



# **Root Vegetables (Radish, Horseradish, Parsnip, Swede & Turnip)**

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:**

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**Purpose of the report:**

This report was funded by Hort Innovation to investigate the pest problem, agrichemical usage and pest management alternatives for the Radish, Horseradish, Parsnip, Swede & Turnip 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

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**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](http://horticulture.com.au)

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## **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 Radish, Horseradish, Parsnip, Swede & Turnip 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 diseases are:

<b>Common name</b>	<b>Scientific name</b>
Black Canker (parsnip)	<i>Itersonilia perplexans, Cylandrocarpon spp., Mycoentrospora acerina</i>
White Blister (radish & horseradish)	<i>Albugo candida</i>

### **1.2 Insects, mites and other pests**

The high priority insects, mites and other pests are:

<b>Common name</b>	<b>Scientific name</b>
Green Peach Aphid (swedes and turnip)	<i>Myzus persicae</i>
Cabbage Aphid (swedes and turnip)	<i>Brevicoryne brassicae</i>
Diamondback Moth (radish, horseradish, swedes and turnip)	<i>Plutella xylostella</i>

### **1.3 Weeds**

The high priority weeds are:

<b>Common name</b>	<b>Scientific name</b>
Wild Radish	<i>Raphanus raphanistrum</i>
Amaranthus	<i>Amaranthus spp.</i>

## **2. The Australian Radish, Horseradish, Parsnip, Swede & Turnip Industry**

The Australian Radish, Horseradish, Parsnip, Swede & Turnip industry is collectively a minor horticultural industry. Parsnip crop production figures are the only ones available for this group.

### **Parsnip**

Major production regions include the Perth in WA, Northwest Tasmania and around Melbourne, Victoria.

Total production<sup>1</sup> for the year ending June 2020 was 3,425 tonnes with a value of \$12.1m. Ninety-seven percent was sent to the fresh market, 3% was used for processing and no exports are recorded.

Due to Australia's varying weather conditions, the industry can supply domestic markets with fresh Parsnip throughout the year.

#### **Fresh Parsnip Seasonality by State**

State	19/20 t	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
New South Wales (5%)	168	High	High	High	High	High	High	High	High	High	High	High	High
Victoria (43%)	1,486	High	High	High	High	High	High	High	High	High	High	High	High
Queensland (8%)	265	High	High	High	High	High	High	High	High	High	High	High	High
Western Australia (26%)	880	High	High	High	High	High	High	High	High	High	High	High	High
South Australia (7%)	250	High	High	High	High	High	High	High	High	High	High	High	High
Tasmania (11%)	375	High	High	High	High	High	High	High	High	High	High	High	High
Availability legend		High	High	High	High	Medium	Medium	Medium	Low	Low	Low	None	None

<sup>1</sup> 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.

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 Radish, Horseradish, Parsnip, Swede & Turnip (Root and tuber vegetables) 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 Radish, Horseradish, Parsnip, Swede & Turnip (Root and tuber vegetables) 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 Radish, Horseradish, Parsnip, Swede & Turnip (Root and tuber vegetables) 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 Radish, Horseradish, Parsnip, Swede & Turnip 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 Radish, Horseradish, Swede & Turnip (Root and tuber vegetables) 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 Industry<sup>2</sup> which covers Radish, Horseradish, Parsnip, Swede & Turnip (Root and tuber vegetables) 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.

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<sup>2</sup> <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 Radish, Horseradish, Parsnip, Swede & Turnip as minor crops. The crop fits within the APVMA Crop Group 016: Root and tuber vegetables. Therefore, access to minor use permits can be relatively straight forward as long as a reasonable justification is provided in accordance to the APVMA's minor use guidance<sup>3</sup>.

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 Radish, Horseradish, Parsnip, Swede, and Turnip (Root and tuber vegetables) industry is for manufacturers to register new pesticides uses in the crop.

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<sup>3</sup> <https://apvma.gov.au/node/10931>



### 3.3 Methods

The current version of the Root Vegetables Strategic Agrichemical Review Process (SARP) 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:

<b>Hort Innovation Project Reference</b>	<b>Process of Review - Activity</b>
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><b>Radish, Horseradish, Parsnip, Swede &amp; Turnip (Root and tuber vegetables) Agrichemical Regulatory Risk Assessment Document</b></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 Radish, Horseradish, Parsnip, Swede &amp; Turnip (Root and tuber vegetables) as well as current initiatives aimed at addressing identified pest management deficiencies.</p>
VG18004 – Vegetable Strategic Agrichemical Review Process (SARP) Report Updates	<p><b>SARP updated via a desktop audit:</b></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 &amp; 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&amp;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 radish, horseradish, parsnip, swede & turnip (Root and tuber vegetables)
- Appendix 2. Products available for control of insects, mites and other pests in radish, horseradish, parsnip, swede & turnip (Root and tuber vegetables)
- Appendix 3. Products available for weed control in radish, horseradish, parsnip, swede & turnip (Root and tuber vegetables)
- Appendix 4. Current permits for use in radish, horseradish, parsnip, swede & turnip (Root and tuber vegetables)
- Appendix 5. Radish, horseradish, parsnip, swede & turnip (Root and tuber vegetables)  
Maximum Residue Limits (MRLs)
- Appendix 6. Radish, horseradish, parsnip, swede & turnip (Root and tuber vegetables)  
Agrichemical Regulatory Risk Assessment

## **4. Diseases, Pests and Weeds of Radish, Horseradish, Parsnip, Swede & Turnip**

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 website<sup>4</sup>.

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.

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

## **4.1 Diseases of radish, horseradish, parsnip, swede & turnip**

### **4.1.1 Disease priorities - parsnip**

<b>Common name</b>	<b>Scientific name</b>
<b>High</b>	
Black Canker	<i>Itersonilia perplexans, Cylandrocarpon spp., Mycocentrospora acerina</i>
<b>Moderate</b>	
Powdery Mildew	<i>Erysiphe spp.</i>
<b>Low</b>	
Soft Rot	Unidentified species
Club Root	<i>Plasmodiophora brassicae</i>
White Blister	<i>Albugo candida</i>
Sclerotinia Rot	<i>Sclerotinia sclerotiorum, Sclerotinia minor</i>
Downy Mildew	<i>Hyaloperonospora spp.</i>
Alternaria Leaf Spot	<i>Alternaria spp.</i>
Black Rot	<i>Xanthomonas spp.</i>
Damping Off	<i>Pythium spp., Phytophthora spp., Fusarium spp., Rhizoctonia spp.</i>
Leaf Spot	<i>Cercospora spp.</i>
Crown Gall	<i>Agrobacterium tumefaciens</i>
Ramularia Leaf Spot	<i>Ramularia pastinacae</i>

### **4.1.2 Disease priorities - radish & horseradish**

<b>Common name</b>	<b>Scientific name</b>
<b>High</b>	
White Blister	<i>Albugo candida</i>
<b>Moderate</b>	
Powdery Mildew	<i>Erysiphe spp.</i>

Common name	Scientific name
<b>Low</b>	
Damping Off	<i>Pythium</i> spp., <i>Phytophthora</i> spp., <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp.
Pythium Root Rot	<i>Pythium</i> spp.
Club Root	<i>Plasmodiophora brassicae</i>
Leaf Spot	<i>Cercospora</i> spp.
Soft Rot	Unidentified species
Sclerotinia Rot	<i>Sclerotinia sclerotiorum</i> , <i>Sclerotinia minor</i>
Downy Mildew	<i>Hyaloperonospora</i> spp.
Alternaria Leaf Spot	<i>Alternaria</i> spp.
Turnip Mosaic Virus	<i>TuMV</i>

#### **4.1.3 Disease priorities - swedes and turnips**

Common name	Scientific name
<b>Moderate</b>	
Powdery Mildew	<i>Erysiphe</i> spp.
Soft Rot	Unidentified species
Club Root	<i>Plasmodiophora brassicae</i>
White Blister	<i>Albugo candida</i>
<b>Low</b>	
Sclerotinia Rot	<i>Sclerotinia sclerotiorum</i> , <i>Sclerotinia minor</i>
Downy Mildew	<i>Hyaloperonospora</i> spp.
Alternaria Leaf Spot	<i>Alternaria</i> spp.
Black Rot	<i>Xanthomonas</i> spp.
Damping Off	<i>Pythium</i> spp., <i>Phytophthora</i> spp., <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp.
Leaf Spot	<i>Cercospora</i> spp.
Crown Gall	<i>Agrobacterium tumefaciens</i>
Ramularia Leaf Spot	<i>Ramularia pastinacae</i>
Turnip Mosaic Virus	<i>TuMV</i>

#### **4.1.4 Non-ranked diseases which have been significant in the past**

<b>Common name</b>	<b>Scientific name</b>
<b>Priority: Unknown</b>	
Anthracnose	<i>Colletotrichum</i> spp.
Grey Mould	<i>Botrytis cinerea</i>
Septoria Leaf Spot	<i>Septoria</i> spp.

The most important disease issues based on the feedback received were White Blister in radish and horseradish and Black Canker in parsnips. Available and potential products for these diseases are listed in Section 4.1.5.

Soil-borne diseases are the main issue faced by root vegetable 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 website<sup>5</sup>, including Downy Mildew and Powdery Mildew.

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<sup>5</sup> [www.croplife.org.au/resources/programs/resistance-management/](http://www.croplife.org.au/resources/programs/resistance-management/)

#### 4.1.5 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
<b>White Blister</b> ( <i>Albugo candida</i> )							
<b>Priority: High</b>							
Radish & Horseradish: White Blister was ranked as a high priority in VIC, NSW & SA.							
Parsnip: White Blister was ranked as a low priority in VIC, WA, SA & TAS.							
Swede & Turnip: White Blister was ranked as a moderate priority in VIC, NSW & SA, and as low priority in QLD, WA & TAS.							
Incidence of White Blister is closely related to extended periods of leaf wetness. The disease can spread from other host crops and weeds through air or soil. Crop hygiene, irrigation management and improved ventilation of the crop are useful cultural practices.							
Azoxystrobin (Amistar)	11	Protectant & Curative	7	A	ALL	Registered in horseradish for control of <b>White Blister Rust</b> and Downy Mildew. [Max. 3 applications per crop; min. re-treatment interval 7 days] Registered in radish for control of <b>White Blister Rust</b> . [Max. 2 applications per crop; re-treatment interval: 7-14 d]	-
Chlorothalonil (Bravo) PER82895	M5	Protectant	1 NG	A	ALL (excl. VIC)	Permitted in radish for control of Alternaria, Downy Mildew, Grey Leaf Spot and <b>White Rust</b> . [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	R3
Copper PER14038	M1	Protectant	1	A	ALL (excl. VIC)	Permitted in horseradish for control of <b>White Blister Rust</b> . [Max. no. of applications not specified; re-treatment interval: 10-14 d]	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Copper Hydroxide + Metalaxyl (Ridomil Gold Plus) Syngenta	M1+4	Protectant	7	A	ALL	Registered in radish, swede & turnip for control of <b>White Blister</b> and Downy Mildew. [Max. 2 applications per crop; re-treatment interval: 7 - 10 d]	-
Mancozeb PER80538	M3	Protectant	14 NG	A	ALL (excl. VIC)	Permitted in radish, swede & turnip for control of Cercospora Leaf Spot, Alternaria and <b>White Blister</b> . [Max 4 sequential treatments; re-treatment interval 7 d]	R2
Amisulbrom + Copper (Amicus Blue) Nufarm	21+M1	Protectant		P		Registered for control of <b>White Blister</b> in brassica vegetables.	-
Cyazofamid (Ranman) UPL	21	Protectant		P		Registered for control of <b>White Blister</b> in broccoli.	-
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.	-
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of <b>White Blister</b> in brassica vegetables.	-
Propamocarb + Fluopicolide (Infinito) Bayer	28+43	Protectant & Curative		P		Registered for control of <b>White Blister</b> in brassica vegetables.	-



Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<p><b>Black Canker</b> (<i>Itersonilia perplexans</i>, <i>Cylindrocarpon</i> spp. &amp; <i>Mycocentrospora acerina</i>)  <b>Priority: High</b></p> <p>Parsnip: Black Canker was ranked as a high priority in VIC, a moderate priority in WA &amp; TAS, and as a low priority in QLD &amp; SA.  Radish &amp; Horseradish: Black Canker was not ranked as an issue.  Swede &amp; Turnip: Black Canker was not ranked as an issue.  Symptoms of parsnip canker are large black lesions on mature parsnip roots, mostly on the shoulder or crown, that can spread to other sections of the root and in extreme cases, cover the entire root, making the product unusable. Infection can be seed-borne or carried over in the soil and crop residues. Several cultural practices are thought to assist in reducing disease incidence, including gradual hilling and covering of parsnip shoulders, later sowing and crop thinning, removal of all roots and plant trash from beds after harvest, and crop rotation.</p>							
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, 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. <b>For use by professional and registered fumigators only.</b>	-
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.	-
<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.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<i>Streptomyces lydicus</i> WYEC108 (Actinovate) Novozymes Bioag	BM 02	Biological	NR	P-A	ALL	Registered in vegetables as a seed treatment for control of <i>Fusarium</i> , <i>Rhizoctonia</i> & <i>Pythium</i> .	-
<b>Powdery Mildew</b> ( <i>Erysiphe</i> spp.)							
<b>Priority: Moderate</b>							
Radish & Horseradish: Powdery Mildew was ranked as a moderate priority in VIC & SA, and as a low priority in NSW. Parsnip: Powdery Mildew was ranked as a moderate priority in VIC, QLD, WA, SA & TAS. Swede & Turnip: Powdery Mildew was ranked as a moderate priority in VIC, WA, NSW & SA, and as a low priority in QLD & TAS. 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 yields.							
Penthiopyrad (Fontelis) Corteva	7	Protectant	7	A	ALL	Registered in parsnip, radish, swede and turnip for control of Early Blight and <b>Powdery Mildew</b> . [Max. 2 sequential applications; re-treatment interval: 7-14 d]	-
Potassium Bicarbonate (Eco-Carb) PER13695	M2	Protectant	NR	A	ALL (excl. VIC)	Permitted in parsnip, radish, swede & turnip for control of <b>Powdery Mildew</b> . [Max. no. of applications not specified; re-treatment interval: 10-14 d]	-
Sulphur	M2	Protectant	NR	A	ALL	Registered in vegetables for control of <b>Powdery Mildew</b> and Rust. [Max. no. of applications not specified; retreatment interval 7-21 d]	-
Triadimenol (Bayfidan)	3	Protectant & Curative	7 NG	A	ALL	Registered in parsnip, radish, swede & turnip for control of <b>Powdery Mildew</b> . [Max. 2 applications per crop; re-treatment interval: 10 d]	R3
<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 <b>Powdery Mildew</b> in cucurbits.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
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 <b>Powdery Mildew</b> in stone fruit and almonds and Canadian registration for control of <b>Powdery Mildew</b> in root and tuber vegetables, brassica leafy vegetables, brassica head and stem vegetables, fruiting vegetables and cucurbits.	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 <b>Powdery Mildew</b> . US registration for control of <b>Powdery Mildew</b> in cucurbits.	-
ADM1700F Adama	TBC			P		Fungicide in development from Adama with <b>Powdery Mildew</b> 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 <b>Powdery Mildew</b> in cucurbits, fruiting vegetables, grapes, hops, pome fruit and strawberries.	-
Boscalid + Kresoxim-Methyl (Colliss) BASF	7+11	Protectant & Curative		P		Registered for control of <b>Powdery Mildew</b> in cucurbits.	-
Bupirimate (Nimrod) Adama	8	Protectant & Curative		P		Registered for control of <b>Powdery Mildew</b> in apples, cucurbits, cut flower, eggplant, melons, nursery stock, ornamentals, peppers and strawberries.	-
Cyflufenamid (Flute) AgNova	U6	Protectant & Curative		P		Registered for control of <b>Powdery Mildew</b> in cucurbits, grapevines and strawberries.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, <b>Powdery Mildew</b> , Botrytis, Anthracnose, Alternaria, Scab, Monilinia, Rust and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-

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 <b>Powdery Mildew</b> 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 <b>Powdery Mildew</b> in grapes, fruiting vegetables, cucurbits and potatoes.	-
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered for control of <b>Powdery Mildew</b> in grapes.	-
Metrafenone (Vivando) BASF	U8	Protectant		P		Registered for control of <b>Powdery Mildew</b> in cucurbits and grapes.	-
Polyoxin-D (Intervene) Nufarm	19	Protectant		P		Pending registration for control of Botrytis and <b>Powdery Mildew</b> in grapes, Botrytis, <b>Powdery Mildew</b> and Rhizopus Fruit Rot in berries, and <b>Powdery Mildew</b> , Alternaria and Fruit Spot in apples.	-
Proquinazid (Talendo) Corteva	13	Protectant		P		Registered for control of <b>Powdery Mildew</b> in fruiting vegetables, cucurbits, grapes and pome fruit.	-
Pyriofenone (Kusabi) AgNova	50	Protectant & Curative		P		Registered for control of <b>Powdery Mildew</b> in cucurbits and grapes.	-
Tea Tree Oil (Timorex)	46	Protectant				Registered for control of <b>Powdery Mildew</b> in fruiting vegetables, cucurbits and grapes.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<b>Club Root (<i>Plasmodiophora brassicae</i>)</b> <b>Priority: Low</b> Radish & Horseradish: Club Root was ranked as a moderate priority in VIC, NSW & SA. Parsnip: Club Root was ranked as a low priority in VIC, QLD, WA, SA & TAS. Swede & Turnip: Club Root was ranked as moderate priority in VIC, NSW, SA & TAS, and as a low priority in QLD & WA. Affected plants produce large, distorted roots and wilting is often the first above-ground symptom. Plants which are severely infected will be stunted, produce poor quality crops, and may die before harvest. Infection is more prevalent in low pH soils, particularly in conjunction with high soil moisture and warm temperatures. Management options include raising soil pH, farm hygiene and crop rotation.							
1,3-Dichloropropene + Chloropicrin + (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, 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. <b>For use by professional and registered fumigators only.</b>	-
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.	-
<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.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<i>Streptomyces lydicus</i> WYEC108 (Actinovate) Novozymes Bioag	BM 02	Biological	NR	P-A	ALL	Registered in vegetables as a seed treatment for control of <i>Fusarium</i> , <i>Rhizoctonia</i> & <i>Pythium</i> .	-
Amisulbrom (Amishield) Nufarm	21	Protectant		P		Registered for control of <b>Club Root</b> in brassica vegetables.	-
Fluazinam (Shirlan)	29	Protectant		P		Registered for control of <b>Club Root</b> in brassica vegetables. Used as a seedling drench or pre-plant soil application.	-
Quintozene (Terraclor)	14	Protectant		P		Registered as a pre-plant soil application for control of <b>Club Root</b> in brassica vegetables.	-
<b>Soft Rot</b> (Unidentified species) <b>Priority: Low</b>							
Radish & Horseradish: Soft Rot was ranked as a low priority in VIC, NSW & SA. Parsnip: Soft Rot was ranked as a low priority in VIC, WA, SA & TAS. Swede & Turnip: Soft Rot was ranked as a moderate priority in QLD, WA, NSW & SA and as a low priority in VIC & TAS. Soft Rot is often attributed to bacteria which may be introduced in seed or in surviving undecomposed crop residue or other host plants. It can spread in water splash and so overhead irrigation should be avoided. Application of copper may reduce disease spread and infection.							
1,3-Dichloropropene + Chloropicrin + (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, 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. <b>For use by professional and registered fumigators only.</b>	-
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.	-

