighbours and modify herbicide choice appropriately.

1. Rieger, M.A. Lamond, M. Preston, C. Powles, S.B. and Roush, R.T. (2002). Pollen-Mediated Movement of Herbicide Resistance Between Commercial Canola Fields. *Science*. V ol. 296. no. 5577, pp. 2386 – 2388.

Disclaimer: Always read and follow the directions and precautions on the label for Roundup Ready® Herbicide with PLANTSHIELD by Monsanto and Roundup Ready® canola, and any other special conditions that may accompany the License and Stewardship Agreement. All the information provided in this plan is provided for general information only and no reader should act upon any material contained in this manual without considering his or her individual situations. Roundup Ready crops contain genes that confer tolerance to glyphosate, the active ingredient in Roundup Ready Herbicide with PLANTSHIELD by Monsanto. Roundup Ready herbicide with PLANTSHIELD by Monsanto will kill plants that are not tolerant to glyphosate.

At the time of printing, dealings with Roundup Ready canola at levels above those prescribed by each state are banned in the Australian Capital Territory, South Australia and Tasmania. This means that dealings, including but not limited to, planting, transport or storage of seed or grain, of Roundup Ready canola must not be conducted in these states.

Monsanto Australia Ltd (ABN 86 006 725 560), 12/600 St Kilda Rd, Melbourne VIC 3004. **Post:** PO Box 6051, St Kilda Rd Central, VIC 8008. **Phone:** 1800 069 569
Email: canola@monsanto.com **www.roundupreadycanola.com.au**

Roundup and Roundup Ready are registered trademarks of Monsanto Technology LLC, Monsanto Australia Limited licensee.



Roundup Ready canola Resistance Management Plan (RMP)

Protecting an important tool – glyphosate

Herbicide resistant weeds have been a reality for decades – no herbicide is immune, including glyphosate. While the problem is significant, it is also manageable. In Australia, glyphosate resistant populations of several weed species have been found. Farmers view glyphosate as a critically important weed control tool and want to make sure that the benefits it delivers are preserved and maintained. Where glyphosate resistance has occurred, it has been effectively managed by good agronomic practices. There are actions that every farmer can take to help prevent or manage glyphosate resistance to ensure the long term sustainable use of glyphosate herbicide in Australian farming systems, by minimising the risk of weeds (particularly annual ryegrass) developing resistance to glyphosate based herbicides.

Understanding your glyphosate resistance risk

Each paddock nominated for planting to Roundup Ready canola will possess a unique glyphosate resistance risk profile. This is based on the implementation of various management strategies throughout the previous crop rotation within the paddock and historical usage of glyphosate. As part of sound Integrated Weed Management Practices, growers are encouraged to assess their glyphosate resistance risk profile prior to planting Roundup Ready canola. This risk profile can be assessed using a range of tools including Monsanto's Paddock Risk Assessment Management Option Guide (PRAMOG). Please see www.pramog.com.au for further details. Growers can also refer to the Australian Glyphosate Sustainability Working Group website at glyphosateresistance.org.au. The Australian Glyphosate Sustainability Working Group have developed a guide for sustainable glyphosate use in winter grain cropping which describes practices that affect the development of resistance.

Factors that decrease risk:

- ✓ The double knock technique*
- ✓ Strategic use of alternative knockdown herbicide groups
- ✓ Full disturbance cultivation at sowing
- ✓ Effective in-crop weed control
- ✓ Use alternative herbicide groups or tillage for inter-row and fallow weed control
- ✓ Non-herbicide practices to prevent formation of viable weed seed
- ✓ Use of crops with high levels of weed competition
- ✓ Use of late season weed control and in-crop spray-topping with alternative herbicide groups
- ✓ Farm hygiene to prevent movement of resistant seed
- ✓ Applying stewardship plans when growing glyphosate tolerant crops
- ✓ Ensuring no weed seed returns to the seed bank.

Factors that increase risk:

- ✗ Continual reliance on glyphosate before seeding
- ✗ Lack of tillage
- ✗ Lack of effective in-crop weed control
- ✗ Frequent glyphosate-based chemical fallow
- ✗ Inter-row glyphosate use (unregistered)
- ✗ Frequent late season weed control and in-crop spray-topping with glyphosate
- ✗ Over-reliance on glyphosate tolerant crops
- ✗ High weed numbers.

