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

Strategic Agrichemical Review Process (SARP)

June 2026

Hort Innovation
Project – MT25005

Hort Innovation Project Number:
MT25005 – Vegetable Strategic Agrichemical Review Process (SARP) 2026 Updates

SARP Service Provider:
AGK Services

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

Date of report:
June 2026

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1. Summary

The strategic levy investment project Vegetable Industry SARP Report Updates (MT25005) 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 root vegetable industry with sound pesticide usage for the future that the industry can pursue for registration with the manufacturer, or minor-use permits with the Australian Pesticide and Veterinary Medicines Authority (APVMA).

1.1 Diseases

The high priority disease is:

Common name	Scientific name
Black Canker	*Itersonilia perplexans*, *Cylindrocarpon* spp., *Mycocentrospora acerina*

1.2 Insects and Mites

The high priority insects and mites are:

Common name	Scientific name
Diamondback Moth	*Plutella xylostella*
False Wireworms	*Gonocephalum* spp.
Wireworm	*Arachnodima* spp., *Agrypnus* spp.
Vegetable Leafminer	*Liriomyza sativae*
Serpentine Leafminer	*Liriomyza huidobrensis*
Chevron Cutworm	*Diarsia intermixta*

1.3 Weeds

The high priority weeds are:

Common Name	Scientific Name
Annual Ryegrass	*Lolium rigidum*
Wild Radish	*Raphanus raphanistrum*
Amaranthus	*Amaranthus* spp.

2. The Australian Root Vegetable 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.

Parsnips are grown across most states of Australia, with the majority of production occurring in Victoria. Year-round production allows for continuous supply to the domestic market.

Production for the year ending June 2025[1] was 3,553 tonnes and was valued at $12.3 million. A total of 3,450 tonnes (97%) was supplied to the fresh domestic market, with the remaining 103 tonnes (3%) going to processing. No parsnips were exported. Total production and revenue are stable for the period 2021-2025.

Fresh Parsnip Seasonality by State

State	24/25 Tonnes	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Victoria	1,541												
Western Australia	913												
Tasmania	389												
Queensland	275												
South Australia	260												
New South Wales	174												
Availability Legend			High			Medium			Low			None	

Root vegetable production in Australia exclusively supplies the domestic market.

[1] Hort Innovation (2026). Australian Horticulture Statistics Handbook 2024/25. [online] Available at: https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/australian-horticulture-statistics-handbook/

3. Introduction

3.1 Background

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

Growers may face severe losses from diseases, pests and weeds due to a lack of registered or approved (via a permit) chemical control tools. Environmental concerns, consumer demands, and public opinion are also significant influences in the marketplace related to pest management practices. Industry IPDM 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 root vegetable production and respective IPDM 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 root vegetable industry regarding pesticide access, Hort Innovation undertook a review of the pesticide requirements via a Strategic Agrichemical Review (SARP) in 2021. 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 root vegetable industry. Against these threats, available registered or permitted pesticides are evaluated for overall suitability in terms of IPDM, 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 root vegetable 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 root 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[2] which covers root vegetable outlines key threats to the industry, risk mitigation plans, identification and categorisation of exotic pests and contingency plans. High priority exotic pests have been assessed based on their potential to enter, establish, and spread in Australia (e.g. environmental factors, host range, vectors) and the cost to industry of control measures.

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

3.2 Minor use permits and registration

From a pesticide access perspective, the APVMA classifies radish, horseradish, parsnip, swede and turnip as minor crops. The crops fit within the APVMA crop group VR0075: Root and Tuber Vegetables, within the subgroup VR2070: Root Vegetables. Access to minor use permits can be achieved as long as a reasonable justification is provided in accordance with the APVMA's minor use guidance[3].

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 root vegetable industry is for manufacturers to register new pesticides uses in the crop.

[3] https://apvma.gov.au/node/10931

3.3 Methods

The current update of the Root Vegetable Strategic Agrichemical Review Process (SARP), which was last updated in 2021, was conducted by desktop audit using industry information gathered through consultation with growers, agronomists and industry bodies, as well as review current information related to pesticide use in the industry. The process included gathering, collating and confirming information:

Hort Innovation Project Reference	Process of Review - Activity
MT25005 - Vegetable Strategic Agrichemical Review Process (SARP) Report Updates	Engagement and consultation with growers and other relevant stakeholders, in conjunction with AUSVEG. Including small group workshops and one on one consultation nationally. Collation of information collected by commodity on applicable pests, diseases and weeds in order of priority.
MT24008 – Regulatory Support & Response Co-ordination (pesticides) DTS Pty Ltd	**Root Vegetable Agrichemical Regulatory Risk Assessment Document** To assist strategic planning, with respect to future pest management options, this document was developed as part of the Hort Innovation funded project MT24008 to highlight the regulatory threats to agrichemicals currently approved for the management of the pests and diseases in root vegetables as well as current initiatives aimed at addressing identified pest management deficiencies.
MT25005 – Vegetable Strategic Agrichemical Review Process (SARP) Report Updates	**SARP updated via a desktop audit:** Review list of priorities rated as high, moderate and low for each plant pest groups (disease, insects and weeds) – provided by VG16060 Identify industries pest priority gaps in order of importance Update current pesticides available via label registrations or minor use permits Update available pesticide use patterns, IPM ranking/compatibility, mode of action and chemical group. Identify pesticides at risk (under review and/or limited uses) via MT24008 Regulatory Support & Response Co-ordination (pesticides) – DTS Pty Ltd. Identify any appropriate solutions through the outcomes of the AgChem Forum's or similar market intelligence and their overall suitability (IPM compatibility, Chemical group to manage resistance, risk profile, existing domestic MRL's or global MRL's including any potential trade barriers, efficacy, OH&S, environmental safety and sustainability). Include known pesticide solutions that are currently under development with registrants for new uses in the nominated crops or in current Hort Innovation projects. Update MRL tables to include Australian MRL's, Codex and any applicable export market MRL's

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 root vegetables
Appendix 2. Products available for control of insects and mites in root vegetables
Appendix 3. Products available for weed control in root vegetables
Appendix 4. Current permits for use in root vegetables
Appendix 5. Root vegetables Maximum Residue Limits (MRLs)
Appendix 6. Root vegetables Agrichemical Regulatory Risk Assessment

4. Diseases, Pests and Weeds of Root Vegetables

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 and permit instructions. Specific resistance management strategies may apply. These can be found, along with other useful information, on the CropLife Australia website[4].