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.	-
Copper PER14038	M1	Protectant	1	P-A	ALL (excl. VIC)	Permitted in horseradish for control of White Blister Rust. Registered for control of <b>Bacterial Soft Rot</b> in brassica vegetables.	-
<b>Sclerotinia Rot</b> ( <i>Sclerotinia sclerotiorum</i> , <i>Sclerotinia minor</i> )							
<b>Priority: Low</b>							
Radish & Horseradish: Sclerotinia Rot was ranked as a low priority in VIC, NSW & SA. Parsnip: Sclerotinia Rot was ranked as a moderate priority in SA and as a low priority in VIC, WA & TAS. Swede & Turnip: Sclerotinia Rot was ranked as moderate priority in SA and as a low priority in VIC, QLD, WA, 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, Symphylans, 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. <b>For use by professional and registered fumigators only.</b>	-
Boscalid (Filan) BASF	7	Protectant	7	A	ALL	Registered in root and tuber vegetables for control of <b>Sclerotinia Rot</b> . [Max. 2 applications per crop and 4 applications per year; 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> , <b>Sclerotinia</b> , <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> , <b>Sclerotinia</b> 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 (Folicur)	3	Protectant & Curative	35 NG	A	ALL	Registered in radish for control of <b>Sclerotinia Rot</b> . [Max. 2 applications per crop; retreatment interval 7-10 d]	R3
<i>Bacillus amyloliquefaciens</i> Strain QST 713 (Serenade Prime Soil Ameliorant & 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.	-
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. Canadian registration for control of <b>Sclerotinia</b> in potato, root vegetables, tuberous and corm vegetables and fruiting vegetables.	R3
<i>Aureobasidium pullulans</i> (Botector) Nufarm	BM 02	Biological		P		Registered for suppression of <b>Sclerotinia</b> in fruiting vegetables.	-
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protectant & Curative		P		Registered for suppression of <b>Sclerotinia</b> in brassica vegetables, cucurbits, endive, leafy vegetables and lettuce.	-
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protectant		P		Registered for control of <b>Sclerotinia</b> in capsicum, green beans, garden peas, snow peas, sugar snap peas, leafy vegetables, lettuce, nursery stock and ornamentals.	R3
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.	-



Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fludioxonil + Pydiflumetofen (Miravis Prime) Syngenta	12+7	Protectant & Curative		P		Registered for control of <b>Sclerotinia</b> in lettuce, leafy vegetables and potato.	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 <b>Sclerotinia</b> in brassica leafy greens and sunflowers. Hort Innovation project ST17000 is generating data to support a label extension for control of <b>Sclerotinia</b> in leafy vegetables.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of <b>Sclerotinia</b> in lettuce.	-
NUL3446	TBC			P		Fungicide in development from Nufarm with activity on <b>Sclerotinia spp.</b>	-
<b>Leaf Spot (Cercospora spp.)</b>							
<b>Priority: Low</b>							
Radish & Horseradish: Cercospora was ranked as a moderate priority in NSW and as a low priority in VIC & SA.							
Parsnip: Cercospora was ranked as a low priority in VIC, WA, SA & TAS.							
Swede & Turnip: Cercospora was ranked as a low priority in VIC, QLD, WA, NSW, 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 crop yield.							
Chlorothalonil (Bravo) PER82895	M5	Protectant	7	A	ALL (excl. VIC)	Permitted in parsnip for control of <b>Early Blight (Cercospora spp.)</b> and Septoria Leaf Spot. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	R3
Mancozeb PER80538	M3	Protectant	14 NG	A	ALL (excl. VIC)	Permitted in radish, swede & turnip for control of <b>Cercospora Leaf Spot</b> , Alternaria and White Blister. [Max 4 sequential treatments; re-treatment interval 7 d]	R2
Copper PER14038	M1	Protectant	1	P-A	ALL (excl. VIC)	Permitted in horseradish for control of White Blister Rust. Registered for control of <b>Cercospora spp.</b> in bananas, fig and celery.	-

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		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 <b>Cercospora</b> 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> , <b>Cercospora</b> , <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 <b>Cercospora</b> in peanuts and sugarbeet.	-
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of <b>Cercospora</b> 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 <b>Cercospora</b> 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 <b>Cercospora</b> 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 / <b>Cercospora Leaf Spot</b> .	R3
Tebuconazole + Azoxystrobin (Veritas) Adama	3+11	Protectant		P		Registered for control of <b>Cercospora Leaf Spot</b> in Faba beans and Broad beans.	R3
Trifloxystrobin (Flint) BASF	11	Protectant & Curative		P		Permitted for control of <b>Cercospora Leaf Spot</b> in beetroot.	-
<b>Alternaria Leaf Spot</b> ( <i>Alternaria</i> spp.) <b>Priority: Low</b>							
Radish & Horseradish: Alternaria Leaf Spot was ranked as a low priority in VIC, NSW & SA. Parsnip: Alternaria Leaf Spot was ranked as a low priority in VIC, WA, SA & TAS. Swede & Turnip: Alternaria Leaf Spot was ranked as a low priority in VIC, QLD, WA, NSW, SA & TAS. Infection is favoured by cool, humid conditions and can be exacerbated by stress such as nutrient deficiencies.							
Chlorothalonil (Bravo) PER82895	M5	Protectant	1 NG	A	ALL (excl. VIC)	Permitted in radish for control of <b>Alternaria</b> , Downy Mildew, Grey Leaf Spot and White Rust. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	R3
Mancozeb PER80538	M3	Protectant	14 NG	A	ALL (excl. VIC)	Permitted in radish, swede & turnip for control of Cercospora Leaf Spot, <b>Alternaria</b> and White Blister. [Max 4 sequential treatments; re-treatment interval 7 d]	R2
Mancozeb + Dimethomorph (Acrobat) PER14958	M3 + 40	Protectant	14 NG	A	ALL (excl. VIC)	Permitted in radish for control of Downy Mildew and <b>Alternaria Leaf Spot</b> . [Max 4 applications per crop; 2 sequential; re-treatment interval 7-10 d]	R2

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Penthiopyrad (Fontelis) Corteva	7	Protectant	7	A	ALL	Registered in parsnip, radish, swede and turnip for control of <b>Early Blight</b> and Powdery Mildew. [Max. 2 sequential applications; re-treatment interval: 7-14 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 <b>Alternaria</b> in almonds, pistachios, stone fruit and tree nuts and Canadian registration for control of <b>Alternaria</b> in potato, root vegetables, tuberous and corm vegetables, bulb vegetables, brassica leafy vegetables, brassica head and stem vegetables, fruiting vegetables and cucurbits.	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 <b>Alternaria</b> in berries, brassica vegetables, citrus, bulb vegetables, herbs/spices, root/tuber and corm vegetables, stone fruit and tree nuts.	-
<i>Bacillus amyloliquefaciens strain MBI 600</i> (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of Botrytis in grapevines and strawberries. US registration for control of <b>Alternaria</b> in artichoke, asparagus, berries, brassica leafy vegetables, bulb vegetables, citrus, cucurbits, pome fruit, stone fruit and tobacco.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis, Anthracnose, <b>Alternaria</b> , 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 <b>Alternaria</b> 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 <b>Alternaria</b> in almond, Brassica leafy greens, bulb vegetables, cucurbits, pistachio, tree nuts and sunflower.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of <b>Alternaria</b> , 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 <b>Alternaria</b> 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 <b>Alternaria Leaf Blight</b> , 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 <b>Alternaria</b> spp.	-
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 <b>Alternaria</b> 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
Trifloxystrobin (Flint) BASF	11	Protectant & Curative		P		Permitted for control of <b>Alternaria Leaf Spot</b> in beetroot.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<b>Black Rot (<i>Xanthomonas</i> spp.)</b> <b>Priority: Low</b> Radish & Horseradish: Black Rot was ranked as a low priority in VIC, NSW & SA. Parsnip: Black Rot was ranked as a low priority in VIC, WA, SA & TAS. Swede & Turnip: Black Rot was ranked as a low priority in VIC, QLD, WA, NSW, SA & TAS. The bacterium may be introduced in seed or in surviving undecomposed crop residue or other host plants. Bacteria spread in water splash during wet, windy weather or by overhead irrigation. It can also disperse on insects, or on people or equipment moving through the crop.							
Copper PER14038	M1	Protectant	1	P-A	ALL (excl. VIC)	Permitted in horseradish for control of White Blister Rust. Registered for control of <b>Bacterial Leaf Spot</b> in mangoes, stone fruit, beans, capsicum, brassicas, lettuce and tomatoes.	-
Acibenzolar-S-methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		Registered for the suppression of Bacterial Speck, Bacterial Spot ( <i>Xanthomonas</i> spp.), Bacterial Canker and Powdery Mildew in tomatoes. US registration for suppression of <i>Xanthomonas</i> spp. in Brassica leafy vegetables, cucurbits, low growing berry, bulb onion, pepper and tomato.	
<i>Bacillus amyloliquefaciens</i> strain QST713 (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for suppression of <b>Bacterial Spot (<i>Xanthomonas</i> spp.)</b> in tomatoes, capsicums and chillies and permitted for suppression of <b>Bacterial Blight (<i>Xanthomonas</i> spp.)</b> in lettuce.	-
<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 <i>Xanthomonas</i> spp. in brassica leafy vegetables, citrus, fruiting vegetables, leafy vegetables, stone fruit, strawberries, root and tuber vegetables and tree nuts.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<p><b>Damping Off</b> (<i>Pythium</i> spp., <i>Phytophthora</i> spp., <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp.)  <b>Priority: Low</b></p> <p>Radish &amp; Horseradish: Damping Off was ranked as a low priority in VIC, NSW &amp; SA.  Parsnip: Damping Off was ranked as a low priority in VIC, WA, SA &amp; TAS.  Swede &amp; Turnip: Damping Off was ranked as a low priority in VIC, QLD, WA, NSW, SA &amp; TAS.  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 root vegetables 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.</p>							
1,3-Dichloropropene + Chloropicrin + (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, 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. <b>For use by professional and registered fumigators only.</b>	-
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.	-
Mancozeb + Metalaxyl (Ridomil Gold MZ) Syngenta PER14045	M3+4	Protectant	7	A	ALL (excl. VIC)	Permitted in parsnip for control of <b><i>Pythium</i> spp.</b> and <b><i>Phytophthora</i> spp.</b> [Max. 2 applications per crop at 4 & 6 weeks after planting]	R2
Metalaxyl-M (Apron)	4	Protectant / Seed Dressing	NR	A	QLD, NSW & TAS	Registered in radish as a seed treatment for control of <b>Damping Off</b> and Downy Mildew. Do not store treated seed for more than 6 months before sowing.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Metalaxyl-M (Ridomil Gold) PER14695	4	Protectant	NR NG	A	ALL (excl. VIC)	Permitted in parsnip for control of <b><i>Phytophthora spp.</i></b> and <b><i>Pythium spp.</i></b> . Apply in water to the soil surface in a 30 cm wide band prior to planting.	-
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 in parsnip for control of <b>Damping Off</b> . [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 control of <b><i>Fusarium</i>, <i>Rhizoctonia</i> &amp; <i>Pythium</i></b> .	-
<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 <b>Pythium Damping Off</b> 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 <b><i>Pythium spp.</i></b> in carrot, leafy greens, succulent-podded and succulent-shelled beans, tuberous and corm vegetables, tomato greenhouse transplants and greenhouse-grown bell 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 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
Metalaxyl-M + Azoxystrobin (Uniform) Syngenta	4+11	Protectant		P		Registered as a seed treatment for control of various foliar and soil-borne diseases including Damping Off in barley and wheat. Permitted for control of Pythium and Rhizoctonia in beetroot, using data generated by Hort Innovation project MT18018.	-
NUL3163 Nufarm	TBC			P		New active in development from Nufarm with activity on <i>Fusarium</i> , <b>Pythium</b> & <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 <b>Pythium</b> , <i>Phytophthora</i> , <i>Rhizoctonia</i> and <i>Thielaviopsis</i> .	-
<b>Downy Mildew (<i>Hyaloperonospora</i> spp.)</b>							
<b>Priority: Low</b>							
Radish & Horseradish: Downy Mildew was ranked as a low priority in VIC, NSW & SA. Parsnip: Downy Mildew was ranked as a low priority in VIC, WA, SA & TAS. Swede & Turnip: Downy Mildew was ranked as a low priority in VIC, QLD, WA, NSW, SA & TAS. Characterised by a white downy fungal growth that develops on the underside of the leaf, Downy Mildew comes up every season. Warm, moist weather favours the spread of the disease. Managing this issue would 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.							
Azoxystrobin (Amistar)	11	Protectant & Curative	7	A	ALL	Registered in horseradish for control of White Blister Rust and <b>Downy Mildew</b> . [Max. 3 applications per crop; min. re-treatment interval 7 days]	-
Chlorothalonil (Bravo) PER82895	M5	Protectant	1 NG	A	ALL (excl. VIC)	Permitted in radish for control of Alternaria, <b>Downy Mildew</b> , Grey Leaf Spot and White Rust. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Copper Hydroxide + Metalaxyl (Ridomil Gold Plus) Syngenta	M1+4	Protectant	7	A	ALL	Registered in radish, swede & turnip for control of White Blister and <b>Downy Mildew</b> . [Max. 2 applications per crop; re-treatment interval: 7 - 10 d]	-
Mancozeb + Dimethomorph (Acrobat) PER14958	M3 + 40	Protectant	14 NG	A	ALL (excl. VIC)	Permitted in radish for control of <b>Downy Mildew</b> and Alternaria Leaf Spot. [Max 4 applications per crop; 2 sequential; re-treatment interval 7-10 d]	R2
Metalaxyl-M (Apron)	4	Protectant / Seed Dressing	NR	A	QLD, NSW & TAS	Registered in radish as a seed treatment for control of Damping Off and <b>Downy Mildew</b> . Do not store treated seed for more than 6 months before sowing.	-
Dimethomorph + Amitoctradin (Zampro) AgNova	45+40	Protectant		P		Registered for control of <b>Downy Mildew</b> in grape vines. Hort Innovation project ST16006 generated data to support a label registration for control of <b>Downy Mildew</b> in beetroot. Label extension submitted and awaiting approval.	-
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 <b>Downy Mildew</b> in Brassica leafy vegetables, cucurbits, leafy vegetables, spinach, and suppression of <b>Downy Mildew</b> in bulb onion.	-
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protectant & Curative		P		Registered for the control of <b>Downy Mildew</b> in Brassica vegetables.	-
Cyazofamid (Ranman) UPL	21	Protectant & Curative		P		Registered for the control of <b>Downy Mildew</b> in Brassica leafy vegetable seedlings. US registration for control of <b>Downy Mildew</b> 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 <b>Downy Mildew</b> in brassica vegetables, bulb vegetables and grapes.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Mandipropamid (Revus) Syngenta	40	Protectant		P		Registered for control of <b>Downy Mildew</b> in grapes and brassica leafy crops.	-
Oxathiapiprolin (Zorvec Enicade) Corteva	49	Protectant		P		Registered for control of <b>Downy Mildew</b> in bulb vegetables, brassica vegetables, cucurbits, leafy vegetables, brassica leafy vegetables and poppies.	-
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 <b>Downy Mildew</b> in ornamentals.	-
Propamocarb Hydrochloride + Fluopicolide (Infinito) Bayer	28+43	Protectant		P		Registered for control of <b>Downy Mildew</b> in brassica vegetables, bulb vegetables, cucurbits, leafy vegetables, lettuce, poppies and potato.	-
Propineb (Antracol) Bayer	M3	Protectant		P		Registered for control of <b>Downy Mildew</b> in cucurbits and onions.	R2
Propineb + Oxadixyl (Rebound) Kiwi Rural Trading	M3+4	Protectant & Curative		P		Registered for control of <b>Downy Mildew</b> in cucurbits, grape vines, lettuce and onions.	R2

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<b>Crown Gall (<i>Agrobacterium tumefaciens</i>)</b>							
<b>Priority: Low</b>							
Radish & Horseradish: Crown Gall was not ranked as an issue. Parsnip: Crown Gall was ranked as a low priority in VIC, WA, SA & TAS. Swede & Turnip: Crown Gall was ranked as a low priority in VIC, QLD, WA, NSW, SA & TAS. The best way to control this disease is to take preventative measures, such as sterilizing pruning tools to avoid infecting new plants. Mandatory inspections of nursery stock and rejecting infected plants as well as not planting susceptible plants in infected fields are also valuable practices. Avoiding wounding the crowns/roots of the plants during cultivation is important for preventing disease. Control of root-chewing insects is also helpful to reduce levels of infection as it minimises bacterial entry points. It is recommended that infected plant material be burned rather than placed in a compost pile due to the bacteria's ability to live in the soil for many years.							
<i>Agrobacterium radiobactor</i> var <i>Radiobactor</i> strain K1026 (Nogall) BASF	-	Biological	NR	P		Registered in stone fruit, almond, pecan & walnuts as a seed treatment for control of <b>Crown gall</b> . Dip and thoroughly wet seeds before planting.	-
<b>Ramularia Leaf Spot (<i>Ramularia pastinacae</i>)</b>							
<b>Priority: Low</b>							
Radish & Horseradish: Ramularia Leaf Spot was not ranked as an issue. Parsnip: Ramularia Leaf Spot was ranked as a low priority in VIC, WA, SA & TAS. Swede & Turnip: Ramularia Leaf Spot was ranked as a low priority in VIC, QLD, WA, NSW, SA & TAS. <i>Ramularia</i> is a pathogenic fungus known to produce toxic metabolites that contribute to symptom development in the host. It can infect most parts of the plant and can be economically damaging. Good on-farm sanitation is recommended.							
Propiconazole + Benzovindiflupyr (Elatus) Syngenta	3+7	Protectant & curative		P		Registered for control of <b>Ramularia Leaf Spot</b> in barley.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<b>Anthracnose</b> ( <i>Colletotrichum</i> spp.)							
<b>Priority: Unknown</b>							
Anthracnose was not ranked as a disease in root vegetables in the recent survey. This fungus can be seed-borne and carry over on crop residue in the soil. It is spread in water droplets and worse in warm, humid weather.							
Chlorothalonil (Bravo) PER82895	M5	Protectant	1 NG	P-A	ALL (excl. VIC)	Permitted in radish for control of Alternaria, Downy Mildew, Grey Leaf Spot and White Rust. Registered for control of <b>Anthracnose</b> in capsicums, peppers, cucurbits and grapes and permitted for control of <b>Anthracnose</b> in lettuce.	R3
Copper PER14038	M1	Protectant	1	P-A	ALL (excl. VIC)	Permitted in horseradish for control of White Blister Rust. Registered for control of <b>Anthracnose</b> in avocado, durians, guavas, macadamias, mangosteens, olives, rambutans, cucurbits and lettuce.	-
Mancozeb + Metalaxyl (Ridomil Gold MZ) Syngenta PER14045	M3+4	Protectant	7	P-A	ALL (excl. VIC)	Permitted in parsnip for control of <i>Pythium</i> spp. and <i>Phytophthora</i> spp. Registered for control of <b>Anthracnose</b> in cucurbits and lettuce.	R2
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 <b>Anthracnose</b> in almonds, stone fruit and tree nuts and Canadian registration for control of <b>Anthracnose</b> in fruiting vegetables and cucurbits.	R3
<i>Aureobasidium pullulans</i> (Botector) Nufarm	BM 02	Biological	NR	P		Registered for control of <b>Anthracnose</b> in berries.	-
<i>Bacillus amyloliquefaciens</i> strain QST713 (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for control of <b>Anthracnose</b> in avocado and mango.	-

