



Beetroot

Strategic Agrichemical Review Process
(SARP)

August 2021

Hort Innovation
Project - VG18004

Hort Innovation Project Number:

VG18004 – Vegetable Strategic Agrichemical Review Process (SARP) Report Updates

SARP Service Provider:

Vasanthe Vithanage T/A Hortigrow Consulting

Purpose of the report:

This report was funded by Hort Innovation to investigate the pest problem, agrichemical usage and pest management alternatives for the Beetroot industry across Australia. The information in this report will assist the industry with its agrichemical selection and usage into the future.

Date of report:

August 2021

Disclaimer:

Hort Innovation makes no representations and expressly disclaims all warranties (to the extent permitted by law) about the accuracy, completeness, or currency of information in the Beetroot industry SARP Report. Users of this material should take independent action before relying on its accuracy in any way.

Reliance on any information provided by Hort Innovation is entirely at your own risk. Hort Innovation is not responsible for, and will not be liable for, any loss, damage, claim, expense, cost (including legal costs) or other liability arising in any way (including from Hort Innovation or any other person's negligence or otherwise) from your use or non-use of the Beetroot industry SARP Report, or from reliance on information contained in the material or that Hort Innovation provides to you by any other means.

Legal Notice:

Copyright © Horticulture Innovation Australia Limited 2021

Copyright subsists in the Beetroot SARP. Horticulture Innovation Australia Limited (Hort Innovation) owns the copyright, other than as permitted under the Copyright ACT 1968 (Cth). The Beetroot SARP (in part or as a whole) cannot be reproduced, published, communicated or adapted without the prior written consent of Hort Innovation. Any request or enquiry to use the Beetroot SARP should be addressed to:

Communications Manager
Hort Innovation
Level 7, 141 Walker Street
North Sydney NSW 2060
Australia
Email: communications@horticulture.com.au
Phone: 02 8295 2300

**Hort
Innovation**
Strategic levy investment

**VEGETABLE
FUND**

This project has been funded by Hort Innovation using the vegetable research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Table of Contents

1. Summary	4
1.1 Diseases	5
1.2 Insects and nematodes	5
1.3 Weeds	5
2. The Australian Beetroot Industry	6
3. Introduction	7
3.1 Background.....	7
3.2 Minor use permits and registration	8
3.3 Methods	9
3.4 Results and discussions	10
3.4.1 Detail.....	10
3.4.2 Appendices	10
4. Diseases, Pests and Weeds of Beetroot	11
4.1 Diseases of beetroot.....	12
4.1.1 Disease priorities	12
4.1.2 Available and potential products for priority diseases	13
4.2 Insect and mite pests of beetroot.....	33
4.2.1 Insect and mite pest priorities	33
4.2.2 Available and potential products for priority insects and mites	35
4.3 Weeds in Beetroot.....	59
4.3.1 Weed priorities	59
4.3.2 Available and potential products for weed control.....	60
5. References.....	73
5.1 Information:	73
5.2 Abbreviations and Definitions:	73
5.3 Acknowledgements:	73
6. Appendices:	74
Appendix 1. Products available for disease control in beetroot	75
Appendix 2. Products available for control of insects and mites in beetroot.....	78
Appendix 3. Products available for weed control in beetroot	82
Appendix 4. Current permits for use in beetroot.....	83
Appendix 5. Beetroot Maximum Residue Limits (MRLs).....	85
Appendix 6: Beetroot Agrichemical Regulatory Risk Assessment.....	88

1. Summary

The strategic levy investment project Vegetable Industry SARP Report Updates (VG18004) is part of the Hort Innovation Vegetable Fund. A Strategic Agrichemical Review Process (SARP), through the process of a desktop audit and industry liaison;

- (i) Assesses the importance of the diseases, insects and weeds (plant pests) that can affect a horticultural industry;
- (ii) Evaluates the availability and effectiveness of fungicides, insecticides and herbicides (pesticides) to control the plant pests;
- (iii) Determines any gaps in the pest control strategy and
- (iv) Identifies suitable new or alternatives pesticides to address the gaps.

Alternative pesticides should ideally be selected for benefits of:

- Integrated Pest Management (IPM) compatibility
- Improved scope for resistance management
- Sound biological profile
- Residue and trade acceptance domestically and for export

The results of this process will provide the Beetroot industry with sound pesticide usage for the future that the industry can pursue for registration with the manufacturer, or minor-use permits with the Australian Pesticide and Veterinary Medicines Authority (APVMA).

1.1 Diseases

The high priority disease is:

Common name	Scientific name
Rhizoctonia	<i>Rhizoctonia solani</i>

1.2 Insects and Mites

The high priority insects and mites are:

Common name	Scientific name
Cutworms	<i>Agrotis</i> spp.
Webworm	<i>Spoladea recurvalis</i>

1.3 Weeds

The high priority weeds are:

Common Name	Scientific Name
Wild Turnip	<i>Brassica tournefortii</i>
Common Sowthistle	<i>Sonchus oleraceus</i>
Fat Hen	<i>Chenopodium album</i>
Red-Root Amaranth	<i>Amaranthus</i> spp.
Marshmallow	<i>Malva parviflora</i>

2. The Australian Beetroot Industry

The Australian Beetroot industry is a minor horticultural industry. Trade data combines fresh Beetroot, celeriac and radishes together.

Eighty-five percent of Beetroot production occurs in Queensland. The major growing regions are the Lockyer Valley and the Fassifern Valley.

Due to the mild climate in these regions, the Australian industry can supply domestic markets with fresh Beetroot throughout the year.

Fresh Beetroot Seasonality by State

State	19/20 t	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
New South Wales (6%)	955												
Victoria (2%)	220												
Queensland (85%)	12,963												
Western Australia (7%)	1,114												
Availability legend			High		Medium		Low						

Production for the year ending June 2020¹ was 15,253 with a value of \$12.2m. Sixty percent was used for processing (mainly tinned), 37% for the fresh market and 2% was exported.

Australia is a net exporter of Beetroot, typically exporting around 2% of produce. For the year ending June 2020, Australia exported 375 tonnes of beetroot. Of this export, 28% was destined for Singapore, followed by Japan (17%), Malaysia (14%), Thailand (10%) and Hong Kong (8%).

¹ Hort Innovation (2020). Australian Horticulture Statistics Handbook 2019/20. [online] Available at: <https://www.horticulture.com.au/globalassets/hort-innovation/resource-assets/ha18002-australian-horticulture-statistics-handbook-2019-20-vegetables.pdf>

3. Introduction

3.1 Background

Growers of some horticultural crops suffer from a lack of legal access to crop protection products (pesticides). The problem may be that whilst a relatively small crop area is valuable in an agricultural sense, it may not be of sufficient size for Agrichemical companies to justify the expense of registering a product use on that crop. Alternately, the disease, pest, or weed problem may be regional or spasmodic, making Agrichemical companies unwilling to bear the initial high cost of registering suitable pesticides.

Growers may face severe losses from diseases, pests and weeds due to a lack of registered or approved (via a permit) chemical control tools. Environmental concerns, consumer demands, and public opinion are also significant influences in the marketplace related to pest management practices. Industry IPM practitioners must strive to implement best management practices and tools to incorporate a pest management regime where strategies work in harmony with each other to achieve the desired effects while posing the least risks.

In combination with cultural practices, pesticides are important tools in Beetroot production and respective IPM programs. They control the various diseases, insects and weeds that affect the crop and can cause severe economic loss in modern high intensity growing operations. Pesticides are utilised during establishment and development, and to maximise quality and customer appeal.

As a consequence of the issues facing the Beetroot industry regarding pesticide access, Hort Innovation undertook a review of the pesticide requirements via a Strategic Agrichemical Review Process (SARP) in 2014. The current project is to update the SARP with the latest information and progress.

The SARP process identifies diseases, insect pests and weeds of major concern to the Beetroot industry. Against these threats, available registered or permitted pesticides are evaluated for overall suitability in terms of IPM, resistance, efficacy, trade, human safety and environmental issues. Where tools are unavailable or unsuitable the process aims to identify potential future solutions. Potential new risks to the industry are also identified.

The results will provide the Beetroot industry with a clear outlook of gaps in existing pest control options. This report is not a comprehensive assessment of ALL pests and control methods used in Beetroot but attempts to prioritise the major problems.

Exotic plant pests, not present in Australia, are not addressed in this document. A biosecurity plan has been developed for the Vegetable Industry in consultation with industry, government and scientists. The Biosecurity Plan for the Vegetable Industry² which covers Beetroot outlines key threats to the industry, risk mitigation plans, identification and categorisation of exotic pests and contingency plans. High priority exotic pests have been assessed based on their potential to enter, establish, and spread in Australia (e.g. environmental factors, host range, vectors) and the cost to industry of control measures.

² <https://ausveg.com.au/app/uploads/2018/06/Industry-Biosecurity-Plan-for-the-Vegetable-Industry.pdf>

3.2 Minor use permits and registration

From a pesticide access perspective, the APVMA classifies Beetroot as a minor crop. The crop fits within the APVMA crop group VR0075: Root and tuber vegetables, within the subgroup VR0574: Beetroot. Therefore, access to minor use permits can be relatively straight forward as long as a reasonable justification is provided in accordance with the APVMA's minor use guidance³.

Possible justification for future permit applications could be based on:

- New disease, insect or weed identified as a cropping issue
- No pesticide approved for the problem
- Insufficient options for resistance management
- Current pesticides ineffective due to resistance
- Trade risk - current pesticides unsuitable where crop commodities will be exported
- IPM, environment or OH&S issues
- Loss of pesticides due to removal from market or chemical review restrictions
- Opportunity to extrapolate a use pattern when a new, effective pesticide is registered in another crop
- Alternate pesticide has overseas registration or minor use permit
- Market failure – insufficient return on investment for registrant.

With each of these options, sound, scientific argument is required to justify any new permit applications. Another option for the Beetroot industry is for manufacturers to register new pesticides uses in the crop.

³ <https://apvma.gov.au/node/10931>

3.3 Methods

The current update of the Beetroot Strategic Agrichemical Review Process (SARP), which was last updated in 2014, was conducted by desktop audit using industry information gathered during 2011-2014 under MT10029 – Managing pesticide access in horticulture and finalised under VG12081 - Review of vegetable SARP reports. The process included gathering, collating and confirming information:

Hort Innovation Project Reference	Process of Review - Activity
VG16060 - Vegetable Agrichemical Pest Management Needs and Priorities (AUSVEG) - Commenced: 2 May 2017	<p>Engagement and consultation with growers and other relevant stakeholders. Including; Online crop specific surveys, workshops and one on one consultation Nationally.</p> <p>Collation of information collected by commodity on applicable pests, diseases and weeds in order of priority.</p>
MT17019 – Regulatory Support & Co-ordination (AKC)	<p>Beetroot Agrichemical Regulatory Risk Assessment Document</p> <p>To assist strategic planning, with respect to future pest management options, this document was developed as part of the Hort Innovation funded project MT17019 to highlight the regulatory threats to agrichemicals currently approved for the management of the pests and diseases in Beetroot as well as current initiatives aimed at addressing identified pest management deficiencies.</p>
VG18004 – Vegetable Strategic Agrichemical Review Process (SARP) Report Updates	<p>SARP updated via a desktop audit:</p> <p>Review list of priorities ranked as high, moderate and low for each plant pest groups (disease, insects and weeds) – provided by VG16060</p> <p>Identify industries pest priority gaps in order of importance</p> <p>Update current pesticides available via label registrations or minor use permits</p> <p>Update available pesticide use patterns, IPM ranking/compatibility, mode of action and chemical group.</p> <p>Identify pesticides at risk (under review and/or limited uses) via MT17019 Regulatory Support & Co-ordination – AKC consulting.</p> <p>Identify any appropriate solutions through the outcomes of the AgChem Forum's or similar market intelligence and their overall suitability (IPM compatibility, Chemical group to manage resistance, risk profile, existing domestic MRL's or global MRL's including any potential trade barriers, efficacy, OH&S, environmental safety and sustainability).</p> <p>Include known pesticide solutions that are currently under development with registrants for new uses in the nominated crops or in current Hort Innovation projects.</p> <p>Update MRL tables to include Australian MRL's, Codex and any applicable export market MRL's</p>

3.4 Results and discussions

3.4.1 Detail

Results and discussions are presented in the body of this document.

3.4.2 Appendices

Refer to additional information in the appendices:

Appendix 1. Products available for disease control in beetroot

Appendix 2. Products available for control of insects and mites in beetroot

Appendix 3. Products available for weed control in beetroot

Appendix 4. Current permits for use in beetroot

Appendix 5. Beetroot Maximum Residue Limits (MRLs)

Appendix 6. Beetroot Agrichemical Regulatory Risk Assessment

4. Diseases, Pests and Weeds of Beetroot

Resistance management: To manage the risk of resistance development, integrated disease/pest/weed management (IDM/IPM/IWM) strategies should be adopted. The general principle is to integrate diverse chemical and non-chemical strategies; maximise efficacy; not rely on singular tools and rotate between different modes of action. It is always essential to follow all the label instructions. Specific resistance management strategies may apply. These can be found, along with other useful information, on the CropLife Australia website⁴.

In Chapter 4 information on regulatory risk derived from project MT17019 (Regulatory support and coordination) has been incorporated.

Some of the suggested options have no overseas MRLs (see Appendix 5).

While care has been taken to ensure the accuracy of the information provided in this document the APVMA registered label and where relevant the APVMA approved permit must always be followed.

⁴ <https://www.croplife.org.au/resources/programs/resistance-management/>

4.1 Diseases of beetroot

4.1.1 Disease priorities

Common name	Scientific name
High	
Rhizoctonia	<i>Rhizoctonia solani</i>
Moderate	
Alternaria Leaf Spot	<i>Alternaria</i> spp.
Cercospora Leaf Spot	<i>Cercospora beticola</i>
Downy Mildew	<i>Peronospora farinosa</i>
Seedling Blight	<i>Aphanomyces cochlioides</i>
Damping Off	<i>Pythium aphanidermatum</i>
Powdery Mildew	<i>Erysiphe polygoni</i>
Sclerotinia Rot	<i>Sclerotinia</i> spp.
Bacterial Leaf Spot	<i>Pseudomonas syringae</i>
Low	
Phoma Leaf Spot	<i>Phoma beta</i>
Ring Spot	<i>Mycosphaerella</i> spp.
Rust	<i>Uromyces betae</i>

The most important disease issue based on the feedback received was Rhizoctonia Rot. Available and potential products for controlling diseases of beetroot are listed in Section 4.1.2.

Soil-borne diseases are the main issue faced by beetroot growers. Outbreaks are favoured by warm, wet conditions particularly after rain events and in water-logged areas. Cultural controls are the most effective way to manage soil-borne disease in the longer term. These include crop rotation, cover cropping, general farm hygiene to destroy crop residues and remove weed hosts, and management of fields and irrigation practices to reduce waterlogging.

Resistance Management

Downy Mildew and Powdery Mildew are both considered to have a high risk of resistance development. In Australia there are confirmed cases of Powdery Mildew resistance to Group 8 Bupirimate, Group 11 Strobilurins and Group 3 Triadimenol.

There are several disease strategies that apply to vegetables on the CropLife website⁵, including Downy Mildew and Powdery Mildew.

⁵ www.croplife.org.au/resources/programs/resistance-management/

4.1.2 Available and potential products for priority diseases

TABLE KEY: Note that blank fields in the table indicate no information has been provided.

Availability		Regulatory risk (refer to Appendix 6)	
A	Available via either registration or permit approval	R1	Short-term: Critical concern over retaining access
P	Potential - a possible candidate to pursue for registration or permit	R2	Medium-term: Maintaining access of significant concern
P-A	Potential, already approved in the crop for another use	R3	Long-term: Potential issues associated with use - Monitoring required
Withholding Period (WHP) – Number of days from last treatment to harvest (H) or Grazing (G)			
Harvest	H	Not Required when used as directed	NR
Grazing	G	No Grazing Permitted	NG