In Chapter 4 information on regulatory risk derived from project MT24008 (Regulatory support and response coordination) has been incorporated.

Some of the suggested options have no overseas MRLs (see Appendix 5). Some importing countries may defer to MRLS established by the Codex Alimentarius Commission (Codex MRLs) but this cannot be automatically assumed.

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

[4] https://www.croplife.org.au/resources/programs/resistance-management/

4.1 Diseases of root vegetables

4.1.1 Disease priorities

Common name	Scientific name
High	
Black Canker	*Itersonilia perplexans*, *Cylindrocarpon* spp., *Mycocentrospora acerina*
Moderate	
White Blister	*Albugo candida*
Powdery Mildew	*Erysiphe* spp.
Club Root	*Plasmodiophora brassicae*
Sclerotinia Rot	*Sclerotinia sclerotiorum* & *S.minor*
Low	
Downy Mildew	*Hyaloperonospora* spp.
Alternaria Leaf Spot	*Alternaria* spp.
Black Rot	*Xanthomonas* spp.
Damping Off	*Pythium* spp., *Phytophthora* spp., *Fusarium* spp., *Rhizoctonia* spp.
Leaf Spot	*Cercospora* spp.
Crown Gall	*Agrobacterium tumefaciens*
Ramularia Leaf Spot	*Ramularia pastinacae*

The high priority disease based on the feedback received was Black Canker. Available and potential products for controlling diseases of root vegetables are listed in Section 4.1.2.

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

CropLife Australia has resistance management strategies[5] related to the control of diseases in various crops, and users should refer to this before using any product.

[5] https://www.croplife.org.au/resources/programs/resistance-management/

4.1.2 Available and potential products for priority diseases

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

Availability		Regulatory risk (refer to Appendix 6)	
A	Available via either registration or permit approval	R1	Short-term risk: Critical concern over retaining access < 1 year
P	Potential - a possible candidate to pursue for registration or permit	R2	Medium-term risk: Maintaining access of significant concern <2-5 years
P-A	Potential, already approved in the crop for another use	R3	Long-term: Potential issues associated with use - Monitoring required < 5 years
		R4	No current risk / concerns

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
Black Canker (*Itersonilia perplexans*, *Cylindrocarpon* spp., *Mycocentrospora acerina*) **Priority: High**							
Black Canker is rated as a high priority in parsnips. It was not rated as a priority in other root vegetables. Black Canker can cause losses of up to 80% in parsnips. Cankers form primarily on the crown and shoulder of roots, although these lesions can extend along the length of the root. Control options are limited with crop rotation and hygiene practices critical for the management of infection.							
1,3-Dichloropropene + Chloropicrin	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	R4
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including *Pythium*, *Phytophthora*, *Sclerotinia*, *Sclerotium*, *Rhizoctonia*, *Verticillium*, *Plasmodiophora*, *Armillaria* and *Fusarium* 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.	R4

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 *Rhizoctonia*, *Pythium*, *Fusarium*, *Phytophthora*, *Verticillium*, *Sclerotinia* and Club Root of crucifers. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	R4
Bacillus amyloliquefaciens 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.	R4
White Blister (*Albugo candida*) **Priority: Moderate**							
White Blister is rated as a moderate priority in root vegetables, specifically being a high priority for radish and horseradish. Symptoms are often found on leaves, stems and flowers and are favoured by cool, moist conditions. Cultural control measures are limited and management of White Blister centres around fungicide programs.							
Azoxystrobin (Amistar)	11	Protectant & Curative	7	A	ALL	Registered in horseradish for control of **White Blister Rust** (*Albugo candida*) and Downy Mildew. Apply as a foliar spray when conditions favour disease development. Use a minimum retreatment interval of 7 days. Maximum of 3 applications per crop. Registered in radish for control of **White Blister Rust** (*Albugo candida*). Apply as a foliar spray using 2 consecutive applications on a retreatment interval of 7-14 days. Maximum of 2 applications per crop.	R4
Chlorothalonil (Bravo) PER82895	M5	Protectant	1 NG	A	ALL (excl. VIC)	Permitted in radish for control of Alternaria (*Alternaria* spp.), Downy Mildew (*Peronospora parasitica*), Grey Leaf Spot (*Stemphylium solani*) and **White Rust** (*Albugo candida*). Apply as a foliar spray commencing as soon as conditions favour disease infection. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	R2
Copper PER14038	M1	Protectant	1	A	ALL (excl. VIC)	Permitted in horseradish for control of **White Blister Rust**. Apply as a folia spray at first sign of disease. Use a retreatment interval of 10-14 days. Maximum number of applications per crop not specified.	R4