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 <b>Anthracnose</b> in artichoke, asparagus, berries, citrus, cucurbits, fruiting vegetables, pome fruit, stone fruit, tobacco, root and tuber vegetables (except sugar beet) and tree nuts.	-
Benzovindiflupyr + Propiconazole (Elatus) Syngenta	7+3	Protectant & Curative		P		Registered for control of various disease in wheat and barley. US registration for control of <b>Anthracnose</b> in sweet corn.	R3
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protectant		P		Registered for control of <b>Anthracnose</b> in lettuce and nursery stock.	-
Dimethomorph (Acrobat) BASF	40	Protectant & Curative		P		Registered for control of <b>Anthracnose</b> in cucurbits and closed head varieties of lettuce.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis, <b>Anthracnose</b> , Alternaria, Scab, Monilinia, Rust and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot. US registration for control of <b>Anthracnose</b> in almonds, cucurbits and tree nuts.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of <b>Anthracnose</b> in tropical and sub-tropical fruit. Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot.	-
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 <b>Anthracnose</b> in cucurbits, leafy vegetables, stone fruit, strawberries and tree nuts.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Isofetamid (Kenja) ISK / AgNova	7	Protectant & Curative		P		Registered in berries for control of Botrytis Grey Mould. US registration for control of <b>Anthracnose</b> in almonds, grapes and low-growing berries.	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of <i>Botrytis</i> in berries, dried grapes, table grapes, wine grapes and strawberries and for control of <i>Botrytis</i> and <i>Sclerotinia</i> in leafy vegetables, lettuce and potato. US registration for control of <b>Anthracnose</b> in berries and tuberous and corm vegetables, suppression of <b>Anthracnose</b> in lemons and limes.	R3
<b>Grey Mould (<i>Botrytis cinerea</i>)</b>							
<b>Priority: Unknown</b>							
Grey Mould was not ranked as a disease in root vegetables in the recent survey. It can affect plants at most stages of production. Affected plant parts become water-soaked and soft and are rapidly covered with a thick grey mould. Botrytis also causes secondary rots on produce in storage or transit and in the marketplace.							
Chlorothalonil (Bravo)	M5	Protectant	1	A	ALL	Registered in radish for control of <b>Grey Mould</b> . [Max. no. of applications not specified; re-treatment interval: 7-10 d]	R3
Boscalid (Filan) BASF	7	Protectant	7	P-A	ALL	Registered in root and tuber vegetables for control of Sclerotinia Rot. Registered for control of <b>Botrytis</b> in grapevines and onions.	-
Penthiopyrad (Fontelis) Corteva	7	Protectant	7	P-A	ALL	Registered in parsnip, radish, swede and turnip for control of Early Blight and Powdery Mildew. Registered for control of <b>Grey Mould</b> in strawberries, onions, shallots, spring onions, cucurbits, fruiting vegetables and leafy vegetables.	-
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. Canadian registration for control of <b>Botrytis</b> in potato, tuberous and corm vegetables, bulb vegetables and fruiting vegetables.	R3
<i>Aureobasidium pullulans</i> (Botector) Nufarm	BM 02	Biological		P		Registered for control of <b>Botrytis</b> in berries, fruiting vegetables and grapes.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<i>Bacillus amyloliquefaciens</i> strain QST713 (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for control of <b>Botrytis</b> in grapevines and strawberries. US registration for control of <b>Botrytis</b> in artichoke, asparagus, berries, bulb vegetables, fruiting vegetables, grapes, cucurbits, grapes, herbs/spices, legume vegetables, root/tuber and corm vegetables, stone fruit and kiwi.	-
<i>Bacillus amyloliquefaciens</i> strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of <b>Botrytis</b> in grapevines and strawberries. US registration for control of <b>Botrytis</b> in artichoke, asparagus, berries, brassica leafy vegetables, bulb vegetables, fruiting vegetables, grapes, leafy vegetables, legume vegetables, pome fruit, stone fruit and tobacco.	-
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 <b>Botrytis</b> in fruiting vegetables, grapes, strawberries and ornamentals.	-
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protectant		P		Registered for control of <b>Botrytis</b> in capsicum, cucumber, cut flowers, grapes, green beans, green peas, lettuce, onions, alliums and strawberries.	-
Fenpyrazamine (Prolectus) Sumitomo	17	Protectant & Curative		P		Registered for <b>Botrytis</b> control in grapes. US registration for control of <b>Botrytis</b> in berries, ginseng, lettuce, pistachio, small fruit vine climbing (except fuzzy kiwifruit) and ornamentals.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, <b>Botrytis</b> , Anthracnose, Alternaria, Scab, Monilinia, Rust and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant		P		Registered for control of <b>Grey Mould</b> in grapevines. US registration for control of <b>Botrytis</b> in almond, artichoke, berries, brassica vegetables, Brassica leafy greens, stone fruit, dill seed, pome fruit, small fruit vine climbing (except fuzzy kiwifruit), herbs, hops, leafy greens, cucurbits, pistachio, fruiting vegetables and root vegetables (except sugar beet).	R3



Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of <b>Botrytis</b> in almonds and stone fruit. US registration for control of <b>Botrytis</b> in almond, artichoke, berries, brassica vegetables, brassica leafy greens, cherries, dill seed, pome fruit, small vine climbing fruit (except fuzzy kiwifruit), ginseng, herbs, hops. leafy greens, melons, pistachio, tomato, pepper and root vegetables.	-
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 <b>Botrytis spp.</b> in bulb vegetables, leafy vegetables, pome fruit, stone fruit, strawberries and tree nuts, and 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.	-
Isfetamid (Kenja) ISK / AgNova	7	Protectant		P		Registered for control of <b>Botrytis</b> in berries.	-
NUL3195 Nufarm	TBC			P		Fungicide in development from Nufarm with activity on Powdery Mildew and <b>Botrytis</b> .	-
Polyoxin-D (Intervene) Nufarm	19	Protectant		P		Pending registration for control of <b>Botrytis</b> and Powdery Mildew in grapes, <b>Botrytis</b> , Powdery Mildew and Rhizopus Fruit Rot in berries, and Powdery Mildew, Alternaria and Fruit Spot in apples.	-
Pyrimethanil (Scala) Bayer	9	Protectant		P		Registered for control of Botrytis Grey Mould in grapevines, ornamentals and strawberries and permitted for use in lettuce (protected) for control of <b>Botrytis Grey Mould</b> .	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of <b>Botrytis</b> in berries, dried grapes, table grapes, wine grapes and strawberries and for control of <b>Botrytis</b> and <i>Sclerotinia</i> in leafy vegetables, lettuce and potato.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<b>Septoria Leaf Spot</b> ( <i>Septoria</i> spp.)							
<b>Priority: Unknown</b>							
Septoria Leaf Spot was not ranked as a disease in root vegetables in the recent survey. Light brown irregular spots occur between the leaf veins which expand rapidly and cover the leaves. The fungus can survive on the old leaves removed at harvest, on weeds, and as spores on seed. The use of drip irrigation is recommended rather than sprinklers.							
Chlorothalonil (Bravo) PER82895	M5	Protectant	7	A	ALL (excl. VIC)	Permitted in parsnip for control of Early Blight ( <i>Cercospora</i> spp.) and <b>Septoria Leaf Spot</b> . [Max. no. of applications not specified; re-treatment interval: 7-10 d]	R3
Copper	M1	Protectant	1	A	ALL	Registered in parsnip for control of <b>Septoria Leaf Spot</b> . [Max. no. of applications not specified; re-treatment interval: 10-14 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 <b>Septoria Leaf Spot</b> in pistachios and tree nuts.	R3
Dimethomorph (Acrobat) BASF	40	Protectant		P		Registered for control of <b>Septoria Spot</b> in cucurbits and lettuce.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on <b>Septoria</b> , Powdery Mildew, Botrytis, Anthracnose, Alternaria, Scab, Monilinia, Rust and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	3+7	Protectant		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas and for control of Grey Mould and Powdery Mildew in grapevines. US registration for control of <b>Septoria Spot</b> in dry and succulent beans and pistachio.	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 <b>Septoria Spot</b> in leafy vegetables.	-

## **4.2 Insects, mites and other pests of radish, horseradish, parsnip, swede & turnip**

### **4.2.1 Insect, mite and other pest priorities - parsnips**

<b>Common name</b>	<b>Scientific name</b>
<b>Moderate</b>	
Green Peach Aphid	<i>Myzus persicae</i>
Cabbage Aphid	<i>Brevicoryne brassicae</i>
Diamondback Moth	<i>Plutella xylostella</i>
Cotton Bollworm	<i>Helicoverpa armigera</i>
Native Budworm	<i>Helicoverpa punctigera</i>
Cluster Caterpillar	<i>Spodoptera litura</i>
Potato Moth	<i>Phthorimaea operculella</i>
Cabbage White Butterfly	<i>Pieris rapae</i>
Cutworms	<i>Agrotis</i> spp.
False Wireworms	<i>Gonocephalum</i> spp.
Wireworm	<i>Arachnodima</i> spp., <i>Agrypnus</i> spp.
Vegetable Weevil	<i>Listroderes difficilis</i>
White-Fringed Weevil	<i>Naupactus leucoloma</i>
Root-Knot Nematodes	<i>Meloidogyne</i> spp.
<b>Low</b>	
Two-Spotted Mite	<i>Tetranychus urticae</i>
Tomato Russet Mite	<i>Aculops lycopersici</i>
European Red Mite	<i>Panonychus ulmi</i>
Rust Mite	Eriophyidae
Western Flower Thrips	<i>Frankliniella occidentalis</i>
Plague Thrips	<i>Thrips imaginis</i>
Onion Thrips	<i>Thrips tabaci</i>
Black Field Cricket	<i>Teleogryllus commodus</i>
Mole Cricket	<i>Gryllotalpa</i> spp.
Grasshoppers	Orthoptera
Jassids / Leafhoppers	Cicadellidae
Rutherglen Bug	<i>Nysius vinitor</i>
Slugs and Snails	Gastropoda

#### **4.2.2 Insect, mite and other pest priorities - radish and horseradish**

<b>Common name</b>	<b>Scientific name</b>
<b>High</b>	
Diamondback Moth	<i>Plutella xylostella</i>
<b>Moderate</b>	
Green Peach Aphid	<i>Myzus persicae</i>
Cabbage Aphid	<i>Brevicoryne brassicae</i>
Cabbage White Butterfly	<i>Pieris rapae</i>
Cutworms	<i>Agrotis</i> spp.
False Wireworms	<i>Gonocephalum</i> spp.
Wireworm	<i>Arachnodima</i> spp., <i>Agrypnus</i> spp.
Vegetable Weevil	<i>Listroderes difficilis</i>
White-Fringed Weevil	<i>Naupactus leucoloma</i>
<b>Low</b>	
Cotton Bollworm	<i>Helicoverpa armigera</i>
Native Budworm	<i>Helicoverpa punctigera</i>
Cluster Caterpillar	<i>Spodoptera litura</i>
Potato Moth	<i>Phthorimaea operculella</i>
Root-Knot Nematodes	<i>Meloidogyne</i> spp.
Western Flower Thrips	<i>Frankliniella occidentalis</i>
Plague Thrips	<i>Thrips imaginis</i>
Onion Thrips	<i>Thrips tabaci</i>
Two-Spotted Mite	<i>Tetranychus urticae</i>
Tomato Russet Mite	<i>Aculops lycopersici</i>
European Red Mite	<i>Panonychus ulmi</i>
Rust Mite	Eriophyidae
Black Field Cricket	<i>Teleogryllus commodus</i>
Mole Cricket	<i>Gryllotalpa</i> spp.
Grasshoppers	Orthoptera
Jassids / Leafhoppers	Cicadellidae
Rutherglen Bug	<i>Nysius vinitor</i>
Slugs and Snails	Gastropoda

### **4.2.3 Insect, mite and other pest priorities - swedes and turnips**

<b>Common name</b>	<b>Scientific name</b>
<b>High</b>	
Green Peach Aphid	<i>Myzus persicae</i>
Cabbage Aphid	<i>Brevicoryne brassicae</i>
Diamondback Moth	<i>Plutella xylostella</i>
<b>Moderate</b>	
Cotton Bollworm	<i>Helicoverpa armigera</i>
Native Budworm	<i>Helicoverpa punctigera</i>
Cluster Caterpillar	<i>Spodoptera litura</i>
Potato Moth	<i>Phthorimaea operculella</i>
Cabbage White Butterfly	<i>Pieris rapae</i>
Cutworms	<i>Agrotis</i> spp.
False Wireworms	<i>Gonocephalum</i> spp.
Wireworm	<i>Arachnodima</i> spp., <i>Agrypnus</i> spp.
Vegetable Weevil	<i>Listroderes difficilis</i>
White-Fringed Weevil	<i>Naupactus leucoloma</i>
Root-Knot Nematodes	<i>Meloidogyne</i> spp.
<b>Low</b>	
Two-Spotted Mite	<i>Tetranychus urticae</i>
Tomato Russet Mite	<i>Aculops lycopersici</i>
European Red Mite	<i>Panonychus ulmi</i>
Rust Mite	Eriophyidae
Western Flower Thrips	<i>Frankliniella occidentalis</i>
Plague Thrips	<i>Thrips imaginis</i>
Onion Thrips	<i>Thrips tabaci</i>
Black Field Cricket	<i>Teleogryllus commodus</i>
Mole Cricket	<i>Gryllotalpa</i> spp.
Grasshoppers	Orthoptera
Jassids / Leafhoppers	Cicadellidae
Rutherglen Bug	<i>Nysius vinitor</i>
Slugs and Snails	Gastropoda

#### **4.2.4 New exotic pest incursions that pose a potential threat**

<b>Common name</b>	<b>Scientific name</b>
<b>New Pest to Australia - Unknown Priority</b>	
Fall Armyworm	<i>Spodoptera frugiperda</i>
Vegetable Leafminer	<i>Liriomyza sativae</i>
Serpentine Leafminer	<i>Liriomyza huidobrensis</i>
Tomato Potato Psyllid	<i>Bactericera cockerelli</i>

The two highest priority insect pests identified by the survey are Diamondback moth and Aphids. Available and potential products for these pests are listed in Section 4.2.5.

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.

#### **Resistance Management**

Constant use of insecticides from one chemical grouping - Mode of Action (MoA), will increase the risk of rapid build-up of resistance to that chemical group. Alternate use of chemical groups with different MoAs will slow down the process of selection for resistance.

There are several insecticide management strategies that apply to various vegetables on the CropLife website<sup>6</sup>, including Diamondback Moth and Aphids.

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<sup>6</sup> [www.croplife.org.au/resources/programs/resistance-management/](http://www.croplife.org.au/resources/programs/resistance-management/)

## 4.2.5 Available and potential products for priority insects, mites and other pests

**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
<b>Green Peach Aphid</b> ( <i>Myzus persicae</i> ) <b>Cabbage Aphid</b> ( <i>Brevicoryne brassicae</i> ) <b>Priority: High</b> Radish & Horseradish: Aphids were ranked as a moderate priority in VIC, NSW & SA. Parsnip: Aphids were ranked as a moderate priority in VIC & SA, and as a low priority in WA & TAS. Swede & Turnip: Aphids were ranked as high priority in VIC & SA and as a moderate priority in QLD, WA, NSW & 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, <b>Green Peach Aphid</b> 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 turnip for control of <b>Aphids</b> , Jassids, Mites, Leafhoppers, Green Vegetable Bug, Thrips and Wingless Grasshoppers. [Max. no. of applications and re-treatment intervals not specified]	H Bee:H	R1