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Rhizoctonia (<i>Rhizoctonia solani</i>) Priority: High Rhizoctonia was ranked as a high priority in QLD & WA and as a moderate priority in VIC, NSW, SA & TAS. A soil-borne disease which is widespread in different soil types. Infection results in reduced marketability of beets through marking and discolouration of the skin.							
1,3-Dichloropropene + Chloropicrin + (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphyllans, Wireworms, soil borne diseases (including <i>Fusarium</i> and <i>Verticillium</i> wilts, <i>Rhizoctonia</i> , <i>Pythium</i>) and suppression of weeds. Restricted chemical. For use by professional and registered fumigators only.	-
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including <i>Pythium</i> , <i>Phytophthora</i> , <i>Sclerotinia</i> , <i>Sclerotium</i> , <i>Rhizoctonia</i> , <i>Verticillium</i> , <i>Plasmodiophora</i> , <i>Armillaria</i> and <i>Fusarium</i> spp. Apply granules to the soil surface and incorporate and seal the soil surface immediately. Do not plant into soil until a positive germination test has been conducted.	-
Metalaxyl-M + Azoxystrobin (Uniform) PER90595	4+11	Protectant & Curative	NR	A	ALL (excl. VIC)	Permitted in beetroot as an in-furrow directed spray at planting for control of <i>Pythium</i> and <i>Rhizoctonia</i> . [Max. 1 application per crop]	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of fungus diseases including <i>Rhizoctonia</i> , <i>Pythium</i> , <i>Fusarium</i> , <i>Phytophthora</i> , <i>Verticillium</i> , <i>Sclerotinia</i> and Club Root of crucifers. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	-
<i>Streptomyces lydicus</i> WYEC108 (Actinovate) Novozymes Bioag	BM 02	Biological	NR	A	ALL	Registered in vegetables as a seed treatment for control of <i>Fusarium</i> , <i>Rhizoctonia</i> & <i>Pythium</i> .	-
Tolclofos-Methyl (Rizolex) Sumitomo	14	Protectant & Curative	NR	A	QLD & NSW	Registered in beetroot for control of <i>Rhizoctonia</i> spp. Apply as in-furrow spray or by water injection at time of planting.	-
<i>Bacillus amyloliquefaciens</i> Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	BM 02	Biological	NR	P-A	ALL	Registered in vegetables for application to soil to improve bioavailability of soil resources to horticultural crops.	-
<i>Bacillus amyloliquefaciens</i> (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered in grapes and strawberries for control of Botrytis, in tomatoes, capsicums and chillies for suppression of Bacterial Spot and in avocado, other tropical fruit crops (excluding banana) and mango for control of Anthracnose and suppression of Stem End Rot.	-
<i>Bacillus amyloliquefaciens</i> strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of <i>Botrytis</i> in grapes and strawberries in Australia. US registration for the management of <i>Pythium</i> spp., <i>Phytophthora</i> spp., <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp. in peppers.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fludioxonil + Sedaxane (Vibrance Premium Seed Treatment) Syngenta	12+7	Protective Seed Treatment		P		Registered in potatoes for control of Black Scurf (<i>Rhizoctonia</i>), Silver Surf, Black Rot, Gangrene and Fusarium Dry Rot and suppression of Scab. Hort innovation Project ST17000 is generating data to support a new registration as seed treatment for the control of <i>Rhizoctonia</i> in beetroot.	R3
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of Powdery Mildew, Alternaria Leaf Spot, Gummy Stem Blight, Septoria, Botrytis, Cladosporium, Cercospora, Sclerotinia, Rust and Anthracnose and suppression of <i>Rhizoctonia</i> in almond, Brassica leafy vegetables, legume vegetables, melons and various fruit crops.	R3
NUL3163 Nufarm	TBC			P		New fungicide in development from Nufarm with activity on <i>Rhizoctonia</i> spp.	-
Thiophanate-Methyl + Etridiazole (Banrot)	1+14	Protectant		P		Registered in container grown ornamentals and in ground bedding plants as a post plant soil drench for control of <i>Pythium</i> , <i>Phytophthora</i> , <i>Rhizoctonia</i> and <i>Thielaviopsis</i> .	-
Thiram + Thiabendazole (P-Pickel T)	1+M3	Protectant		P		Registered as a seed treatment for control of <i>Fusarium</i> and <i>Pythium</i> seedling root rots (<i>Macrophomina</i> spp.) in faba beans.	R2
Alternaria Leaf Spot (<i>Alternaria</i> spp.) Priority: Moderate							
Alternaria Leaf Spot was ranked as a high priority in VIC & NSW and as a moderate priority in QLD, WA, SA & TAS. Infection is favoured by cool, humid conditions and can be exacerbated by stress such as nutrient deficiencies.							
Chlorothalonil (Bravo) PER82895	M5	Protectant	7	A	ALL (excl. VIC)	Permitted for in beetroot for control of <i>Alternaria</i> spp., <i>Botrytis</i> spp., Cercospora Leaf Spot and Phoma Leaf Spot [Max. 4 applications per season; re-treatment interval 7-14 d]	R3
Difenoconazole (Digger) Nufarm	3	Protectant & Curative	7	A	ALL	Registered in beetroot for control of Alternaria Leaf Spot & Cercospora Leaf Spot. [Max. 6 applications per crop; 2 consecutive; re-treatment interval 10-14 d]	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Iprodione (Rovral) PER81589	2	Curative	14 G:7	A	ALL (excl. VIC)	Permitted in beetroot for control Alternaria Leaf Spot , Sclerotinia Rot and Grey Mould. [Max. 2 applications per crop; re-treatment interval 14 d]	R2
Mancozeb + Dimethomorph (Acrobat) PER14958	M3+40	Protectant & Curative	14	A	ALL (excl. VIC)	Permitted in beetroot (field only) for control of Downy Mildew and Alternaria Leaf Spot . [Max. 4 applications per crop; 2 sequential; re-treatment interval: 7-10 d]	R2
Mancozeb + Metalaxyl (Ridomil Gold MZ) Syngenta PER14045	M3+4	Protectant & Curative	14	A	ALL (excl. VIC)	Permitted in beetroot (field only) for control of Downy Mildew and Alternaria Leaf Spot . [Max. 2 applications per crop; re-treatment interval: 7-10 d]	R2
Penthiopyrad (Fontelis) Corteva	7	Protectant	7	A	ALL	Registered in beetroot for control of Early Blight (<i>Alternaria</i> spp.) and Powdery Mildew (<i>Erisiphe</i> spp.). [Max 2 sequential treatments; re-treatment interval 7-14 d]	-
Trifloxystrobin (Flint) PER14891	11	Protectant & Curative	7 G:7	A	ALL (excl. VIC)	Permitted in beetroot for control of Alternaria Leaf Spot and Cercospora Leaf Spot. [Max. 3 applications per crop; re-treatment interval 10 d]	-
Pydiflumetofen +Difenoconazole (Miravis Duo) Syngenta	7+3	Protectant & Curative		P		Submitted for registration in June 2021 for control of various diseases in fruiting vegetables, cucurbits, root vegetables, celery and peanuts. US registration for control of Alternaria in almonds, pistachios, stone fruit and tree nuts.	R3
<i>Bacillus amyloliquefaciens</i> (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered in grapes and strawberries for control of Botrytis, in tomatoes, capsicums and chillies for suppression of Bacterial Spot and in avocado, other tropical fruit crops (excluding banana) and mango for control of Anthracnose and suppression of Stem End Rot. US registration for control of Alternaria in berries, brassica vegetables, citrus, bulb vegetables, herbs/spices, root/tuber and corm vegetables, stone fruit and tree nuts.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<i>Bacillus amyloliquefaciens</i> strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of Botrytis in grapevines and strawberries. US registration for control of Alternaria in artichoke, asparagus, berries, brassica leafy vegetables, bulb vegetables, citrus, cucurbits, pome fruit, stone fruit and tobacco.	-
Florylpicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis, Anthracnose, Alternaria , Scab, Monilinia, Rust and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
Fluazinam (Shirlan) Syngenta	29	Protectant		P		Registered in Brassica vegetables for control of Club Root. US registration for control of Alternaria in carrots.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of Alternaria in almond, Brassica leafy greens, bulb vegetables, cucurbits, pistachio, tree nuts and sunflower.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of Alternaria , Black Spot and Powdery Mildew in apples, Black Spot in pears, Blossom Blight, Brown Rot, Hull Rot, Shot Hole and Rust in stone fruit, and various leaf diseases in tropical fruits. US registration for control of Alternaria in almond, Brassica vegetables, Brassica leafy vegetables, carrot, citrus, pome fruit, small vine climbing fruit except kiwi fruit, leafy greens, cucurbits, tree nuts, fruiting vegetables & root vegetables except sugar beet.	-
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of Alternaria Leaf Spot, Black Spot, Brown Rot Nut Scab, Shot Hole and Rust in almond, Brown Rot in cherries and Husk Spot in macadamia. US registration for control of Alternaria Leaf Blight , Powdery Mildew, Anthracnose, Cercospora Leaf Spot, Gummy Stem Blight, Microdochium Blight, Target Leaf Spot and suppression of Downy Mildew in cucurbits.	-
NUL3446 Nufarm	TBC	TBC		P		New active in development from Nufarm with activity on Alternaria spp.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of Botrytis in berries and grapes, and Botrytis and Sclerotinia in leafy vegetables and potato. US registration for control of Alternaria in berries, brassica vegetables, bulb vegetables, carrots, cucurbits, fruiting vegetables, grape and small fruit vine climbing (except fuzzy kiwifruit), specific leaf petioles, specific leafy greens, root and tuber vegetables, lemon and lime, mustard greens, pistachio, potato, root vegetables and tuberous and corm vegetables.	R3
Cercospora Leaf Spot (<i>Cercospora beticola</i>) Priority: Moderate Cercospora Leaf Spot was ranked as a high priority in VIC & NSW and as moderate priority in QLD, WA, SA & TAS. The disease is transmitted through undecomposed crop residues, weed hosts and via seed. Outbreaks are favoured by warm, showery weather and severe infections can result in reduced size of beets.							
Chlorothalonil (Bravo) PER82895	M5	Protectant	7	A	ALL (excl. VIC)	Permitted for in beetroot for control of <i>Alternaria</i> spp., <i>Botrytis</i> spp., Cercospora Leaf Spot and Phoma Leaf Spot [Max. 4 applications per season; re-treatment interval 7-14 d]	R3
Difenoconazole (Digger) Nufarm	3	Protectant & Curative	7	A	ALL	Registered in beetroot for control of Alternaria Leaf Spot & Cercospora Leaf Spot . [Max. 6 applications per crop; 2 consecutive; re-treatment interval 10-14 d]	R3
Mancozeb	M3	Protectant	14	A	ALL	Registered in beetroot for control of Cercospora Leaf Spot & Downy Mildew. [Max. no. of applications not specified; re-treatment interval 7-10 d]	R2
Propiconazole (Tilt) PER14479	3	Protectant & Curative	7	A	ALL (excl. VIC)	Permitted in beetroot (field) for control of Cercospora Leaf Spot . [Max. 5 applications per crop; 3 consecutive; re-treatment interval 14 d]	R3
Trifloxystrobin (Flint) PER14891	11	Protectant & Curative	7 G:7	A	ALL (excl. VIC)	Permitted in beetroot for control of Alternaria Leaf Spot and Cercospora Leaf Spot . [Max. 3 applications per crop; re-treatment interval 10 d]	-
Zineb	M3	Protectant	7	A	ALL	Registered in beets for control of Cercospora Leaf Spot . [Max no. of applications and re-treatment interval not specified]	R2
Copper	M1	Protectant	1	P-A	ALL	Registered in red beet for control of Downy Mildew and Rust. Registered for control of Cercospora spp. in bananas, fig and celery.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Pydiflumetofen + Difenconazole (Miravis Duo) Syngenta	7+3	Protectant & Curative		P		Submitted for registration in June 2021 for control of various diseases in fruiting vegetables, cucurbits, root vegetables, celery and peanuts.	R3
<i>Bacillus amyloliquefaciens</i> (Serenade Opti) Bayer	BM 02	Biological		P		Registered in grapes and strawberries for control of Botrytis, in tomatoes, capsicums and chillies for suppression of Bacterial Spot and in avocado, other tropical fruit crops (excluding banana) and mango for control of Anthracnose and suppression of Stem End Rot.	-
<i>Bacillus amyloliquefaciens</i> strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of <i>Botrytis</i> in grapes and strawberries. US registration for control of Cercospora in leafy vegetables, sugar beet and tobacco.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis, Anthracnose, Alternaria, Scab, Monilinia, Rust and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of a variety of diseases including Powdery Mildew, Alternaria Leaf Spot, Gummy Stem Blight, Septoria, <i>Botrytis</i> , <i>Cladosporium</i> , Cercospora , <i>Sclerotinia</i> and Anthracnose in almond, Brassica leafy vegetables, legume vegetables, melons and various fruit crops.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of various leaf diseases in almonds, pome fruit, stone fruit and tropical and sub-tropical fruit (inedible peel). US registration for control of Cercospora in peanuts and sugarbeet.	-
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of Cercospora spp. in celery.	-
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered for control of Black Spot in apples and Powdery Mildew in grapes. US registration for control of Cercospora in corn, legume vegetables, peanuts, sorghum, millet, soybean and sugar beet.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of Botrytis in berries and grapes, and Botrytis and Sclerotinia in leafy vegetables and potato. US registration for control of Cercospora in brassicas, carrots, cucurbits, stalk vegetables and root and tuber vegetables. Hort Innovation Project ST17000 generating data to support a label registration in celery for control of Early Blight / Cercospora Leaf Spot .	R3
Tebuconazole + Azoxystrobin (Veritas) Adama	3+11	Protectant		P		Registered for control of Cercospora Leaf Spot in Faba beans and Broad beans.	R3

Downy Mildew (*Peronospora farinosa*)

Priority: Moderate

Downy Mildew was ranked as a moderate priority in VIC, QLD, NSW, WA, SA & TAS. Characterised by a white downy fungal growth that develops on the underside of the leaf. It is a common disease that is favoured by warm, moist weather. Management options include general farm hygiene, crop rotation, planting space (to allow air movement) and the use of protectant and curative fungicide spray applications when conditions favour disease outbreaks.

Copper	M1	Protectant	1	A	ALL	Registered in red beet for control of Downy Mildew and Rust. [Max. no. applications not specified; Re-treatment interval 10-14 d].	-
Mancozeb	M3	Protectant	14	A	ALL	Registered in beetroot for control of Cercospora Leaf Spot & Downy Mildew . [Max. no. of applications not specified; re-treatment interval 7-10 d]	R2
Mancozeb + Dimethomorph (Acrobat) PER14958	M3+40	Protectant & Curative	14	A	ALL (excl. VIC)	Permitted in beetroot (field only) for control of Downy Mildew and Alternaria Leaf Spot. [Max. 4 applications per crop; 2 sequential; re-treatment interval: 7-10 d]	R2
Mancozeb + Metalaxyl (Ridomil Gold MZ) Syngenta PER14045	M3+4	Protectant & Curative	14	A	ALL (excl. VIC)	Permitted in beetroot (field only) for control of Downy Mildew and Alternaria Leaf Spot. [Max. 2 applications per crop; re-treatment interval: 7-10 d]	R2
Phosphorous Acid PER14184	33	Curative	1	P-A	ALL (excl. VIC)	Permitted in beetroot for control of Damping Off. Registered for control of Downy Mildew in grapes.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Dimethomorph + Amitoctradin (Zampro) AgNova	45+40	Protectant		P		Registered for control of Downy Mildew in grape vines. Hort Innovation project ST16006 is generating data to support a label registration for control of Downy Mildew in beetroot. AgNova via BASF submitted a variation to label approval to the APVMA in July-20 to add control of Downy Mildew in bulb onion, spring onion, leafy vegetables including brassica leafy vegetables, cucurbits & beetroots	-
Acibenzolar-S-Methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		Registered in tomatoes for the suppression of Bacterial Speck, Bacterial Spot, Bacterial Canker and Powdery Mildew. US registration for control of Downy Mildew in Brassica leafy vegetables, cucurbits, leafy vegetables, spinach, and suppression of Downy Mildew in bulb onion.	-
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protectant & Curative		P		Registered for the control of Downy Mildew in Brassica vegetables.	-
Cyazofamid (Ranman) UPL	21	Protectant & Curative		P		Registered for the control of Downy Mildew in Brassica leafy vegetable seedlings. US registration for control of Downy Mildew in herbs, brassica leafy vegetables, cucurbits, grapes, hops, leafy greens, succulent-podded and succulent-shelled beans and bulb vegetables.	-
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of Downy Mildew in brassica vegetables, bulb vegetables and grapes.	-
Mandestrobin (Intuity) Sumitomo	11	Protectant		P		Registered for control of White Mould in green beans and lettuce and control of Blossom Blight and Brown Rot in stone fruit. Label variation submitted July 2021 to add new use patterns including control of White Rot in onions and control of Downy Mildew in onions, lettuce, spinach, rockmelon and zucchini.	-
Mandipropamid (Revus) Syngenta	40	Protectant		P		Registered for control of Downy Mildew in grapes and brassica leafy crops.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Oxathiapiprolin (Zorvec Enicade) Corteva	49	Protectant		P		Registered for control of Downy Mildew in bulb vegetables, brassica vegetables, cucurbits, leafy vegetables, brassica leafy vegetables and poppies.	-
Oxathiapiprolin + Mancozeb (Zorvec Enibel) Corteva	49+M3	Protectant		P		Submitted for registration in June 2021 for control of various diseases including Downy Mildew in vegetables and poppies.	R2
Polyoxin-D (Intervene) Nufarm	19	Protectant		P		Pending registration for control of Botrytis and Powdery Mildew in grapes, Botrytis, Powdery Mildew and Rhizopus Fruit Rot in berries, and Powdery Mildew, Alternaria and Fruit Spot in apples. US registration for control of Downy Mildew in ornamentals.	-
Propamocarb Hydrochloride + Fluopicolide (Infinito) Bayer	28+43	Protectant		P		Registered for control of Downy Mildew in brassica vegetables, bulb vegetables, cucurbits, leafy vegetables, lettuce, poppies and potato.	-
Propineb (Antracol) Bayer	M3	Protectant		P		Registered for control of Downy Mildew in cucurbits and onions.	R2
Propineb + Oxadixyl (Rebound) Kiwi Rural Trading	M3+4	Protectant & Curative		P		Registered for control of Downy Mildew in cucurbits, grape vines, lettuce and onions.	R2

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Seedling Blight (<i>Aphanomyces cochliformis</i>) Priority: Moderate Seedling Blight was ranked as a moderate priority in VIC, QLD, NSW, WA, SA & TAS. Soil-borne disease that survives in crop residues and in the soil. Cultural controls such as crop rotation, farm hygiene, cover crops and improving soil drainage are important management techniques. Soil fumigation should only be used for severe infestations.							
1,3-Dichloropropene + Chloropicrin + (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphyllans, Wireworms, soil borne diseases (including <i>Fusarium</i> and <i>Verticillium</i> wilts, <i>Rhizoctonia</i> , <i>Pythium</i>) and suppression of weeds. Restricted chemical. For use by professional and registered fumigators only.	-
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including <i>Pythium</i> , <i>Phytophthora</i> , <i>Sclerotinia</i> , <i>Sclerotium</i> , <i>Rhizoctonia</i> , <i>Verticillium</i> , <i>Plasmodiophora</i> , <i>Armillaria</i> and <i>Fusarium</i> spp. Apply granules to the soil surface and incorporate and seal the soil surface immediately. Do not plant into soil until a positive germination test has been conducted.	-
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of fungus diseases including <i>Rhizoctonia</i> , <i>Pythium</i> , <i>Fusarium</i> , <i>Phytophthora</i> , <i>Verticillium</i> , <i>Sclerotinia</i> and Club Root of crucifers. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	-
Hymexazol (Tachigaren) Mitsui Chemicals	32	Curative		P		Not registered in Australia. US registration as a soil and seed treatment for control of soil-borne diseases caused by <i>Fusarium</i> , <i>Aphanomyces</i> , <i>Pythium</i> , and <i>Corticium</i> spp. in rice, sugar beet, fodder beet, vegetables, cucurbits, ornamentals, carnations, and forest tree seedlings.	