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 and turnip for control of **White Blister** (*Albugo candida*) and Downy Mildew. Apply as 2 consecutive foliar sprays, commencing prior to the main infection period, and using a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	R4
Mancozeb PER80538	M3	Protectant	14 NG	A	ALL (excl. VIC)	Permitted in radish, swede and turnip for control of Cercospora Leaf Spot, Alternaria and **White Blister**. Apply as a foliar spray commencing when conditions favour disease development. Use a minimum retreatment interval of 7 days. Maximum of 4 applications per crop.	R2
Amisulbrom + Copper (Amicus Blue) Nufarm	21+M1	Protectant		P		Registered for control of **White Blister** (*Albugo candida*) in brassica vegetables.	R4
Cyazofamid (Ranman) UPL	21	Protectant		P		Registered for control of **White Blister** (*Albugo candida*) in broccoli.	R4
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of **White Blister** in brassica vegetables.	R4
Propamocarb Hydrochloride + Fluopicolide (Infinito) Bayer	28+43	Protectant		P		Registered for control of **White Blister** (*Albugo candida*) in brassica vegetables.	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Powdery Mildew (*Erysiphe* spp.) **Priority: Moderate**							
Powdery Mildew is rated as a moderate priority. Powdery Mildew is a serious disease of root vegetables which can cause severe impacts on the foliage if not controlled effectively. The disease is favoured by high humidity in conjunction with temperatures from 15-27°C. Infections can be spread long distances by wind, and a well-planned fungicide program is essential to manage this disease in root vegetables.							
Penthiopyrad (Fontelis) Corteva	7	Protectant	7	A	ALL	Registered in root and tuber vegetables for control of Early Blight (*Alternaria* spp.) and **Powdery Mildew** (*Erysiphe* spp.) Apply as a foliar spray commencing prior to disease development. Use a retreatment interval of 7-14 days. Maximum of 2 applications per crop.	R4
Potassium Bicarbonate (Eco-Carb) PER13695	M2	Protectant	NR	A	ALL (excl. VIC)	Permitted in parsnip, radish, swede and turnip for control of **Powdery Mildew**. Apply as a foliar spray commencing at first sign of disease. Use a retreatment interval of 10-14 days. Maximum number of applications per crop not specified.	R4
Pydiflumetofen + Difenoconazole (Miravis Duo) Syngenta	7+3	Protectant	7 NG	A	ALL	Registered in root vegetables for control of Early Blight / Target Spot (*Alternaria* spp.), **Powdery Mildew** (*Erysiphe* spp., *Oidium* spp.) and Cercospora Leaf Spot (*Cercospora* spp.) Apply as a foliar spray commencing when conditions favour disease development and before the onset of symptoms. Use a retreatment interval of 7-10 days. Maximum of 2 applications per crop.	R3
Sulphur	M2	Protectant	NR	A	ALL	Registered in vegetables for control of **Powdery Mildew** and Rust. Apply as a foliar spray when disease is first seen. Use a retreatment interval of 14-21 days. Maximum number of applications per crop not specified.	R4
Triadimenol (Bayfidan)	3	Protectant & Curative	7 NG	A	ALL	Registered in parsnip, radish, swede & turnip for control of **Powdery Mildew**. Apply as a foliar spray when first sign of infection is evident or conditions are highly conducive to disease development. Use a minimum retreatment interval of 10 days. Maximum of 2 applications per crop.	R3
Streptomyces lydicus WYEC108 (Actinovate) Novozymes Bioag	BM 02	Biological	NR	P-A	ALL	Registered in vegetables as a seed treatment for *Fusarium, Rhizoctonia* & *Pythium* Management. Registered for suppression of **Powdery Mildew** in cucurbits**.**	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Acibenzolar-S-Methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		Registered for the suppression of **Powdery Mildew** in tomatoes.	R4
BLAD (ProBlad Plus)	BM 01	Biological	NR	P		Registered for control of Brown Rot and Blossom Blight in stone fruit. US registration for control of **Powdery Mildew** in cucurbits, fruiting vegetables, grapes, hops, pome fruit and strawberries.	R4
Boscalid + Kresoxim-Methyl (Colliss) BASF	7+11	Protectant & Curative		P		Registered for control of **Powdery Mildew** in cucurbits.	R4
Bupirimate (Nimrod) Adama	8	Protectant & Curative		P		Registered for control of **Powdery Mildew** in apples, cucurbits, cut flower, eggplant, melons, nursery stock, ornamentals, peppers and strawberries.	R4
Cyflufenamid (Flute) AgNova	U6	Protectant & Curative		P		Registered for control of **Powdery Mildew** in cucurbits, grapevines and strawberries.	R4
Florylpicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		Registered for control of **Powdery Mildew** in cucurbits, capsicum, tomato, strawberries and grapevines.	R4
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of **Powdery Mildew** in almonds, brassica leafy greens, cucurbits, grapes, hops, dry and succulent beans, stone fruit and sunflowers.	R4
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of **Powdery Mildew** in grapes, fruiting vegetables, cucurbits and root vegetables.	R4
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered for control of **Powdery Mildew** in grapes.	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Metrafenone (Vivando) BASF	U8	Protectant		P		Registered for control of **Powdery Mildew** in cucurbits and grapes.	R4
Polyoxin-D (Intervene) Nufarm	19	Protectant		P		Registered for control of **Powdery Mildew** in apples, berries, grapes, basil and thyme.	R4
Proquinazid (Talendo) Corteva	13	Protectant		P		Registered for control of **Powdery Mildew** in fruiting vegetables, cucurbits, grapes and pome fruit.	R4
Pyriofenone (Kusabi) AgNova	50	Protectant & Curative		P		Registered for control of **Powdery Mildew** in cucurbits and grapes.	R4
Tea Tree Oil (Timorex)	46	Protectant		P		Registered for control of **Powdery Mildew** in fruiting vegetables, cucurbits and grapes.	R4
Club Root (*Plasmodiophora brassicae*) **Priority: Moderate**							
Club Root is rated as a moderate priority in root vegetables, particularly the brassica types in radish and horseradish. It is a soil-borne disease that causes swollen galls in the roots that reduce water and nutrient uptake and stunt growth. Crop rotation, farm hygiene and soil drainage are important management strategies.							
1,3-Dichloropropene + Chloropicrin	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	R4
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including *Pythium*, *Phytophthora*, *Sclerotinia*, *Sclerotium*, *Rhizoctonia*, *Verticillium*, *Plasmodiophora*, *Armillaria* and *Fusarium* 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.	R4