*The double knock technique is defined as using a full cut cultivation OR the full label rate of a paraquat-based product (Herbicide Group L) following the glyphosate (Herbicide Group M) knockdown application.



Resistance management principles for Roundup Ready canola

Incorporating a range of cultural and herbicide management practices will maximise the control of weeds that may be resistant to glyphosate. The implementation of these practices should result in a reduction in the weed population entering the subsequent phase of crop rotation.

1. Aim to enter the Roundup Ready canola phase of the rotation with a low weed burden
2. Integrate as many different weed control options (chemical and cultural) as possible through all phases of the crop rotation
3. Make every herbicide application count – use registered rates at the correct application growth stage and assess effectiveness
4. Rotate herbicides with different modes of action throughout the crop rotation
5. Rotate herbicide tolerant crops with tolerance to different modes of action herbicides throughout the crop rotation
6. Regularly monitor the effectiveness of resistance management practices
7. Test weed populations for herbicide resistance status as part of ongoing integrated weed management
8. Growers should not plant Roundup Ready canola in paddocks with populations of confirmed glyphosate resistant weeds.

TACTIC	RYEGRASS CONTROL LEVEL (%) LIKELY (RANGE)
Mowing	95 (90-98)
Double knock*	90 (80-95)
Hay, silage, green manure	90 (80-98)
Strategic grazing	75 (30-95)
Pasture manipulation to reduce grasses	75 (50-90)
Weed seed collection at harvest	60 (45-75)
Pre-sowing cultivation	50 (35-70)
High seeding rates	40 (25-50)
Strategic burning	40 (10-90)
Minimise burial of seed	40 (20-50)
Autumn tickle followed by control	35 (15-55)
Swathing/windrowing	35 (10-80)
Herbicide group rotation	Group and situation specific

Table 1 – Resistance management principles for Roundup Ready canola

*Definition: A glyphosate Double knock must be a full label rate of glyphosate followed either by a full label rate of paraquat or a full cut cultivation within 1-14 days. Weeds should be treated at very small growth stages (refer to label) to get maximum efficacy from the paraquat treatment.



Records

It is important that growers keep paddock records, which outline the pre-planting, in-crop and post-harvest activities undertaken and management practices implemented to minimise the risk of glyphosate resistance development. To facilitate good record keeping practices, growers must use the Roundup Ready canola grower logbook or other record keeping systems that maintain records as described in the grower logbook.

All growers must maintain paddock records annually regardless of their proposed management practice intentions during and post harvest of Roundup Ready canola. The Technology Service Providers will be conducting Resistance Management Surveys and these records will form the basis of the surveys.

What records should be kept:

1. All growers must maintain records annually for each paddock they plant to Roundup Ready canola
2. Glyphosate herbicide should not be used in the year following Roundup Ready canola unless this is not feasible or practical. Where it is not feasible or practical, alternate management practices should be specified in the grower logbook. Alternate management practices should be derived from the weed management strategies list in **Table 1**
3. Prior to planting Roundup Ready canola, growers must record the pre-planting details pertaining to their field history in the grower logbook
4. During the season and post harvest, the grower must record all other relevant details including management practices implemented following harvest of the Roundup Ready canola crop and continuing through to in-crop weed control practices undertaken in crop grown in the same field after Roundup Ready canola
5. Each year, a sample of grower farms will be selected by Monsanto to have a Resistance Management Survey completed, where the Technology Service Provider will use these records to complete the survey.

Roundup Ready canola grower logbook

Season	
Grower name	
Trading entity	
Farm name	
Paddock name	
TSP	
Planting declaration number	



To facilitate good record keeping practices, growers must use this Roundup Ready canola grower logbook OR other record keeping systems that maintain records as described below.

These records will be referenced for a sample of growers by Technology Service Providers to form the basis of the Resistance Management Survey.