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Damping Off (<i>Pythium aphanidermatum</i>) Priority: Moderate Damping Off was ranked as a moderate priority in VIC, QLD, WA, SA & TAS and as a low priority in NSW. Symptoms of damping-off and root rot consist of poor seed germination, pre-emergence and death of seedlings, post-emergence death of newly emerged seedlings, stunted plants, yellowed lower leaves, general poor growth, wilting, and eventual collapse and death of older plants. Roots of infected plants can appear water-soaked or brown to black in colour. In severe cases, nearly all roots may be girdled or rotted off. While all stages of beetroot can be infected by root rot organisms, newly emerging plants and young seedlings are very susceptible. Control options are limited and include the use of crop rotation to break the disease cycle.							
1,3-Dichloropropene + Chloropicrin + (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphyllans, Wireworms, soil borne diseases (including <i>Fusarium</i> and <i>Verticillium</i> wilts, <i>Rhizoctonia</i> , <i>Pythium</i>) and suppression of weeds. Restricted chemical. For use by professional and registered fumigators only.	-
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including <i>Pythium</i> , <i>Phytophthora</i> , <i>Sclerotinia</i> , <i>Sclerotium</i> , <i>Rhizoctonia</i> , <i>Verticillium</i> , <i>Plasmodiophora</i> , <i>Armillaria</i> and <i>Fusarium</i> spp. Apply granules to the soil surface and incorporate and seal the soil surface immediately. Do not plant into soil until a positive germination test has been conducted.	-
Metalaxyl-M (Apron)	4	Protectant Seed Treatment	NR	A	ALL	Registered in beetroot as a seed treatment for control of Damping Off .	-
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of fungus diseases including <i>Rhizoctonia</i> , <i>Pythium</i> , <i>Fusarium</i> , <i>Phytophthora</i> , <i>Verticillium</i> , <i>Sclerotinia</i> and Club Root of crucifers. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	-
Phosphorous Acid PER14184	33	Curative	1	A	ALL (excl. VIC)	Permitted use in beetroot for control of Damping Off . [Max. 4 applications per crop; re-treatment interval 7 d]	-
<i>Streptomyces lydicus</i> WYEC108 (Actinovate) Novozymes Bioag	BM 02	Biological	NR	A	ALL	Registered in vegetables as a seed treatment for <i>Fusarium</i> , <i>Rhizoctonia</i> & <i>Pythium</i> Management.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fludioxonil + Sedaxane (Vibrance Premium Seed Treatment) Syngenta	12 +7	Protective Seed Treatment		P		Registered for control of Black Scurf (<i>Rhizoctonia</i>), Silver Surf, Black Rot, Gangrene and Fusarium Dry Rot and suppression of Scab in potatoes. Hort Innovation Project ST17000 is generating data to support a new registration as seed treatment for the control of <i>Rhizoctonia</i> in beetroot.	R3
<i>Bacillus amyloliquefaciens</i> Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	BM 02	Biological	NR	P-A	ALL	Registered in vegetables for application to soil to improve bioavailability of soil resources to horticultural crops.	-
<i>Bacillus amyloliquefaciens</i> (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of <i>Botrytis</i> in grapes. US registration for control of Pythium Damping Off in artichoke, asparagus, brassica leafy vegetables, bulb vegetables, citrus, cucurbits, corn, fruiting vegetables, legume vegetables, oilseeds, soybean, strawberry and root and tuber vegetables (except sugar beet).	-
Cyazofamid (Ranman) UPL	21	Protectant & Curative		P		Registered in Brassica leafy vegetable seedlings for the control of Downy Mildew. US registration for control of Pythium spp. in carrot, leafy greens, succulent-podded and succulent-shelled beans, tuberous and corm vegetables, tomato greenhouse transplants and greenhouse-grown bell peppers.	-
NUL3163 Nufarm	TBC			P		New active in development from Nufarm with activity on <i>Fusarium</i> , Pythium & <i>Rhizoctonia</i> .	-
Thiophanate-Methyl + Etridiazole (Banrot)	1+14	Protectant		P		Registered in container grown ornamentals and in ground bedding plants as a post plant soil drench for control of Pythium , <i>Phytophthora</i> , <i>Rhizoctonia</i> and <i>Thielaviopsis</i> .	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Powdery Mildew (<i>Erysiphe polygoni</i>) Priority: Moderate Powdery Mildew was ranked as a moderate priority in VIC, QLD, WA, SA & TAS and as a low priority in NSW. The characteristic white, powdery growth occurs on plants infected by this fungus. Photosynthetic efficiency is reduced in affected leaves, and this can lead to reduced beet yields.							
Penthiopyrad (Fontelis) Corteva	7	Protectant	7	A	ALL	Registered in beetroot for control of Early Blight (<i>Alternaria</i> spp.) and Powdery Mildew (<i>Erysiphe</i> spp.). [Max 2 sequential treatments; re-treatment interval 7-14 d]	-
Sulphur	M2	Protectant	NR	A	ALL	Registered in vegetables for control of Powdery Mildew and Rust. Apply when disease is first seen [Max. no. of applications not specified; retreatment interval 14-21 d]	-
<i>Streptomyces lydicus</i> WYEC108 (Actinovate) Novozymes Bioag	BM 02	Biological	NR	P-A	ALL	Registered in vegetables as a seed treatment for <i>Fusarium</i> , <i>Rhizoctonia</i> & <i>Pythium</i> Management. Registered for suppression of Powdery Mildew in cucurbits.	-
Trifloxystrobin (Flint) PER14891	11	Protectant & Curative	7 G:7	P-A	ALL (excl. VIC)	Permitted in beetroot for control of Alternaria Leaf Spot and Cercospora Leaf Spot. Registered for control of Powdery Mildew in apples, pears & grapevine.	-
Pydiflumetofen +Difenoconazole (Miravis Duo) Syngenta	7+3	Protectant & Curative		P		Submitted for registration in June 2021 for control of various diseases in fruiting vegetables, cucurbits, root vegetables, celery and peanuts. US registration for control of Powdery Mildew in almonds and stone fruit.	R3
Acibenzolar-S-Methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		Registered in tomatoes for the suppression of Bacterial Speck, Bacterial Spot, Bacterial Canker and Powdery Mildew. US registration for control of Powdery Mildew in cucurbits.	-
ADM1700F Adama	TBC			P		Fungicide in development from Adama with Powdery Mildew activity	-
BLAD (ProBlad Plus)	BM 01	Biological	NR	P		Registered for control of Brown Rot and Blossom Blight in stone fruit. US registration for control of Powdery Mildew in cucurbits, fruiting vegetables, grapes, hops, pome fruit and strawberries.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Boscalid + Kresoxim-Methyl (Colliss) BASF	7+11	Protectant & Curative		P		Registered for control of Powdery Mildew in cucurbits.	-
Bupirimate (Nimrod) Adama	8	Protectant & Curative		P		Registered for control of Powdery Mildew in apples, cucurbits, cut flower, eggplant, melons, nursery stock, ornamentals, peppers and strawberries.	-
Cyflufenamid (Flute) AgNova	U6	Protectant & Curative		P		Registered for control of Powdery Mildew in cucurbits, grapevines and strawberries.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew , Botrytis, Anthracnose, Alternaria, Scab, Monilinia, Rust and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of Powdery Mildew in almonds, brassica leafy greens, cucurbits, grapes, hops, dry and succulent beans, stone fruit and sunflowers.	R3
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of Powdery Mildew in grapes, fruiting vegetables, cucurbits and potatoes.	-
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered for control of Powdery Mildew in grapes.	-
Metrafenone (Vivando) BASF	U8	Protectant		P		Registered for control of Powdery Mildew in cucurbits and grapes.	-
Polyoxin-D (Intervene) Nufarm	19	Protectant		P		Pending registration for control of Botrytis and Powdery Mildew in grapes, Botrytis, Powdery Mildew and Rhizopus Fruit Rot in berries, and Powdery Mildew , Alternaria and Fruit Spot in apples.	-
Proquinazid (Talendo) Corteva	13	Protectant		P		Registered for control of Powdery Mildew in fruiting vegetables, cucurbits, grapes and pome fruit.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Pyriofenone (Kusabi) AgNova	50	Protectant & Curative		P		Registered for control of Powdery Mildew in cucurbits and grapes.	-
Tea Tree Oil (Timorex)	46	Protectant				Registered for control of Powdery Mildew in fruiting vegetables, cucurbits and grapes.	-
Sclerotinia Rot (<i>Sclerotinia</i> spp.)							
Priority: Moderate							
Sclerotinia Rot was ranked as a moderate priority in VIC, QLD, WA & SA, and as a low priority in NSW & TAS. Sclerotinia tends to be a problem at canopy closure, particularly if plants have sustained mechanical injuries. Management options include general farm hygiene, crop rotation, planting space (to allow air movement) and the use of protectant and curative fungicide spray applications when conditions favour disease outbreaks. Correct timing and good penetration of foliage are essential for effective control.							
1,3-Dichloropropene + Chloropicrin + (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphyllans, Wireworms, soil borne diseases (including <i>Fusarium</i> and <i>Verticillium</i> wilts, <i>Rhizoctonia</i> , <i>Pythium</i>) and suppression of weeds. Restricted chemical. For use by professional and registered fumigators only.	-
Boscalid (Filan) BASF	7	Protectant	7	A	ALL	Registered in root and tuber vegetables for control of Sclerotinia Rot . [Max 4 applications per crop; re-treatment interval 7-14 d]	-
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including <i>Pythium</i> , <i>Phytophthora</i> , Sclerotinia , <i>Sclerotium</i> , <i>Rhizoctonia</i> , <i>Verticillium</i> , <i>Plasmodiophora</i> , <i>Armillaria</i> and <i>Fusarium</i> spp. Apply granules to the soil surface and incorporate and seal the soil surface immediately. Do not plant into soil until a positive germination test has been conducted.	-
Iprodione (Rovral) PER81589	2	Curative	14 G:7	A	ALL (excl. VIC)	Permitted in beetroot for control Alternaria Leaf Spot, Sclerotinia Rot and Grey Mould. [Max. 2 applications per crop; re-treatment interval 14 d]	R2
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of fungus diseases including <i>Rhizoctonia</i> , <i>Pythium</i> , <i>Fusarium</i> , <i>Phytophthora</i> , <i>Verticillium</i> , Sclerotinia and Club Root of crucifers. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Tebuconazole	3	Protectant & Curative	35 NG	A	ALL	Registered in beetroot (field only) for control of Sclerotinia Rot . [Max. 2 applications per crop; retreatment interval 7-10 d]	R3
<i>Bacillus amyloliquefaciens</i> Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	BM 02	Biological	NR	P-A	ALL	Registered in vegetables for application to soil to improve bioavailability of soil resources to horticultural crops.	-
Penthiopyrad (Fontelis) Corteva	7	Protectant	7	P-A	ALL	Registered in beetroot for control of Early Blight and Powdery Mildew. Registered for control of Sclerotinia in brassica vegetables, brassica leafy vegetables and leafy vegetables.	-
<i>Aureobasidium pullulans</i> (Botector) Nufarm	BM 02	Biological		P		Registered for suppression of Sclerotinia in fruiting vegetables.	-
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protectant & Curative		P		Registered for suppression of Sclerotinia in brassica vegetables, cucurbits, endive, leafy vegetables and lettuce.	-
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protectant		P		Registered for control of Sclerotinia in capsicum, green beans, garden peas, snow peas, sugar snap peas, leafy vegetables, lettuce, nursery stock and ornamentals.	R3
Fludioxonil + Pydiflumetofen (Miravis Prime) Syngenta	12+7	Protectant & Curative		P		Registered for control of Sclerotinia in lettuce, leafy vegetables and potato.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of Sclerotinia in brassica leafy greens and sunflowers. Hort Innovation project ST17000 is generating data to support a label extension for control of Sclerotinia in leafy vegetables.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of Sclerotinia in lettuce.	-
Mandestrobin (Intuity) Sumitomo	11	Protectant		P		Registered for control of White Mould in green beans and lettuce and control of Blossom Blight and Brown Rot in stone fruit. Label variation submitted July 2021 to add new use patterns including control of White Rot in onions and control of Downy Mildew in onions, lettuce, spinach, rockmelon and zucchini.	-
NUL3446	TBC			P		Fungicide in development from Nufarm with activity on Sclerotinia spp.	-
Bacterial Leaf Spot (<i>Pseudomonas syringae</i>) Priority: Moderate Bacterial Leaf Spot was ranked as a moderate priority in QLD & NSW. <i>P. syringae</i> can be moved by wind, rain, and transportation via nursery material. Mechanical equipment and pruning tools may be a frequently overlooked means of dispersal. Cultural management, host resistance, biological control with microbial antagonists would help in controlling this disease.							
Copper	M1	Protectant	1	P-A	ALL	Registered in red beet for control of Downy Mildew and Rust. Registered for control of Bacterial Spot in stone fruit, brassica vegetables, cucurbits, peas and tomatoes.	-
Acibenzolar-S-Methyl (Actigard Plant Activator) Syngenta	P01	Protectant	NR	P		Registered to reduce symptoms of Bacterial Speck (<i>Pseudomonas syringae</i>) in tomatoes.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<i>Bacillus amyloliquefaciens</i> (Serenade Opti) Bayer	BM 02	Biological	NR	P		Permitted for suppression of Bacterial Blight in lettuce.	-
<i>Bacillus amyloliquefaciens</i> strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered in grapes and strawberries for control of Botrytis. US registration for control of Pseudomonas spp. in berries, fruiting vegetables, leafy vegetables, stone fruit, tobacco and tree nuts.	-
Phoma Leaf Rot (<i>Phoma beta</i>) Priority: Low Phoma Leaf Spot was ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Soil-borne disease that can infect the leaves as well as the beets. Infections can cause seedling death in young crops and in later growth stages will cause abnormal root shape reducing quality of beets. Cultural control measures are important, particularly farm hygiene and crop rotation.							
Chlorothalonil (Bravo) PER82895	M5	Protectant	7	A	ALL (excl. VIC)	Permitted for in beetroot for control of <i>Alternaria</i> spp., <i>Botrytis</i> spp., Cercospora Leaf Spot and Phoma Leaf Spot [Max. 4 applications per season; re-treatment interval 7-14 d]	R3
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protectant		P		Registered for control of Phoma spp. in pyrethrum.	R3
Fludioxonil + Sedaxane (Vibrance Premium Seed Treatment) Syngenta	12+7	Protective Seed Treatment		P		Registered as a seed treatment for control of Phoma spp. infections in potatoes. Hort innovation Project ST17000 is generating data to support a new registration as seed treatment for the control of <i>Rhizoctonia</i> in beetroot.	R3
Ring Spot (<i>Mycosphaerella</i> spp.) Priority: Low Ring Spot was ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Infections can affect most parts of the plant and can cause economic losses by reducing beet size and quality. Cultural controls are important management techniques.							
Copper	M1	Protectant	1	P-A	ALL	Registered in red beet for control of Downy Mildew and Rust. Registered for control of Leaf Spot in strawberries.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Florylpicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis, Anthracnose, Alternaria, Scab, Monilinia, Rust and Mycosphaerella spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas.	R3
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of Alternaria Leaf Spot, Black Spot, Brown Rot Nut Scab, Shot Hole and Rust in almond, Brown Rot in cherries and Husk Spot in macadamia. US registration for control of Leaf Spot in strawberries.	-
Rust (<i>Uromyces betae</i>) Priority: Low Rust was ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS.							
Copper	M1	Protectant	1	A	ALL	Registered in red beet for control of Downy Mildew and Rust . [Max. no. applications not specified; Re-treatment interval 10-14 d].	-
Sulphur	M2	Protectant	NR	A	ALL	Registered in vegetables for control of Powdery Mildew and Rust . Apply when disease is first seen [Max. no. of applications not specified; retreatment interval 14-21 d]	-
Pydiflumetofen + Difenconazole (Miravis Duo) Syngenta	7+3	Protectant & Curative		P		Submitted for registration in June 2021 for control of various diseases in fruiting vegetables, cucurbits, root vegetables, celery and peanuts. US registration for control of Rust in stone fruit.	R3
Azoxystrobin + Cyproconazole (Amistar Xtra) Syngenta	11+3	Protectant & Curative		P		Registered for control of Rust in maize, sweet corn and peanuts.	R3
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of Rust in almond, bulb vegetables, dry and succulent beans, stone fruit and sunflower.	R3

4.2 Insect and mite pests of beetroot

4.2.1 Insect and mite pest priorities

Common name	Scientific name
High	
Cutworms	<i>Agrotis</i> spp.
Webworm	<i>Spoladea recurvalis</i>
Moderate	
Green Peach Aphid	<i>Myzus persicae</i>
Potato Aphid	<i>Macrosiphum euphorbiae</i>
Cluster Caterpillar	<i>Spodoptera litura</i>
Cotton Bollworm / Corn Earworm	<i>Helicoverpa armigera</i>
Native Budworm	<i>Helicoverpa punctigera</i>
Earwigs	<i>Nala lividipes</i>
Rutherglen Bug	<i>Nysius vinitor</i>
Green Vegetable Bug	<i>Nezara viridula</i>
Low	
Jassids / Leafhoppers	Cicadellidae
Beet Leafminer	<i>Liriomyza chenopodii</i>
Vegetable Leafminer	<i>Liriomyza sativae</i>
Serpentine Leafminer	<i>Liriomyza huidobrensis</i>
Crickets	Gryllotalpidae
Looper Caterpillar	Geometridae
Two Spotted Mite	<i>Tetranychus urticae</i>
Weevils	Curculionidae
Wireworms	Tenebrionidae
Beet Cyst Nematode	<i>Heterodera schachtii</i>

New incursions of an exotic pest which poses a potential threat.

Common name	Scientific name
Fall Armyworm	<i>Spodoptera frugiperda</i>

The high priority insect pests identified by the survey are Cutworms and Webworms. Available and potential products for these pests are listed in Section 4.2.2.

Soil insects can be highly damaging to root crops such as beetroot and it is important to identify what species are causing crop damage. Sampling for soil insects is best conducted using a baiting technique, such as outlined on Page 35 of the Cotton Pest Management Guide⁶.

Resistance to some insect groups has reduced control options despite a range of actives registered. Additionally, not all actives have broad registrations across Lepidoptera. Growers should not exceed the maximum number of applications permitted on the insecticide label.