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 *Rhizoctonia*, *Pythium*, *Fusarium*, *Phytophthora*, *Verticillium*, *Sclerotinia* and **Club Root** of crucifers. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	R4
Bacillus amyloliquefaciens 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.	R4
Amisulbrom (Amishield) Nufarm	21	Protectant		P		Registered for control of **Club Root** in brassica vegetables.	R4
Fluazinam (Emblem) Nufarm	29	Protectant		P		Registered for control of **Club Root** in broccoli, brussels sprouts, cabbage, cauliflower and kohlrabi.	R4
Quintozene (Terrraclor)	14	Protectant		P		Registered for control of Club Root in cabbage, cauliflower and broccoli.	R4
Sclerotinia Rot (*Sclerotinia sclerotiorum & S.minor*) **Priority: Moderate**							
Sclerotinia Rot is rated as a moderate priority in root vegetables, particularly radish, horseradish, swedes and turnips. 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	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Boscalid (Filan) BASF	7	Protectant	7	A	ALL	Registered in root and tuber vegetables for control of **Sclerotinia Rot** (*Sclerotinia minor*, *S. sclerotorium*). Apply 2 consecutive foliar sprays commencing before the disease has developed, using a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	R4
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including *Pythium*, *Phytophthora*, ***Sclerotinia***, *Sclerotium*, *Rhizoctonia*, *Verticillium*, *Plasmodiophora*, *Armillaria* and *Fusarium* 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.	R4
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of fungus diseases including *Rhizoctonia*, *Pythium*, *Fusarium*, *Phytophthora*, *Verticillium*, ***Sclerotinia*** and Club Root of crucifers. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	R4
Tebuconazole (Folicur)	3	Protectant & Curative	35 NG	A	ALL	Registered in radish for control of **Sclerotinia Rot** (*Sclerotinia* spp.) Apply as a foliar spray during the early stages of plant development. Use a retreatment interval of 7-14 days. Maximum of 2 applications per crop.	R4
Bacillus amyloliquefaciens 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.	R4
Penthiopyrad (Fontelis) Corteva	7	Protectant	7	P-A	ALL	Registered in root and tuber vegetables for control of Early Blight (*Alternaria* spp.) and Powdery Mildew (*Erysiphe* spp.) Registered for control of **Sclerotinia** in brassica vegetables, brassica leafy vegetables and leafy vegetables.	R4
Aureobasidium pullulans (Botector) Nufarm	BM 02	Biological		P		Registered for suppression of **Sclerotinia** in fruiting vegetables.	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protectant & Curative		P		Registered for suppression of **Sclerotinia** in brassica vegetables, cucurbits, endive, leafy vegetables and lettuce.	R4
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protectant		P		Registered for control of **Sclerotinia** in capsicum, green beans, garden peas, snow peas, sugar snap peas, leafy vegetables, lettuce, nursery stock and ornamentals.	R3
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of ***Sclerotinia*** in brassica leafy greens and sunflowers.	R4
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of **Sclerotinia** in lettuce.	R4
Mandestrobin (Intuity) Sumitomo	11	Protectant		P		Registered for control of **White Mould** in green beans and lettuce and control of Blossom Blight and Brown Rot in stone fruit.	R4
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of **Sclerotinia** in lettuce, leafy vegetables and root vegetables.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Downy Mildew (*Hyaloperonospora* spp.) **Priority: Low**							
Downy Mildew is rated as a low priority in root vegetables. It is characterised by a white downy fungal growth that develops on the underside of the leaf. Downy Mildew is a common disease that is favoured by warm, moist weather. Management options include general farm hygiene, crop rotation, planting space (to allow air movement) and the use of protectant and curative fungicide spray applications when conditions favour disease outbreaks.							
Azoxystrobin (Amistar)	11	Protectant & Curative	7	A	ALL	Registered in horseradish for control of White Blister Rust (*Albugo candida*) and **Downy Mildew**. Apply as a foliar spray when conditions favour disease development. Use a minimum retreatment interval of 7 days. Maximum of 3 applications per crop.	R4
Chlorothalonil (Bravo) PER82895	M5	Protectant	1 NG	A	ALL (excl. VIC)	Permitted in radish for control of Alternaria (*Alternaria* spp.), **Downy Mildew** (*Peronospora parasitica*), Grey Leaf Spot (*Stemphylium solani*) and White Rust (*Albugo candida*). Apply as a foliar spray commencing as soon as conditions favour disease infection. Use a retreatment interval of 7-14 days. Maximum number of applications per crop not specified.	R2
Copper Hydroxide + Metalaxyl (Ridomil Gold Plus) Syngenta	M1+4	Protectant	7	A	ALL	Registered in radish, swede and turnip for control of White Blister (*Albugo candida*) and **Downy Mildew**. Apply as 2 consecutive foliar sprays, commencing prior to the main infection period, and using a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	R4
Mancozeb + Dimethomorph (Acrobat) PER14958	M3 + 40	Protectant	14 NG	A	ALL (excl. VIC)	Permitted in radish for control of **Downy Mildew** and Alternaria Leaf Spot. Apply as a foliar spray when conditions favour disease development, applying 2 consecutive applications using a retreatment interval of 7-10 days. Maximum of 4 applications per crop.	R2
Metalaxyl-M (Apron)	4	Protectant	NR	A	QLD, NSW & TAS	Registered in radish for control of **Downy Mildew**. Apply as a seed dressing.	R4
Copper	M1	Protectant	1	P-A	ALL	Registered in parsnip for control of Leaf Spot. Registered for control of **Downy Mildew** in vines, brassicas, lettuce, onions, ornamentals, rhubarb, silver beet and spinach.	R4
Phosphorous Acid PER14184	33	Protectant & Curative	1	P-A	ALL (excl. VIC)	Permitted in parsnips for control of Damping Off. Registered for control of **Downy Mildew** in grapes.	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Acibenzolar-S-Methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		Registered in tomatoes for the suppression of Bacterial Speck, Bacterial Spot, Bacterial Canker and Powdery Mildew. US registration for control of **Downy Mildew** in Brassica leafy vegetables, cucurbits, leafy vegetables, spinach, and suppression of **Downy Mildew** in bulb onion.	R4
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protectant & Curative		P		Registered for the control of **Downy Mildew** in Brassica vegetables.	R4
Cyazofamid (Ranman) UPL	21	Protectant & Curative		P		Registered for the control of **Downy Mildew** in Brassica leafy vegetable seedlings. US registration for control of **Downy Mildew** in herbs, brassica leafy vegetables, cucurbits, grapes, hops, leafy greens, succulent-podded and succulent-shelled beans and bulb vegetables.	R4
Dimethomorph + Amitoctradin (Zampro) AgNova	45+40	Protectant		P		Registered for control of **Downy Mildew** in grape vines.	R4
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of **Downy Mildew** in brassica vegetables, bulb vegetables and grapes.	R4
Mandestrobin (Intuity) Sumitomo	11	Protectant		P		Registered for suppression of **Downy Mildew** in bulb onions.	R4
Mandipropamid (Revus) Syngenta	40	Protectant		P		Registered for control of **Downy Mildew** in grapes and brassica leafy crops.	R4
Oxathiapiprolin (Zorvec Enicade) Corteva	49	Protectant		P		Registered for control of **Downy Mildew** in bulb vegetables, brassica vegetables, cucurbits, leafy vegetables, brassica leafy vegetables and poppies.	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Oxathiapiprolin + Mancozeb (Zorvec Enibel) Corteva	49+M3	Protectant		P		Registered for control of **Downy Mildew** in bulb vegetables.	R2
Oxathiapiprolin + Famoxadone (Zorvec Encantia) Corteva	49+11	Protectant		P		Registered for control of **Downy Mildew** in spinach and rocket.	R4
Polyoxin-D (Intervene) Nufarm	19	Protectant		P		Pending registration for control of Botrytis and Powdery Mildew in grapes, Botrytis, Powdery Mildew and Rhizopus Fruit Rot in berries, and Powdery Mildew, Alternaria and Fruit Spot in apples. US registration for control of **Downy Mildew** in ornamentals.	R4
Propamocarb Hydrochloride + Fluopicolide (Infinito) Bayer	28+43	Protectant		P		Registered for control of **Downy Mildew** in brassica vegetables, bulb vegetables, cucurbits, leafy vegetables, lettuce, poppies and root vegetable.	R4
Propineb (Antracol) Bayer	M3	Protectant		P		Registered for control of **Downy Mildew** in cucurbits and onions.	R2
Propineb + Oxadixyl (Rebound) Kiwi Rural Trading	M3+4	Protectant & Curative		P		Registered for control of **Downy Mildew** in cucurbits, grape vines, lettuce and onions.	R2