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, <b>Aphids</b> , 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	1	A	ALL	Registered in radish for control of <b>Aphids</b> , Mites, Thrips and Leafhopper. [Max. 4 applications per season; re-treatment intervals 14 d]	VL Bee:L	-
Pirimicarb (Aphidex)	1A	Contact	2	A	ALL	Registered in radishes, swede, turnip and turnip greens for control of <b>Cabbage Aphid</b> and <b>Green Peach Aphid</b> . [Max. no. of applications not specified; re-treatment interval 10-14 d]	VL Bee:VL	R3
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of <b>Aphids</b> , Thrips, Mealybug, Two Spotted Mites, Spider Mite and Whitefly. Apply when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	7	A	ALL	Registered in root and tuber vegetables for control of <b>Green Peach Aphid</b> and suppression of Tomato Potato Psyllid and Rutherglen Bug. [Max. no. applications not specified; re-treatment interval 7-10 d]	M Bee:VH	-
Afidopyropen (Versys) BASF	9D	Ingestion		P		Registered for the control of <b>Green Peach Aphid</b> 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, <b>Aphids</b> and Thrips. Pending regulatory approvals, first market introduction in Australia is expected early 2023.	-	-
Flonicamid (Mainman) UPL	9C	Ingestion		P		Registered for control of <b>Green Peach Aphid</b> in canola, cucurbits and potato.	M 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 label extension for control of Silverleaf Whitefly, <b>Green Peach Aphid</b> and Cotton Aphid in green beans, sweet potatoes and potatoes. US registration for control of <b>Green Peach Aphid</b> in brassica leafy vegetables, cucurbits, fruiting vegetables, leafy vegetables, tuberous and corm vegetables and turnip greens.	L Bee:VL	-
Pymetrozine (Chess) Syngenta	9B	Contact & Ingestion		P		Registered for control of <b>Cabbage Aphid</b> and <b>Green Peach Aphid</b> in brassica vegetables and for control of <b>Green Peach Aphid</b> in fruiting vegetables, lettuce, leafy vegetables, cucurbits, potatoes, stone fruit, almonds, pistachios, beetroot, cut flowers and nursery stock, and control of <b>Aphids</b> in celery.	L Bee:VL	R3
Spirotetramat (Movento) Bayer	23	Ingestion		P		Registered for control of <b>Green Peach Aphid</b> 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	-
<b>Diamondback Moth (<i>Plutella xylostella</i>)</b>								
<b>Priority: High</b>								
Radish & Horseradish: Diamondback Moth was ranked as a high priority in VIC, NSW & SA.								
Parsnip: Diamondback Moth was ranked as a moderate priority in VIC and as a low priority in WA, SA & TAS.								
Swede & Turnip: Diamondback Moth was ranked as high priority in VIC, QLD, NSW & SA, and as a moderate priority in WA & TAS.								
They are a problem when abundant early rains and mild winters allow them to multiply on volunteer canola plants and radish. Resistance to commonly used insecticides is a major concern. Crop monitoring is key to making effective decisions for controlling Diamondback Moth.								
Alpha-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of <b>Cabbage Moth</b> , Cabbage White Butterfly, Cluster Caterpillar and <i>Helicoverpa</i> spp. [Max no. of applications and re-treatment interval not specified]	VH Bee:H	-
<i>Bacillus thuringiensis subsp. Kurstaki</i> (DiPel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Caterpillars, including <b>Diamondback Moth</b> . [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
Beta-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of <b>Diamondback Moth</b> , <i>Helicoverpa punctigera</i> and <i>Helicoverpa armigera</i> . [Max no. of applications and re-treatment interval not specified]	VH Bee:H	-
Carbaryl	1A	Contact	3	A	ALL	Registered in swede and turnip for control of Vegetable Weevil, Wingless Grasshopper, Cabbage White Butterfly, Green Vegetables Bug, Heliothis, Pumpkin Beetle, Leaf Eating Ladybird, Cutworms, European Earwig, Potato Moth, Rutherglen Bug, Armyworms and <b>Cabbage Moth</b> . [Max no. of applications and re-treatment interval not specified]	H Bee:H	R3
Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of <b>Cabbage Moth</b> , Cabbage White Butterfly and <i>Helicoverpa</i> spp. [Max no. of applications and re-treatment interval not specified]	VH Bee:H	-
Diazinon	1B	Contact	14 G:14	A	ALL (excl. TAS)	Registered in parsnip for control of Cutworms and Caterpillars. [Max no. of applications and re-treatment interval not specified]	H Bee:VH	R3
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in root and tuber vegetables for control of <b>Diamondback Moth</b> , Cabbage White Butterfly, Heliothis, Cluster Caterpillar and Loopers. [Max. 4 applications per crop; min. re-treatment interval 7 d]	M Bee:H	-
Fipronil (Regent)	2B	Contact & Ingestion	7 NG	A	ALL	Registered in swede and turnip for control of <b>Diamondback Moth</b> . [Max. 4 applications per year, preferably applied within an 8 week period]	M Bee:VH	R3
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in root and tuber vegetables including radish, swede, turnip and parsnip for control of <b>Diamondback Moth</b> , 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, <b>Caterpillars</b> , 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	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Lambda-Cyhalothrin (Karate Zeon) PER11949	3A	Contact	2	A	ALL (excl. VIC)	Permitted in radish for control of <b>Diamondback Moth</b> and Vegetable Loopers. [Max no. of applications per crop and re-treatment interval not specified]	VH Bee:H	-
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in radishes, swede and turnip for control of <b>Diamondback Moth</b> , Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Lightbrown Apple Moth, Loopers, Helicoverpa, Potato Moth, Tomato Potato Psyllid and Western Flower Thrips [Max 2 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 and tuber vegetables for control of <b>Diamondback Moth</b> , Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Lightbrown Apple Moth, Loopers, Helicoverpa, Potato Moth and Western Flower Thrips [Max 4 applications per crop; re-treatment interval: 7-14 d]	M Bee:H	-
Trichlorfon (Lepidex)	1B	Contact	2	A	ALL	Registered in vegetables for control of Cabbage White Butterfly, <b>Cabbage Moth</b> , Rutherglen Bug and Green Vegetable Bug. [Max no. of applications not specified; re-treatment interval 7-10 d]	H Bee:H	R2
Zeta-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of <b>Cabbage Moth</b> , Cabbage White Butterfly and <i>Helicoverpa</i> spp. [Max no. of applications and re-treatment interval not specified]	VH Bee:H	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of <b>Diamondback Moth</b> in brassica vegetables.	L Bee:H	R3
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, Mites and <b>Caterpillars</b> . 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 <b>Lepidopteran</b> pests. Registrations and permits to control Lepidoptera pests in various vegetables including fruiting vegetables and lettuce.	VL Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
Spirotetramat (Movento) Bayer	23	Ingestion		P		Registered for control of <b>Diamondback Moth</b> in brassica vegetables.	M Bee:VL	-
<p><b>Cotton Bollworm</b> (<i>Helicoverpa armigera</i>)  <b>Native Budworm</b> (<i>Helicoverpa punctigera</i>)  <b>Cluster Caterpillar</b> (<i>Spodoptera litura</i>)  <b>Potato Moth</b> (<i>Phthorimaea operculella</i>)  <b>Cabbage White Butterfly</b> (<i>Pieris rapae</i>)  <b>Priority: Moderate</b></p> <p>Radish &amp; Horseradish: Caterpillars were ranked as a moderate priority in NSW and as a low priority in VIC &amp; SA. Cabbage White Butterfly was ranked as a moderate priority in VIC &amp; SA and as a low priority in NSW.  Parsnip: Caterpillars were ranked as a moderate priority in VIC, WA, SA &amp; TAS. Cabbage White Butterfly was ranked as a low priority in VIC, WA, SA &amp; TAS.  Swede &amp; Turnip: Caterpillars were ranked as a moderate priority in VIC, QLD, NSW &amp; TAS, and as a low priority in WA &amp; SA. Cabbage White Butterfly was ranked as moderate priority in VIC, SA &amp; TAS and as a low priority in QLD, NSW &amp; WA.  Young larvae feed on the leaf surface. Caterpillars are controlled by most conventional pesticides targeting <i>Helicoverpa</i>.  Young larvae feed on the leaf surface. Caterpillars are controlled by most conventional pesticides. Caterpillar attacks can induce fungal rots thus downgrading the produce quality.</p>								
Alpha-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Cabbage Moth, <b>Cabbage White Butterfly, Cluster Caterpillar</b> and <b><i>Helicoverpa</i> spp.</b> [Max no. of applications and re-treatment interval not specified]	VH Bee:H	-
<i>Bacillus thuringiensis</i> subsp. <i>Kurstaki</i> (DiPel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Caterpillars, including <b>Heliothis, Cluster Caterpillar</b> and <b>Cabbage White Butterfly</b> . [Apply a minimum of 2 sprays; re-treatment interval 3-5 d]	VL Bee:L	-
Beta-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Diamondback Moth, <b><i>Helicoverpa punctigera</i></b> and <b><i>Helicoverpa armigera</i></b> . [Max no. of applications and re-treatment interval not specified]	VH Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Carbaryl	1A	Contact	3	A	ALL	Registered in swede and turnip for control of Vegetable Weevil, Wingless Grasshopper, <b>Cabbage White Butterfly</b> , Green Vegetables Bug, <b>Heliothis</b> , Pumpkin Beetle, Leaf Eating Ladybird, Cutworms, European Earwig, <b>Potato Moth</b> , Rutherglen Bug, <b>Armyworms</b> and Cabbage Moth. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R3
Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Cabbage Moth, <b>Cabbage White Butterfly</b> and <b>Helicoverpa spp.</b> [Max no. of applications and re-treatment interval not specified]	VH Bee:H	-
					NSW, SA, TAS, VIC & WA	Registered in turnips for control of <b>Cluster Caterpillar</b> . [Max no. of applications and re-treatment interval not specified]		
Diazinon	1B	Contact	14 G:14	A	ALL (excl. TAS)	Registered in parsnip for control of Cutworms and Caterpillars. [Max no. of applications and re-treatment interval not specified]	H Bee:VH	R3
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in root and tuber vegetables for control of Diamondback Moth, <b>Cabbage White Butterfly</b> , <b>Heliothis</b> , <b>Cluster Caterpillar</b> 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 radish, swede, turnip and parsnip for control of Diamondback Moth, <b>Cabbage White Butterfly</b> , <b>Cluster Caterpillar</b> , <b>Potato Moth</b> and <b>Helicoverpa spp.</b> [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, <b>Caterpillars</b> , 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 NG	A	ALL	Permitted in radish, swede and turnip for control of <b>Helicoverpa spp.</b> , Cucumber Moth, <b>Cluster Caterpillar</b> , Loopers, Webworm, Rutherglen Bug & Thrips including Western Flower Thrips [Max 4 applications per crop; min. re-treatment interval 7 d]	H Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in radishes, swede and turnip for control of Diamondback Moth, <b>Cabbage White Butterfly</b> , Cabbage <b>Cluster Caterpillar</b> , Cabbage Centre Grub, Lightbrown Apple Moth, Loopers, <b>Helicoverpa</b> , <b>Potato Moth</b> , Tomato Potato Psyllid and Western Flower Thrips [Max 2 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 and tuber vegetables for control of Diamondback Moth, <b>Cabbage White Butterfly</b> , Cabbage <b>Cluster Caterpillar</b> , Cabbage Centre Grub, Lightbrown Apple Moth, Loopers, <b>Helicoverpa</b> , <b>Potato Moth</b> and Western Flower Thrips [Max 4 applications per crop; re-treatment interval: 7-14 d]	M Bee:H	-
Trichlorfon (Lepidex)	1B	Contact	2	A	ALL	Registered in vegetables for control of <b>Cabbage White Butterfly</b> , Cabbage Moth, Rutherglen Bug and Green Vegetable Bug. [Max no. of applications not specified; re-treatment interval 7-10 d]	H Bee:H	R2
Zeta-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Cabbage Moth, <b>Cabbage White Butterfly</b> and <b>Helicoverpa spp.</b> [Max no. of applications and re-treatment interval not specified]	VH Bee:H	-
					NSW, SA, TAS, VIC & WA	Registered in turnips for control of <b>Cluster Caterpillar</b> . [Max no. of applications and re-treatment interval not specified]		
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of <b>Cabbage White Butterfly</b> , <b>Helicoverpa</b> and <b>Cluster Caterpillar</b> in brassica vegetables, control of <b>Helicoverpa</b> in leafy vegetables and celery, control of <b>Helicoverpa</b> , <b>Cluster Caterpillar</b> and <b>Potato Moth</b> in fruiting vegetables, control of <b>Helicoverpa</b> and <b>Cluster Caterpillar</b> in cucurbits, and suppression of <b>Helicoverpa</b> in sweet corn.	L Bee:H	R3

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, Mites and <b>Caterpillars</b> . 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 <b>Lepidopteran</b> 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.	-	-
<b>Cutworms</b> ( <i>Agrotis</i> spp.)								
<b>Priority: Moderate</b>								
Radish & Horseradish: Cutworms were ranked as a moderate priority in VIC & SA and as a low priority in NSW.								
Parsnip: Cutworms were ranked as a moderate priority in VIC, SA & TAS and as a low priority in WA.								
Swede & Turnip: Cutworms were ranked as a moderate priority in VIC, SA & TAS and as a low priority in QLD, WA & NSW.								
Cutworms are caterpillars that attack seedling crops by chewing through leaves and stems at ground level. This frequently results in loss of whole plants which has a significant impact on production. If insecticide control is required, application should be made late afternoon to evening to coincide with when the larvae are feeding. MT16009 IPM Project Recommends: Predatory wasps, rotation, and early insecticide applications.								
Carbaryl	1A	Contact	3	A	ALL	Registered in swede and turnip for control of Vegetable Weevil, Wingless Grasshopper, Cabbage White Butterfly, Green Vegetables Bug, Heliopsis, Pumpkin Beetle, Leaf Eating Ladybird, <b>Cutworms</b> , European Earwig, Potato Moth, Rutherglen Bug, Armyworms and Cabbage Moth. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R3
Chlorpyrifos (Lorsban)	1B	Contact	NR	A	ALL	Registered in radish and turnip for control of <b>Cutworms</b> . [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Diazinon	1B	Contact	14 G:14	A	ALL (excl. TAS)	Registered in parsnip for control of <b>Cutworms</b> and Caterpillars. [Max no. of applications and re-treatment interval not specified]	H Bee:VH	R3
Alpha-Cypermethrin	3A	Contact	1	P-A	ALL	Registered in turnips for control of Cabbage Moth, Cabbage White Butterfly, Cluster Caterpillar and <i>Helicoverpa</i> spp. Registered for control of <b>Cutworms</b> in cereal crops, pulse crops and non-bearing grapevines.	VH Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Clothianidin + Imidacloprid (Poncho Plus) BASF	4A	Protectant / Seed Treatment		P		Registered for control of <b>Cutworms</b> as a seed treatment in sweet corn, sunflower, canola & forage brassica. Will provide early protection for 3-4 weeks after sowing.	M Bee:VH	R2
NUL3445 Nufarm	TBC			P		New active in development. Nufarm claims activity on <b>Lepidoptera</b> .	-	-
<p><b>False Wireworm</b> (<i>Gonocephalum</i> spp.)  <b>Wireworm</b> (<i>Arachnodima</i> spp., <i>Agrypnus</i> spp.)  <b>Priority: Moderate</b></p> <p>Radish &amp; Horseradish: Wireworms were ranked as a moderate priority in VIC &amp; NSW and as a low priority in SA. False Wireworms were ranked as a moderate priority in VIC and as a low priority in NSW &amp; SA.  Parsnip: Wireworms were ranked as a moderate priority in VIC &amp; TAS and as a low priority in WA &amp; SA. False Wireworms were ranked as a moderate priority in VIC, WA, SA &amp; TAS.  Swede &amp; Turnip: Wireworms were ranked as a moderate priority in VIC, QLD, NSW &amp; TAS and as a low priority in WA &amp; SA. False Wireworms were ranked as a moderate priority in VIC, WA &amp; TAS and as a low priority in QLD, NSW &amp; SA.  The larvae are soil-dwelling and will attack newly germinated seedlings by chewing the leaves and stems. This can lead to destruction of the whole plant.</p>								
1,3-Dichloropropene + Chloropicrin + (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, <b>Wireworms</b> , soil borne diseases and suppression of weeds. Restricted chemical. <b>For use by professional and registered fumigators only.</b>	-	-
Chlorpyrifos (Lorsban) PER14583	1B	Contact	28	A	ALL (excl. VIC)	Permitted in swede and turnip for control of African Black Beetle, <b>False Wireworms</b> and <b>Wireworms</b> . [Max no. of applications per crop and re-treatment interval not specified].	H Bee:H	R1
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi, Nematodes, <b>soil insects</b> and suppression of 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.	-	-
Fipronil (Regent) BASF	2B	Contact & stomach	7 NG	P-A	ALL	Registered in swede and turnip for control of Diamondback Moth. Registered for control of <b>Wireworms</b> in potato, sweet potato and sugarcane.	M Bee:VH	R3



Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
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 <b>Wireworms</b> , and a foliar treatment for the control of chewing pests in various crops.	-	-
Clothianidin + Imidacloprid (Poncho Plus) BASF	4A	Protectant / Seed Treatment		P		Registered for control of <b>Wireworm</b> as a seed treatment in sweet corn, sunflower, canola & forage brassica. Will provide early protection for 3-4 weeks after sowing.	M Bee:VH	R2
<b>Vegetable Weevil (<i>Listroderes difficilis</i>)</b> <b>White-Fringed Weevil (<i>Naupactus leucoloma</i>)</b> <b>Priority: Moderate</b> Radish & Horseradish: Weevils were ranked as a moderate priority in VIC & NSW, and as a low priority in SA. Parsnip: Weevils were ranked as a moderate priority in VIC & TAS, and as a low priority in WA & SA. Swede & Turnip: Weevils were ranked as a moderate priority in VIC, QLD, NSW & TAS, and as a low priority in WA & SA. 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.								
Carbaryl	1A	Contact	3	A	ALL	Registered in swede and turnip for control of <b>Vegetable Weevil</b> , Wingless Grasshopper, Cabbage White Butterfly, Green Vegetables Bug, Heliothis, Pumpkin Beetle, Leaf Eating Ladybird, Cutworms, European Earwig, Potato Moth, Rutherglen Bug, Armyworms and Cabbage Moth. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R3
Chlorpyrifos (Lorsban)	1B	Contact	NR	A	NSW & WA	Registered in vegetables including radish and turnip for control of <b>Vegetable Weevil</b> . [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Fipronil (Regent) BASF	2B	Contact & stomach	7 NG	P-A	ALL	Registered in swede and turnip for control of Diamondback Moth. Registered for control of <b>Weevils</b> in asparagus, potato and sweet potato.	M Bee:VH	R3
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of <b>Weevils</b> in pome fruit and stone fruit.	L Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/ <b>Weevils</b> , 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. Hort Innovation project ST17000 is generating data to support a label extension for control of Sweet Potato Weevil and White Fringe Weevil in root and tuber vegetables (sweet potato).	M Bee:VH	-
<b>Root-Knot Nematode</b> ( <i>Meloidogyne</i> spp.)								
<b>Priority: Moderate</b>								
Radish & Horseradish: Root-Knot Nematode was ranked as a low priority in VIC, NSW & SA.								
Parsnip: Root-Knot Nematode were ranked as a moderate priority in VIC & SA and as low priority in WA & TAS.								
Swede & Turnip: Root-Knot Nematode was ranked as a moderate priority in VIC, QLD, NSW & SA and as a low priority in WA & TAS.								
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)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic <b>Nematodes</b> , Symphylans, 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. <b>For use by professional and registered fumigators only.</b>	-	-
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi, <b>Nematodes</b> , soil insects and suppression of 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 soil fungal diseases and <b>Nematodes</b> . Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Abamectin (Tervigo) Syngenta	6	Contact		P		Registered for control of <b>Root-Knot Nematode</b> in peppers, chillis, cucurbits, eggplant and tomatoes.	M Bee:H	-
Fluazaindolizine (Reklemel, Salibro) Corteva	TBC			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.	-	-
Fluensulfone (Nimitz) Adama	-	Contact		P		Registered for control of <b>Root-Knot Nematode</b> in peppers, carrot, chilli, cucurbits, eggplant, okra, potato, sugarcane, sweet potato and tomato.	L Bee:L	-
Fluopyram (Velum) Bayer	7			P		US registration for control of <b>nematodes</b> in a range of vegetables.	L Bee:L	-
NUL3145 Nufarm	TBC			P		New product in development from Nufarm with activity on Scale, <b>nematodes</b> , 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
<b>Two-Spotted Mite</b> ( <i>Tetranychus urticae</i> ) <b>Tomato Russet Mite</b> ( <i>Aculops lycopersici</i> ) <b>European Red Mite</b> ( <i>Panonychus ulmi</i> ) <b>Rust Mite</b> (Eriophyidae) <b>Priority: Low</b> Radish & Horseradish: Mites were ranked as a low priority in VIC, NSW & SA. Parsnip: Mites were ranked as a moderate priority in WA and as a low priority in VIC, SA & TAS. Swedes & Turnip: Mites were ranked as a moderate priority in WA and as a low priority in VIC, QLD, NSW, SA & TAS. Mites feed on aerial parts of the plant with the damage caused providing entry points for soil-borne disease. Two-Spotted Mite causes minor and infrequent damage to the aerial parts of the plant. 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 <b>Two-Spotted Spider Mites</b> . [Max. 3 application per crop; re-treatment interval 3-14 d]	L Bee:L	-
Dimethoate	1B	Contact	14	A	ALL	Registered in turnip for control of Aphids, Jassids, <b>Mites</b> , Leafhoppers, Green Vegetable Bug, Thrips and Wingless Grasshoppers. [Max. no. of applications and re-treatment intervals not specified]	H Bee:H	R1
Petroleum Oil	UN	Contact	1	A	ALL	Registered in radish for control of Aphids, <b>Mites</b> , 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, <b>Two Spotted Mites, Spider Mite</b> and Whitefly. Apply when temperatures are cooler. [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 <b>Spider Mite</b> and <b>Two-Spotted Mites</b> . [Max no. of applications per crop and re-treatment interval not specified]	M Bee:L	R3
Sulphur	UN	Contact	NR	A	ALL	Registered in vegetables for control of <b>Mites</b> . [Max. no. of applications not specified; re-treatment interval 14-21 d]	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Abamectin	6	Contact & Ingestion		P		Registered for control of <b>Mites</b> in capsicums, tomatoes, strawberries and ornamentals.		
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 <b>Two-Spotted Mites</b> in pome fruit, stone fruit, almonds and grapes.	L Bee:VL	-
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, <b>Mites</b> and Caterpillars. Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables.	-	-
Spiromesifen (Oberon) Bayer	23	Ingestion		P		Australian Registration pending for control of <b>Mites</b> in various vegetables crops.	M Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
<b>Western Flower Thrips</b> ( <i>Frankliniella occidentalis</i> ) <b>Plague Thrips</b> ( <i>Thrips imaginis</i> ) <b>Onion Thrips</b> ( <i>Thrips tabaci</i> ) <b>Priority: Low</b> Radish & Horseradish: Thrips were ranked as a moderate priority in NSW and as a low priority in VIC & SA. Parsnip: Thrips were ranked as a low priority in VIC, WA, SA & TAS. Swedes & Turnip: Thrips were ranked as a low priority in VIC, QLD, WA, NSW, SA & TAS. Identification of the correct species is important prior to treatment. MT16009 IPM Project Recommends: The use of predatory thrips, mites & bug releases, control flowering weeds, mulch and use of certified seed.								
<i>Beauveria bassiana</i> (Velifer) BASF	UNF	Biological	NR	A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including <b>Western Flower Thrips</b> , <b>Onion Thrips</b> , 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 turnip for control of Aphids, Jassids, Mites, Leafhoppers, Green Vegetable Bug, <b>Thrips</b> and Wingless Grasshoppers. [Max. no. of applications and re-treatment intervals 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, <b>Thrips</b> 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 NG	A	ALL	Permitted in radish, swede and turnip for control of <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug and <b>Thrips</b> including <b>Western Flower Thrips</b> [Max 4 applications per crop; min. re-treatment interval 7 d]	H Bee:H	R3
Petroleum Oil	UN	Contact	1	A	ALL	Registered in radish for control of Aphids, Mites, <b>Thrips</b> 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
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of Aphids, <b>Thrips</b> , Mealybug, Two Spotted Mites, Spider Mite and Whitefly. Apply when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in radishes, swede and turnip for control of Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Lightbrown Apple Moth, Loopers, Helicoverpa, Potato Moth, Tomato Potato Psyllid and <b>Western Flower Thrips</b> . [Max 2 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 and tuber vegetables for control of Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Lightbrown Apple Moth, Loopers, Helicoverpa, Potato Moth and <b>Western Flower Thrips</b> . [Max 4 applications per crop; re-treatment interval: 7-14 d]	M Bee:H	-
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 <b>Thrips</b> . Pending regulatory approvals, first market introduction in Australia is expected by late 2022 or early 2023.	-	-
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 Aphid, Cotton Aphid, Fruit Spotting Bugs and Planthoppers. US registration for suppression of <b>Thrips</b> in berries, citrus, fruiting vegetables, tropical and subtropical fruit.	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 <b>Thrips</b> , Bugs, 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 <b>Thrips</b> .	-	-
Spirotetramat (Movento) Bayer	23	Ingestion		P		Registered for control of <b>Thrips</b> in green beans, celery, rhubarb, eggplant, peppers, tomatoes, herbs, lettuce, and bulb vegetables.	M Bee:VL	-
<b>Black Field Cricket</b> ( <i>Teleogryllus commodus</i> ) <b>Mole Cricket</b> ( <i>Gryllotalpa</i> spp.) <b>Priority: Low</b> Radish & Horseradish: Crickets were ranked as a low priority in VIC, NSW & SA. Parsnip: Crickets were ranked as a low priority in VIC, WA, SA & TAS. Swede & Turnip: Crickets were ranked as a low priority in VIC, QLD, WA, NSW, 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.								
1,3-Dichloropropene + Chloropicrin + (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, 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. <b>For use by professional and registered fumigators only.</b>	-	-
Chlorpyrifos (Lorsban)	1B	Contact	NR	A	QLD & WA	Registered in radish and turnip for the control of <b>Field Crickets</b> and <b>Mole Crickets</b> . Apply as a soil drench or boom spray. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi, Nematodes, soil insects and suppression of 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.	-	-



Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Fipronil (Regent) BASF	2B	Contact & stomach	7 NG	P-A	ALL	Registered in swede and turnip for control of Diamondback Moth. Registered for control of <b>Mole Crickets</b> in potatoes.	M Bee:VH	R3
<b>Grasshoppers</b> (Orthoptera)								
<b>Priority: Low</b>								
Radish & Horseradish: Grasshoppers were ranked as a low priority in VIC, NSW & SA.								
Parsnip: Grasshoppers were ranked as a low priority in VIC, WA, SA & TAS.								
Swede & Turnip: Grasshoppers were ranked as a low priority in VIC, QLD, WA, NSW, 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.								
Carbaryl	1A	Contact	3	A	ALL	Registered in swede and turnip for control of Vegetable Weevil, <b>Wingless Grasshopper</b> , Cabbage White Butterfly, Green Vegetables Bug, Heliothis, Pumpkin Beetle, Leaf Eating Ladybird, Cutworms, European Earwig, Potato Moth, Rutherglen Bug, Armyworms and Cabbage Moth. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R3
Chlorpyrifos (Lorsban)	1B	Contact	NR	A	NSW, ACT, WA, VIC & TAS	Registered in radish and turnip for the control of <b>Wingless Grasshopper</b> . Apply as a soil drench or boom spray. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Dimethoate	1B	Contact	14	A	ALL	Registered in turnip for control of Aphids, Jassids, Mites, Leafhoppers, Green Vegetable Bug, Thrips and <b>Wingless Grasshoppers</b> . [Max. no. of applications and re-treatment intervals not specified]	H Bee:H	R1

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
<b>Jassids / Leafhoppers</b> (Cicadellidae)								
<b>Priority: Low</b>								
Radish & Horseradish: Jassids were ranked as a low priority in VIC, NSW & SA.								
Parsnip: Jassids were ranked as a low priority in VIC, WA, SA & TAS.								
Swede & Turnip: Jassids were ranked as a low priority in VIC, QLD, WA, NSW, SA & TAS.								
Adult and nymph leafhoppers suck sap and inject toxins. Some leafhopper species transmit diseases such as viruses and phytoplasmas. Perimeter sprays may be an option to minimise vector transmission.								
Dimethoate	1B	Contact	14	A	ALL	Registered in turnip for control of Aphids, <b>Jassids</b> , Mites, <b>Leafhoppers</b> , Green Vegetable Bug, Thrips and Wingless Grasshoppers. [Max. no. of applications and re-treatment intervals 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 <b>Leafhoppers</b> . 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	1	A	ALL	Registered in radish for control of Aphids, Mites, Thrips and <b>Leafhopper</b> . [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 <b>Leafhoppers</b> in berries, pome fruit and root and tuber vegetables.	M Bee:VH	-
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 label extension for control of Silverleaf Whitefly, Green Peach Aphid and Cotton Aphid in green beans, sweet potatoes and potatoes. US registration for control of Aphids, Leafhoppers and Whiteflies in sweet corn.	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, <b>Bugs</b> , Mites and Caterpillars. Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables	-	-
<b>Rutherglen Bug (<i>Nysius vinitor</i>)</b>								
<b>Priority: Low</b>								
Radish & Horseradish: Rutherglen Bug was ranked as a low priority in VIC, NSW & SA. Parsnip: Rutherglen Bug was ranked as a low priority in VIC, WA, SA & TAS. Swede & Turnip: Rutherglen Bug was ranked as a low priority in VIC, QLD, WA, NSW, 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. Repeated influxes of migrating adults can make repeat insecticide applications necessary. Large numbers can cause significant feeding damage to foliage by sucking the sap and depleting the crop of nutrients.								
Carbaryl	1A	Contact	3	A	ALL	Registered in swede and turnip for control of Vegetable Weevil, Wingless Grasshopper, Cabbage White Butterfly, Green Vegetables Bug, Heliothis, Pumpkin Beetle, Leaf Eating Ladybird, Cutworms, European Earwig, Potato Moth, <b>Rutherglen Bug</b> , Armyworms and Cabbage Moth. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R3
Methomyl (Lannate) PER82428	1A	Contact	7 NG	A	ALL	Permitted in radish, swede and turnip for control of <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, <b>Rutherglen Bug</b> and Thrips including Western Flower Thrips. [Max 4 applications per crop; min. re-treatment interval 7 d]	H Bee:H	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 <b>Rutherglen Bug</b> . [Max. no. 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, <b>Rutherglen Bug</b> and Green Vegetable Bug. [Max no. of applications not specified; re-treatment interval 7-10 d]	H Bee:H	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Dimethoate	1B	Contact	14	P-A	ALL	Registered in turnip for control of Aphids, Jassids, Mites, Leafhoppers, Green Vegetable Bug, Thrips and Wingless Grasshoppers. Registered for control of <b>Rutherglen Bug</b> in cotton, berries, ornamentals and wildflowers.	H Bee:H	R1
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 label extension for control of Silverleaf Whitefly, Green Peach Aphid and Cotton Aphid in green beans, sweet potatoes and potatoes. US registration for control of Aphids, Leafhoppers and Whiteflies in sweet corn.	L Bee:VL	-
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, <b>Bugs</b> , Mites and Caterpillars. Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables	-	-
<b>Snails &amp; Slugs</b> (Gastropoda)								
<b>Priority: Low</b>								
Radish & Horseradish: Slugs and Snails were ranked as a low priority in VIC, NSW & SA.								
Parsnip: Slugs and Snails were ranked as a low priority in VIC, WA, SA & TAS.								
Swede & Turnip: Slugs and Snails were ranked as a low priority in VIC, QLD, WA, NSW, SA & TAS.								
They are active after dusk when chemical treatments can be most effective.								
Iron EDTA Complex	-	Contact & Ingestion	NR	A	ALL	Registered in all plants for the control of <b>Snails &amp; Slugs</b> . Spread pellets evenly on ground. [Max no. of applications and re-treatment not specified]	-	-
Metaldehyde	-	Contact & Ingestion	7	A	ALL	Registered in vegetables for the control of <b>Snails &amp; Slugs</b> . Spread pellets evenly on ground. [Max no. of applications and re-treatment not specified]	-	-
Methiocarb (MesuroI)	1A	Contact & Ingestion	NR	A	ALL	Registered in vegetables for control of <b>Snails &amp; Slugs</b> . [Max no. of applications and re-treatment not specified]	H Bee:M	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
<b>Fall Armyworm</b> ( <i>Spodoptera frugiperda</i> )								
<b>Priority: Unknown</b>								
Fall Armyworm was not ranked as a pest in parsnip, swede, turnip, radish & horseradish. 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 (except potato) for control of <b>Fall Armyworm</b> [Max 3 applications per crop; re-treatment interval 7-14 d]	L Bee:VL	-
Emamectin (Proclaim Opti) Syngenta PER89263	6	Ingestion	3 NG	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of <b>Fall Armyworm</b> . [Max 4 applications per crop; re-treatment interval: 7 d]	M Bee:H	-
Methomyl (Lannate) PER89293	1A	Contact	1 NG	A	ALL	Permitted in radish, swede & turnip for control of <b>Fall Armyworm</b> . [Max. 4 application per crop; re-treatment interval 7 d]	H Bee:H	R2
Spinetoram (Success Neo) Corteva PER89241	5	Ingestion	3	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of <b>Fall Armyworm</b> . [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 in root and tuber vegetables for control of <b>Fall Armyworm</b> . [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 in root & tuber vegetables for control of <b>Fall Armyworm</b> . [Max 10 applications per crop; Min. re-treatment interval: 3 d]	VL Bee:L	-

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 <b>Fall Armyworm</b> 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 <b>Spodoptera spp.</b> 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 <b>Fall Armyworm</b> in sweet corn, brassica vegetables, celery, capsicum, eggplant, peppers, tomato, leafy vegetables, Chinese leafy vegetables, pome fruit, stone fruit, grapes, berries and macadamia nuts.	L Bee:H	R3
Isocycloseram (Plinazolin) Syngenta	30	Ingestion		P		First global application is proposed for 2023 for Thrips, Bugs, Mites and <b>Caterpillars</b> . Registration submitted May 2021 for isocycloseram to control Mites, Thrips and Helicoverpa in fruiting vegetables	-	-
<b>Vegetable Leafminer (<i>Liriomyza sativae</i>)</b> <b>Serpentine Leafminer (<i>Liriomyza huidobrensis</i>)</b> <b>Priority: Unknown</b>								
Liriomyza Leafminers were not ranked as a pest in root vegetables. 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	Permitted in root & tuber vegetables for suppression of <b>Liriomyza Leafminers</b> . [Max 2 applications per crop; Re-treatment interval: 7-14 d]	M Bee:H	-
Cyromazine (Diptex 150WP) PER81867	17	Contact	7 NG	A	ALL	Permitted in root and tuber vegetables for control of <b>Liriomyza Leafminers</b> . [Max. 6 applications per crop; re-treatment interval 7 d]	L Bee:L	-
Spinetoram (Success Neo) Corteva PER91155	5	Ingestion	3	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of <b>Liriomyza Leafminers</b> . [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 PER90928	5	Ingestion	3 G:14	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of <b>Liriomyza Leafminers</b> . [Max. 4 applications per crop; min. re-treatment interval 5 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 <b>Leafminers</b> ( <i>Liriomyza</i> spp.) in spinach and silverbeet.	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. Permitted for control of <b>Liriomyza</b> species, including <b>Vegetable Leafminer</b> ( <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 <b>Liriomyza</b> species, including <b>Vegetable Leafminer</b> ( <i>Liriomyza sativae</i> ), <b>Pea Leafminer/Serpentine Leafminer</b> ( <i>Liriomyza huidobrensis</i> ) and <b>American Serpentine Leafminer</b> ( <i>Liriomyza trifolii</i> ).	L Bee:L	-
Spirotetramat (Movento) Bayer	23	Ingestion		P		Permitted for control of <b>Liriomyza Leafminers</b> in snow peas, sugar snap peas, lettuce, parsley, eggplant, capsicums, chilies, tomatoes, green beans, celery and rhubarb.	M Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
<b>Tomato Potato Psyllid</b> ( <i>Bactericera cockerelli</i> )								
<b>Priority: Unknown</b>								
Tomato Potato Psyllid was not ranked as a pest in Root Vegetables. 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.								
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in radishes, swede and turnip for control of Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Lightbrown Apple Moth, Loopers, Helicoverpa, Potato Moth, <b>Tomato Potato Psyllid</b> and Western Flower Thrips. [Max 2 applications per crop; re-treatment interval: 7-14 d]	M Bee:H	-
Spinetoram (Success Neo) Corteva PER84757	5	Ingestion	3	A	ALL (excl. VIC)	Permitted root & tuber vegetables for control of <b>Tomato Potato Psyllid</b> . [Max. 4 application per crop; re-treatment interval 7-14 d]	M Bee:H	-
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	7	A	ALL	Registered in root and tuber vegetables for control of Green Peach Aphid and suppression of <b>Tomato Potato Psyllid</b> and Rutherglen Bug. [Max. no. applications not specified; re-treatment interval 7-10 d]	M Bee:VH	-
Sulfoxaflor (Transform) Corteva PER84743	4C	Contact & Ingestion	7	A	ALL	Permitted in root and tuber vegetables for control of <b>Tomato Potato Psyllid</b> . [Max 4 applications per crop, no more than 2 consecutive; re-treatment interval 7-10 d]	M Bee:VH	-
Abamectin PER81876	6	Contact & Ingestion	14 NG	P-A	ALL	Permitted in root & tuber vegetables for suppression of Liriomyza Leafminers. Permitted for control of <b>Tomato Potato Psyllid</b> in tomato, eggplant, capsicum, chilli pepper and nursery stock.	M Bee:H	-
Cyantraniliprole (Benevia) FMC	28	Ingestion		P		Permitted for control of <b>Tomato Potato Psyllid</b> in fruiting vegetables, potatoes and sweet potatoes.	M Bee:VH	-



<b>Pest / Active Ingredient (Trade Name)</b>	<b>Chemical group</b>	<b>Activity</b>	<b>WHP, days</b>	<b>Availability</b>	<b>States</b>	<b>Comments</b>	<b>Impact on beneficials</b>	<b>Regulatory risk</b>
Spiromesifen (Oberon) Bayer	23	Ingestion		P		Registration pending for control of Mites. US registration for control of <b>Tomato Potato Psyllid</b> in tuberous and corm vegetables. Hort Innovation is undertaking data generation projects across multiple commodities for a new label registration in Australia.	M Bee:VL	-
Spirotetramat (Movento) Bayer	23	Ingestion		P		Registered for control of various species of Aphids, Thrips and Whitefly in various vegetables crops. Permitted for control of <b>Tomato Potato Psyllid</b> in potato, sweet potato, tomato, capsicum, chilli, pepper and eggplant.	M Bee:VL	-

### **4.3 Weeds in radish, horseradish, parsnip, swede & turnip**

#### **4.3.1 Weed priorities**

<b>Common Name</b>	<b>Scientific Name</b>
<b>High</b>	
Wild Radish	<i>Raphanus raphanistrum</i>
Amaranthus	<i>Amaranthus</i> spp.
<b>Moderate</b>	
Chickweed	<i>Stellaria media</i>
Fat Hen	<i>Chenopodium album</i>
Annual Ryegrass	<i>Lolium rigidum</i>
Blackberry Nightshade	<i>Solanum nigrum</i>
Stinging Nettle	<i>Urtica</i> spp.
Fumitory	<i>Fumaria</i> spp.
Nutgrass	<i>Cyperus rotundus</i>

The high priority weed issues based on the feedback received were Wild Radish and Amaranthus. 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 webpage<sup>7</sup>.

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<sup>7</sup> <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
<b>Wild Radish</b> ( <i>Raphanus raphanistrum</i> )							
<b>Priority: High</b>							
Radish & Horseradish: Wild Radish was ranked as a moderate priority in VIC, NSW & SA.							
Parsnip: Wild Radish was ranked as a high priority in WA, SA & TAS and as a moderate priority in VIC.							
Swede & Turnip: Wild Radish was ranked as a high priority in WA, SA & TAS and as a moderate priority in VIC, QLD & NSW.							
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
Linuron	C**	Parsnip / Post-plant / Pre-emergence	Registered in parsnip for control of grass and broadleaf weeds, including <b>Wild Radish</b> . [Max. 1 application per crop]	70	A	ALL	R3
Linuron PER12357	C**	Parsnip / Early post- emergent	Permitted in turnip for control of grass and broadleaf weeds, including <b>Wild Radish</b> . Apply early post-emergence from the 1-2 true leaf stage. [Max. 1 application per crop]	70 NG	A	ALL (excl. VIC)	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

