Big 6 + 3 for managing herbicide resistance

Factsheet - August 2022

National Vegetable Extension Network
TASMANIA

(Photo: Peter Boutsalis)

Strategies for minimising resistant weeds in high rainfall areas

In irrigated crops, especially in high rainfall areas with long cool wet seasons, managing weeds can be challenging. Integrated weed management will lead to more effective control of weeds, particularly over the longer term.

WeedSmart's Big 6 is a framework with a range of options and strategies to keep weed resistance at bay and the weed seed bank low. No one tool can provide a complete solution for weed control that works across all farming systems.

WeedSmart has been developed for grain producers; it is also relevant for vegetable production systems.

WeedSmart recommends using and 'stacking' (combining) the Big 6 for tackling weed resistance effectively:

- Diverse rotations
- Crop competition
- Combine and rotate herbicides
- Double knock
- Stopping seed set
- Harvest weed seed control.

All of the options can be combined as required to get a result. Different combinations may have to be tried to fit a certain production system.

There are 3 management approaches that are integral to successful weed management:

- Farm hygiene and biosecurity.
- Planning
- Data collection and management.

Key messages

- **Test weeds for resistance and susceptibility to herbicides, you can't manage what you don't measure.**
- **Adopt a long term, strategic approach to managing herbicide resistance.**
- **Planning and data gathering underpin a long-term approach.**
- **Don't always use the same approach, there are multiple tools in the toolbox, alternate them.**
- **Use several tools/options simultaneously for greater effectiveness.**
- **Good farm hygiene and biosecurity are essential to avoid spreading herbicide resistance.**

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1. Diverse rotations

Why?

Rotating a variety of crops, including cover crops, allows different groups of herbicides to be used.

How?

- Choose rotations that allow a variety of herbicides to be used
- Use cover crops as a tool, especially if they are tolerant to a different herbicide group
- Work out which paddocks to prioritise for longer term management
- Categorise all paddocks on the farm using a rating for herbicide resistance (e.g. none, moderate, severe)
- Make a 3 year control plan for each paddock.

Diverse rotations is probably the most important tool available with many options available, such as:

- Spring cropping – e.g. barley, wheat, poppies, potatoes, carrots, onions, peas, pyrethrum, linseed, hemp, maize, silage
- Grass and pasture seed crops
- Winter fodder cropping – turnip/radish, dairy agistment, lamb and cattle finishing
- Dual purpose canola and wheat
- A range of single species and mixed species cover crops are available.

Livestock phases are a very good option and can be very profitable. Grazing has a place in crop management when used strategically, however it can open up the canopy potentially allowing greater weed growth.

2. Crop competition

Why?

Dense planting where possible and/or growing crops that reach row cover quickly suppresses weeds. Some cover crops do achieve complete cover quickly.

Healthy plants compete better. Healthy plants grow on healthy soils and are well managed. If a crop is too dense so that airflow is reduced, compared to wider spacings, fungal diseases or insect pressure may be an issue.

How?

- Use high sowing rates for broadacre crops or cover crops
- Fine tune seeding rates to suit your crops and production systems
- Use narrow row spacing if possible
- Sow broadacre crops early
- Use precision seed placement
- Use tools such as NDVI to pinpoint poor growth areas and remediate them as soon as possible to reduce weed pressure
- Be strategic about grazing paddocks

Act to ensure crop vigour:

- sow/plant on-time or early, never late
- irrigate early to promote a knockdown prior to sowing, if possible
- use timely nutrition, irrigation and pest and disease control
- use balanced nutrition without overuse of nitrogen.

Address areas of poor crop vigour using:

- precision agronomy, e.g. NDVI and yield and/or nutrient maps to identify them
- drainage work to prevent waterlogging
- soil amelioration and amendments as required.

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Crop Science Australia
Mode of Action search tool
for each group:
mode of action
symptoms
common herbicides
resistant weeds in Australia
herbicides to treat resistant weeds

CropLife Australia
Herbicide mode of action table
list of herbicides with high and moderate resistance risk by group/ mode of action
(also lists active consitutents and first registered trade name)

International survey of herbicide resistant weeds
Herbicide group classifications
WSSA (US, Canada) - numbers
Australian system - letters
HRAC (everywhere else) - letters

details each group
maps groups systems to each other (WSSA, Aust, HRAC)
good diagram of all modes of action at cellular level

3. Mix and rotate herbicides

Why?

Using the same herbicides continually will select for resistant weeds.

How?