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Alternaria Leaf Spot (*Alternaria* spp.) **Priority: Low**							
Alternaria Leaf Spot is rated as a low priority in root vegetables. 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 **Alternaria** (*Alternaria* spp.), Downy Mildew (*Peronospora parasitica*), Grey Leaf Spot (*Stemphylium solani*) and White Rust (*Albugo candida*). Apply as a foliar spray commencing as soon as conditions favour disease infection. Use a retreatment interval of 7-14 days. Maximum number of applications per crop not specified.	R2
Mancozeb PER80538	M3	Protectant	14 NG	A	ALL (excl. VIC)	Permitted in radish, swede and turnip for control of Cercospora Leaf Spot, **Alternaria** and White Blister. Apply as a foliar spray commencing when conditions favour disease development. Use a minimum retreatment interval of 7 days. Maximum of 4 applications per crop.	R2
Mancozeb + Dimethomorph (Acrobat) PER14958	M3 + 40	Protectant	14 NG	A	ALL (excl. VIC)	Permitted in radish for control of Downy Mildew and **Alternaria Leaf Spot**. Apply as a foliar spray when conditions favour disease development, applying 2 consecutive applications using a retreatment interval of 7-10 days. Maximum of 4 applications per crop.	R2
Penthiopyrad (Fontelis) Corteva	7	Protectant	7	A	ALL	Registered in root and tuber vegetables for control of **Early Blight** (*Alternaria* spp.) and Powdery Mildew (*Erysiphe* spp.) Apply as a foliar spray commencing prior to disease development. Use a retreatment interval of 7-14 days. Maximum of 2 applications per crop.	R4
Pydiflumetofen + Difenoconazole (Miravis Duo) Syngenta	7+3	Protectant	7 NG	A	ALL	Registered in root vegetables for control of **Early Blight** / Target Spot (*Alternaria* spp.), Powdery Mildew (*Erysiphe* spp., *Oidium* spp.) and Cercospora Leaf Spot (*Cercospora* spp.) Apply as a foliar spray commencing when conditions favour disease development and before the onset of symptoms. Use a retreatment interval of 7-10 days. Maximum of 2 applications per crop.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Bacillus amyloliquefaciens (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered in grapes and strawberries for control of Botrytis, in tomatoes, capsicums and chillies for suppression of Bacterial Spot and in avocado, other tropical fruit crops (excluding banana) and mango for control of Anthracnose and suppression of Stem End Rot. US registration for control of ***Alternaria*** in berries, brassica vegetables, citrus, bulb vegetables, herbs/spices, root/tuber and corm vegetables, stone fruit and tree nuts.	R4
Bacillus amyloliquefaciens strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of Botrytis in grapevines and strawberries. US registration for control of ***Alternaria*** in artichoke, asparagus, berries, brassica leafy vegetables, bulb vegetables, citrus, cucurbits, pome fruit, stone fruit and tobacco.	R4
Florylpicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		Registered for control of **Alternaria** in capsicum, chilli, eggplant, okra and tomato.	R4
Fluazinam (Emblem) Nufarm	29	Protectant		P		Registered in Brassica vegetables for control of Club Root. US registration for control of ***Alternaria*** in carrots.	R4
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of ***Alternaria*** in almond, Brassica leafy greens, bulb vegetables, cucurbits, pistachio, tree nuts and sunflower.	R4
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of ***Alternaria***, Black Spot and Powdery Mildew in apples, Black Spot in pears, Blossom Blight, Brown Rot, Hull Rot, Shot Hole and Rust in stone fruit, and various leaf diseases in tropical fruits. US registration for control of ***Alternaria*** in almond, Brassica vegetables, Brassica leafy vegetables, carrot, citrus, pome fruit, small vine climbing fruit except kiwi fruit, leafy greens, cucurbits, tree nuts, fruiting vegetables & root vegetables except sugar beet.	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of Alternaria Leaf Spot, Black Spot, Brown Rot Nut Scab, Shot Hole and Rust in almond, Brown Rot in cherries and Husk Spot in macadamia. US registration for control of **Alternaria Leaf Blight**, Powdery Mildew, Anthracnose, Cercospora Leaf Spot, Gummy Stem Blight, Microdochium Blight, Target Leaf Spot and suppression of Downy Mildew in cucurbits.	R4
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 root vegetables. US registration for control of ***Alternaria*** in berries, brassica vegetables, bulb vegetables, carrots, cucurbits, fruiting vegetables, grape and small fruit vine climbing (except fuzzy kiwifruit), specific leaf petioles, specific leafy greens, root and tuber vegetables, lemon and lime, mustard greens, pistachio, root vegetable, root vegetables and tuberous and corm vegetables.	R4
Black Rot (*Xanthomonas* spp.) **Priority: Low**							
Black Rot is rated as a low priority in root vegetables. Infection causes leaf spots on the foliage which can lead to indirect impacts on root growth. Farm hygiene, crop rotation, seed treatments and fungicides can all play a role in management of the disease.							
Chlorine	-	Sanitiser	NR	A	ALL	Registered as a sanitiser / post-harvest treatment for control of bacteria and fungi. Spray or dip harvested produce, minimum of 30 seconds contact time with treated water.	R4
Iodine	-	Sanitiser	NR	A	ALL	Registered in root crops as a sanitiser / post-harvest treatment for control of bacteria and fungi. Dip harvested produce, minimum of 1 minute contact time with treated water.	R4
Peroxyacetic Acid	M	Sanitiser / Post-Harvest Treatment	NR	A	ALL	Registered as a sanitiser / post-harvest treatment for control of bacteria. Spray or dip harvested produce.	R4
Copper	M1	Protectant	1	P-A	ALL	Registered in parsnip for control of Leaf Spot. Registered for control of Bacterial Spot in stone fruit, brassica vegetables, cucurbits, peas and tomatoes.	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Bacillus amyloliquefaciens (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for suppression of Bacterial Spot in tomatoes, capsicums and chillies.	R4
Bacillus amyloliquefaciens strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of Botrytis in grapevines, strawberries and berries. US registration for control of bacterial diseases in root & tuber vegetables (except sugar beet), tree nuts, berries, fruiting vegetables, leafy vegetables and stone fruit.	R4
Damping Off (*Pythium* spp., *Phytophthora* spp., *Fusarium* spp., *Rhizoctonia* spp.) **Priority: Low**							
Damping Off is rated as a low priority in root vegetables. Symptoms of Damping Off consists 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 most susceptible. Control options are limited and include the use of crop rotation to break the disease cycle.							
1,3-Dichloropropene + Chloropicrin	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	R4
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including *Pythium*, *Phytophthora*, *Sclerotinia*, *Sclerotium*, *Rhizoctonia*, *Verticillium*, *Plasmodiophora*, *Armillaria* and *Fusarium* 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.	R4
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of fungus diseases including *Rhizoctonia*, *Pythium*, *Fusarium*, *Phytophthora*, *Verticillium*, *Sclerotinia* and Club Root of crucifers. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Phosphorous Acid PER14184	33	Protectant & Curative	1	A	ALL (excl. VIC)	Permitted in parsnips for control of **Damping Off**. Apply as a foliar spray when conditions favour disease development. Use a minimum retreatment interval of 7 days. Maximum of 4 applications per crop.	R4
Streptomyces lydicus WYEC108 (Actinovate) Novozymes Bioag	BM 02	Biological	NR	A	ALL	Registered in vegetables as a seed treatment for *Fusarium, Rhizoctonia* & ***Pythium*** Management.	R4
Bacillus amyloliquefaciens 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.	R4
Bacillus amyloliquefaciens (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of *Botrytis* in grapes. US registration for control of **Pythium Damping Off** in artichoke, asparagus, brassica leafy vegetables, bulb vegetables, citrus, cucurbits, corn, fruiting vegetables, legume vegetables, oilseeds, soybean, strawberry and root and tuber vegetables (except sugar beet).	R4
Cyazofamid (Ranman) UPL	21	Protectant & Curative		P		Registered in Brassica leafy vegetable seedlings for the control of Downy Mildew. US registration for control of ***Pythium* spp.** in carrot, leafy greens, succulent-podded and succulent-shelled beans, tuberous and corm vegetables, tomato greenhouse transplants and greenhouse-grown bell peppers.	R4
Fludioxonil + Sedaxane (Vibrance Premium Seed Treatment) Syngenta	12 +7	Protective Seed Treatment		P		Registered for control of Black Scurf (*Rhizoctonia*), Silver Surf, Black Rot, Gangrene and Fusarium Dry Rot and suppression of Scab in root vegetables.	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Leaf Spot (*Cercospora beticola*) **Priority: Low**							
Cercospora Leaf Spot is rated as a low priority in root vegetables. The disease is transmitted through undecomposed crop residues, weed hosts and via seed. Outbreaks are favoured by warm, showery weather and severe infections can result in reduced size of tubers.							
Chlorothalonil (Bravo) PER82895	M5	Protectant	7	A	ALL (excl. VIC)	Permitted in parsnip for control of **Early Blight** (*Cercospora apii*) and Septoria Leaf Spot (*Septoria apiicola*). Apply as a foliar spray as soon as conditions favour disease development. Use a retreatment interval of 10-14 days. Maximum number of applications per crop not specified.	R2
Mancozeb PER80538	M3	Protectant	14 NG	A	ALL (excl. VIC)	Permitted in radish, swede and turnip for control of **Cercospora Leaf Spot**, Alternaria and White Blister. Apply as a foliar spray commencing when conditions favour disease development. Use a minimum retreatment interval of 7 days. Maximum of 4 applications per crop.	R2
Pydiflumetofen + Difenoconazole (Miravis Duo) Syngenta	7+3	Protectant	7 NG	A	ALL	Registered in root vegetables for control of Early Blight / Target Spot (*Alternaria* spp.), Powdery Mildew (*Erysiphe* spp., *Oidium* spp.) and **Cercospora Leaf Spot** (*Cercospora* spp.) Apply as a foliar spray commencing when conditions favour disease development and before the onset of symptoms. Use a retreatment interval of 7-10 days. Maximum of 2 applications per crop.	R3
Copper	M1	Protectant	1	P-A	ALL	Registered in parsnip for control of Leaf Spot. Registered for control of ***Cercospora* spp.** in bananas, fig and celery.	R4
Bacillus amyloliquefaciens (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.	R4
Bacillus amyloliquefaciens strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of *Botrytis* in grapes and strawberries. US registration for control of **Cercospora** in leafy vegetables, sugar beet and tobacco.	R4