Pre-planting activities

Glyphosate usage prior to sowing (list dates and rates of applications - include all applications post harvest of the previous crop)	
Non-glyphosate harvest (previous season) and pre-sowing control practices implemented (eg. Cultivation, Herbicide group L) (list dates and rates of applications and alternative cultural weed control practices)	
Crop planted in previous season (include sowing date and variety)	
Intended weed control management strategies to be implemented post harvest and year following Roundup Ready canola	

In-crop activities

Target weeds	
Roundup Ready Herbicide applications used in crop (number and dates)	
Other post-emergent herbicides used (products, dates and rates)	
Weed control rating at 14-28 days after last Roundup Ready Herbicide application. Excellent: >95% Good: 90-95% Average: 80-89% Poor: <80%	
Any surviving weeds at 14-28 days after last Roundup Ready Herbicide application. If so, comment on reason for survival	



<p>Weed control rating at harvest</p> <p>Excellent: >95%</p> <p>Good: 90–95%</p> <p>Average: 80 – 89%</p> <p>Poor: <80%</p>	
Harvest and stubble management activities	

Post-harvest activities

<p>Crop planted in season after Roundup Ready canola</p>	
<p>Glyphosate usage prior to sowing next crop (list dates and rates of applications). Include post – harvest applications</p>	
<p>Non-glyphosate pre-sowing control practices implemented (eg. Cultivation, Herbicide group L, list dates and rates of applications and alternative cultural weed control practices)</p>	
<p>In crop weed control practices implemented in year following</p>	
<p>Roundup Ready canola (list dates and rates of applications)</p>	
<p>Were Roundup Ready canola volunteers controlled?</p>	

Comments



Resistance Management Plan (RMP)

Monitoring and non-compliance

Monitoring and non-compliance

The grower or the agronomist must inspect paddocks between 14 and 28 days after spraying Roundup Ready Herbicide with PLANTSHIELD® by Monsanto to monitor the effectiveness of the herbicide application. During these surveys, any surviving weeds that are normally sensitive to glyphosate application should be identified. The outcomes of the inspections and any remedial actions to be undertaken should be recorded.

Monsanto or the grower's Technology Service Provider will undertake random audits on a sample of Roundup Ready canola paddocks and of records maintained by the grower to ensure that the implementation of the Resistance Management Plan has been undertaken and that the grower is in compliance with the Roundup Ready canola License and Stewardship Agreement terms and conditions.

If through random audits by Monsanto or the Technology Service Provider a Roundup Ready canola grower is found to be non-compliant with the Resistance Management Plan or the Licence and Stewardship Agreement terms and conditions, Monsanto will request the farmer to implement appropriate practices to ensure they are brought back into compliance. The Technology Service Provider must notify Monsanto if he/she becomes aware of any non-compliances. It is the responsibility of the farmer and the Technology Service Provider to undertake and implement appropriate management practices to bring the farmer back into compliance. Monsanto may randomly audit farmers with a history of non-compliance at their sole discretion.

Dispute resolution and arbitration

If a dispute occurs between the farmer, the Technology Service Provider and Monsanto regarding implementation of the Resistance Management Plan, the dispute will be referred to independent arbitration for resolution.

Naturally occurring resistance to glyphosate

Naturally occurring weed populations, for example ryegrass, may possess biotypes with resistance to glyphosate. Farmers should be aware of this prior to using glyphosate based herbicides and should aim to decrease the development and growth of resistant populations. If you suspect resistant biotypes are present, these should be sampled and tested.

The Resistance Management Plan aims to reduce the likelihood of glyphosate resistance developing. It does not provide a guarantee that there will be no resistance to glyphosate. Please notify your Technology Service Provider and Monsanto if any weeds survive an application of glyphosate.

Disclaimer: Always read and follow the directions and precautions on the label for Roundup Ready® Herbicide with PLANTSHIELD by Monsanto and Roundup Ready® canola, and any other special conditions that may accompany the License and Stewardship Agreement. All the information provided in this plan is provided for general information only and no reader should act upon any material contained in this manual without considering his or her individual situations. Roundup Ready crops contain genes that confer tolerance to glyphosate, the active ingredient in Roundup Ready Herbicide with PLANTSHIELD by Monsanto. Roundup Ready herbicide with PLANTSHIELD by Monsanto will kill plants that are not tolerant to glyphosate.

At the time of printing, dealings with Roundup Ready canola at levels above those prescribed by each state are banned in the Australian Capital Territory, South Australia and Tasmania. This means that dealings, including but not limited to, planting, transport or storage of seed or grain, of Roundup Ready canola must not be conducted in these states.

Monsanto Australia Ltd (ABN 86 006 725 560), 12/600 St Kilda Rd, Melbourne VIC 3004. **Post:** PO Box 6051, St Kilda Rd Central, VIC 8008. **Phone:** 1800 069 569
Email: canola@monsanto.com **www.roundupreadycanola.com.au**

Roundup and Roundup Ready are registered trademarks of Monsanto Technology LLC, Monsanto Australia Limited licensee.