- Take chemical weed control methods and potential herbicide residues in the soil from previous crops into account
- Record your herbicide usage and discuss with your agronomists and field staff to avoid reliance on single actives or groups
- Test for resistance and susceptibility
- Don't rely on one herbicide group to do all the heavy lifting.
- Follow the label and recommendations. Check to see if an adjuvant is required

Testing for herbicide resistance and susceptibility is available at:

- Peter Boutsalis, Plant Science Consulting, Adelaide
  0400 664 460
  info@plantscienceconsulting.com.au
- John Broster, Charles Sturt University, Wagga Wagga
  0457 272 075
  jbroster@csu.edu.au
- Roberto Busi, University of Western Australia, Perth
  (08) 6488 7870
  roberto.busi@uwa.edu.au

Talk to your agronomist about which herbicides to test for if unsure.

4. Double knock

Why?

Using two herbicides with different modes of action to control weeds. Do not tank mix herbicides, use them consecutively.

How?

- Follow glyphosate with paraquat
- Use strategic cultivation – encourage weed germination prior to knockdown
- Control resistant survivors before they can set seed
- Target weeds when they're small
- A number of Group G herbicides have grass activity
- Group 14 herbicides fit in with paraquat.

5. Stopping seed set

Why?

Stopping weeds before they set seed decreases the seed bank and spread.

How?

- Act before seed set for long term gain
- Aim to reduce the seed bank
- Investigate emerging technologies, e.g. shield spraying with selective herbicides, cameras with weed detection algorithms.

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Figure 1. Herbicide resistance field trial (photo: Peter Boutsalis)

6. Harvest weed seed control in grain crops

Why?

Decreasing the seed bank.

How?

- Chaff decking in tramlines then site specific weed control
- Impact mill attached to header – collects seeds and grinds them to a fine dust
- Narrow windrow burning
- Chaff cart and baling.

7. Farm hygiene and biosecurity

Why?

Good farm hygiene decreases the risk of transferring herbicide resistant material (plants and/or seeds) between and within farms. Weeds can also host pests and disease vectors.

How?

- use signage to inform visitors of biosecurity expectations
- ask visitors where they have been recently
- have a visitor register (or app, e.g. Onside)
- have a designated visitor parking area
- have foot brushes and baths - use them between different risk areas
- control and limit access to production areas
- divide your farm into zones and limit access according to risk
- have a dedicated farm vehicle that doesn't leave the property for moving people about the farm
- have a wash-down area and ensure vehicles coming onto the property are washed down
- ensure washdown water is collected and disposed of
- have a weed management plan in place (check out the FarmBiosecurity app as well)
- know the weeds common in your area so you'll recognise if something different is present
- use declared weed free seed/products from your supplier
- be aware that reuse of water runoff from paddocks can pose a risk
- monitor for weeds
- dispose of production waste carefully
- ensure harvesters are cleaned between paddocks and farms
- include biosecurity in all staff inductions and visitor briefings.

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8. Planning

Why?

In the long run, planning will enable better, more effective weed management.

How?

- Keep notes and photos
- Work with all the agronomists in your rotation so they know what you are trying to achieve
- Aim for double or triple breaks of no weed seed set
- Combine all tools
- Look to create the long term conditions where it is hardest for the weeds to grow
- Look at your paddocks, prioritise which ones to concentrate on.

Having weeds costs money, fighting weeds costs money. In the long term fighting weeds should cost less than losses due to weeds.

9. Data

Having data available will enable better planning and management.

Useful data for weed management over time include:

- which herbicide has been used, rate and paddock details
- herbicide resistance test results
- yields
- NDVI
- seeding rates
- row spacings
- crop health observations.