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Pendimethalin (Stomp) PER14858	D**	Parsnip/ Pre-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including suppression of <b>Wild Radish</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Pendimethalin (Stomp) PER14048	D**	Radish/ Pre-emergent	Permitted in radish for control of grass and broadleaf weeds, including suppression of <b>Wild Radish</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Prometryn PER12048	C**	Parsnip / Pre- and post-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Wild Radish</b> . [Max. 1 application per crop]	NR NG	A	ALL (excl. VIC)	-
Clomazone	Q**		Registered for control of broadleaf weeds including suppression of <b>Wild Radish</b> in poppies.		P		-
Fluroxypyr (Starane)	I**		Registered for control of broadleaf weeds, including <b>Wild Radish</b> in winter cereals.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including <b>Wild Radish</b> in berries, tomatoes, beans and fallow.		P		R3
Norflurazon (Zoliar) Agnova	F**		Registered for control of grass and broadleaf weeds including <b>Wild Radish</b> 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 <b>Wild Radish</b> 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
<b>Amaranthus</b> ( <i>Amaranthus</i> spp.)							
<b>Priority: High</b>							
Radish & Horseradish: Amaranthus was ranked as a moderate priority in VIC & NSW.							
Parsnip: Amaranthus was ranked as a high priority in WA & TAS and as a moderate priority in VIC.							
Swede & Turnip: Amaranthus was ranked as a high priority in WA & TAS and as a moderate priority in VIC, QLD & NSW.							
Short-lived annual weed that can pose a problem every year as they are prolific seed producers.							
Chlorthal-Dimethyl (Dacthal)	D**	Turnip, Radish / Pre-Plant / Pre-Emergent	Registered in turnip and radish for control of grass and broadleaf weeds, including <b>Amaranth</b> . Apply as a pre-emergence application at transplanting.	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
Linuron	C**	Parsnip / Post-plant / Pre-emergence	Registered in parsnip for control of grass and broadleaf weeds, including <b>Amaranth</b> . [Max. 1 application per crop]	70	A	ALL	R3
Linuron PER12357	C**	Parsnip / Early post-emergent	Permitted in turnip for control of grass and broadleaf weeds, including <b>Amaranth</b> . Apply early post-emergence from the 1-2 true leaf stage. [Max. 1 application per crop]	70 NG	A	ALL (excl. VIC)	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
Pendimethalin (Stomp) PER14858	D**	Parsnip/ Pre-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Amaranth</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Pendimethalin (Stomp) PER14048	D**	Radish/ Pre-emergent	Permitted in radish for control of grass and broadleaf weeds, including <b>Amaranth</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Prometryn PER12048	C**	Parsnip / Pre- and post-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Amaranth</b> . [Max. 1 application per crop]	NR NG	A	ALL (excl. VIC)	-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Trifluralin	D**	Swede, turnip & parsnip / Pre-Plant / Pre-Emergent	Registered in swede, turnip & parsnip for control of grass and broadleaf weeds, including <b>Amaranthus</b> . Incorporate into soil within 4 hours of application. [Max 1 application per crop]	NR NG	A	ALL	-
Clomazone	Q**		Registered for control of broadleaf weeds including suppression of <b>Amaranth</b> in beans, poppies, potato and tobacco transplants.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds, including <b>Amaranth</b> in sweet corn, beans, peas, pumpkins and kabocho.		P		-
Fluroxypyr (Starane)	I**		Registered for control of broadleaf weeds, including <b>Amaranth</b> in sorghum, maize, sweet corn and millet.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including <b>Amaranth</b> in berries, tomatoes, beans and fallow.		P		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 <b>Amaranth</b> 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 <b>Amaranth</b> in Brassica vegetables and beans.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
<b>Chickweed (<i>Stellaria media</i>)</b>							
<b>Priority: Moderate</b>							
Radish & Horseradish: Chickweed was ranked as a moderate priority in VIC.							
Parsnip: Chickweed was ranked as high priority in TAS and as a moderate priority in VIC & WA.							
Swede & Turnip: Chickweed was ranked as high priority in TAS and as a moderate priority in VIC, QLD & WA.							
Low growing, winter annual weed that can continue growing all through summer. Targeting weed control prior to their flowering is critical.							
Chlorthal-Dimethyl (Dacthal)	D**	Turnip, Radish / Pre-Plant / Pre-Emergent	Registered in turnip and radish for control of grass and broadleaf weeds, including <b>Chickweed</b> . Apply as a pre-emergence application at transplanting.	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
Linuron	C**	Parsnip / Post-plant / Pre-emergence	Registered in parsnip for control of grass and broadleaf weeds, including <b>Chickweed</b> . [Max. 1 application per crop]	70	A	ALL	R3
Linuron PER12357	C**	Parsnip / Early post-emergent	Permitted in turnip for control of grass and broadleaf weeds, including <b>Chickweed</b> . Apply early post-emergence from the 1-2 true leaf stage. [Max. 1 application per crop]	70 NG	A	ALL (excl. VIC)	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
Pendimethalin (Stomp) PER14858	D**	Parsnip/ Pre-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Chickweed</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Pendimethalin (Stomp) PER14048	D**	Radish/ Pre-emergent	Permitted in radish for control of grass and broadleaf weeds, including <b>Chickweed</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Prometryn PER12048	C**	Parsnip / Pre- and post-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Chickweed</b> . [Max. 1 application per crop]	NR NG	A	ALL (excl. VIC)	-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Propachlor (Ramrod) PER11441	K**	Radish, swede & turnip / Pre-emergent / Post-transplant	Permitted in radish for control of grass and broadleaf weeds, including <b>Chickweed</b> . Apply to the soil surface prior to weed or seeded-crop emergence. Rainfall or irrigation is required soon after application to activate the product.	NR	A	ALL (excl. VIC)	R3
Norflurazon (Zoliar) Agnova	F**		Registered for control of grass and broadleaf weeds including <b>Chickweed</b> 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 <b>Chickweed</b> 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 <b>Chickweed</b> in Brassica vegetables and beans.		P		-
<b>Fat Hen</b> ( <i>Chenopodium album</i> )							
<b>Priority: Moderate</b>							
Radish & Horseradish: Fat Hen was ranked as a moderate priority in VIC, NSW & SA.							
Parsnip: Fat Hen was ranked as a high priority in TAS and as a moderate priority in VIC & SA.							
Swede & Turnip: Fat Hen was ranked as a high priority in TAS and as a moderate priority in VIC, QLD, SA & NSW.							
Herbicide control can be difficult and targeting weeds at early growth stages is critical.							
Chlorthal-Dimethyl (Dacthal)	D**	Turnip, Radish / Pre-Plant / Pre-Emergent	Registered in turnip and radish for control of grass and broadleaf weeds, including <b>Fat Hen</b> . Apply as a pre-emergence application at transplanting.	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
Linuron	C**	Parsnip / Post-plant / Pre-emergence	Registered in parsnip for control of grass and broadleaf weeds, including <b>Fat Hen</b> . [Max. 1 application per crop]	70	A	ALL	R3



Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Linuron PER12357	C**	Parsnip / Early post-emergent	Permitted in turnip for control of grass and broadleaf weeds, including <b>Fat Hen</b> . Apply early post-emergence from the 1-2 true leaf stage. [Max. 1 application per crop]	70 NG	A	ALL (excl. VIC)	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
Pendimethalin (Stomp) PER14858	D**	Parsnip/ Pre-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Fat Hen</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Pendimethalin (Stomp) PER14048	D**	Radish/ Pre-emergent	Permitted in radish for control of grass and broadleaf weeds, including <b>Fat Hen</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Prometryn PER12048	C**	Parsnip / Pre- and post-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Fat Hen</b> . [Max. 1 application per crop]	NR NG	A	ALL (excl. VIC)	-
Propachlor (Ramrod) PER11441	K**	Radish, swede & turnip / Pre-emergent / Post-transplant	Permitted in radish for control of grass and broadleaf weeds, including <b>Fat Hen</b> . Apply to the soil surface prior to weed or seeded-crop emergence. Rainfall or irrigation is required soon after application to activate the product.	NR	A	ALL (excl. VIC)	R3
Trifluralin	D**	Swede, turnip & parsnip / Pre-Plant / Pre-Emergent	Registered in swede, turnip & parsnip for control of grass and broadleaf weeds. Registered for control of <b>Fat Hen</b> in oil tea tree.	NR NG	P-A	ALL	-
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. <b>Fat Hen</b> is listed as susceptible.		P		-
Clomazone	Q**		Registered for control of broadleaf weeds including <b>Fat Hen</b> in beans, poppies, potato and tobacco transplants.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds, including <b>Fat Hen</b> in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including <b>Fat Hen</b> in berries, tomatoes, beans and fallow.		P		R3
Norflurazon (Zoliar) Agnova	F**		Registered for control of grass and broadleaf weeds including <b>Fat Hen</b> 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 <b>Fat Hen</b> 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 <b>Fat Hen</b> in Brassica vegetables and beans.		P		-
<b>Annual Ryegrass</b> ( <i>Lolium rigidum</i> ) <b>Priority: Moderate</b>							
Radish & Horseradish: Annual Ryegrass was ranked as a moderate priority in VIC and as a low priority in NSW & SA. Parsnip: Annual Ryegrass was ranked as a high priority in TAS, as a moderate priority in VIC & WA and as a low priority in SA. Swede & Turnip: Annual Ryegrass was ranked as a high priority in TAS, as a moderate priority in VIC & WA and as a low priority in QLD, NSW & SA. Populations of Annual Ryegrass are prone to herbicide resistance so integrated weed management and rotation of herbicide modes of action are important aspects of a long-term control strategy. It is important to use alternate, broad-spectrum products in non-crop periods.							
Chlorthal-Dimethyl (Dacthal)	D**	Turnip, Radish / Pre-Plant / Pre-Emergent	Registered in turnip and radish for control of grass and broadleaf weeds, including <b>Ryegrass</b> . Apply as a pre-emergence application at transplanting.	NR	A	ALL	-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Clethodim (Select) PER82459	A***	Radish & Parsnip / Post-emergent	Permitted in radish and parsnip for control of grass weeds, including <b>Annual Ryegrass</b> . [Max. 1 application per crop]	28	A	ALL	R3
Fluazifop-P (Fusilade) PER82556	A***	Parsnip / Post- emergent / Grass selective	Permitted in parsnip for control of grass weeds, including <b>Annual Ryegrass</b> . [Max. 1 application per crop]	49	A	ALL (excl. VIC)	-
Fluazifop-P (Fusilade) PER81244	A***	Swede & turnip / Post-emergent	Permitted in swede and turnip for control of grass weeds, including <b>Annual Ryegrass</b> . [Max. 1 application per crop]	49 G:49	A	ALL (excl. VIC)	-
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
Linuron	C**	Parsnip / Post-plant / Pre-emergence	Registered in parsnip for control of grass and broadleaf weeds, including <b>Annual Ryegrass</b> . [Max. 1 application per crop]	70	A	ALL	R3
Linuron PER12357	C**	Parsnip / Early post- emergent	Permitted in turnip for control of grass and broadleaf weeds, including <b>Annual Ryegrass</b> . Apply early post-emergence from the 1-2 true leaf stage. [Max. 1 application per crop]	70 NG	A	ALL (excl. VIC)	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
Pendimethalin (Stomp) PER14858	D**	Parsnip/ Pre-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Annual Ryegrass</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Pendimethalin (Stomp) PER14048	D**	Radish/ Pre-emergent	Permitted in radish for control of grass and broadleaf weeds, including <b>Annual Ryegrass</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Prometryn PER12048	C**	Parsnip / Pre- and post-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including suppression of <b>Annual Ryegrass</b> . [Max. 1 application per crop]	NR NG	A	ALL (excl. VIC)	-
Propachlor (Ramrod) PER11441	K**	Radish, swede & turnip / Pre-emergent / Post-transplant	Permitted in radish for control of grass and broadleaf weeds, including <b>Annual Ryegrass</b> . Apply to the soil surface prior to weed or seeded-crop emergence. Rainfall or irrigation is required soon after application to activate the product.	NR	A	ALL (excl. VIC)	R3
Quizalofop-P-Ethyl	A***	Radish / Post-emergent grass selective	Registered in radish for control of grass weeds, including <b>Annual Ryegrass</b> . Apply when weeds are actively growing at 1-3 leaf stage. [Max. no. of applications not specified]	21	A	ALL	R3
Trifluralin	D**	Swede, turnip & parsnip / Pre-emergent or pre-sowing	Registered in swede, turnip & parsnip for control of grass and broadleaf weeds, including <b>Annual Ryegrass</b> . Incorporate into soil within 4 hours of application. [Max 1 application per crop]	NR NG	A	ALL	-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds, including suppression of <b>Ryegrass</b> in sweet corn, beans, peas, pumpkins and kabocho.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including <b>Annual Ryegrass</b> in berries, tomatoes, beans and fallow.		P		R3
Norflurazon (Zoliar) Agnova	F**		Registered for control of grass and broadleaf weeds including <b>Annual Ryegrass</b> in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including <b>Annual Ryegrass</b> 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 <b>Annual Ryegrass</b> in Brassica vegetables and beans.		P		-
<b>Blackberry Nightshade</b> ( <i>Solanum nigrum</i> )							
<b>Priority: Moderate</b>							
Radish & Horseradish: Blackberry Nightshade was ranked as a moderate priority in VIC, NSW & SA.							
Parsnip: Blackberry Nightshade was ranked as a moderate priority in VIC, WA, SA & TAS.							
Swede & Turnip: Blackberry Nightshade was ranked as a moderate priority in VIC, QLD, WA, NSW, SA & TAS.							
Prolific weed that is widely adapted and difficult to eradicate, mainly due to its long-term seed viability.							
Chlorthal-Dimethyl (Dacthal)	D**	Turnip, Radish / Pre-Plant / Pre-Emergent	Registered in turnip and radish for control of grass and broadleaf weeds, including <b>Blackberry Nightshade</b> . Apply as a pre-emergence application at transplanting.	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
Linuron	C**	Parsnip / Post-plant / Pre-emergence	Registered in parsnip for control of grass and broadleaf weeds, including <b>Blackberry Nightshade</b> . [Max. 1 application per crop]	70	A	ALL	R3
Linuron PER12357	C**	Parsnip / Early post-emergent	Permitted in turnip for control of grass and broadleaf weeds, including <b>Blackberry Nightshade</b> . Apply early post-emergence from the 1-2 true leaf stage. [Max. 1 application per crop]	70 NG	A	ALL (excl. VIC)	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
Pendimethalin (Stomp) PER14858	D**	Parsnip/ Pre-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including suppression of <b>Blackberry Nightshade</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Pendimethalin (Stomp) PER14048	D**	Radish/ Pre-emergent	Permitted in radish for control of grass and broadleaf weeds, including suppression of <b>Blackberry Nightshade</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Prometryn PER12048	C**	Parsnip / Pre- and post-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Blackberry Nightshade</b> . [Max. 1 application per crop]	NR NG	A	ALL (excl. VIC)	-
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. <b>Blackberry Nightshade</b> is listed as moderately susceptible at a high rate.		P		-
Clomazone	Q**		Registered for control of broadleaf weeds including <b>Blackberry Nightshade</b> in beans, poppies, potato and tobacco transplants.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds, including <b>Blackberry Nightshade</b> in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Fluroxypyr (Starane)	I**		Registered for control of broadleaf weeds, including <b>Blackberry Nightshade</b> in sweet corn and sugarcane.		P		-
Norflurazon (Zoliar) Agnova	F**		Registered for control of grass and broadleaf weeds including <b>Blackberry Nightshade</b> 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 <b>Blackberry Nightshade</b> 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 <b>Blackberry Nightshade</b> in Brassica vegetables and beans.		P		-
<b>Stinging Nettle</b> ( <i>Urtica</i> spp.)							
<b>Priority: Moderate</b>							
Radish & Horseradish: Stinging Nettle was ranked as a moderate priority in VIC & NSW.							
Parsnip: Stinging Nettle was ranked as a moderate priority in VIC & WA.							
Swedes & Turnip: Stinging Nettle was ranked as a moderate priority in VIC, QLD, WA & NSW.							
Soft herb whose leaves are sparsely covered with rigid, stinging hairs.							
Chlorthal-Dimethyl (Dacthal)	D**	Turnip, Radish / Pre-Plant / Pre-Emergent	Registered in turnip and radish for control of grass and broadleaf weeds, including <b>Stinging Nettle</b> . Apply as a pre-emergence application at transplanting.	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
Linuron	C**	Parsnip / Post-plant / Pre-emergence	Registered in parsnip for control of grass and broadleaf weeds, including <b>Stinging Nettle</b> . [Max. 1 application per crop]	70	A	ALL	R3
Linuron PER12357	C**	Parsnip / Early post-emergent	Permitted in turnip for control of grass and broadleaf weeds, including <b>Stinging Nettle</b> . Apply early post-emergence from the 1-2 true leaf stage. [Max. 1 application per crop]	70 NG	A	ALL (excl. VIC)	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
Pendimethalin (Stomp) PER14858	D**	Parsnip/ Pre-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including suppression of <b>Annual Nettles</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Pendimethalin (Stomp) PER14048	D**	Radish/ Pre-emergent	Permitted in radish for control of grass and broadleaf weeds, including suppression of <b>Annual Nettles</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Prometryn PER12048	C**	Parsnip / Pre- and post-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Nettles</b> . [Max. 1 application per crop]	NR NG	A	ALL (excl. VIC)	-
Propachlor (Ramrod) PER11441	K**	Radish, swede & turnip / Pre-emergent / Post-transplant	Permitted in radish for control of grass and broadleaf weeds, including <b>Stinging Nettle</b> . Apply to the soil surface prior to weed or seeded-crop emergence. Rainfall or irrigation is required soon after application to activate the product.	NR	A	ALL (excl. VIC)	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 <b>Stinging Nettle</b> 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 <b>Stinging Nettle</b> in Brassica vegetables and beans.		P		-
<b>Fumitory</b> ( <i>Fumaria</i> spp.) <b>Priority: Moderate</b>							
Radish & Horseradish: Fumitory was ranked as a moderate priority in VIC & NSW. Parsnip: Fumitory was ranked as a moderate priority in VIC. Swede & Turnip: Fumitory was ranked as a moderate priority in VIC, QLD & NSW. Strongly competitive weed with highly persistent seeds making it an ongoing problem every year.							
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



Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Pendimethalin (Stomp) PER14858	D**	Parsnip/ Pre-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including suppression of <b>Fumitory</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Pendimethalin (Stomp) PER14048	D**	Radish/ Pre-emergent	Permitted in radish for control of grass and broadleaf weeds, including suppression of <b>Fumitory</b> . Optimum weed control with incorporation by rainfall or irrigation within 1 day of application. [Max. 1 application per crop, within 2 days of sowing]	NR	A	ALL (excl. VIC)	-
Prometryn PER12048	C**	Parsnip / Pre- and post-emergent	Permitted in parsnip for control of grass and broadleaf weeds, including <b>Fumitory</b> . [Max. 1 application per crop]	NR NG	A	ALL (excl. VIC)	-
Trifluralin	D**	Swede, turnip & parsnip / Pre-Plant / Pre-Emergent	Registered in swede, turnip & parsnip for control of grass and broadleaf weeds. Registered for control of <b>Fumitory</b> in cereal and pulse crops.	NR NG	P-A	ALL	-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds, including <b>Fumitory</b> in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Fluroxypyr (Starane)	I**		Registered for control of broadleaf weeds, including <b>Fumitory</b> in poppies.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including <b>Fumitory</b> in berries, tomatoes, beans and fallow.		P		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 <b>Fumitory</b> in onions. Compatible with glyphosate and diquat/paraquat.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
<b>Nutgrass (<i>Cyperus rotundus</i>)</b> <b>Priority: Moderate</b> Radish & Horseradish: Nutgrass was ranked as a moderate priority in VIC. Parsnip: Nutgrass was ranked as a moderate priority in VIC. Swede & Turnip: Nutgrass was ranked as a moderate priority in VIC & QLD. 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 grass, broadleaf weeds and Nutgrass in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-

## 5. References

### 5.1 Information

AgChem Access Priority Access Forum	<a href="https://www.agrifutures.com.au/national-rural-issues/agvet-chemicals/">https://www.agrifutures.com.au/national-rural-issues/agvet-chemicals/</a>
Australian Pesticide and Veterinary Medicines Authority	<a href="http://www.apvma.gov.au">www.apvma.gov.au</a>
APVMA Chemical review	<a href="https://apvma.gov.au/chemicals-and-products/chemical-review/listing">https://apvma.gov.au/chemicals-and-products/chemical-review/listing</a>
APVMA MRLs	<a href="http://www.legislation.gov.au/Details/F2021C00634">www.legislation.gov.au/Details/F2021C00634</a>
APVMA Permit search	<a href="https://productsearch.apvma.gov.au/permits">https://productsearch.apvma.gov.au/permits</a>
APVMA Product search	<a href="https://productsearch.apvma.gov.au/products">https://productsearch.apvma.gov.au/products</a>
AUSVEG	<a href="https://ausveg.com.au">https://ausveg.com.au</a>
Codex MRL database	<a href="http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/">http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/</a>
Cotton Pest Management Guide 2018-19	<a href="https://www.cottoninfo.com.au/publications/cotton-pest-management-guide">https://www.cottoninfo.com.au/publications/cotton-pest-management-guide</a>
CropLife Australia (resistance management)	<a href="https://www.croplife.org.au/resources/programs/resistance-management/">https://www.croplife.org.au/resources/programs/resistance-management/</a>
Growcom – Infopest Database	<a href="http://www.infopest.com.au">www.infopest.com.au</a>
Hort Innovation	<a href="http://www.horticulture.com.au">www.horticulture.com.au</a>

### 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 radish, horseradish, parsnip, swede & turnip
- Appendix 2. Products available for control of insects, mites and other pests in radish, horseradish, parsnip, swede & turnip
- Appendix 3. Products available for weed control in radish, horseradish, parsnip, swede & turnip
- Appendix 4. Current permits for use in radish, horseradish, parsnip, swede & turnip
- Appendix 5. Radish, horseradish, parsnip, swede & turnip Maximum Residue Limits (MRLs)
- Appendix 6. Radish, horseradish, parsnip, swede & turnip Agrichemical Regulatory Risk Assessment

**Appendix 1. Products available for disease control in radish, horseradish, parsnip, swede & turnip**

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	-
Azoxystrobin (Amistar)	11	Horseradish	White Blister Rust, Downy Mildew	ALL	7	-
		Radish	White Blister Rust			
Boscalid (Filan) BASF	7	Root & tuber vegetables	Sclerotinia Rot	ALL	7	-
Chlorothalonil (Bravo)	M5	Radish	Grey Mould	ALL	1	R3
Chlorothalonil (Bravo) PER82895	M5	Parsnip	Early Blight ( <i>Cercospora apii</i> ), Septoria Leaf Spot ( <i>Septoria apiicola</i> )	ALL (excl. VIC)	7	R3
		Radish	Alternaria ( <i>Alternaria</i> spp.), Downy Mildew ( <i>Peronospora parasitica</i> ), Grey Leaf Spot ( <i>Stemphylium solani</i> ), White Rust ( <i>Albugo candida</i> )		1 NG	
Copper	M1	Parsnip	Septoria Leaf Spot	ALL	1	-
Copper PER14038	M1	Horseradish	White Blister Rust	ALL (excl. VIC)	1	-
Copper Hydroxide + Metalaxyl (Ridomil Gold Plus) Syngenta	M1+4	Radish, swede & turnip	White Blister, Downy Mildew	ALL	7	-