Biological control involving other insects or fungal organisms in insect pest control is another option that need to be further evaluated. There are several identified biological control agents commercially available for pests in Australia.

Aphids are pests across many vegetables and specific resistance management strategies⁷ are available on the Croplife Australia website.

⁶ www.cottoninfo.com.au/publications/cotton-pest-management-guide

⁷ <https://www.croplife.org.au/resources/programs/resistance-management/various-cottonmelon-aphid-and-green-peach-aphid/>

4.2.2 Available and potential products for priority insects and mites

TABLE KEY: Note that blank fields in the table indicate no information has been provided.

Availability		Regulatory risk (refer to Appendix 6)	
A	Available via either registration or permit approval	R1	Short-term: Critical concern over retaining access
P	Potential - a possible candidate to pursue for registration or permit	R2	Medium-term: Maintaining access of significant concern
P-A	Potential, already approved in the crop for another use	R3	Long-term: Potential issues associated with use - Monitoring required
Withholding Period (WHP) – Number of days from last treatment to harvest (H) or Grazing (G)			
Harvest	H	Not Required when used as directed	NR
Grazing	G	No Grazing Permitted	NG
IPM – indicative overall impact on beneficials (based on the Cotton Pest Management Guide 2018-19 and cotton use patterns)			
VL – Very low; L – Low; M – Moderate; H – High; VH – Very High; - not specified			