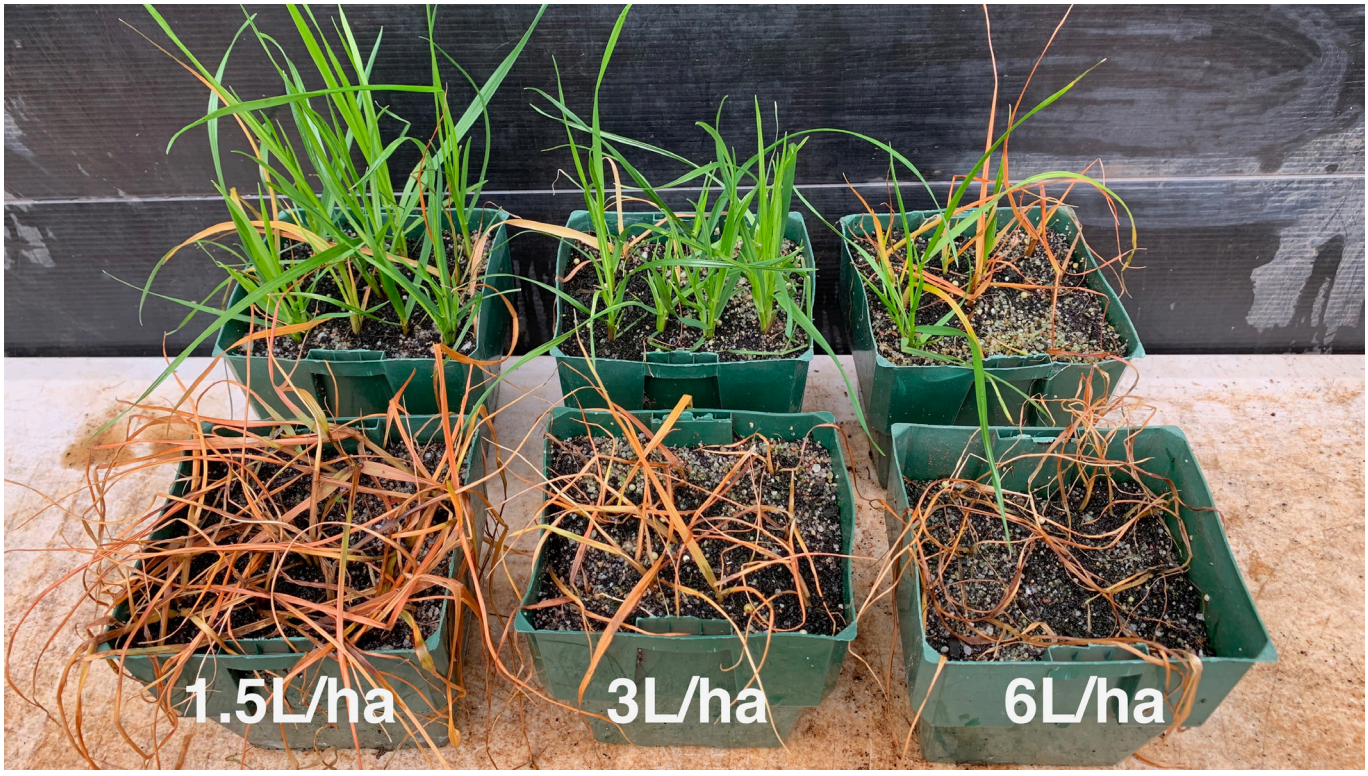

Figure 1. Response of resistant (back row) and susceptible (front row) ryegrass to Glyphosate 540 (photo: Peter Boutsalis)

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References and Resources

This factsheet is basd on a presentation by Jana Dixon, High Rainfall Extension Agronomist, WeedSmart, entitled 'WeedSmart: Solutions for controlling resistant weeds', presented at the 2021 Crop Protection Forum, Launceston - https://www.youtube.com/watch?v=MbGaJcZ94bE

with additional information supplied by RMCG.

- Australian Herbicide Resistance Initiative at https://ahri.uwa.edu.au
- VegNet factsheets: Group A Herbicide Resistance in Tasmanian ryegrass populations https://static1.squarespace.com/static/56cbdd3e20c647ad15b4d92f/t/5c6624226e9a7f1953b0a584/1550197965464/Group+A+Herbicide+Resistance+FS+V6.pdf
- Cover crop A3 poster for vegetable growers - https://www.soilwealth.com.au/resources/posters/cover-crops-for-australian-vegetable-growers/
- CropLife Australia at https://www.croplife.org.au
- Charles Sturt University Plant Interactions Group https://www.csu.edu.au/plantinteractionsgroup/herbicide-resistance
- DPIRD (WA) - Herbicide resistance and susceptibility testing - https://agric.wa.gov.au/n/5756
- Farm Biosecurity at http://www.farmbiosecurity.com.au
- GRDC Integrated Weed Management Manual at https://grdc.com.au/resources-and-publications/all-publications/publications/2014/07/iwmm
- Plant Science Counsulting by Peter Boutsalis at http://www.plantscienceconsulting.com.au
- WeedSmart at http://www.weedsmart.org.au
- Biosecurity checklist p 29-33 of Potato Growers' Biosecurity Manual - https://www.planthealthaustralia.com.au/wp-content/uploads/2019/06/Potato-Growers-Biosecurity-Manual.pdf
- Herbicide resistance in onion cropping systems - webinar https://www.soilwealth.com.au/resources/webinar-recordings/herbicide-resistance-in-onion-cropping-systems/
- A strategic approach to weed management for the Australian Vegetable Industry https://www.une.edu.au/about-une/faculty-of-science-agriculture-business-and-law/school-of-environmental-and-rural-science/research/plant-soil-and-environment-systems/weed-science/a-strategic-approach-to-weed-management-for-the-australian-vegetable-industry
- Herbicide resistant weeds in Tasmania - https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2020/07/how-best-to-tackle-herbicide-resistance-with-new-and-old-chemistries-in-tasmanian-farming-systems
- Pest ID tool - pests, diseases and weeds, available here: http://www.pestid.com.au

Further Information

If you need further information or help with testing, contact VegNET Tasmania, Regional, Development Officer, Ossie Lang on ossiel@rmcg.com.au or your local agronomist.

Acknowledgements

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