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 a variety of diseases including Powdery Mildew, Alternaria Leaf Spot, Gummy Stem Blight, Septoria, *Botrytis, Cladosporium,* ***Cercospora****, Sclerotinia* and Anthracnose in almond, Brassica leafy vegetables, legume vegetables, melons and various fruit crops.	R4
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of various leaf diseases in almonds, pome fruit, stone fruit and tropical and sub-tropical fruit (inedible peel). US registration for control of ***Cercospora*** in peanuts and sugarbeet.	R4
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of ***Cercospora*** **spp.** in celery.	R4
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered for control of Black Spot in apples and Powdery Mildew in grapes. US registration for control of ***Cercospora*** in corn, legume vegetables, peanuts, sorghum, millet, soybean and sugar beet.	R4
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 root vegetables. US registration for control of **Cercospora** in brassicas, carrots, cucurbits, stalk vegetables and root and tuber vegetables.	R3
Crown Gall (*Agrobacterium tumefaciens*) **Priority: Low**							
Crown Gall is rated as a low priority in root vegetables. It is a soil-borne bacterial disease that infects the crops through a wound, usually at ground level or on the roots. It can be spread by infested soil, infected plant material, and via budding and grafting materials. Prevention of infection is essential through crop hygiene and disinfecting budding and grafting materials.							
Bacillus amyloliquefaciens 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.	R4

