



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. By acting now we can ensure the long-term sustainable use of glyphosate in Australian farming systems, by minimising the risk of weeds (particularly annual ryegrass) developing resistance to glyphosate based herbicides.

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 prevent the development of resistant populations. If you suspect resistant biotypes are present, these should be sampled and tested.

The Resistance Management Plan (RMP) aims to reduce the likelihood of glyphosate resistance developing. It does not provide a guarantee that there will be no resistance to glyphosate.

UNDERSTANDING YOUR GLYPHOSATE RESISTANCE RISK

Each paddock planted to Roundup Ready® canola has a unique glyphosate resistance risk profile. This is based on the paddock's history of various management strategies, throughout the previous crop rotation 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. Growers can 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.

*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.

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.

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 cropping 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 Regularly monitor the effectiveness of resistance management practices.
- 6 Test weed populations for herbicide resistance status as part of ongoing integrated weed management.
- 7 If planting into a paddock with suspected glyphosate resistance growers must have a plan to manage such weeds.

Incorporating weed control management practices which rotate away from glyphosate herbicide, in the year immediately following Roundup Ready canola, is the simplest and most effective way to minimise the risk of weeds developing glyphosate resistance. However, rotating away from glyphosate herbicide use in the year following Roundup Ready canola is not always practical or feasible. Farmers need options that allow the continued use of glyphosate, while taking proactive action to minimise the risk of resistance development. These options should include a range of those specified in Table 1. Farmers should aim to include the management practices specified in the table where possible and appropriate, as part of an integrated weed management plan.

TABLE 1 – WEED MANAGEMENT STRATEGIES FOR OTHER PHASES OF THE CROP ROTATION.

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

*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 should use appropriate record keeping systems.

All growers should maintain paddock records annually regardless of their proposed management practice intentions during and post harvest of Roundup Ready canola.

A sample of paddock records that should be kept is located at www.monsanto.com.au/growerlogbook.

WHAT RECORDS SHOULD BE KEPT

- 1 All growers should 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 implemented. Alternate management practices should be derived from those listed in Table 1.

- 3 Prior to planting Roundup Ready canola, growers should record the pre-planting details pertaining to their field history.

- 4 During the season and post harvest, the grower should record all other relevant details. These include 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.

MONITORING HERBICIDE EFFICACY

The grower or the agronomist should inspect paddocks between 14 and 28 days after spraying Roundup Ready Herbicide with PLANTSHIELD® by Monsanto or Roundup Ready PL Herbicide with PLANTSHIELD Technology to monitor the effectiveness of the herbicide application. During these inspections, 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. As per the Roundup Ready Herbicide with PLANTSHIELD by Monsanto and Roundup Ready PL Herbicide with PLANTSHIELD Technology label requirements, growers must report all cases of confirmed or suspected resistance to glyphosate to Monsanto.

TESTING OF SUSPECTED RESISTANCE

If a spray failure to Roundup Ready Herbicide with PLANTSHIELD by Monsanto or Roundup Ready PL Herbicide with PLANTSHIELD Technology occurs, it is essential to determine if this was due to resistance. Possible reasons for spray failure other than resistance can include poor spray application or emergence after the glyphosate application. Any weeds that are suspected to be glyphosate resistant should be tested to confirm this. The Australian Glyphosate Sustainability Working Group website at glyphosateresistance.org.au provides contacts that can advise on sampling suspect plants for testing and confirmation of the resistance status.

WEEDSMART

WeedSmart is an initiative that promotes the long term sustainability of glyphosate use and herbicide use generally in Australian agriculture. This program centers on providing farmers and agronomists with all the latest tools and resources to manage herbicide resistance. Commitment to the WeedSmart initiative has come from research and development organisations, advisors and agronomists, chemical companies, agribusiness and grower representative bodies who share a common goal to safeguard the industry's future. Central to this initiative is the campaign hub located at weedsmart.org.au.





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Reference: 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. Vol. 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 PL Herbicide with PLANTSHIELD Technology 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 and Roundup Ready PL Herbicide with PLANTSHIELD Technology. Roundup Ready Herbicide with PLANTSHIELD by Monsanto and Roundup Ready PL Herbicide with PLANTSHIELD Technology 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.



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