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cutworms (<i>Agrotis</i> spp.) Priority: High Cutworm was ranked as a high priority in QLD, as a moderate priority in VIC, NSW, SA & TAS and as a low priority in WA. Cutworms are caterpillars that attack seedling crops by chewing through leaves and stems at ground level. Cutworms can be a pest of emerging seedlings but the incidence of this pest causing economic damage is generally rare in most crops, but it can impact plant densities. This pest is typically found along field margins that adjoin pastures or where crops have been sown into recently sprayed out weedy fallows. Soil pests can reduce plant establishment, row density and vigour. Symptoms can be confused with other establishment problems and may be worse if seedling development is slow due to climate or other factors. Soil pests, predominantly feed on germinating seed and seedling roots, resulting in poor establishment. Bait sampling prior to planting should be used to determine their presence. Clean fallows (free from weeds) generally cause pest insect numbers to decline due to a lack of food. MT16009 IPM Project Recommends: Predatory wasps, rotation, and early insecticide applications.								
Chlorpyrifos	1B	Contact	NR	A	ALL	Registered in beetroot for control of Cutworms , Field Crickets, Mole Crickets, Vegetable Weevil and Wingless Grasshopper. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Diazinon	1B	Contact	14	P-A	ALL (excl. TAS)	Registered in beetroot for control of Webworm. Registered for control of Black Cutworm in capsicum eggplant, tomato and sundry vegetables crops.	H Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Methomyl (Lannate) PER82428	1A	Contact	7	P-A	ALL	Permitted for use in beetroot for control of <i>Helicoverpa</i> spp. Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug and Thrips including Western Flower Thrips. Registered for control of Cutworms in tobacco.	H Bee:H	R2
Trichlorfon (Lepidex)	1B	Contact	2	P-A	ALL	Registered in vegetables for control of Cabbage White Butterfly, Cabbage Moth, Rutherglen Bug and Green Vegetable Bug. Registered for control of Cutworms in strawberries, beans, celery, crucifers, cucurbits, lettuce, peas, potatoes and tomato.	H Bee:H	R2
Alpha-Cypermethrin	3A	Contact		P		Registered for control of Cutworms in winter cereals, various pulse crops and grapevines.	VH Bee:H	-
Chlorantraniliprole (Acelepryn) Syngenta	28	Ingestion		P		Registered for control of Black Cutworm in turf. Note that rate in turf is higher than in vegetables.	L Bee:VL	-
Clothianidin + Imidacloprid (Poncho Plus Seed Treatment) BASF	4A	Contact & Ingestion		P		Registered for control of Cutworms as seed treatment in canola, forage brassicas, maize, sweet corn, sorghum, sunflower and pastures.	M Bee:M	R2
Cyantraniliprole + Thiamethoxam (Spinner) Syngenta	28+4A	Contact & Ingestion		P		Registered for control of Black Cutworm in turf.	M Bee:VH	R2
Indoxacarb (Provaunt) Syngenta	22A	Ingestion		P		Registered for control of Black Cutworm in turf.	L Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Webworm (<i>Spodoptera recurvalis</i>) Priority: High Webworm was ranked as a high priority in QLD & WA, as a moderate priority in VIC, NSW & SA and as a low priority in TAS. Webworm larvae are leaf-chewing pests of seedlings. It is important to monitor crops for eggs and larvae by regular field scouting. Target sprays against mature eggs and larvae before pests become entrenched.								
Diazinon	1B	Contact	14	A	ALL (excl. TAS)	Registered in beetroot for control of Webworm . [Max no. of applications and re-treatment interval not specified]	H Bee:VH	R3
Methomyl (Lannate) PER82428	1A	Contact	7	A	ALL	Permitted for use in beetroot for control of <i>Helicoverpa</i> spp. Cucumber Moth, Cluster Caterpillar, Loopers, Webworm , Rutherglen Bug and Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval 7 d]	H Bee:H	R2
Chlorantraniliprole (Coragen) FMC PER89353	28	Ingestion	3 NG	P-A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of Fall Armyworm. Registered for control of a broad range of Lepidopteran pests in various vegetables crops.	L Bee:VL	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	P-A	ALL	Registered in root and tuber vegetables including beetroot for control of Diamondback Moth, Cabbage White Butterfly, Heliothis, Cluster Caterpillar and Loopers.	M Bee:H	-
Spinetoram (Success Neo) Corteva	5	Ingestion	3	P-A	ALL	Registered in root and tuber vegetables including beetroot for control of Light Brown Apple Moth, Loopers, Helicoverpa and Potato Moth.	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	P-A	ALL	Registered in root & tuber vegetables including beetroot for control of Lightbrown Apple Moth, Loopers, Helicoverpa and Potato Moth.	L Bee:L	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of a broad range of Lepidopteran pests in various vegetables crops.	L Bee:H	R3
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, Aphids, Mites and Caterpillars . Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Methoxyfenozide (Prodigy) Corteva	18	Insect Growth Regulator		P		Controls a range of Lepidopteran pests. Registrations and permits to control Lepidoptera pests in various vegetables including fruiting vegetables and lettuce.	VL Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
Green Peach Aphid (<i>Myzus persicae</i>) Potato Aphid (<i>Macrosiphum euphorbiae</i>) Priority: Moderate								
Aphids were ranked as a high priority in NSW, as a moderate priority in VIC, QLD, WA & SA and as a low priority in TAS. Aphids suck on sap, causing loss of vigour, and in some cases yellowing, stunting or distortion of plant parts. Honeydew (unused sap) secreted by the insects can cause sooty mould to develop on leaves.								
<i>Beauveria bassiana</i> (Velifer) BASF	UNF	Biological	NR	A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid and Two-Spotted Spider Mites. [Max. 3 application per crop; re-treatment interval 3-14 d]	L Bee:L	-
Dimethoate	1B	Contact	14	A	ALL	Registered in beetroot for control of Aphids , Jassids, Mites, Leafhoppers, Green Vegetable Bug, Thrips and Wingless Grasshopper. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids , Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Imidacloprid PER81260	4A	Contact & Ingestion	3	A	ALL (excl. VIC)	Permitted for use in beetroot for control of Aphids and Thrips (excluding Western Flower Thrips). [Max. 2 applications per crop; re-treatment interval not specified]	M Bee:M	R2
Petroleum Oil	UN	Contact	NR	A	ALL	Registered in beet for control of Aphids , Mites, Thrips and Leafhopper. [Max. 4 applications per season; re-treatment intervals 14 d]	VL Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Pirimicarb (Aphidex)	1A	Contact & Ingestion	2	A	ALL	Registered in beetroot for control of Green Peach Aphid . [Max. no. of applications & re-treatment interval not specified]	VL Bee:VL	R3
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of Aphids , Thrips, Mealybug, Two Spotted Mites, Spider Mite and Whitefly. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Pymetrozine (Chess) Syngenta	9B	Contact & Ingestion	14	A	ALL	Registered in beetroot for control of Potato Aphid and Green Peach Aphid . [Max. 2 sprays per crop; re-treatment interval: 14 d]	L Bee:VL	R3
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	7	A	ALL	Registered in root and tuber vegetables for control of Green Peach Aphid , and suppression of Tomato Potato Psyllid and Rutherglen Bug. [Max no. of applications not specified; Re-treatment interval: 7-10 d]	M Bee:VH	-
Afidopyropen (Versys) BASF	9D	Ingestion		P		Registered for the control of Green Peach Aphid in sweet corn, rhubarb, artichoke, brassica vegetables, celery, cucurbits, fruiting vegetables, strawberry, leafy vegetables and brassica leafy vegetables.	L Bee:L	-
Dimpropridaz (Axalion) BASF	TBC			P		BASF has applied for registration in leafy vegetables, brassica vegetables and fruiting vegetables, including cucurbits to control Whitefly, Aphids and Thrips. Pending regulatory approvals, first market introduction in Australia is expected early 2023.	-	-
Flonicamid (Mainman) UPL	9C	Ingestion		P		Registered for control of Green Peach Aphid in canola, cucurbits and potato.	M Bee:L	-
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. Pending 2021 Australian variation of registration and label approval to extend the uses to include avocados, mangoes, papayas, cucurbits, eggplant, peppers, green beans, potatoes, sweet potatoes for control of Silverleaf Whitefly, Greenhouse Whitefly, Green Peach Aphids, Cotton Aphid, Tropical Fruits: Fruit Spotting Bugs and Planthoppers.	L Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, Aphids , Mites and Caterpillars. Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables.	-	-
Spirotetramat (Movento) Bayer	23	Ingestion		P		Registered for control of Green Peach Aphid in beans, peas, brassica vegetables, brassica leafy vegetables, celery, rhubarb, cucurbits, eggplant, peppers, tomatoes, herbs, leafy vegetables, lettuce, chicory, endive, radicchio, potatoes and sweet potatoes.	M Bee:VL	-
Cluster Caterpillar (<i>Spodoptera litura</i>) Priority: Moderate								
Cluster Caterpillar was ranked as a moderate priority in VIC, QLD, NSW, WA & SA and as a low priority in TAS. Larvae feed on the leaf surface and can cause extensive leaf loss when the pest is in large numbers.								
Eamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in root and tuber vegetables including beetroot for control of Diamondback Moth, Cabbage White Butterfly, Heliothis, Cluster Caterpillar and Loopers. [Max. 4 applications per crop; min. re-treatment interval 7 d]	M Bee:H	-
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in root and tuber vegetables including beetroot for control of Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillar , Potato Moth and <i>Helicoverpa</i> spp. [Max 3 applications per crop; re-treatment interval 7-14 d]	L-M Bee:L	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars , Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Methomyl (Lannate) PER82428	1A	Contact	7	A	ALL	Permitted for use in beetroot for control of <i>Helicoverpa</i> spp. Cucumber Moth, Cluster Caterpillar , Loopers, Webworm, Rutherglen Bug and Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval 7 d]	H Bee:H	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Chlorantraniliprole (Coragen) FMC PER89353	28	Ingestion	3 NG	P-A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of Fall Armyworm. Registered for control of a broad range of Lepidopteran pests in various vegetables crops. Registered for control of Cluster Caterpillar in brassica vegetables, brassica leafy vegetables and strawberries.	L Bee:VL	-
Spinetoram (Success Neo) Corteva	5	Ingestion	3	P-A	ALL	Registered in root and tuber vegetables including beetroot for control of Light Brown Apple Moth, Loopers, Helicoverpa and Potato Moth. Registered for control of Cluster Caterpillar in brassica vegetables.	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	P-A	ALL	Registered in root & tuber vegetables including beetroot for control of Lightbrown Apple Moth, Loopers, Helicoverpa and Potato Moth. Registered for control of Cluster Caterpillar in brassica vegetables.	L Bee:L	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of Cluster Caterpillar in brassica vegetables, fruiting vegetables and cucurbits.	L Bee:H	R3
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, Aphids, Mites and Caterpillars . Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables.	-	-
Methoxyfenozide (Prodigy) Corteva	18	Insect Growth Regulator		P		Controls a range of Lepidopteran pests. Registrations and permits to control Lepidoptera pests in various vegetables including fruiting vegetables and lettuce.	VL Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered for control of Sigastus Weevil in macadamia and control of Apple Weevil, Fuller's Rose Weevil and Garden Weevil in pome fruit and stone fruit. Also has activity on Lepidoptera.	M Bee:VH	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cotton Bollworm / Corn Earworm (<i>Helicoverpa armigera</i>) Native Budworm (<i>Helicoverpa punctigera</i>) Priority: Moderate Helicoverpa was ranked as a moderate priority in VIC, QLD, WA & SA and as a low priority in NSW & TAS. <i>Helicoverpa armigera</i> is generally regarded as the more serious pest because of its greater capacity to develop resistance to insecticides, broader host range, and persistence in cropping areas from year to year. Larvae feed on leaves but are most damaging when feeding on growing terminals, buds, flowers & fruit.								
<i>Bacillus thuringiensis</i> <i>subsp. Kurstaki</i> (DiPel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Caterpillars, including <i>Helicoverpa</i> . [Apply a minimum of 2 sprays; re-treatment interval 3-5 d]	VL Bee:L	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in root and tuber vegetables including beetroot for control of Diamondback Moth, Cabbage White Butterfly, Heliothis , Cluster Caterpillar and Loopers. [Max. 4 applications per crop; min. re-treatment interval 7 d]	M Bee:H	-
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in root and tuber vegetables including beetroot for control of Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillar, Potato Moth and <i>Helicoverpa</i> spp. [Max 3 applications per crop; re-treatment interval 7-14 d]	L-M Bee:L	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars , Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Methomyl (Lannate) PER82428	1A	Contact	7	A	ALL	Permitted for use in beetroot for control of <i>Helicoverpa</i> spp. Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug and Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval 7 d]	H Bee:H	R2
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in root and tuber vegetables including beetroot for control of Light Brown Apple Moth, Loopers, <i>Helicoverpa</i> and Potato Moth. [Max 4 applications per crop; re-treatment interval: 7-14 d]	M Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in root & tuber vegetables including beetroot for control of Lightbrown Apple Moth, Loopers, Helicoverpa and Potato Moth. [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-
Chlorantraniliprole (Coragen) FMC PER89353	28	Ingestion	3 NG	P-A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of Fall Armyworm. Registered for control of a broad range of Lepidopteran pests in various vegetables crops. Registered for control of Helicoverpa spp. in brassica vegetables, brassica leafy vegetables, stalk and stem vegetables, leafy vegetables, lettuce, fruiting vegetables, cucurbits, legume vegetables, potatoes, strawberries and sweet corn.	L Bee:VL	-
<i>Clitoria ternatea</i> Extract (Sero-X) Growth Agriculture	-	Biological	NR	P		Registered in cotton for control of Helicoverpa spp. , Green Mirids and Silverleaf Whitefly and in brassica leafy vegetables for control of Diamondback Moth. Label extension has been submitted (22-Jan-21) seeking to add new uses for control of Silverleaf Whitefly and Thrips in brassicas and cucurbits.	L Bee:VL	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of Helicoverpa spp. in brassica vegetables, leafy vegetables, Chinese leafy vegetables, fruiting vegetables, celery, cucurbits, sweet corn and pome fruit.	L Bee:H	R3
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, Aphids, Mites and Caterpillars . Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables.	-	-
Methoxyfenozide (Prodigy) Corteva	18	Insect Growth Regulator		P		Controls a range of Lepidopteran pests. Registrations and permits to control Lepidoptera pests in various vegetables including fruiting vegetables and lettuce.	VL Bee:VL	-
Helicoverpa NPV (Vivus Max) AgBiTech	31	Biological		P		Registered in several vegetable groups for control of Lepidoptera pests . Effective on larvae of <7 mm.	VL L-Bees	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered for control of Sigastus Weevil in macadamia and control of Apple Weevil, Fuller's Rose Weevil and Garden Weevil in pome fruit and stone fruit. Also has activity on Lepidoptera.	M Bee:VH	-
Earwigs (<i>Nala lividipes</i>) Priority: Moderate Earwigs were ranked as a moderate priority in VIC & QLD and as a low priority in NSW, WA, SA & TAS. Soil pests can reduce plant establishment, row density and vigour. Symptoms can be confused with other establishment problems and may be worse if seedling development is slow due to climate or other factors. Earwigs, predominantly feed on germinating seed and seedling roots, resulting in poor establishment. Bait sampling prior to planting should be used to determine the presence of earwigs. The use of in-furrow insecticide treatments has been found to be generally ineffective for the protection of newly sown grain crops where dense populations are present. Clean fallows (free from weeds) generally cause pest insect numbers to decline due to a lack of food.								
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs , Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of Earwigs in stone fruit and strawberries.	L Bee:H	R3
Broflanilide (Vedira) BASF	30	Contact & Ingestion		P		Pending registration as an ant bait. It also has potential uses as a seed treatment for the control of Wireworms and other soil pests, and a foliar treatment for the control of chewing pests in various crops. Cimegra® (Broflanilide 100 g/L) is registered in Canada in corn and potatoes for the control of wireworms and corn rootworm applied as an in-furrow treatment at planting.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Rutherglen Bug (<i>Nysius vinitor</i>) Priority: Moderate Rutherglen Bug was ranked as a moderate priority in VIC & QLD and as a low priority in NSW, WA, SA & TAS. They breed up on weeds adjacent to cropping areas. It is important to monitor crops for eggs and nymphs by regular field scouting. Large numbers can cause significant feeding damage to foliage by sucking the sap and depleting the crop of nutrients. Growers should anticipate potential migrations of pests from one finishing crop to another emerging one. Rutherglen Bugs can be controlled by removing the weeds they use as hosts and by ploughing a deep furrow around the emerging crop, preventing wingless nymphs from migrating from weeds or harvested crops.								
Lambda-Cyhalothrin (Karate Zeon) PER11949	3A	Contact	2	A	ALL (excl. VIC)	Permitted for use in beetroot for control of Onion Thrips, Plague Thrips, Rutherglen Bug , Vegetable Loopers and Vegetable Weevil. [Max 2 applications per crop; re-treatment interval 7 d]	VH Bee:H	-
Methomyl (Lannate) PER82428	1A	Contact	7	A	ALL	Permitted for use in beetroot for control of <i>Helicoverpa</i> spp. Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug and Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval 7 d]	H Bee:H	R2
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	7	A	ALL	Registered in root and tuber vegetables for control of Green Peach Aphid, and suppression of Tomato Potato Psyllid and Rutherglen Bug . [Max no. of applications not specified; Re-treatment interval: 7-10 d]	M Bee:VH	-
Trichlorfon (Lepidex)	1B	Contact	2	A	ALL	Registered in vegetables for control of Cabbage White Butterfly, Cabbage Moth, Rutherglen Bug and Green Vegetable Bug. [Max no. of applications not specified; re-treatment interval 7-10 d]	H Bee:H	R2
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. Pending 2021 Australian variation of registration and label approval to extend the uses to include avocados, mangoes, papayas, cucurbits, eggplant, peppers, green beans, potatoes, sweet potatoes for control of Silverleaf Whitefly, Greenhouse Whitefly, Green Peach Aphids, Cotton Aphid, Tropical Fruits: Fruit Spotting Bugs and Planthoppers.	L Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs , Aphids, Mites and Caterpillars. Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables	-	-
Green Vegetable Bug (<i>Nezara viridula</i>) Priority: Moderate								
Green Vegetable Bugs (GVB) were ranked as a moderate priority in QLD and as a low priority in VIC, NSW, WA, SA & TAS. These bugs use their long, thin mouthpart to suck nutrients from the aerial parts of the plant. In Qld there are two GVB generations during the warmer part of the year. The preferred weed hosts of the first, spring generation include turnip weed, wild radish and variegated thistle. The second generation breeds in late summer and early autumn. GVB populations are usually much lower in mid-summer, mainly due to a lack of suitable hosts.								
Dimethoate	1B	Contact	14	A	ALL	Registered in beetroot for control of Aphids, Jassids, Mites, Leafhoppers, Green Vegetable Bug , Thrips and Wingless Grasshopper. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Trichlorfon (Lepidex)	1B	Contact	2	A	ALL	Registered in vegetables for control of Cabbage White Butterfly, Cabbage Moth, Rutherglen Bug and Green Vegetable Bug . [Max no. of applications not specified; re-treatment interval 7-10 d]	H Bee:H	R2
Methomyl (Lannate) PER82428	1A	Contact	7	P-A	ALL	Permitted for use in beetroot for control of <i>Helicoverpa</i> spp. Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug and Thrips including Western Flower Thrips.	H Bee:H	R2
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. Pending 2021 Australian variation of registration and label approval to extend the uses to include avocados, mangoes, papayas, cucurbits, eggplant, peppers, green beans, potatoes, sweet potatoes for control of Silverleaf Whitefly, Greenhouse Whitefly, Green Peach Aphids, Cotton Aphid, Tropical Fruits: Fruit Spotting Bugs and Planthoppers.	L Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs , Aphids, Mites and Caterpillars. Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables. Syngenta submitted for registration May 2020 in conjunction with approval for the active for use in citrus and vegetables for control of various insect and mite pests.	-	-
Jassids / Leafhoppers (Cicadellidae) Priority: Low								
Jassids were ranked as a high priority in NSW, as a moderate priority in VIC and as a low priority in QLD, WA, SA & TAS. Adult and nymph leafhoppers suck sap and inject toxins.								
Dimethoate	1B	Contact	14	A	ALL	Registered in beetroot for control of Aphids, Jassids , Mites, Leafhoppers , Green Vegetable Bug, Thrips and Wingless Grasshopper. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers . Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Petroleum Oil	UN	Contact	NR	A	ALL	Registered in beet for control of Aphids, Mites, Thrips and Leafhopper . [Max. 4 applications per season; re-treatment intervals 14 d]	VL Bee:L	-
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	7	P-A	ALL	Registered in root and tuber vegetables for control of Green Peach Aphid, and suppression of Tomato Potato Psyllid and Rutherglen Bug. US registration for control of Leafhoppers in berries, pome fruit and root and tuber vegetables.	M Bee:VH	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. Pending 2021 Australian variation of registration and label approval to extend the uses to include avocados, mangoes, papayas, cucurbits, eggplant, peppers, green beans, potatoes, sweet potatoes for control of Silverleaf Whitefly, Greenhouse Whitefly, Green Peach Aphids, Cotton Aphid, Tropical Fruits: Fruit Spotting Bugs and Planthoppers.	L Bee:VL	-
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs , Aphids, Mites and Caterpillars. Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables	-	-
Liriomyza Leafminers: Beet Leafminer (<i>Liriomyza chenopodii</i>) Vegetable Leafminer (<i>Liriomyza sativae</i>) Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) Priority: Low Beet Leafminer was ranked as a moderate priority in VIC, NSW, WA & SA and as a low priority in QLD & TAS. Dipteran leaf miners (<i>Liriomyza</i> spp.) are exotic pests that have recently been detected and become problematic in Australia. For example, the Serpentine Leafminer was first detected in the Sydney area in October 2020 and has since been found in crops in SE Qld. As a group they are destructive pests and can cause significant economic loss through reduced yields and quality when uncontrolled.								
Abamectin PER81876	6	Contact & Ingestion	14 NG	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for suppression of Liriomyza Leafminers . [Max 2 applications per crop; Re-treatment interval: 7-14 d]	M Bee:H	-
Cyromazine (Diptex 150 WP) PER81867	17	Insect Growth Regulator	7 NG	A	ALL	Permitted in root and tuber vegetables for control of Liriomyza species, including Vegetable Leafminer (<i>Liriomyza sativa</i>) and Serpentine Leafminer (<i>Liriomyza huidobrensis</i>). [Max. 6 applications per crop; re-treatment interval 7 d]	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinetoram (Success Neo) Corteva PER91155	5	Ingestion	3	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of <i>Liriomyza</i> Leafminers, including Vegetable Leafminer (<i>Liriomyza sativa</i>), Pea Leafminer / Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) & American Serpentine Leafminer (<i>Liriomyza trifolii</i>). [Max. 4 applications per crop; re-treatment interval 7-14 d]		
Spinosad (Entrust Organic) Corteva PER90928	5	Ingestion	3 G:14	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of <i>Liriomyza</i> Leafminers, including Vegetable Leafminer (<i>Liriomyza sativa</i>), Pea Leafminer / Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) & American Serpentine Leafminer (<i>Liriomyza trifolii</i>). [Max. 4 applications per crop; re-treatment interval 4 d]	L Bee:L	-
Chlorantraniliprole (Coragen) FMC PER89353	28	Ingestion	3 NG	P-A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of Fall Armyworm. Registered for control of a broad range of Lepidopteran pests in various vegetables crops. Permitted for control of Leafminers (<i>Liriomyza</i> spp.) in spinach and silverbeet.	L Bee:VL	-
Enamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	P-A	ALL	Registered in root and tuber vegetables including beetroot for control of Diamondback Moth, Cabbage White Butterfly, Heliothis, Cluster Caterpillar and Loopers. Permitted for control of <i>Liriomyza</i> species, including Vegetable Leafminer (<i>Liriomyza sativae</i>) in brassica vegetables.	M Bee:H	-
Cyantraniliprole (Benevia) FMC	28	Ingestion		P		Permitted for use in bulb vegetables, fruiting vegetables (all) and potatoes for control of <i>Liriomyza</i> species, including Vegetable Leafminer (<i>Liriomyza sativae</i>), Pea Leafminer/Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) and American Serpentine Leafminer (<i>Liriomyza trifolii</i>).	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. Pending 2021 Australian variation of registration and label approval to extend the uses to include avocados, mangoes, papayas, cucurbits, eggplant, peppers, green beans, potatoes, sweet potatoes for control of Silverleaf Whitefly, Greenhouse Whitefly, Green Peach Aphids, Cotton Aphid, Tropical Fruits: Fruit Spotting Bugs and Planthoppers.	L Bee:VL	-
Spirotetramat (Movento) Bayer	23	Ingestion		P		Permitted for control of Liriomyza Leafminers in snow peas, sugar snap peas, lettuce, parsley, eggplant, capsicums, chilies, tomatoes, green beans, celery and rhubarb.	M Bee:VL	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered for control of Sigastus Weevil in macadamia and control of Apple Weevil, Fuller's Rose Weevil and Garden Weevil in pome fruit and stone fruit. Also has activity on Leafminers.	M Bee:VH	-
Crickets (Gryllotalpidae)								
Priority: Low								
Crickets were ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. They have a voracious appetite and can cause severe damage to foliage if the numbers get high. Damage is limited to feeding on newly established plants and reducing plant populations.								
Chlorpyrifos	1B	Contact	NR	A	ALL	Registered in beetroot for control of Cutworms, Field Crickets , Mole Crickets , Vegetable Weevil and Wingless Grasshopper. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Fipronil (Regent)	2B	Contact		P		Registered for control of Mole Crickets in potatoes.	M H-Bees	R3
Looper Caterpillar (Geometridae)								
Priority: Low								
Looper caterpillars were ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. The last two larval instars are the most voracious feeders and will usually eat the entire leaf but may avoid the midrib or other large veins.								
<i>Bacillus thuringiensis subsp. Kurstaki</i> (DiPel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Caterpillars, including Loopers . [Apply a minimum of 2 sprays; re-treatment interval 3-5 d]	VL Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in root and tuber vegetables including beetroot for control of Diamondback Moth, Cabbage White Butterfly, Heliothis, Cluster Caterpillar and Loopers . [Max. 4 applications per crop; min. re-treatment interval 7 d]	M Bee:H	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars , Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Lambda-Cyhalothrin (Karate Zeon) PER11949	3A	Contact	2	A	ALL (excl. VIC)	Permitted for use in beetroot for control of Onion Thrips, Plague Thrips, Rutherglen Bug, Vegetable Loopers and Vegetable Weevil. [Max 2 applications per crop; re-treatment interval 7 d]	VH Bee:H	-
Methomyl (Lannate) PER82428	1A	Contact	7	A	ALL	Permitted for use in beetroot for control of <i>Helicoverpa</i> spp. Cucumber Moth, Cluster Caterpillar, Loopers , Webworm, Rutherglen Bug and Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval 7 d]	H Bee:H	R2
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in root and tuber vegetables including beetroot for control of Light Brown Apple Moth, Loopers , Helicoverpa and Potato Moth. [Max 4 applications per crop; re-treatment interval: 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in root & tuber vegetables including beetroot for control of Lightbrown Apple Moth, Loopers , Helicoverpa and Potato Moth. [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-
Chlorantraniliprole (Coragen) FMC PER89353	28	Ingestion	3 NG	P-A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of Fall Armyworm. Registered for control of a broad range of Lepidopteran pests in various vegetables crops. Registered for control of Soybean Looper in brassica vegetables and brassica leafy vegetables.	L Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Flubendiamide (Belt) Bayer	28	Ingestion	1	P-A	ALL	Registered in root and tuber vegetables including beetroot for control of Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillar, Potato Moth and <i>Helicoverpa</i> spp. Registered for control of Soybean Looper in brassica vegetables and brassica leafy vegetables.	L-M Bee:L	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of Soybean Looper in fruiting vegetables.	L Bee:H	R3
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, Aphids, Mites and Caterpillars . Registration submitted May 2021 for isocycloseram to control Mites, Thrips and <i>Helicoverpa</i> in fruiting vegetables.	-	-
Methoxyfenozide (Prodigy) Corteva	18	Insect Growth Regulator		P		Controls a range of Lepidopteran pests. Registrations and permits to control Lepidoptera pests in various vegetables including fruiting vegetables and lettuce.	VL Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
Two Spotted Mite (<i>Tetranychus urticae</i>) Priority: Low								
Two Spotted Mite was ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Mites feed on aerial parts of the plant with the damage caused providing entry points for soil-borne disease. Predatory mites (<i>Phytoseiulus persimilis</i>) which attack two-spotted mites are available commercially.								
<i>Beauveria bassiana</i> (Velifer) BASF	UNF	Biological	NR	A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid and Two-Spotted Spider Mites . [Max. 3 application per crop; re-treatment interval 3-14 d]	L Bee:L	-
Dimethoate	1B	Contact	14	A	ALL	Registered in beetroot for control of Aphids, Jassids, Mites , Leafhoppers, Green Vegetable Bug, Thrips and Wingless Grasshopper. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Petroleum Oil	UN	Contact	NR	A	ALL	Registered in beet for control of Aphids, Mites , Thrips and Leafhopper. [Max. 4 applications per season; re-treatment intervals 14 d]	VL Bee:L	-
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of Aphids, Thrips, Mealybug, Two Spotted Mites , Spider Mite and Whitefly. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Propargite (Omite)	12C	Contact	7	A	ALL	Registered in vegetables for control of Two-Spotted Mites and Spider Mites . [Max. no. of applications not specified; re-treatment interval 10-14 d]	M Bee:L	R3
Sulphur	UN	Contact	NR	A	ALL	Registered in vegetables for control of Mites . [Max. no. of applications not specified; re-treatment interval 14-21 d]	-	-
Abamectin PER81876	6	Contact	14 NG	P-A	ALL (excl. VIC)	Permitted in root and tuber vegetables for the control of <i>Liriomyza</i> spp. Registered for control of Two-Spotted Mite in pome fruit, berries, cotton, cucumber, squash, zucchini, spring onions, shallots, snow peas, sugar snap peas, sweet corn, fruiting vegetables, custard apple, hops, lettuce, lychee, ornamentals, papaya, passionfruit and strawberries.	M Bee:H	-
Spiromesifen (Oberon) Bayer	23	Ingestion		P		Australian Registration pending for control of Mites in various vegetables crops. Hort Innovation project ST19020 is generating data to support a label registration in rhubarb, artichoke, legume vegetables, cucurbits and fruiting vegetables for control of various mites.	M Bee:VL	-
Bifenazate (Acramite) UPL	20D	Contact & Ingestion		P		Registered for control of various mites in almonds, pome fruit, stone fruit, cucurbits, eggplant, pawpaw, pepper, strawberries and tomatoes.	L Bee:H	-
Cyflumetofen (Danisaraba) BASF	25A	Contact		P		BASF is seeking registration in Australia for the control of Spider Mites in various crops.	L Bee:L	-
Etoxazole (Paramite) Sumitomo	10B	Contact		P		Registered for control of Two-Spotted Mites in pome fruit, stone fruit, almonds and grapes.	L Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, Aphids, Mites and Caterpillars. Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables.	-	-
Weevils (Curculionidae) Priority: Low Weevils were ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Can cause damage by tunnelling into leaves and reducing plant vigour. MT16009 IPM Project Recommends: Control broadleaf weed hosts (e.g., marshmallow) in the season prior to planting.								
Chlorpyrifos	1B	Contact	NR	A	ALL	Registered in beetroot for control of Cutworms, Field Crickets, Mole Crickets, Vegetable Weevil and Wingless Grasshopper. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Lambda-Cyhalothrin (Karate Zeon) PER11949	3A	Contact	2	A	ALL (excl. VIC)	Permitted for use in beetroot for control of Onion Thrips, Plague Thrips, Rutherglen Bug, Vegetable Loopers and Vegetable Weevil . [Max 2 applications per crop; re-treatment interval 7 d]	VH Bee:H	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of Weevils in pome fruit and stone fruit.	L Bee:H	R3
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, Aphids, Mites and Caterpillars. Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables.	-	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/ Weevils , Fruit Fly and Thrips.	-	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered for control of Sigastus Weevil in macadamia and control of Apple Weevil, Fuller's Rose Weevil and Garden Weevil in pome fruit and stone fruit.	M Bee:VH	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Wireworms (Tenebrionidae) Priority: Low Wireworms were ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Larvae attack germinating seeds, the hypocotyl, roots and at the surface of young plants resulting in seedling death and patchy plant stands. The adult beetles can also damage seedlings by chewing at or just above ground level. Soil pests can reduce plant establishment, row density and vigour. Symptoms can be confused with other establishment problems and may be worse if seedling development is slow due to climate or other factors. Soil pests predominantly feed on germinating seed and seedling roots, resulting in poor establishment. Bait sampling prior to planting should be used to determine the presence of soil pests in beetroot (Wireworms, Earwigs & Cutworms). Clean fallows (free from weeds) generally cause pest insect numbers to decline due to a lack of food. Infestations of wireworm larvae detected after crop emergence cannot be controlled with baiting or surface spraying. Therefore, this pest must be detected before planting for control actions to be effective.								
1,3-dichloropropene + Chloropicrin + (Telone C-35)	8	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of Wireworms . Leave soil undisturbed at least 7 days after treatment. Aerate for a minimum of 21 days before planting. <i>For use by professional and registered fumigators only.</i>	-	-
Broflanilide (Vedira) BASF	30	Contact & Ingestion		P		Pending registration as an ant bait. It also has potential uses as a seed treatment for the control of Wireworms and other soil pests, and a foliar treatment for the control of chewing pests in various crops. Cimegra® (Broflanilide 100 g/L) is registered in Canada in corn and potatoes for the control of Wireworms and Corn Rootworm applied as an in-furrow treatment at planting.	-	-
Beet Cyst Nematode (<i>Heterodera schachtii</i>) Priority: Low Beet Cyst Nematode was ranked as a low priority in WA. Soil-borne nematodes are minute, worm-like animals that can invade plant roots near the root tip. Affected plants have an unthrifty appearance and often show symptoms of stunting, wilting or chlorosis. Management options include soil fumigation and crop rotation.								
1,3-dichloropropene + Chloropicrin + (Telone C-35)	8	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of soil borne pests including Nematodes . Leave soil undisturbed at least 7 days after treatment. Aerate for a minimum of 21 days before planting. <i>For use by professional and registered fumigators only.</i>	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Registered as a pre-plant fumigant in seed beds for control of Soil fungi, Nematodes , soil insects and weeds. Apply granules to the soil surface and incorporate and seal the soil surface immediately. Do not plant into soil until a positive germination test has been conducted.	-	-
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of Plant Parasitic Nematodes , weed seeds, and various fungal diseases. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	-	-
Abamectin (Tervigo) Syngenta	N-2	Contact		P		Registered for control of Root-Knot Nematode in peppers, chillis, cucurbits, eggplant and tomatoes.	M Bee:H	-
Fluazaindolizine (Reklamel, Salibro) Corteva	UN			P		Development underway in AU, to be launched globally in 2021. New MOA nematicide from Corteva. Submitted for registration December 2019 and includes control of nematodes in root and tuber vegetables, including beetroot.	-	-
Fluensulfone (Nimitz) Adama	UN	Contact		P		Registered for control of Root-Knot Nematode in peppers, carrot, chilli, cucurbits, eggplant, okra, potato, sugarcane, sweet potato and tomato.	L Bee:L	-
Fluopyram (Velum) Bayer	N-3			P		Registration pending for control of nematodes in various crops. US registration for control of nematodes in a range of vegetables.	L Bee:L	-
NUL3145 Nufarm	TBC			P		New product in development from Nufarm with activity on Scale, nematodes , Mealybug and Whitefly.		-
SYNSTN1 Syngenta	TBC			P		Nematicide in development from Syngenta.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Fall Armyworm (<i>Spodoptera frugiperda</i>) Priority: Unknown Fall Armyworm was not ranked as a pest in Beetroot. It is an exotic pest that is considered a potential threat that could affect most vegetable crops if allowed to spread. It is important to monitor crops for eggs and larvae of pest species by regular field scouting. Target sprays against mature eggs and newly hatched larvae before pests become entrenched.								
Chlorantraniliprole (Coragen) FMC PER89353	28	Ingestion	3 NG	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of Fall Armyworm . [Max 3 applications per crop; re-treatment interval 7-14 d]	L Bee:VL	-
Emamectin (Proclaim Opti) Syngenta PER89263	6	Ingestion	3	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of Fall Armyworm . [Max 4 applications per crop; re-treatment interval 7 d]	M Bee:H	-
Spinetoram (Success Neo) Corteva PER89241	5	Ingestion	3	A	ALL (excl. VIC)	Permitted for use in root and tuber vegetables for control of Fall Armyworm . [Max. 4 applications per crop; re-treatment interval 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva PER89870	5	Ingestion	3 G:14	A	ALL (excl. VIC)	Permitted for use in root and tuber vegetables for control of Fall Armyworm . [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-
<i>Spodoptera frugiperda</i> Multiple Nucleopolyhedrovirus (Fawligen) AgBiTech PER90820	31	Biological	NR	A	ALL	Permitted for use in root & tuber vegetables for control of Fall Armyworm . [Max 10 applications per crop; Min. re-treatment interval 3 d]	VL Bee:L	-
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, Aphids, Mites and Caterpillars . Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Amorphous Silica (Abrade)	-	Contact		P		Permitted for control of Fall Armyworm in sweet corn.	L Bee:L	-
Broflanilide (Vedira) BASF	30	Contact & Ingestion		P		Registration submitted concurrently in Australia, Canada, USA, and Mexico as a soil application and seed treatment against chewing insects such as ants, cockroaches and <i>Spodoptera spp.</i> BASF are seeking registrations in amenity turf initially, then potential horticultural crops thereafter.	H Bee:VH	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Permitted for control of Fall Armyworm in sweet corn.	L Bee:H	R3