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Rhizobium rhizogenes Strain K1026 (NoGall)	-	Protectant		P	ALL	Registered for control of **Crown Gall** in stone fruit.	R4
Ramularia Leaf Spot (*Ramularia pastinacae*) **Priority: Low**							
Ramularia Leaf Spot is rated as a low priority in root vegetables. Infection is favoured by cool to moderate temperatures and humid conditions. The pathogen can be spread long distances by wind but the required conditions for infection tend to make its occurrence sporadic and control measures are rarely required.							
Azoxystrobin + Prothioconazole (Maxentis) Adama	11+3	Protectant		P		Registered for control of **Ramularia Leaf Spot** in barley.	R4
Mefentrifluconazole + Fluxapyroxad (Revystar) BASF	3+7	Protectant		P		Registered for control of **Ramularia Leaf Spot** in barley.	R4
Propiconazole + Benzovindiflupyr (Elatus Ace Solatenol) Syngenta	3+7	Protectant		P		Registered for control of **Ramularia Leaf Spot** in barley.	R4

4.2 Insect and mite pests of root vegetables

4.2.1 Insect and mite pest priorities

Common name	Scientific name
High	
Diamondback Moth	*Plutella xylostella*
False Wireworms	*Gonocephalum* spp.
Wireworm	*Arachnodima* spp., *Agrypnus* spp.
Vegetable Leafminer	*Liriomyza sativae*
Serpentine Leafminer	*Liriomyza huidobrensis*
Chevron Cutworm	*Diarsia intermixta*
Moderate	
Green Peach Aphid	*Myzus persicae*
Cabbage Aphid	*Brevicoryne brassicae*
Vegetable Weevil	*Listroderes difficilis*
White-Fringed Weevil	*Naupactus leucoloma*
Cotton Bollworm / Corn Earworm	*Helicoverpa armigera*
Native Budworm	*Helicoverpa punctigera*
Cluster Caterpillar	*Spodoptera litura*
Potato Moth	*Phthorimaea operculella*
Cabbage White Butterfly	*Pieris rapae*
Root-Knot Nematode	*Meloidogyne* spp.
Low	
Two-Spotted Mite	*Tetranychus urticae*
Tomato Russet Mite	*Aculops lycopersici*
European Red Mite	*Panonychus ulmi*
Western Flower Thrips	*Frankliniella occidentalis*
Plague Thrips	*Thrips imaginis*
Onion Thrips	*Thrips tabaci*
Black Field Cricket	*Teleogryllus commodus*
Australian Mole Cricket	*Gryllotalpa australis*
Rutherglen Bug	*Nysius vinitor*

The high priority insect pests identified were Diamondback Moth, False Wireworm, Wireworm, Vegetable Leafminer, Serpentine Leafminer and Chevron Cutworm. Available and potential products for these pests are listed in Section 4.2.2.