Active Ingredient (Trade Name)	Chemical group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
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	-
Iodine	-	Root crops	Post-Harvest Sanitiser – Bacteria and Fungi	ALL	NR	-
Mancozeb PER80538	M3	Radish, swede & turnip	Cercospora Leaf Spot, Alternaria and White Blister	ALL (excl. VIC)	14 NG	R2
Mancozeb + Dimethomorph (Acrobat) PER14958	M3 + 40	Radish	Downy Mildew, Alternaria Leaf Spot	ALL (excl. VIC)	14 NG	R2
Mancozeb + Metalaxyl (Ridomil Gold MZ) Syngenta PER14045	M3 + 4	Parsnips	<i>Pythium</i> spp. and <i>Phytophthora</i> spp.	ALL (excl. VIC)	7	R2
Metalaxyl-M (Apron)	4	Radish / Seed Dressing	Damping Off, Downy Mildew	QLD, NSW & TAS	NR	-
Metalaxyl-M (Ridomil Gold) PER14695	4	Parsnips	<i>Phytophthora</i> spp and <i>Pythium</i> spp.	ALL (excl. VIC)	NR NG	-
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	Parsnip, radish, swede & turnip	Early Blight ( <i>Alternaria</i> spp.), Powdery Mildew	ALL	7	-
Phosphorous Acid PER14184	33	Parsnips	Damping Off	ALL (excl. VIC)	1	-

Active Ingredient (Trade Name)	Chemical group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
Potassium Bicarbonate (Eco-Carb) PER13695	M2	Parsnip, radish, swede & turnip	Powdery Mildew	ALL (excl. VIC)	NR	-
<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 (Folicur)	3	Radish	Sclerotinia Rot	ALL	35 NG	R3
Triadimenol (Bayfidan)	3	Parsnip, radish, swede & turnip	Powdery Mildew	ALL	7 NG	R3

**Appendix 2. Products available for control of insects, mites and other pests in radish, horseradish, parsnip, swede & turnip**

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
1,3-dichloropropene + Chloropicrin + (Telone C-35)	8B	Vegetables / Soil fumigant	Plant parasitic nematodes, symphylans, wireworms, soil borne diseases and suppression of weeds. <i>For use by professional and registered fumigators only.</i>	ALL	NR	-
Abamectin PER81876	6	Root & Tuber vegetables	Suppression of Liriomyza Leafminers	ALL	14 NG	-
Alpha-Cypermethrin	3A	Turnips	Cabbage White Butterfly, Cabbage Moth, Cluster Caterpillar, <i>Helicoverpa punctigera</i> , <i>Helicoverpa armigera</i>	ALL	1	-
<i>Bacillus thuringiensis subsp. kurstaki</i> (DiPel)	11A	Vegetables	Lepidoptera	ALL	NR	-
<i>Beauveria bassiana</i> (Velifer) BASF	UNF	Protected vegetables & ornamentals	Suppression of Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites.	ALL	NR	-
Beta-Cypermethrin	3A	Turnips	Diamondback Moth, <i>Helicoverpa punctigera</i> , <i>Helicoverpa armigera</i>	ALL	1	-
Carbaryl	1A	Swede & turnip	Vegetable Weevil, Wingless Grasshopper, Cabbage White Butterfly, Green Vegetables Bug, Heliothis, Pumpkin Beetle, Leaf Eating Ladybird, Cutworm, European Earwig, Potato Moth, Rutherglen Bug, Armyworms, Cabbage Moth	ALL	3	R3
Chlorantraniliprole (Coragen) FMC PER89353	28	Root and Tuber Vegetables (except potato)	Fall Armyworm ( <i>Spodoptera frugiperda</i> )	ALL (excl. VIC)	3 NG	-



Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Chlorpyrifos	1B	Radish & turnip	Wingless Grasshopper	NSW, ACT, WA, VIC & TAS	NR	R1
			Cutworm	ALL		
			Field Crickets, Mole Crickets	QLD & WA		
			Vegetable Weevil	NSW & WA		
Chlorpyrifos PER14583	1B	Swede & turnip	African Black Beetle	ALL (excl. VIC)	NR	R1
			False Wireworms & Wireworms		28	
Cypermethrin	3A	Turnips	Cabbage Moth, Cabbage White Butterfly, <i>Helicoverpa</i> spp.	ALL	1	-
			Cluster Caterpillar	NSW, SA, TAS, VIC & WA		
Cyromazine (Diptex 150WP) PER81867	17	Root and Tuber vegetables	Lyriomyza Leafminers	ALL	7 NG	-
Diazinon	1B	Parsnip	Cutworms, Caterpillars	ALL (excl. TAS)	14 G:14	R3
Dimethoate	1B	Turnip	Aphids, Jassids, Mites, Leafhoppers, Green Vegetable Bug, Thrips & Wingless Grasshoppers	ALL	14	R1
Emamectin (Proclaim Opti) Syngenta	6	Root and Tuber Vegetables	Diamondback Moth, Cabbage White Butterfly, <i>Heliothis</i> , Cluster Caterpillar, Loopers	ALL	3 NG	-
Emamectin (Proclaim Opti) Syngenta PER89263	6	Root and Tuber Vegetables	Fall Armyworm ( <i>Spodoptera frugiperda</i> )	ALL (excl. VIC)	3 NG	-

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Emulsifiable Botanical Oils (Eco-Oil)	-	Vegetables	Greenhouse Whitefly	ALL	NR	-
Fipronil (Regent)	2B	Swede & turnip	Diamondback Moth	ALL	7 NG	R3
Flubendiamide (Belt) Bayer	28	Root & Tuber Vegetables	Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillar, Potato Moth, <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	-
Iron EDTA Complex	-	All plants	Snails & Slugs	ALL	NR	-
Lambda-Cyhalothrin (Karate Zeon) PER11949	3A	Radish	Vegetable Loopers, Diamondback Moth	ALL (excl. VIC)	2	-
Metaldehyde	-	Vegetables	Snails & Slugs	ALL	7	-
Metham Sodium	-	Soil Fumigant	Nematodes, weed seeds, and various fungal diseases	ALL	NR	-
Methiocarb (MesuroI)	1A	Vegetables	Snails & Slugs	ALL	NR	R2
Methomyl (Lannate) PER82428	1A	Radish, swede & turnip	<i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug & Thrips including Western Flower Thrips	ALL	7 NG	R2
Methomyl (Lannate) PER89293	1A	Radish, swede & turnip	Fall Armyworm ( <i>Spodoptera frugiperda</i> )	ALL	1 NG	R2
Petroleum Oil	UN	Radish	Aphids, Mites, Thrips & Leafhopper	ALL	1	-
Pirimicarb (Aphidex)	1A	Radishes swede, turnip	Cabbage Aphid & 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	Regulatory risk
Propargite (Omite)	12C	Vegetables	Two-Spotted Mites & Spider Mites.	ALL	7	R3
Spinetoram (Success Neo) Corteva	5	Radishes, swede & turnip	Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Lightbrown Apple Moth, Loopers, Helicoverpa, Potato Moth, Tomato Potato Psyllid, Western Flower Thrips	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	ALL (excl. VIC)	3	-
Spinetoram (Success Neo) Corteva PER91155	5	Root & Tuber Vegetables	Liriomyza Leafminers	ALL (excl. VIC)	3	-
Spinosad (Entrust Organic) Corteva	5	Root & Tuber Vegetables	Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Lightbrown Apple Moth, Loopers, Helicoverpa, Potato Moth, Western Flower Thrips	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	ALL (excl. VIC)	3 G:14	-

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	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 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, Green Vegetable Bug and Rutherglen Bug	ALL	2	R2
Zeta-Cypermethrin	3A	Turnips	Cabbage Moth, Cabbage White Butterfly, <i>Helicoverpa</i> spp. Cluster Caterpillar	ALL NSW, SA, TAS, VIC & WA	1	-

### Appendix 3. Products available for weed control in radish, horseradish, parsnip, swede & turnip

Active ingredient (Trade Name)	Chemical group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory risk
1,3-dichloropropene + Chloropicrin (Telone C-35)	8B	Vegetables / Soil fumigant	plant parasitic nematodes, symphylans, wireworms, soil borne diseases and suppression of weeds. <i>For use by professional and registered fumigators only.</i>	NR	ALL	-
Clethodim (Select) PER82459	A***	Radish & Parsnip / Post-emergent	Grass weeds	28	ALL	R3
Chlorthal-Dimethyl (Dacthal)	D**	Turnip, Radish / Pre-Plant / Pre-Emergent	Grass and broadleaf weeds	NR	ALL	-
Fluazifop-P (Fusilade) PER82556	A***	Parsnip / Post-emergent / Grass selective	Grass weeds	49	ALL (excl. VIC)	-
Fluazifop-P (Fusilade) PER81244	A***	Swede & turnip / Post-emergent	Grass weeds	49 G:49	ALL (excl. VIC)	-
Glyphosate (Roundup)	M**	General Pre-Crop Spray	Grass and Broadleaf Weeds	NR	ALL	R3
Linuron	C**	Parsnip / Pre-emergent	Grass and broadleaf weeds	70	ALL	R3
Linuron PER12357	C**	Parsnip / Early post-emergent	Grass and broadleaf weeds	70 NG	ALL (excl. VIC)	R3
Paraquat + Diquat (SpraySeed)	L***	General Pre-Crop Spray	Grass and Broadleaf Weeds	7	ALL	R3
Pendimethalin (Stomp) PER14858	D**	Parsnip/ Pre-emergent	Grass and broadleaf weeds	NR	ALL (excl. VIC)	-
Pendimethalin (Stomp) PER14048	D**	Radish/ pre-emergent	Grass and broadleaf weeds	NR	ALL (excl. VIC)	-

Active ingredient (Trade Name)	Chemical group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory risk
Prometryn PER12048	C**	Parsnip / Early post-emergent	Broadleaf weeds	NR NG	ALL (excl. VIC)	-
Propachlor (Ramrod) PER11441	K**	Radish, swede & turnip / Pre-emergent / Post-transplant	Grass and broadleaf weeds	NR	ALL (excl. VIC)	R3
Quizalofop-P-Ethyl	A***	Radish / Post-emergent grass selective	Grass weeds	21	ALL	R3
Sethoxydim (Sertin)	A***	Swede / Post-emergent	English Couch, Onion Twitch	42	TAS	-
Trifluralin	D**	Swede turnip & parsnip / Pre-Plant / Pre-Emergent	Grasses & broadleaf weeds	NR NG	ALL	-

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

**Appendix 4. Current permits for use in radish, horseradish, parsnip, swede & turnip**

<b>Permit No.</b>	<b>Description</b>	<b>Issued Date</b>	<b>Expiry Date</b>	<b>Permit Holder</b>
PER81876 Version 4	Abamectin / Root & 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) / Radish & parsnip / Early Blight, Septoria Leaf Spot, Downy Mildew, Grey Leaf Spot, Alternaria & White Rust	04-Aug-17	31-Aug-25	Hort Innovation
PER14583 Version 5	Chlorpyrifos / Swede & Turnip / African Black Beetle, False Wireworms & Wireworms	01-Apr-14	31-Oct-24	Hort Innovation
PER82459	Clethodim (Select) / Radish & parsnip / Grass weeds	19-Apr-17	30-Sep-21	Hort Innovation
PER14038 Version 2	Copper / Various Vegetable Crops including Horseradish / White Blister Rust	01-Apr-13	30-Sep-23	Hort Innovation
PER81867 Version 2	Cyromazine (Diptex 150 WP) / Root and tuber vegetables / Leafminer	02-Dec-19	30-Nov-23	Hort Innovation
PER14958 Version 2	Dimethomorph (Acrobat) & Mancozeb / Radish / Downy Mildew & Alternaria Leaf Spot	21-Dec-14	31-Dec-22	Hort Innovation
PER89263 Version 2	Emamectin (Proclaim Opti) / Root & tuber vegetables / Fall Armyworm	10-Mar-20	31-Mar-23	Hort Innovation
PER82556	Fluazifop-P (Fusilade) / Parsnip / Grass weeds	16-Apr-14	31-Jan-23	Hort Innovation
PER81244 Version 3	Fluazifop-P (Fusilade) / Swede & turnip / Annual Grass Weeds	01-Jul-16	30-Jun-22	Hort Innovation
PER11949 Version 4	Lambda-Cyhalothrin (Karate) / Radish / Loopers & Diamondback Moth	01-Apr-10	31-Mar-25	Hort Innovation
PER12357 Version 4	Linuron / Parsnips / Grass and broadleaf weeds	09-May-12	31-Jul-25	Hort Innovation
PER80538 Version 2	Mancozeb / Radish, Swede & Turnip/ Cercospora, Alternaria & White Blister	01-Apr-15	31-Mar-25	Hort Innovation
PER14045 Version 3	Mancozeb + Metalaxyl-M (Ridomil Gold MZ) / Parsnips / Pythium & Phytophthora	01-Apr-13	31-Mar-22	Hort Innovation
PER14695 Version 4	Metalaxyl-M (Ridomil Gold) / Parsnip / Pythium spp. and Phytophthora spp.	01-May-14	30-Jun-24	Hort Innovation

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER82428 Version 4	Methomyl (Lannate) / Radish, swede & turnip / <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug & Thrips including Western Flower Thrips	22-Apr-16	31-Mar-24	Hort Innovation
PER89293	Methomyl (Lannate) / Radish, swede & turnip / Fall Armyworm	10-Apr-20	30-Apr-23	Hort Innovation
PER14858 Version 3	Pendimethalin (Stomp) / Parsnip / Grasses and Broadleaf Weeds	16-Jan-09	31-Mar-25	Hort Innovation
PER14048 Version 2	Pendimethalin (Stomp) / Radish / Grass & broadleaf weeds	01-May-13	31-Mar-23	Hort Innovation
PER14184 Version 2	Phosphorous Acid / Parsnip / Damping Off	01-Jul-13	30-Jun-22	Hort Innovation
PER13695 Version 3	Potassium Bicarbonate (Ecocarb) / Parsnip, radish, swede & turnip / Powdery Mildew	31-Oct-12	31-Jul-25	Hort Innovation
PER12048 Version 4	Prometryn / Parsnip / Broadleaf weeds	09-May-12	31-Jul-25	Hort Innovation
PER11441 Version 3	Propachlor (Ramrod) / Radish, swede, turnip / Grass and broadleaf weeds	27-May-09	31-Oct-24	Hort Innovation
PER89241	Spinetoram (Success Neo) / Root & tuber vegetables / Fall Armyworm	06-Mar-20	31-Mar-23	Hort Innovation
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 / 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 / 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



## **Appendix 5. Radish, Horseradish, Parsnip, Swede & Turnip Maximum Residue Limits (MRLs)**

CODEX commodity groupings of Root and Tuber vegetables (016):

VR0583	Horseradish
VR0588	Parsnip
VR0494	Radish
VR0591	Radish, Japanese
VR0497	Swede
VR0506	Turnip, garden
VR0075	Root and tuber vegetables Vegetables

Note: Currently production of all Horseradish, Radish, Swede & Turnip are for the Australian market and no exports are recorded. 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.

<b>Chemical</b>	<b>Codex</b>	<b>Description</b>	<b>APVMA MRL mg/kg</b>	<b>Codex MRL mg/kg</b>
<b>Abamectin</b>	VR0075	Root and tuber vegetables	*0.01	-
<b>Aldrin &amp; Dieldrin</b>	VR0075	Root and tuber vegetables	E0.1	E0.1
<b>Azoxystrobin</b>	VR0583	Horseradish	0.5	-
	VR0494	Radish	0.5	-
	VR0075	Root and tuber vegetables (except potato)	-	1
<b>Bifenthrin</b>	VR0075	Root and tuber vegetables	-	0.05
<b>Boscalid</b>	VR0075	Root and tuber vegetables	1	2
<b>Bromide ion</b>	VR0494	Radish	-	200
	VR0506	Turnip, garden	-	200
<b>Carbaryl</b>	VR0497	Swede	2	-
	VR0506	Turnip, garden	2	1
<b>Chlorantraniliprole</b>	VR0494	Radish	-	0.5
	VR0075	Root and tuber vegetables (except carrot and radish)	-	0.02
	VR0075	Root and tuber vegetables (except potato)	T0.5	-
<b>Chlorothalonil</b>	VR0583	Horseradish	-	1
	VR0075	Root and tuber vegetables (except horseradish)	-	0.3
<b>Chlorpyrifos</b>	VR0497	Swede	T0.3	-
<b>Clothianidin</b>	VR0075	Root and tuber vegetables	-	0.2
<b>Cyantraniliprole</b>	VR0075	Root and tuber vegetables (except potato)	-	0.05
<b>Cycloxydim</b>	VR0497	Swede	-	0.2
<b>Cyhalothrin (includes lambda-cyhalothrin)</b>	VR0075	Root and tuber vegetables	-	*0.01
	VR0494	Radish	*0.01	-
	VR0497	Swede	-	-
	VR0506	Turnip	-	-
<b>Cypermethrin</b>	VR0494	Radish	T0.05	-
	VR0075	Root and tuber vegetables (except	-	*0.01

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
		sugarbeet)		
<b>Cyprodinil</b>	VR0494	Radish	-	0.3
	VR0588	Parsnip	-	0.7
<b>Cyromazine</b>	VR0075	Root and tuber vegetables	T1	-
<b>Deltamethrin</b>	VR0494	Radish	-	*0.01
<b>Diazinon</b>	VR0494	Radish	-	0.1
<b>Dicofol</b>		Vegetables (some exceptions)	5	-
<b>Dimethoate</b>	VR0506	Turnip, garden	*0.2	0.1
	VR0588	Parsnip	-	-
	VR0494	Radish	-	-
<b>Dimethomorph</b>	VR0494	Radish	T0.3	-
<b>Diquat</b>		Vegetables (some exceptions)	*0.05	-
<b>Dithiocarbamates (mancozeb, metham, metiram, thiram, zineb and ziram)</b>	VR0588	Parsnip	T1	-
	VR0494	Radish	T1	-
<b>Emamectin</b>	VR0075	Root and tuber vegetables (except potato)	*0.01	-
<b>Ethoprophos</b>	VR0506	Turnip, garden	-	*0.02
<b>Fenvalerate</b>	VR0506	Turnip, garden	0.1	-
<b>Fipronil</b>	VR0497	Swede	0.1	-
	VR0506	Turnip, garden	0.1	-
<b>Flonicamid</b>	VR0494	Radish	-	0.4
<b>Fluazaindolizine</b>	VR0075	Root and tuber vegetables	0.3	-
<b>Fluazifop-p-butyl</b>	VR0497	Swede	-	4
	VR0506	Turnip, garden	-	4
	VR0075	Root and tuber vegetables (some exceptions)	T1	-
<b>Flubendiamide</b>	VR0075	Root and tuber vegetables (except potato)	0.2	-
<b>Fludioxonil</b>	VR0494	Radish	-	0.3
<b>Fluensulfone</b>	VR0494	Radish	-	4
	VR0591	Radish, Japanese	-	4
	VR0497	Swede	-	4
	VR0506	Turnip, garden	-	4
	VR0583	Horseradish	-	4
	VR0588	Parsnip	-	4
	VR0075	Root and tuber vegetables (not specified elsewhere)	2	3
<b>Flupyradifurone</b>	VR0075	Root and tuber vegetables (except potato)	-	0.7
<b>Fluxapyroxad</b>	VR0494	Radish	-	0.2
	VR0588	Parsnip	-	1
<b>Glyphosate</b>	VR0075	Root and tuber vegetables	*0.1	-
<b>Imidacloprid</b>	VR0591	Radish, Japanese	T0.05	-
	VR0075	Root and tuber vegetables	-	0.5