4.3 Weeds in Beetroot

4.3.1 Weed priorities

Common Name	Scientific Name
High	
Wild Turnip	<i>Brassica tournefortii</i>
Common Sowthistle	<i>Sonchus oleraceus</i>
Fat Hen	<i>Chenopodium album</i>
Red-Root Amaranth	<i>Amaranthus</i> spp.
Marshmallow	<i>Malva parviflora</i>
Moderate	
Wireweed	<i>Polygonaceae</i> spp.
Caltrop	<i>Tribulus terrestris</i>
Chickweed	<i>Stellaria media</i>
Stinging Nettle	<i>Urtica</i> spp.
Nutgrass	<i>Cyperus rotundus</i>
Potato Weed	<i>Galinsoga</i> spp.
Shepherd's Purse	<i>Capsella bursa-pastoris</i>
Grass Weeds	Various species

The high priority weed issues based on the feedback received were Wild Turnip, Common Sowthistle, Fat Hen, Red-Root Amaranth and Marshmallow. Herbicide options are listed in Appendix 3 which can be used in conjunction with various management practices such as soil fumigation, pre-crop spraying, spot spraying and mechanical controls.

Growers generally use a pre-plant weed control (general knockdown herbicides) to prepare the paddock. Growers then either alternate the herbicides used or use them in combination for effective weed control.

Resistance management

Specific resistance management strategies for high resistance risk (A and B) and moderate resistance risk (C, D, F, G, I, J, K, L, M, N, Q and Z) herbicide modes of action are available on the CropLife Australia webpage⁸.

⁸ <https://www.croplife.org.au/resources/programs/resistance-management/herbicide-resistance-management-strategies-2/>

4.3.2 Available and potential products for weed control

TABLE KEY: Note that blank fields in the table indicate no information has been provided.

Availability			
A	Available via either registration or permit approval		
P	Potential – a possible candidate to pursue for registration or permit		
P-A	Potential, already approved in the crop for another use		
Resistance risk		Regulatory risk (refer to Appendix 6)	
		R1	Short-term: Critical concern over retaining access
**	Moderate resistance risk	R2	Medium-term: Maintaining access of significant concern
***	High resistance risk	R3	Long-term: Potential issues associated with use - Monitoring required
Withholding Period (WHP) – Number of days from last treatment to harvest (H) or Grazing (G)			
Harvest	H	Not Required when used as directed	NR
Grazing	G	No Grazing Permitted	NG

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Wild Turnip (<i>Brassica tournefortii</i>) Priority: High							
Wild Turnip was ranked as a high priority in QLD & WA and as a moderate priority in TAS. Winter growing weed that competes aggressively with crops and runs to seed quickly.							
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Wild Turnip in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Common Sowthistle (<i>Sonchus oleraceus</i>)							
Priority: High							
Common Sow thistle was ranked as a high priority in QLD & NSW and as a moderate priority in VIC, WA, SA & TAS. Spring to autumn are the best times to control Thistle. Spraying at early stages of growth is the most effective.							
Chloridazon (Pyramin) BASF	C**	Red Beet / Pre-Emergent	Registered in red beet for control of grass and broadleaf weeds, including Sowthistle .	NR	A	ALL	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Beetroot / Post-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Common Sowthistle . Do not apply before the crop has at least 2 true leaves. [Max. 1 application per crop]	56	A	ALL	R3
Propachlor (Ramrod) Nufarm	K**	Beetroot / Pre-Emergent	Registered in beetroot for control of Potato Weed. Registered for control of grass and broadleaf weeds, including Milk Thistle in maize, sorghum, sweet corn, onions, broccoli, brussel sprouts, cabbages, cauliflower and Chinese cabbage.	NR	P-A	ALL	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Sowthistle , as a pre-emergence application in various vegetable crops.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including Sowthistle in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including Sowthistle in berries, tomatoes, beans and fallow.		P		R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Sowthistle in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Sowthistle in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including Sowthistle in Brassica vegetables and beans.		P		-
Fat Hen (<i>Portulaca oleracea</i>) Priority: High Fat Hen was ranked as a high priority in QLD & NSW and as a moderate priority in VIC, WA, SA & TAS. Herbicide control can be difficult and targeting weeds at early growth stages is critical.							
Chloridazon (Pyramin) BASF	C**	Red Beet / Pre-Emergent	Registered in red beet for control of grass and broadleaf weeds, including Fat Hen .	NR	A	ALL	-
Ethofumesate (Tramat)	J**	Beet Crops / Pre-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Fat Hen .	NR	A	ALL	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Beetroot / Post-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Fat Hen . Do not apply before the crop has at least 2 true leaves. [Max. 1 application per crop]	56	A	ALL	R3
Propachlor (Ramrod) Nufarm	K**	Beetroot / Pre-Emergent	Registered in beetroot for control of Potato Weed. Registered for control of grass and broadleaf weeds, including Fat Hen in maize, sorghum, sweet corn, onions, broccoli, brussels sprouts, cabbages, cauliflower and Chinese cabbage.	NR	P-A	ALL	R3

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Aclonifen (Emerger) Bayer	H**	Pre-Emergence	Bayer is expected to seek registration for pre-emergent control of grass and broadleaf weeds in various vegetable crops. Registered in Europe for use in potatoes, legume vegetables and cereals. Fat Hen is listed as susceptible.		P		-
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Fat Hen , as a pre-emergence application in various vegetable crops.		P		-
Clomazone	Q**		Registered for control of broadleaf weeds including Fat Hen in beans, poppies, potato and tobacco transplants.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including Fat Hen in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Glufosinate- Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including Fat Hen in berries, tomatoes, beans and fallow.		P		R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Fat Hen in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Fat Hen in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including Fat Hen in Brassica vegetables and beans.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Red-Root Amaranth (<i>Amaranthus</i> spp.) Priority: High							
Red-Root Amaranth was ranked as a high priority in QLD & WA and as a moderate priority in VIC, NSW, SA & TAS. It is a short-lived annual weed that can pose a problem every year as they are prolific seed producers.							
Ethofumesate (Tramat)	J**	Beet Crops / Pre-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Amaranthus .	NR	A	ALL	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Beetroot / Post-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Amaranthus . Do not apply before the crop has at least 2 true leaves. [Max. 1 application per crop]	56	A	ALL	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Green Amaranth , as a pre-emergence application in various vegetable crops.		P		-
Clomazone	Q**		Registered for control of broadleaf weeds including suppression of Amaranthus in beans, poppies, potato and tobacco transplants.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including Amaranthus in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including Amaranthus in berries, tomatoes, beans and fallow.		P		R3
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including suppression of Redroot Amaranth in Brassica vegetables, maize, sweet corn, sorghum and sugarcane.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Marshmallow (<i>Malva parviflora</i>) Priority: High							
Marshmallow was ranked as a high priority in QLD and as a moderate priority in VIC, NSW, WA, SA & TAS. Adapted to a wide variety of environments and highly competitive weed. Control with knockdown herbicides can be unreliable.							
Chloridazon (Pyramin) BASF	C**	Red Beet / Pre-Emergent	Registered in red beet for control of grass and broadleaf weeds, including Marshmallow .	NR	A	ALL	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Small Flowered Mallow in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Wireweed (<i>Polygonaceae</i> spp.) Priority: Moderate							
Wireweed was ranked as a high priority in NSW, SA & TAS and as a moderate priority in VIC, QLD & WA. Wireweed needs a period of low soil temperature to germinate, but its long taproot allows it to persist through hot, dry weather. A second post-emergent herbicide spraying should help manage its late emergence and a rotation to renovation crops may be required to clean up heavily infested paddocks.							
Ethofumesate (Tramat)	J**	Beet Crops / Pre-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Wireweed .	NR	A	ALL	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Wireweed , as a pre-emergence application in various vegetable crops.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Wireweed in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Wireweed in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including suppression of Wireweed in Brassica vegetables.		P		-
Caltrop (<i>Tribulus terrestris</i>) Priority: Moderate							
Caltrop was ranked as a high priority in VIC and as a moderate priority in NSW. Caltrop is a flat, sprawling, summer-growing, annual weed that tolerates drought and frost. The tough seed gets spread widely via farm machinery. Targeting weeds at early growth stages is critical.							
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Caltrop , as a pre-emergence application in various vegetable crops.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Caltrop in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Caltrop in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including Caltrop in maize, sweet corn, sorghum and sugar cane.		P		-
Chickweed (<i>Stellaria media</i>) Priority: Moderate							
Chickweed was ranked as a high priority in WA and as a moderate priority in VIC. A low growing, winter annual weed that can continue growing all through summer. Targeting weeds prior to flowering is critical.							
Chloridazon (Pyramin) BASF	C**	Red Beet / Pre-Emergent	Registered in red beet for control of grass and broadleaf weeds, including Chickweed .	NR	A	ALL	-
Ethofumesate (Tramat)	J**	Beet Crops / Pre-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Chickweed .	NR	A	ALL	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Beetroot / Post-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Chickweed . Do not apply before the crop has at least 2 true leaves. [Max. 1 application per crop]	56	A	ALL	R3
Propachlor (Ramrod) Nufarm	K**	Beetroot / Pre-Emergent	Registered in beetroot for control of Potato Weed. Registered for control of grass and broadleaf weeds, including Chickweed in maize, sorghum, sweet corn, onions, broccoli, brussel sprouts, cabbages, cauliflower and Chinese cabbage.	NR	P-A	ALL	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Chickweed , as a pre-emergence application in various vegetable crops.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Chickweed in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Chickweed in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including Chickweed in Brassica vegetables.		P		-
Stinging Nettle (<i>Urtica</i> spp.) Priority: Moderate							
Stinging Nettle was ranked as a high priority in WA and as a moderate priority in VIC & TAS. This is a soft herb whose leaves are sparsely covered with rigid, stinging hairs.							
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Propachlor (Ramrod) Nufarm	K**	Beetroot / Pre- Emergent	Registered in beetroot for control of Potato Weed. Registered for control of grass and broadleaf weeds, including Stinging Nettle in maize, sorghum, sweet corn, onions, broccoli, brussel sprouts, cabbages, cauliflower and Chinese cabbage.	NR	P-A	ALL	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Stinging Nettle , as a pre-emergence application in various vegetable crops.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Stinging Nettle in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including Stinging Nettle in Brassica vegetables.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Nutgrass (<i>Cyperus rotundus</i>) Priority: Moderate							
Nutgrass was ranked as a moderate priority in VIC & NSW. Prefers damp, water-logged soils but can survive for years underground during dry times. Herbicide options are limited and unreliable. Improve soil drainage if possible.							
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of Nutgrass in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
Potato Weed (<i>Galinsoga</i> spp.) Priority: Moderate							
Potato Weed was ranked as a moderate priority in WA. Potato weed is spread via seed, producing several generations in one year that can remain dormant for some time. It forms a dense mat, outcompeting newly germinating crop seedlings. Cultivation is an option to supplement herbicide use.							
Chloridazon (Pyramin) BASF	C**	Red Beet / Pre-Emergent	Registered in red beet for control of grass and broadleaf weeds, including Potato Weed .	NR	A	ALL	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Beetroot / Post-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Potato Weed . Do not apply before the crop has at least 2 true leaves. [Max. 1 application per crop]	56	A	ALL	R3
Propachlor (Ramrod) Nufarm	K**	Beetroot / Pre-Emergent	Registered in beetroot for control of Potato Weed . [Max. no. of applications not specified]	NR	A	ALL	R3
NUL3438 Nufarm	NEW		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Potato Weed in Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including Potato Weed in Brassica vegetables, beans and sweet potato.		P		-
Shepherd's Purse (<i>Capsella bursa-pastoris</i>) Priority: Moderate Shepherd's Purse was ranked as a moderate priority in VIC. Shepherd's purse is an annual weed that has seeds which can remain dormant for several years.							
Chloridazon (Pyramin) BASF	C**	Red Beet / Pre-Emergent	Registered in red beet for control of grass and broadleaf weeds, including Shepherd's Purse .	NR	A	ALL	-
Ethofumesate (Tramat)	J**	Beet Crops / Pre-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Shepherd's Purse .	NR	A	ALL	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Beetroot / Post-Emergent	Registered in beetroot for control of grass and broadleaf weeds, including Shepherd's Purse . Do not apply before the crop has at least 2 true leaves. [Max. 1 application per crop]	56	A	ALL	R3
Propachlor (Ramrod) Nufarm	K**	Beetroot / Pre-Emergent	Registered in beetroot for control of Potato Weed. Registered for control of grass and broadleaf weeds, including Shepherd's Purse in maize, sorghum, sweet corn, onions, broccoli, brussel sprouts, cabbages, cauliflower and Chinese cabbage.	NR	P-A	ALL	R3
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including Shepherd's Purse in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Shepherd's Purse in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including Shepherd's Purse in Brassica vegetables, culinary herbs, rhubarb, spinach, silverbeet, spring onions, beans, sweet corn, sweet potato and fallow.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Shepherd's Purse in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including Shepherd's Purse in Brassica vegetables.		P		-

Grass Weeds (Poaceae)

Priority: Moderate

Grass Weeds were ranked as a high priority in TAS and as a moderate priority in VIC & NSW. Grass weeds compete aggressively with the crop and usually require ongoing control measures.

Chloridazon (Pyramin) BASF	C**	Red Beet / Pre-Emergent	Registered in red beet for control of grass and broadleaf weeds.	NR	A	ALL	-
Clethodim (Select)	A***	Beetroot / Post-Emergent	Registered in Beetroot for control of grass weeds. Weeds should be 2-5 leaf stage. [Max. no. of applications not specified]	49	A	ALL	R3
Ethofumesate (Tramat)	J**	Beet Crops / Pre-Emergent	Registered in beetroot for control of grass and broadleaf weeds.	NR	A	ALL	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Beetroot / Post-Emergent	Registered in beetroot for control of grass and broadleaf weeds. Do not apply before the crop has at least 2 true leaves. [Max. 1 application per crop]	56	A	ALL	R3

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Quizalofop-P-Ethyl	A***	Beetroot / Post Emergent	Registered in beetroot for control of grass weeds. Apply when weeds are actively growing. [Max no of applications not specified]	14	A	ALL	R3
Sethoxydim (Sertin)	A***	Red Beet / Post- Emergent	Registered in red beet for control of grass weeds. Apply when weeds at 2-6 leaf stage and actively growing. [Max no of applications not specified]	28	A	ALL	-
Propachlor (Ramrod) Nufarm	K**	Beetroot / Pre- Emergent	Registered in beetroot for control of Potato Weed. Registered for control of grass and broadleaf weeds in maize, sorghum, sweet corn, onions, broccoli, brussel sprouts, cabbages, cauliflower and Chinese cabbage.	NR	P-A	ALL	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds as a pre-emergence application in various vegetable crops.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Glufosinate- Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds in berries, tomatoes, beans and fallow.		P		R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds in Brassica vegetables, culinary herbs, rhubarb, spinach, silverbeet, spring onions, beans, sweet corn, sweet potato and fallow.		P		-

5. References

5.1 Information:

AgChem Access Priority Access Forum	https://www.agrifutures.com.au/national-rural-issues/agvet-chemicals/
Australian Pesticide and Veterinary Medicines Authority	www.apvma.gov.au
APVMA Chemical review	https://apvma.gov.au/chemicals-and-products/chemical-review/listing
APVMA MRLs	www.legislation.gov.au/Details/F2021C00634
APVMA Permit search	https://productsearch.apvma.gov.au/permits
APVMA Product search	https://productsearch.apvma.gov.au/products
AUSVEG	https://ausveg.com.au
Codex MRL database	http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/
Cotton Pest Management Guide 2020-21	https://www.cottoninfo.com.au/publications/cotton-pest-management-guide
CropLife Australia (resistance management)	https://www.croplife.org.au/resources/programs/resistance-management/
Growcom – Infopest Database	www.infopest.com.au
Hort Innovation	www.horticulture.com.au

5.2 Abbreviations and Definitions:

APVMA	Australian Pesticides and Veterinary Medicines Authority
IPM	Integrated pest management
LOQ	Limit of quantification
MRL	Maximum residue limit (mg/kg or ppm)
Pesticides	Plant protection products (fungicide, insecticide, herbicide, nematicides, rodenticides, etc.).
Plant pests	Diseases, insects, nematodes, rodents, viruses, weeds, etc.
SARP	Strategic Agrichemical Review Process
TBC	To be confirmed
WHP	Withholding Period

5.3 Acknowledgements:

Thanks go to the many industry people who contributed information and collaborated on the review of this report.