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
<b>Kresoxim-Methyl</b>	VR4571	Turnip	-	*0.05
<b>Linuron</b>	VR0588	Parsnip	T0.05	-
<b>Malathion</b>	VR0506	Turnip, garden	-	0.2
<b>Metalaxyl</b>		Vegetables (some exceptions)	T0.1	-
<b>Metaldehyde</b>		Vegetables	1	-
<b>Methiocarb</b>		Vegetables	0.1	-
<b>Methomyl</b>	VR0075	Root and tuber vegetables	1	-
<b>Methoxyfenozide</b>	VR0494	Radish	-	0.4
<b>Myclobutanil</b>	VR0075	Root and tuber vegetables		0.06
<b>Omethoate</b>	VR0506	Turnip, garden	*0.1	-
<b>Oxamyl</b>	VR0588	Parsnip	-	*0.01
<b>Paraquat</b>	VR0075	Root and tuber vegetables	-	0.05
	-	Vegetables	*0.05	-
<b>Pendimethalin</b>	VR0075	Root and tuber vegetables (except carrots)	*0.05	-
<b>Penthiopyrad</b>	VR0494	Radish	-	3
	VR0075	Root and tuber vegetables (except potato)	2	-
<b>Permethrin</b>	VR0583	Horseradish	-	0.5
	VR0591	Radish, Japanese	-	0.1
<b>Phosphine</b>	VR0075	Root and tuber vegetables	T*0.01	-
<b>Phosphorous acid</b>	VR0075	Root and tuber vegetables (except potato)	T100	-
<b>Piperonyl Butoxide</b>	VR0075	Root and tuber vegetables (except carrot)	-	0.5
		Vegetables	8	-
<b>Pirimicarb</b>	VR0075	Root and tuber vegetables	-	0.05
		Vegetables (some exceptions)	1	-
<b>Prometryn</b>		Vegetables	*0.1	-
<b>Propachlor</b>	VR0497	Swede	*0.02	-
	VR0506	Turnip, garden	*0.02	-
	VR0494	Radish	*0.02	-
<b>Propargite</b>		Vegetables	3	-
<b>Propiconazole</b>	VR0494	Radish	T0.2	-
<b>Propamocarb</b>	VR0494	Radish	-	1
<b>Pydiflumetofen</b>	VR0075	Root and tuber vegetables	T0.05	-
<b>Pyraclostrobin</b>	VR0494	Radish	-	0.5
<b>Pyrethrins</b>	VR0075	Root and tuber vegetables		*0.05
	-	Vegetables	1	-
<b>Quizalofop-ethyl</b>	VR0494	Radish	*0.02	-
<b>Quizalofop-P-tefuryl</b>	VR0494	Radish	*0.02	-
<b>Sethoxydim</b>	VR0075	Root and tuber vegetables	1	-
<b>Spinetoram</b>	VR0075	Root and tuber vegetables,	0.02	-
<b>Spinosad</b>	VR0075	Root and tuber vegetables	0.02	-
<b>Sulfoxaflor</b>	VR0075	Root and tuber vegetables (except potato)	0.05	-
	VR0075	Root and tuber vegetables (except carrot)	-	0.03
<b>Tebuconazole</b>	VR0494	Radish	T0.3	-
<b>Thiamethoxam</b>	VR0075	Root and tuber vegetables	T0.7	0.3

<b>Chemical</b>	<b>Codex</b>	<b>Description</b>	<b>APVMA MRL mg/kg</b>	<b>Codex MRL mg/kg</b>
<b>Tolclofos-Methyl</b>	VR0494	Radish	-	0.1
<b>Trichlorfon</b>		Vegetables (some exceptions)	0.1	-
<b>Triadimenol</b>	VR0506	Turnip, garden	0.2	-
	VR0588	Parsnip	0.2	-
	VR0494	Radish	0.2	0.08
	VR0497	Swede	0.2	-
<b>Trifluralin</b>	VR0588	Parsnip	T0.5	-

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. Radish, Horseradish, Parsnip, Swede & Turnip Agrichemical Regulatory Risk Assessment**

### **Chicory, Horseradish, Radish, Swede & Turnip 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 requiring the generation of new data. A consequence of which can be that many of these agrichemicals 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 agrichemicals 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 prohibit use in the exporting country so as to ensure compliance, as an MRL breach would adversely affect market access.

The effects of the above are greater regulatory pressure placed on the use of individual agrichemicals 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 Brassica leafy vegetables as well as current initiatives aimed at addressing identified pest management deficiencies.

## Radish, Horseradish, Parsnip, Swede & Turnip Agrichemical Regulatory Risk Assessment

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

Problem	Active Constituents	Chemical Group	Comment	Actions
<b>INSECT AND MITE PESTS</b>				
Seed harvesting ants	Chlorpyrifos	<b>1B</b>	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: Cancellation of use USA: EPA decision to allow continued use	
<b>Aphids</b>				
Aphids	Dimethoate (Turnip)	<b>1B</b>	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
	Paraffinic oil/petroleum oil (Radish)( PER12221 Chicory)			
Brown thistle aphid	Spirotetramat (Chicory)	<b>23</b>		
Cabbage aphid	Pirimicarb (Radish, Swede and Turnip)	<b>1A</b>	Codex: JMPR Periodic re-evaluation 2022/23 EU: Candidate for substitution	
Currant lettuce aphid	Imidacloprid (Chicory)	<b>4A</b>	APVMA: Under review Canada: Under review EU: Removal of all field uses USA: Re-registration with new risk mitigation measures	
	Spirotetramat (Chicory)	<b>23</b>		
Green peach aphid	Pirimicarb (Radish, Swede and Turnip)	<b>1A</b>	Codex: JMPR Periodic re-evaluation 2022/23 EU: Candidate for substitution	
	Spirotetramat (Chicory)	<b>23</b>		
	Sulfoxaflor	<b>4C</b>	USA: Pollinator concerns	

Problem	Active Constituents	Chemical Group	Comment	Actions
Green peach aphid	Pirimicarb (Radish, Swede and Turnip)	1A	Codex: JMPR Periodic re-evaluation 2022/23 EU: Candidate for substitution	
	Spirotetramat (Chicory)	23		
	Sulfoxaflor	4C	USA: Pollinator concerns	
<b>Beetles</b>				
African black beetle	Chlorpyrifos (PER14583 Swedes & Turnips)	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: Cancellation of use USA:EPA decision to allow continued use	
	Dimethoate (Swedes & Turnips)	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
False wireworm	Chlorpyrifos (PER14583 Swedes & Turnips)	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: Cancellation of use USA:EPA decision to allow continued use	
Leafeating ladybirds	Carbaryl (Swedes & Turnips)	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled EU: Authorisation not renewed	
Pumpkin beetle	Carbaryl (Swedes & Turnips)	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled EU: 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	

Problem	Active Constituents	Chemical Group	Comment	Actions
			Canada: Cancellation of all uses. EU: Cancellation of use USA: EPA decision to allow continued use	

Problem	Active Constituents	Chemical Group	Comment	Actions
Vegetable weevil	Carbaryl (Swedes & Turnips)	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled EU: deregistered	
	Chlorpyrifos	1B	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure. Codex: Scheduled for review by JMPR	
Wireworm	Chlorpyrifos (PER14583) (Swedes & Turnips)	1B	Canada: Cancellation of all uses. EU: Cancellation of use USA: EPA decision to allow continued use	
<b>Caterpillars/Lepidoptera</b>				
Armyworms	Carbaryl (Swedes & Turnips)	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled EU: deregistered	
Budworms: Native ( <i>Helicoverpa punctigera</i> )	Alpha-cypermethrin (Radish, Turnip & Swede)	3A	EU: Proposed restricted authorisation & Candidate for substitution	
Corn earworm/Cotton bollworm ( <i>Helicoverpa armigera</i> )	Emamectin benzoate	6	EU: Candidate for substitution	
	Flubendiamide	28		
	Indoxacarb (Chicory)	22	EU: Proposed non-renewal	
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Spinetoram	5		
	Spinosad	5		



Problem	Active Constituents	Chemical Group	Comment	Actions
Cabbage white butterfly	Alpha-cypermethrin (Radish, Turnip & Swede)	3A	EU: Proposed restricted authorisation & Candidate for substitution	
	Carbaryl (Swedes & Turnips)	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled EU: deregistered	
	Diazinon (Turnip)	1B	EU: Deregistered Codex: Scheduled to be reviewed	
	Emamectin benzoate	6	EU: Candidate for substitution	
	Flubendiamide	28		
	Spinetoram (Radish, Swede & Turnip)	5		
	Spinosad (Radish, Swede & Turnip)	5		
Cabbage-centre grub	Spinetoram (Radish, Swede & Turnip)	5		
	Spinosad (Radish, Swede & Turnip)	5		
Caterpillars	Diazinon (Parsnip)	1B	EU: Deregistered Codex: Scheduled to be reviewed	
	Spinetoram	5		
Cluster caterpillar	Alpha-cypermethrin (Radish, Swede & Turnip)	3A	EU: Proposed restricted authorisation & Candidate for substitution	
	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 (Radish, Swede & Turnip)	5		
	Spinosad (Radish, Swede & Turnip)	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	
Cutworms	Carbaryl (Swedes & Turnips)	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled EU: deregistered	
	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: Cancellation of use USA:EPA decision to allow continued use	
	Diazinon (Parsnip)	1B	EU: Deregistered Codex: Scheduled to be reviewed	
Diamondback moth (Cabbage moth)	Alpha-cypermethrin (Turnips)	3A	EU: Proposed restricted authorisation & Candidate for substitution	
	Carbaryl (Swedes & Turnips)	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled EU: deregistered	
	Diazinon (Turnips)	1B	EU: Deregistered Codex: Scheduled to be reviewed	
	Emamectin benzoate	6	EU: Candidate for substitution	
	Fipronil (Swedes & Turnips)	2B	APVMA: Under review EU: No authorisation in place	
	Flubendiamide	28		
	Lambda-cyhalothrin (Radish: PER11949)	3A		
Spinosad (Radish, Swede & Turnip)	5			

Problem	Active Constituents	Chemical Group	Comment	Actions
Fall armyworm	Chlorantraniliprole (PER89353)	28		
	Emamectin benzoate (PER89263)	6	EU: Candidate for substitution	
	Methomyl (PER89293: Radish, swede, turnip)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Spinetoram (PER89241)	5		
	Spinosad (PER89870)	5		
Lightbrown apple moth	Spinetoram	5		
	Spinosad	5		
Loopers	Emamectin benzoate	6	EU: Candidate for substitution	
	Lambda-cyhalothrin (Radish: 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 (Swedes & Turnips)	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled EU: deregistered	
	Flubendiamide	28		
	Spinetoram	5		
Webworms	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
<b>Grasshoppers/Locusts</b>				
Australian plague locust	Alpha-cypermethrin (Turnips)	<b>3A</b>	EU: Proposed restricted authorisation & Candidate for substitution	
	Chlorpyrifos (Radish & Turnip: PER11843)	<b>1B</b>	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure.	
Field crickets	Chlorpyrifos	<b>1B</b>	Codex: Scheduled for review by JMPR	
Migratory locust	Chlorpyrifos (Radish & Turnip: PER11843)	<b>1B</b>	Canada: Cancellation of all uses. EU: Cancellation of use	
Mole crickets	Chlorpyrifos	<b>1B</b>	USA:EPA decision to allow continued use	
Spur-throated locust	Chlorpyrifos (Radish & Turnip: PER11843)	<b>1B</b>		
	Alpha-cypermethrin (Turnips)	<b>3A</b>	EU: Proposed restricted authorisation & Candidate for substitution	
	Carbaryl (Swede & Turnip)	<b>1A</b>	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled EU: deregistered	
	Chlorpyrifos	<b>1B</b>	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: Cancellation of use USA:EPA decision to allow continued use	
	Dimethoate (Turnip)	<b>1B</b>	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	

Problem	Active Constituents	Chemical Group	Comment	Actions
<b>Jassids/Plant bugs</b>				
Bugs	Dimethoate (Turnip)	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
Green vegetable bug	Carbaryl (Swedes & Turnip)	1A	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled EU: deregistered	
	Dimethoate (Turnip)	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
	Paraffinic oil/petroleum oil ( PER12221 Chicory)			
	Trichlorfon	1B	APVMA: nominated for review Codex: No MRLs EU: deregistered US: No MRLs	
Jassids	Dimethoate (Turnip)	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
Leafhoppers	Dimethoate (Turnip)	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
	Paraffinic oil/petroleum oil ( PER12221 Chicory)			
Rutherglen bug	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Paraffinic oil/petroleum oil ( PER12221 Chicory)	-		
	Trichlorfon	1B	APVMA: nominated for review Codex: No MRLs EU: deregistered US: No MRLs	
Tomato potato psyllid	Spinetoram (PER84757)	5		

Problem	Active Constituents	Chemical Group	Comment	Actions
<b>Mites</b>				
Blue oat mite	Chlorpyrifos (Swede & Turnip)	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: Cancellation of use USA: EPA decision to allow continued use	
Mites	Dimethoate (Turnip)	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
	Paraffinic/Petroleum oil (Radish) (PER12221 Chicory)	-		
Redlegged earth mite	Alpha-cypermethrin (Radish; PER14457: Chicory)	3A	EU: Proposed restricted authorisation & Candidate for substitution	
	Chlorpyrifos (Swede & Turnip)	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: Cancellation of use USA: EPA decision to allow continued use	
	Dimethoate (Turnip)	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
<b>Thrips</b>				
Thrips	Dimethoate (Turnip)	1B	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Paraffinic/Petroleum oil (Radish) (PER12221 Chicory)	-		

Problem	Active Constituents	Chemical Group	Comment	Actions
Western flower thrips	Abamectin (Chicory)	6		
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Re-evaluation completed (2018). Majority of uses removed EU: No authorisations	
	Spinetoram (Radish, Swede & Turnip)	5		
<b>Other</b>				
Earwig	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: Cancellation of use USA:EPA decision to allow continued use	
Vegetable leafminer	Abamectin (PER81876)	6		
	Spinetoram (PER91155)	5		
	Spinosad (PER90928)	5		

Problem	Active Constituents	Chemical Group	Comment	Actions
<b>DISEASES</b>				
Alternaria leaf spot	Dimethomorph (Radish)	<b>40</b>		
	Mancozeb (PER80538: Radish, Swede & Turnip)	<b>M3</b>	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Penthiopyrad	<b>7</b>		
Alternaria spot	Chlorothalonil	<b>M5</b>	APVMA: Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Deregistered'	
Anthraco nose	Mancozeb (PER14045/80538)	<b>M3</b>	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
Bacterial blight	Copper (Parsnips)	<b>M1</b>	EU: Candidate for substitution	
Black rot	Copper (Turnips)	<b>M1</b>	EU: Candidate for substitution	
Cercospora leaf spot	Mancozeb (PER80538: Radish, Swede & Turnip)	<b>M3</b>	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Propiconazole (Radish)	<b>3</b>	APVMA: Nominated for review EU: Deregistered: phased-out	
Damping off	Phosphorous acid (Parsnips)	<b>33</b>		



Problem	Active Constituents	Chemical Group	Comment	Actions
Downy mildew	Azoxystrobin (Horseradish)	<b>11</b>		
	Chlorothalonil (Radish)	<b>M5</b>	APVMA: Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Deregistered	
	Copper (Radish, Swede & Turnip)	<b>M1</b>	EU: Candidate for substitution	
	Dimethomorph + mancozeb (PER14958: Chicory & Radish)	<b>40 + M3</b>	Mancozeb APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Mancozeb (PER14045: Chicory)	<b>M3</b>	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Oxathiapiprolin	<b>49</b>		
	Phosphonic acid (PER11951 Chicory)	<b>33</b>		
Early blight	Chlorothalonil (Parsnips)	<b>M5</b>	APVMA: Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Deregistered	
Grey leaf spot	Chlorothalonil (Radish)	<b>M5</b>		
Grey mould	Chlorothalonil (Radish)	<b>M5</b>		
	Iprodione (PER81589 Chicory)	<b>2</b>	Canada: Majority of food crop uses deleted Codex: Review scheduled for 2022/23 EU: Deregistered	
Leaf spots	Copper (Parsnips)	<b>M1</b>	EU: Candidate for substitution	
	Propiconazole (PER14479: Chicory)	<b>3</b>	APVMA: Nominated for review EU: Deregistered: phased-out	
Peppery leaf spot	Copper (Turnips)	<b>M1</b>	EU: Candidate for substitution	

Problem	Active Constituents	Chemical Group	Comment	Actions
Phytophthora soil fungus (Dieback)	Metalaxyl + Metalaxyl-M (Parsnips)	4	EU: Metalaxyl candidate for substitution Metalaxyl-M restricted use approval	
Powdery mildew	Difenoconazole (PER87973: Chicory)	3	APVMA: Nominated for review Canada: Currently being reviewed EU: Candidate for substitution	
	Penthiopyrad	7		
	Potassium bicarbonate (PER13695 Parsnip, radish, swede & turnip)	M2		
	Trifloxystrobin (PER14494: Chicory)	11		
	Triadimenol (Radish, Swede & Turnip)	3	APVMA: Nominated for review EU: No authorisation in place	
Pythium	Metalaxyl + Metalaxyl-M (Parsnips)	4	EU: Metalaxyl candidate for substitution Metalaxyl-M restricted use approval	
Ring spot	Copper (Turnips)	M1	EU: Candidate for substitution	
Rust	Propiconazole (PER14479: Chicory)	3	APVMA: Nominated for review EU: Deregistered: phased-out	
Sclerotinia rot	Iprodione (PER81589 Chicory)	2	Canada: Majority of food crop uses deleted Codex: Review scheduled for 2022/23 EU: Deregistered	
	Tebuconazole (Chicory & Radish)	3	APVMA: Nominated for review EU: Candidate for substitution	
Septoria leaf spot	Chlorothalonil (Parsnips)	M5	APVMA: Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Deregistered	
	Copper (Parsnips)	M1	EU: Candidate for substitution	
	Mancozeb (PER80538: Chicory)	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Propiconazole (PER14479: Chicory)	3	APVMA: Nominated for review EU: Deregistered: phased-out	

Problem	Active Constituents	Chemical Group	Comment	Actions
White blister	Azoxystrobin (Horseradish & Radish)	11		
	Chlorothalonil (Radish)	M5	APVMA: Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Deregistered	
	Copper		EU: Candidate for substitution	
	Mancozeb (PER80538: Radish, Swede & Turnip)	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
<b>WEEDS</b>				
Broadleaf weeds and grasses	Chlorthal-dimethyl	3	EU: No authorisation in place	
	Clethodim <sup>ii</sup> (PER82459 Chicory)	1	Codex: MRLs proposed for deletion	
	Fluazifop-P (PER81244: Swede & Turnip; PER82556: Parsnip)	1		
	Linuron (PER12357: Parsnips)	5	EU: No authorisation in place	
	Metribuzin	5	EU: Candidate for substitution	
	Pendimethalin (PER14858: Parsnips; PER14048: Radish)	3	EU: Candidate for substitution	
	Phenmedipham (PER81241: Chicory)	5	EU: Under review	
	Prometryn (PER12048: Parsnips)	4		
	Propachlor (PER11441: Radish, Swede & Turnip)	15	EU: No authorisation in place	
	Propyzamide (Chicory)	3	EU: Restricted approval & candidate for substitution	
	Quizalofop-P	1	Canada: Under re-evaluation: proposed completion June 2019. EU: Candidate for substitution	
	Sethoxydim	1	EU: No authorisation in place	
	Trifluralin (Chicory; PER14337: Swedes & Turnips; PER13696: Parsnips)	3	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.*

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

<sup>ii</sup> Registered for use in pasture chicory