6. Appendices:

- Appendix 1. Products available for disease control in beetroot
- Appendix 2. Products available for control of insects and mites in beetroot
- Appendix 3. Products available for weed control in beetroot
- Appendix 4. Current permits for use in beetroot
- Appendix 5. Beetroot Maximum Residue Limits (MRLs)
- Appendix 6. Beetroot Agrichemical Regulatory Risk Assessment

Appendix 1. Products available for disease control in beetroot

Active Ingredient (Trade Name)	Chemical group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
1,3-dichloropropene + Chloropicrin + (Telone C-35)	8B	Vegetables / Soil fumigant	Plant parasitic nematodes, symphylans, wireworms, soil borne diseases (including <i>Fusarium</i> , <i>Verticillium</i> wilts, <i>Rhizoctonia</i> , & <i>Pythium</i>) and suppression of weeds. <i>For use by professional and registered fumigators only.</i>	ALL	NR	-
Boscalid (Filan) BASF	7	Root & Tuber Vegetables	Sclerotinia Rot	ALL	7	-
Chlorothalonil (Bravo) PER82895	M5	Beetroot	<i>Alternaria</i> spp., <i>Botrytis</i> spp., <i>Cercospora</i> Leaf Spot and <i>Phoma</i> Leaf Spot	ALL (excl. VIC)	7	R3
Copper	M1	Red Beet	Downy Mildew & Rust	All	1	-
Dazomet (Basamid)	8F	General soil fumigant	Pre-plant fumigant in seed beds for control of soil fungi including <i>Pythium</i> , <i>Phytophthora</i> , <i>Sclerotinia</i> , <i>Sclerotium</i> , <i>Rhizoctonia</i> , <i>Verticillium</i> , <i>Plasmodiophora</i> , <i>Armillaria</i> and <i>Fusarium</i> spp. Nematodes, plus insects, weeds & soil fungi	ALL	NR	-
Difenoconazole (Digger) Nufarm	3	Beetroot	<i>Alternaria</i> Leaf Spot & <i>Cercospora</i> Leaf Spot	ALL	7	R3
Iodine	-	Beetroot	Post-Harvest Sanitiser – Bacteria and Fungi	ALL	NR	-
Iprodione (Rovral) PER81589	2	Beetroot	<i>Alternaria</i> Leaf Spot, <i>Sclerotinia</i> Rot, Grey Mould	ALL (excl. VIC)	14 G:7	R2
Mancozeb	M3	Beetroot	<i>Cercospora</i> Leaf Spot & Downy Mildew	ALL	14	R2
Mancozeb + Dimethomorph (Acrobat) PER14958	M3 + 40	Beetroot	Downy Mildew and <i>Alternaria</i> Leaf Spots	ALL (excl. VIC)	14 NG	R2

Active Ingredient (Trade Name)	Chemical group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
Mancozeb + Metalaxyl (Ridomil Gold MZ) Syngenta PER14045	M3 + 4	Beetroot	Downy Mildew and Alternaria Leaf Spots	ALL (excl. VIC)	14	R2
Metalaxyl-M (Apron)	4	Beetroot / Seed Treatment	Damping Off	ALL	NR	-
Metalaxyl-M + Azoxystrobin (Uniform) PER90595	4+11	Beetroot	Pythium and Rhizoctonia	ALL (excl. VIC)	NR	-
Metham Sodium	-	Food Crops / Pre-Plant Fumigant	Fungal diseases including <i>Rhizoctonia</i> , <i>Pythium</i> , <i>Fusarium</i> , <i>Phytophthora</i> , <i>Verticillium</i> , <i>Sclerotinia</i> and Club Root of crucifers & Nematodes	ALL	NR	-
Penthiopyrad (Fontelis) Corteva	7	Beetroot	Early Blight (<i>Alternaria</i> spp.) and Powdery Mildew (<i>Erisiphe</i> spp.)	ALL	7	-
Phosphorous Acid PER14184	33	Beetroot	Damping Off	ALL (excl. VIC)	1	-
Propiconazole (Tilt) PER14479	3	Beetroot	Cercospora Leaf Spot	ALL (excl. VIC)	1	R3
<i>Streptomyces lydicus</i> WYEC108 (Actinovate) Novozymes Bioag	BM 02	Vegetables	As a seed treatment for <i>Fusarium</i> , <i>Rhizoctonia</i> & <i>Pythium</i> Management	ALL	NR	-
Sulphur	M2	Vegetables	Powdery Mildew and Rust	ALL	NR	-
Tebuconazole	3	Beetroot	Sclerotinia Rot	ALL	35 NG	R3
Tolclofos-Methyl (Rizolex) Sumitomo	14	Beetroot	<i>Rhizoctonia</i> spp.	QLD & NSW	NR	-

Active Ingredient (Trade Name)	Chemical group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
Trifloxystrobin (Flint) PER14891	11	Beetroot	Alternaria Leaf Spot, Cercospora Leaf Spot	ALL (excl. VIC)	7 G:7	-
Zineb	M3	Beets	Cercospora Leaf Spot	ALL	7	R2

Appendix 2. Products available for control of insects and mites in beetroot

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory risk
1,3-dichloropropene + Chloropicrin + (Telone C-35)	8	Vegetables	Soil borne pests including Nematodes. <i>For use by professional and registered fumigators only.</i>	ALL	NR	-
Abamectin PER81876	6	Root & Tuber vegetables	Suppression of Liriomyza Leafminers including Vegetable Leafminer & Serpentine Leafminer	ALL (excl. VIC)	14 NG	-
<i>Bacillus thuringiensis subsp. kurstaki</i> (DiPel)	11A	Vegetables	Lepidoptera	ALL	NR	-
<i>Beauveria bassiana</i> (Velifer) BASF	UNF	Protected vegetables and ornamentals	Suppression of various pests including Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites.	ALL	NR	-
Chlorantraniliprole (Coragen) FMC PER89353	28	Root & Tuber vegetables	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	3 NG	-
Chlorpyrifos	1B	Beetroot	Cutworms, Field Crickets, Mole Crickets, Vegetable Weevil, Wingless Grasshopper	ALL	NR	R1
Cyromazine (Diptex 150WP) PER81867	17	Root & Tuber vegetables	Liriomyza Leafminers	ALL	7 NG	-
Dazomet (Basamid)	8F	Soil fumigant	Soil fungi, Nematodes, soil insects and weeds.	ALL	NR	-
Diazinon	1B	Beetroot	Webworm	ALL (excl. TAS)	14	R3
Dimethoate	1B	Beetroot	Aphids, Jassids, Mites, Leafhoppers, Green Vegetable Bug, Thrips, Wingless Grasshopper Leaf Mining Fly	ALL NSW	14	R1

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory risk
Emamectin (Proclaim Opti) Syngenta	6	Root & Tuber Vegetables including Beetroot	Diamondback Moth, Cabbage White Butterfly, Heliothis, Cluster Caterpillar, Loopers	ALL	3 NG	-
Emamectin (Proclaim Opti) Syngenta PER89263	6	Root & Tuber Vegetables	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	3	-
Emulsifiable Botanical Oil (Eco-Oil)	-	Vegetables	Greenhouse Whitefly	ALL	NR	-
Flubendiamide (Belt) Bayer	28	Root & Tuber Vegetables including Beetroot	Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillar, Potato Moth and <i>Helicoverpa</i> spp.	ALL	1	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Vegetables	Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers	ALL	1	-
Imidacloprid PER81260	4A	Beetroot	Aphids, Thrips (excluding Western Flower Thrips)	ALL (excl. VIC)	3	R2
Lambda-Cyhalothrin (Karate Zeon) PER11949	3A	Beetroot	Onion Thrips, Plague Thrips, Rutherglen Bug, Vegetable Loopers, Vegetable Weevil	ALL (excl. VIC)	2	-
Metham Sodium	-	Pre-Plant Soil Fumigant	Plant parasitic Nematodes, weed seeds, and various fungal diseases	ALL	NR	-
Methomyl (Lannate) PER82428	1A	Beetroot	<i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug, Thrips including Western Flower Thrips	ALL	7	R2
Petroleum Oil	-	Beet	Aphids, Mites, Thrips & Leafhopper	ALL	NR	-
Pirimicarb (Aphidex)	1A	Beetroot	Green Peach Aphid	ALL	2	R3
Potassium Salts of Fatty Acids (Natrasoap)	-	Vegetables	Aphids, Thrips, Mealybug, Two Spotted Mites, Spider Mite and Whitefly	ALL	NR	-

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory risk
Propargite (Omite)	12C	Vegetables	Two-Spotted Mites & Spider Mites.	ALL	7	R3
Pymetrozine (Chess) Syngenta	9B	Beetroot	Potato Aphid & Green Peach Aphid	ALL	14	R3
Spinetoram (Success Neo) Corteva	5	Root & Tuber Vegetables including Beetroot	<i>Helicoverpa</i> spp., Lightbrown Apple Moth, Loopers, Potato Moth, Tomato Potato Psyllid	ALL	3	-
Spinetoram (Success Neo) Corteva PER89241	5	Root & Tuber Vegetables	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	3	-
Spinetoram (Success Neo) Corteva PER84757	5	Root & Tuber Vegetables	Tomato Potato Psyllid (<i>Bactericera cockerelli</i>)	ALL (excl. VIC)	3	-
Spinetoram (Success Neo) Corteva PER91155	5	Root & Tuber Vegetables	Liriomyza Leafminers, including Vegetable Leafminer (<i>Liriomyza sativa</i>), Pea Leafminer / Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) & American Serpentine Leafminer (<i>Liriomyza trifolii</i>)	ALL (excl. VIC)	3	-
Spinosad (Entrust Organic) Corteva	5	Root & Tuber Vegetables including Beetroot	Lightbrown Apple Moth, Loopers, <i>Helicoverpa</i> spp. & Potato Moth	ALL	3 G:14	-
Spinosad (Entrust Organic) Corteva PER89870	5	Root & Tuber Vegetables	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	3 G:14	-
Spinosad (Entrust Organic) Corteva PER90928	5	Root & Tuber Vegetables	Liriomyza Leafminers, including Vegetable Leafminer (<i>Liriomyza sativa</i>), Pea Leafminer / Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) & American Serpentine Leafminer (<i>Liriomyza trifolii</i>)	ALL (excl. VIC)	3 G:14	

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP Days	Regulatory risk
<i>Spodoptera frugiperda</i> Multiple Nucleopolyhedrovirus (Fawligen) AgBiTech PER90820	31	Root & Tuber Vegetables	Fall Armyworm	ALL	NR	-
Sulfoxaflor (Transform) Corteva	4C	Root & Tuber Vegetables	Green Peach Aphid, and suppression of Tomato Potato Psyllid and Rutherglen Bug	ALL	7	-
Sulfoxaflor (Transform) Corteva PER84743	4C	Root & Tuber Vegetables	Tomato Potato Psyllid	ALL (excl. VIC)	7	-
Sulphur	UN	Vegetables	Mites	ALL	NR	-
Trichlorfon (Lepidex)	1B	Vegetables	Cabbage White Butterfly, Cabbage Moth, Rutherglen Bug & Green Vegetable Bug	ALL	2	R2

Appendix 3. Products available for weed control in beetroot

Active Ingredient (Trade Name)	Chemical Group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory risk
1,3-dichloropropene + Chloropicrin + (Telone C-35)	8	Vegetables	Plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases and suppression of weeds. <i>For use by professional and registered fumigators only.</i>	NR	ALL	-
Chloridazon (Pyramin) BASF	C**	Red Beet / Pre-Emergent	Grass and Broadleaf Weeds	NR	ALL	-
Clethodim (Select)	A***	Beetroot / Post-Emergent	Grass Weeds	49	ALL	-
Ethofumesate (Tramat)	J**	Beet Crops / Pre-Emergent	Grass and Broadleaf Weeds	NR	ALL (excl. WA)	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Grass and Broadleaf Weeds	NR	ALL	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Grass and Broadleaf Weeds	7	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Beetroot / Post-Emergent	Grass and Broadleaf Weeds	56	ALL	R3
Propachlor (Ramrod) Nufarm	K**	Beetroot / Pre-Emergent	Potato Weed	NR	ALL	-
Quizalofop-P-Ethyl	A***	Beetroot / Post Emergent	Grass Weeds	14	ALL	-
Sethoxydim (Sertin)	A***	Red Beet / Post-Emergent	Grass Weeds	28	ALL	-

Chemical Group Resistance Risk: ** Moderate, *** High

Appendix 4. Current permits for use in beetroot

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER81876 Version 4	Abamectin / Root and tuber vegetables / Liriomyza Leafminers	24-Jun-16	30-Apr-24	Hort Innovation
PER89353 Version 2	Chlorantraniliprole (Coragen) / Root & Tuber Vegetables / Fall Armyworm	05-May-20	31-May-23	Hort Innovation
PER82895 Version 2	Chlorothalonil (Bravo) / Beetroot / Various Leaf Diseases	04-Aug-17	31-Aug-25	Hort Innovation
PER81867 Version 2	Cyromazine (Diptex 150 WP) / Root & tuber vegetables / Liriomyza Leafminers	02-Dec-19	30-Nov-23	Hort Innovation
PER89263 Version 2	Emamectin (Proclaim Opti) / Root & tuber vegetables / Fall Armyworm	10-Mar-20	31-Mar-23	Hort Innovation
PER81260 Version 3	Imidacloprid / Beetroot / Aphids & Thrips	01-Dec-15	31-Jul-25	Hort Innovation
PER81589 Version 3	Iprodione / Beetroot, beetroot leaves / Sclerotinia Rot, Grey Mould, Alternaria Leaf Spot	21-Sep-16	31-Jun-26	Hort Innovation
PER11949 Version 4	Lambda-Cyhalothrin (Karate Zeon) / Beetroot / Onion Thrips, Plague Thrips, Rutherglen Bug, Vegetable Loopers, Vegetable Weevil	01-Apr-10	31-Mar-25	Hort Innovation
PER14958 Version 2	Mancozeb and Dimethomorph (Acrobat) / Beetroot / Downy Mildew & Alternaria Leaf Spots	21-Dec-14	31-Dec-22	Hort Innovation
PER14045 Version 3	Mancozeb + Metalaxyl (Ridomil Gold MZ) / Beetroot / Downy Mildew & Alternaria Leaf Spots	01-Apr-13	31-Mar-22	Hort Innovation
PER90595	Metalaxyl-M + Azoxystrobin (Uniform) / Beetroot / Pythium & Rhizoctonia	30-Jun-21	30-Jun-24	Hort Innovation
PER82428 Version 4	Methomyl (Lannate) / Root & Tuber Vegetables / <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Looper, Webworm, Rutherglen Bug, Thrips including Western Flower Thrips	22-Apr-16	31-Mar-24	Hort Innovation
PER89293	Methomyl / Various including root & tuber vegetables / Fall Armyworm	10-Apr-20	30-Apr-23	Hort Innovation
PER14184 Version 2	Phosphorous Acid / Beetroot / Damping Off	01-Jul-13	30-Jun-22	Hort Innovation
PER14479 Version 4	Propiconazole (Tilt) / Beetroot / Cercospora Leaf Spot	12-May-14	30-Nov-24	Hort Innovation
PER89241	Spinetoram (Success Neo) / Root & Tuber Vegetables / Fall Armyworm	06-Mar-20	31-Mar-23	Hort Innovation

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER84757 Version 2	Spinetoram (Success Neo) / Root & Tuber Vegetables / Tomato Potato Psyllid	28-Nov-17	31-Aug-25	Hort Innovation
PER91155	Spinetoram (Success Neo) / Root & Tuber Vegetables including Beetroot / Liriomyza Leafminers	09-Jun-21	30-Jun-24	Hort Innovation
PER89870	Spinosad (Entrust Organic) / Root & Tuber Vegetables / Fall Armyworm	21-Jul-20	31-Jul-23	Hort Innovation
PER90928	Spinosad (Entrust Organic) / Root & Tuber Vegetables including Beetroot / Liriomyza Leafminers	23-Apr-21	30-Apr-24	Hort Innovation
PER90820 Version 3	<i>Spodoptera frugiperda</i> Multiple Nucleopolyhedrovirus (Fawligen) / Root & Tuber Vegetables / Fall Armyworm	30-Mar-21	31-Mar-24	AgBiTech
PER84743	Sulfoxaflor (Transform) / Root & Tuber Vegetables / Tomato Potato Psyllid	24-Oct-17	31-Oct-22	Hort Innovation
PER14891 Version 3	Trifloxystrobin (Flint) / Beetroot / Alternaria Leaf Spot and Cercospora Leaf Spot	01-Jan-15	30-Sep-24	Hort Innovation

Appendix 5. Beetroot Maximum Residue Limits (MRLs)

CODEX commodity groupings of root and tuber vegetables and subgroups:

VR 0075 Root and tuber vegetables
VR 0574 Beetroot
 Beetroot leaves
 Vegetables

Note: Major export markets for Beetroot include Singapore, Malaysia, Japan, Hong Kong and PNG. Available information indicates that in the absence specific limits in legislation the most countries defer to Codex, followed by EU MRL standards, or apply a 0.01ppm default value. Food exported to New Zealand from Australia may be legally sold if it complies with Australian requirements. MRLs and legislation are subject to change; the values presented should not be relied on.

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
2,2-DPA		Vegetables	*0.1	-
Abamectin	VR0075	Root and tuber vegetables	*0.01	-
		Beetroot leaves	0.5	-
Aldrin and Dieldrin	VR0075	Root and tuber vegetables	E0.1	E0.1
Ametoctradin	VR0574	Beetroot	0.3	-
Azoxystrobin	VR0075	Root and tuber vegetables	-	1
	VR0574	Beetroot	T*0.005	-
Bifenthrin	VR0075	Root and tuber vegetables	-	0.05
Boscalid	VR0075	Root and tuber vegetables	1	2
Carbaryl	VR0574	Beetroot	0.5	0.1
Chlorantraniliprole	VR0075	Root and tuber vegetables	T0.5	0.02
Chlordane		Vegetables	E0.02	-
Chloridazon	VR0574	Beetroot	*0.05	-
		Beetroot leaves	1	-
Chlorothalonil	VR0075	Root and tuber vegetables	-	0.3
		Vegetables	T7	-
Chlorpyrifos		Vegetables	T*0.01	-
Chlorthal-dimethyl		Vegetables	5	-
Clothianidin	VR0075	Root and tuber vegetables	-	0.2
Cyantraniliprole	VR0075	Root and tuber vegetables	-	0.05
Cycloxydim	VR0574	Beetroot	-	0.2
Cyhalothrin (includes lambda-cyhalothrin)	VR0075	Root and tuber vegetables	-	*0.01
	VR0574	Beetroot	*0.01	-
Cypermethrins (including alpha- and zeta- cypermethrin)	VR0075	Root and tuber vegetables	-	*0.01
	VR0574	Beetroot	T0.1	-
Cyromazine	VR0075	Root and tuber vegetables	T1	-
DDT		Vegetables	E1	-
Diazinon		Vegetables	0.7	-
Dicofol		Vegetables	5	-
Difenoconazole	VR0574	Beetroot	0.5	-
Dimethenamid-P	VR0574	Beetroot	-	0.01*

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Dimethoate	VR0574	Beetroot	*0.1	-
Dimethomorph	VR0574	Beetroot	0.3	-
Diquat		Vegetables	*0.05	-
Dithiocarbamates	VR0574	Beetroot	1	-
EPTC		Vegetables	*0.04	-
Emamectin	VR0075	Root and tuber vegetables	*0.01	-
		Beetroot leaves	T0.5	
Ethofumesate	VR0574	Beetroot	0.1	-
Fluazaindolizine	VR0075	Root and tuber vegetables	0.3	-
Fluazifop-p-butyl	VR0075	Root and tuber vegetables	T1	-
Flubendiamide	VR0075	Root and tuber vegetables	0.2	-
Fludioxonil	VR0574	Beetroot	T0.2	-
Fluensulfone	VR0075	Root and tuber vegetables	2	-
	VR0574	Beetroot	-	4
Flupyradifurone	VR0075	Root and tuber vegetables	-	0.7
Glyphosate	VR0075	Root and tuber vegetables	*0.1	-
Heptachlor		Vegetables	E0.05	-
Imidacloprid	VR0075	Root and tuber vegetables	-	0.5
	VR0574	Beetroot	T0.05	-
		Beetroot leaves	T1	
Iprodione	VR0574	Beetroot	T0.1	-
		Beetroot leaves	T20	
Kresoxim-Methyl		Beetroot	-	*0.05
Linuron		Vegetables	*0.05	-
Metalaxyl	VR0574	Beetroot	T*0.01	-
		Beetroot leaves	T0.1	
Metaldehyde		Vegetables	1	-
Methiocarb		Vegetables	0.1	-
Methomyl	VR0075	Root and tuber vegetables	1	-
Myclobutanil	VR0075	Root and tuber vegetables	-	0.06
Omethoate	VR0574	Beetroot	*0.05	-
Paraquat	VR0075	Root and tuber vegetables	-	0.05
		Vegetables	*0.05	-
Pendimethalin	VR0075	Root and tuber vegetables	*0.05	-
Penthiopyrad	VR0075	Root and tuber vegetables	2	-
Phenmedipham	VR0574	Beetroot	0.5	-
Phosphine	VR0075	Root and tuber vegetables	T*0.01	-
Phosphorous acid	VR0075	Root and tuber vegetables	T100	-
Piperonyl Butoxide	VR0075	Root and tuber vegetables	-	0.5
		Vegetables	8	-
Pirimicarb	VR0075	Root and tuber vegetables	-	0.05
		Vegetables	1	-
Prometryn		Vegetables	*0.1	-
Propachlor	VR0574	Beetroot	*0.05	-
Propargite		Vegetables	3	-
Propazine		Vegetables	*0.1	-
Propiconazole	VR0574	Beetroot	*0.02	-
Pydiflumetofen	VR0075	Root and tuber vegetables	T0.05	-
Pyrethrins	VR0075	Root and tuber vegetables	-	*0.05

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
		Vegetables	1	-
Pymetrozine	VR0574	Beetroot	*0.02	-
Quizalofop-ethyl	VR0574	Beetroot	0.02	-
Quizalofop-P-tefuryl	VR0574	Beetroot	0.02	-
Sethoxydim	VR0075	Root and tuber vegetables	1	-
Spinetoram	VR0075	Root and tuber vegetables	0.02	-
Spinosad	VR0075	Root and tuber vegetables	0.02	-
Sulfoxaflor	VR0075	Root and tuber vegetables	0.05	0.03
Tebuconazole	VR0574	Beetroot	T0.3	-
		Beetroot leaves	T2	-
Thiamethoxam	VR0075	Root and tuber vegetables	T0.7	0.3
Tolclofos-methyl	VR0574	Beetroot	*0.01	-
Trichlorfon	VR0574	Beetroot	0.2	-
Trifloxystrobin	VR0574	Beetroot	T0.5	-
		Beetroot leaves	T10	-

NOTE: MRLs are constantly under review and subject to change. Check for current MRLs and do not rely on the values stated above.

* Indicates that an MRL is at the Limit of Quantitation (LOQ)

T =Temporary MRL

E = The MRL is based on extraneous residues

Sources: APVMA MRLs: Agricultural and Veterinary Chemicals Code (MRL Standard) Instrument 2019. Compilation 4. Prepared 10 July 2021. CODEX MRLs: CODEX Alimentarius International Food Standards database (July 2021), <http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/>

Appendix 6: Beetroot Agrichemical Regulatory Risk Assessment

Beetroot Agrichemical Regulatory Risk Assessment

July 2021

Regulatory pressures on agrichemicals are increasing globally, with many being either restricted or withdrawn from use. For older agrichemicals these pressures are often the result of reconsiderations involving new or refined risk assessment methodologies that require the generation of new data. A consequence of which can be that many of these chemicals are not meeting contemporary risk assessment standards as the necessary data is unavailable, or where data is available, the risk posed is considered unacceptable.

The use of farm chemicals can also be impacted through differences in standards between trading partners. The lack of an appropriate pesticide maximum residue limit (MRL) in an importing country can, for practical purposes, effectively prohibiting the use in the exporting country to ensure compliance, as breaches of MRLs would adversely affect market access.

The effects of the above are greater pressure placed on the availability and use of individual chemicals or chemical groups. As a consequence, it is possible that the number of approved agrichemical options could be adversely impacted.

To assist strategic planning, with respect to future pest management options, the following tables have been developed to highlight the regulatory threats to agrichemicals currently approved for the management of the pests and diseases in beetroot as well as current initiatives aimed at addressing identified pest management deficiencies.

R1	Short-term: Critical concern over retaining access
R2	Medium-term: Maintaining access of significant concern
R3	Long-term: Potential issues associated with use: Monitoring required

Problem	Active Constituents	Chemical Group	Comment	Actions
Aphids				
Aphids	Dimethoate	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
	Imidacloprid (PER81260)	4A	APVMA: Under review Canada: Under review EU: Removal of all field uses USA: Re-registration with new risk mitigation measures	
	Paraffinic oil/ petroleum oil	-		
Green peach aphid	Pirimicarb	1A	Codex: JMPR Periodic re-evaluation 2022/23 EU: Candidate for substitution	
	Pymetrozine	9B	Canada: Restricted use to glasshouses only Codex: No registrant support EU: Being phased out	
	Sulfoxaflor	4C	USA: Pollinator concerns	
Potato aphid	Pymetrozine	9B	Canada: Restricted use to glasshouses only Codex: No registrant support EU: Being phased out	
Beetles				
False wire worm	Chlorpyrifos	1B	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure. Codex: Scheduled for review by JMPR Canada: Cancellation of all uses. EU: No authorisation in place ⁱ USA: EPA decision to allow continued use	

Problem	Active Constituents	Chemical Group	Comment	Actions
Leaf eating Ladybirds	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
Pumpkin beetle	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
Spotted vegetable weevil	Chlorpyrifos	1B	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure. Codex: Scheduled for review by JMPR Canada: Cancellation of all uses. EU: No authorisation in place USA: EPA decision to allow continued use	
Vegetable weevil	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
	Chlorpyrifos	1B	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure. Codex: Scheduled for review by JMPR Canada: Cancellation of all uses. EU: No authorisation in place USA: EPA decision to allow continued use	
	Lambda-cyhalothrin (PER11949)	3A		
Caterpillars/Lepidoptera				
Armyworm	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	

Problem	Active Constituents	Chemical Group	Comment	Actions
Budworm/Helicoverpa	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
	Emamectin benzoate	6	EU: Candidate for substitution	
	Flubendiamide	28		
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Spinetoram	5		
	Spinosad	5		
Cabbage centre grub	Spinosad	5		
Cabbage white butterfly	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
	Emamectin benzoate	6	EU: Candidate for substitution	
	Flubendiamide	28		
	Spinosad	5		
Cluster caterpillar	Emamectin benzoate	6	EU: Candidate for substitution	
	Flubendiamide	28		
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Spinosad	5		

Problem	Active Constituents	Chemical Group	Comment	Actions
Cucumber moth	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Spinosad	5		
Cutworms	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
	Chlorpyrifos	1B	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure. Codex: Scheduled for review by JMPR Canada: Cancellation of all uses. EU: No authorisation in place USA: EPA decision to allow continued use	
Diamondback moth	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
	Emamectin benzoate	6	EU: Candidate for substitution	
	Flubendiamide	28		
Fall armyworm	Chlorantraniliprole (PER89353)	28		
	Emamectin benzoate (PER89623)	6	EU: Candidate for substitution	
	Methomyl (PER89293)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Spinetoram (PER89241)	5		
	Spinosad (PER89870)	5		

Problem	Active Constituents	Chemical Group	Comment	Actions
Lightbrown apple moth	Spinetoram	5		
	Spinosad	5		
Loopers	Emamectin benzoate	6	EU: Candidate for substitution	
	Lambda-cyhalothrin (PER11949)	3A		
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Spinetoram	5		
	Spinosad	5		
Potato moth	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
	Flubendiamide	28		
	Spinetoram	5		
	Spinosad	5		
Webworms	Diazinon	1B	EU: No authorisation in place Codex: To be reviewed.	
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	

Problem	Active Constituents	Chemical Group	Comment	Actions
Mites				
Mites	Dimethoate	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
	Paraffinic oil	-		
Red-legged earth mite	Dimethoate	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
Plant bugs and leaf hoppers				
Green vegetable bug	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
	Dimethoate	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
Rutherglen bugs	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
	Lambda-cyhalothrin (PER11949)	3A		
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
Jassids/Leafhoppers	Dimethoate	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
	Paraffinic oil	-		

Problem	Active Constituents	Chemical Group	Comment	Actions
Grasshoppers and crickets				
Black field cricket	Chlorpyrifos	1B	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure.	
Field crickets	Chlorpyrifos	1B		
Mole crickets	Chlorpyrifos	1B	Codex: Scheduled for review by JMPR Canada: Cancellation of all uses. EU: No authorisation in place USA: EPA decision to allow continued use	
Wingless grasshopper	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
	Chlorpyrifos	1B	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure. Codex: Scheduled for review by JMPR Canada: Cancellation of all uses. EU: No authorisation in place USA: EPA decision to allow continued use	
	Dimethoate	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	

Problem	Active Constituents	Chemical Group	Comment	Actions
Thrips				
Onion thrips	Lambda-cyhalothrin (PER11949)	3A		
Plague thrips	Lambda-cyhalothrin (PER11949)	3A		
Thrips	Dimethoate	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
	Imidacloprid (PER81260)	4A	APVMA: Under review Canada: Under review EU: Removal of all field uses USA: Re-registration with new risk mitigation measures	
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Paraffinic oil			
Western flower thrips	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Spinosad	5		

Problem	Active Constituents	Chemical Group	Comment	Actions
Other insect pests				
Earwigs	Carbaryl	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled Europe: Authorisation not renewed	
	Chlorpyrifos	1B	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure. Codex: Scheduled for review by JMPR Canada: Cancellation of all uses. EU: No authorisation in place USA: EPA decision to allow continued use	
Leafminer flies	Dimethoate	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
Tomato/potato psyllid	Spinetoram	5		
	Sulfoxaflor	4C	USA: Pollinator concerns	
Vegetable leafminer	Abamectin	6		
	Spinetoram (PER91155)	5		
	Spinosad (PER90928)	5		

Problem	Active Constituents	Chemical Group	Comment	Actions
DISEASES				
Alternaria leaf spot	Chlorothalonil (PER82895)	M5	APVMA: Nominated for review Canada: Review recently completed; continued use considered acceptable Europe: Authorisation not renewed ⁱⁱ .	
	Difenoconazole	3	APVMA: Nominated for review Canada: Currently being reviewed EU: Candidate for substitution	
	Dimethomorph (PER14958)	40		
	Iprodione (PER81589)	2	Europe: Deregistered Canada: Majority of food crop uses deleted Codex: Review scheduled for 2022/23	
	Mancozeb	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Penthiopyrad	7		
	Trifloxystrobin	11		
Botrytis grey mould	Chlorothalonil (PER82895)	M5	APVMA: Nominated for review Canada: Review recently completed; continued use considered acceptable Europe: Deregistration proposed.	
	Iprodione (PER81589)	2	Canada: Majority of food crop uses deleted Codex: Review scheduled for 2022/23 Europe: Deregistered	

Problem	Active Constituents	Chemical Group	Comment	Actions
Cercospora leaf spot	Chlorothalonil (PER82895)	M5	APVMA: Nominated for review Canada: Review recently completed; continued use considered acceptable Europe: Deregistration proposed.	
	Mancozeb	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Propiconazole (PER14479)	3	APVMA: Nominated for review Europe: Deregistered: being phased-out	
Damping off / Pythium	Azoxystrobin + metalaxyl-M (PER90595)	11+ 4	Metalaxyl-M EU: Restricted use approval	MT18018: Data generation project completed for Uniform® seed treatment PER90595 Issued 30-Jun-21
	Metalaxyl/metalaxyl-M	4	Metalaxyl EU: Candidate for substitution Metalaxyl-M EU: Restricted use approval	
	Phosphorous acid (PER14184)	33		
Downy mildew	Copper	M1	EU: Candidate for substitution	ST16000: Data generation project for Zampro® underway for label extension
	Dimethomorph (PER14958)	40		
	Mancozeb	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Metalaxyl/metalaxyl-M	4	Metalaxyl EU: Candidate for substitution Metalaxyl-M EU: Restricted use approval	

Problem	Active Constituents	Chemical Group	Comment	Actions
Leaf spot	Difenoconazole	3	APVMA: Nominated for review Canada: Currently being reviewed EU: Candidate for substitution	
	Mancozeb	M3	APVMA: Nominated for review Canada: Under review Codex: To be reviewed 2022/23 EU: Proposed non-renewal of authorisation	
	Trifloxystrobin (PER14891)	11		
	Zineb	M3	APVMA: Nominated for review Codex: To be reviewed 2022/23 EU: No authorisation in place	
Phoma leaf spot	Chlorothalonil (PER82895)	M5	APVMA: Nominated for review Canada: Review completed; use considered acceptable Europe: Deregistration proposed.	
Powdery mildew	Mancozeb	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Penthiopyrad	7		
Rhizoctonia	Azoxystrobin + metalaxyl-M (PER90595)	11+ 4	Metalaxyl-M EU: Restricted use approval	ST17000: Data generation project underway for Sedaxane 40g/L + Fludioxonil 50g/L (New product) Group 7+12 for label registration.
	Tolclofos-methyl	14		
Rust	Copper	M1	EU: Candidate for substitution	
	Mancozeb	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	

Problem	Active Constituents	Chemical Group	Comment	Actions
Sclerotinia rot	Boscalid	7		
	Iprodione (PER81589)	2	Canada: Majority of food crop uses deleted Codex: Review scheduled for 2022/23 Europe: Deregistered	
	Tebuconazole (PER82461)	3	APVMA: Nominated for review	

Problem	Active Constituents	Chemical Group	Comment	Actions
WEEDS				
Broadleaf weeds and grasses	Chloridazon	5	EU: No authorisation in place	
	Clethodim	1	Codex: MRLs proposed for deletion	
	Ethofumesate	15		
	Phenmedipham	5	EU: Review outcome not positive	
	Propachlor	15	EU: No authorisation in place	
	Quizalofop-P	1	Canada: Under re-evaluation EU: Candidate for substitution	
	Sethoxydim	1	EU: No authorisation in place	

MT20007: Regulatory support and coordination. This multi-industry project has been funded by Hort Innovation using industry research and development levies and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

ⁱⁱ Chlorothalonil –EU Commission Implementing Regulation (EU) 2019/677 <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32019R0677&from=EN>