Soil insects can be highly damaging to root crops such as root vegetables, and it is important to identify what species are causing crop damage. Sampling for soil insects is best conducted using a baiting technique, such as outlined on Page 35 of the Cotton Pest Management Guide[6].

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 strategies[7] are available on the Croplife Australia website.

[6] www.cottoninfo.com.au/publications/cotton-pest-management-guide
[7] https://www.croplife.org.au/resources/programs/resistance-management/

4.2.2 Available and potential products for priority insects and mites

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

Availability		Regulatory risk (refer to Appendix 6)	
A	Available via either registration or permit approval	R1	Short-term risk: Critical concern over retaining access < 1 year
P	Potential - a possible candidate to pursue for registration or permit	R2	Medium-term risk: Maintaining access of significant concern <2-5 years
P-A	Potential, already approved in the crop for another use	R3	Long-term: Potential issues associated with use - Monitoring required < 5 years
		R4	No current risk / concerns

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 2025-26 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
Diamondback Moth (*Plutella xylostella*) **Priority: High**								
Diamondback Moth is rated as a high priority in root vegetables. The larvae are voracious feeders on plant foliage. Diamondback Moth populations have developed resistance to most insecticide groups making reliance on chemical control problematic. It is important to adopt an integrated pest management approach to controlling this pest, particularly preserving beneficial predators and parasitoids, as well as careful crop monitoring and judicious rotation of different modes of action.								
Alpha-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Cabbage White Butterfly (*Pieris rapae*), Cabbage Moth / **Diamondback Moth** (*Plutella xylostella*), Cluster Caterpillar (*Spodoptera litura*), Native Budworm (*Helicoverpa punctigera*) and Cotton Bollworm (*Helicoverpa armigera*). Apply as a foliar spray according to pest incidence. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Bacillus thuringiensis subsp. kurstaki (DiPel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Lepidoptera. Time spraying to coincide with egg hatch. Treatments per season not limited.	VL Bee:VL	R4
Beta-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of **Diamondback Moth** (*Plutella xylostella*), Native Budworm (*Helicoverpa punctigera*) and Cotton Bollworm (*Helicoverpa armigera*). Apply as a foliar spray according to pest infestation. Retreatment interval and maximum number of applications per crop not specified.	VH Bee:H	R4
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, Cutworm, European Earwig, Potato Moth, Rutherglen Bug, Armyworms and **Cabbage Moth**. Apply as a foliar spray at first sign of pest activity. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R4
Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of **Cabbage Moth** (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*) and Cotton Bollworm / Native Budworm (*Helicoverpa* spp.) Apply as a foliar spray according to pest infestation. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in root and tuber vegetables for control of **Diamondback Moth** (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*), Heliothis (*Helicoverpa* spp.), Cluster Caterpillar (*Spodoptera litura*), Loopers (*Chrysodeixis* spp.) and Cabbage Centre Grub (*Hellula hydralis*). Apply as a foliar spray at first sign of insect infestation. Use a minimum retreatment interval of 7 days. Maximum of 4 applications per crop.	M Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Fipronil	2B	Contact	7 NG	A	ALL	Registered in swede and turnip for control of **Diamondback Moth** (*Plutella xylostella*). Apply as a foliar spray when pest is present. Retreatment interval not specified. Maximum of 4 applications per crop.	M Bee:VH	R2
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in root and tuber vegetables for control of **Diamondback Moth** (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*), Cluster Caterpillar (*Spodoptera litura*), Potato Moth (*Phthorimaea operculella*) and Heliothis (*Helicoverpa* spp.) Apply as a foliar spray once local economic thresholds are reached. Use a retreatment interval of 7-14 days. Maximum of 3 applications per crop.	L-M Bee:L	R4
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, **Caterpillars**, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a foliar spray when pest is evident. Use a retreatment interval of 14-21 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Lambda-Cyhalothrin (Karate Zeon) PER11949	3A	Contact	2	A	ALL (excl. VIC)	Permitted in radish for control of Vegetable Loopers and **Diamondback Moth**. Apply as a foliar spray when pest is present in sufficient numbers to cause economic damage. Use a minimum retreatment interval of 7 days. Maximum of 2 applications per crop.	VH Bee:H	R4
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in radishes, swedes and turnips for control of **Diamondback Moth**, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, Helicoverpa, Cluster Caterpillar and Western Flower Thrips. Apply as a foliar spray targeting mature eggs and newly hatched larvae. Use a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	M Bee:H	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in radishes, swedes and turnips for control of **Diamondback Moth**, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, Heliothis and Western Flower Thrips and in root and tuber vegetables for control of Light Brown Apple Moth, Loopers, Helicoverpa, Potato Moth and Tomato Potato Psyllid (*Bactericera cockerelli*). Apply as a foliar spray targeting mature eggs and newly hatched larvae. Use a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	L Bee:L	R4
Trichlorfon	1B	Contact	2	A	ALL	Registered in vegetables for control of Cabbage White Butterfly, **Cabbage Moth**, Rutherglen Bug and Green Vegetable Bug. Apply as a foliar spray when pests are first seen. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	H Bee:H	R3
Zeta-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of **Cabbage Moth** (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*) and Cotton Bollworm / Native Budworm (*Helicoverpa* spp.) Apply as a foliar spray when pest populations indicate. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Broflanilide (Cimegra) BASF	30	Contact & Ingestion		P		Registered for control of **Diamondback Moth** (*Plutella xylostella*) in brassica vegetables.	H Bee:VH	R4
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of **Diamondback Moth** in brassica vegetables.	L Bee:H	R3
Isocycloseram (Simodis Plinazolin) Syngenta	30	Ingestion		P		Registered for control of **Diamondback Moth** in brassica vegetables.	H Bee:H	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Methoxyfenozide (Prodigy) Corteva	18	Insect Growth Regulator		P		Registered for control of various Lepidoptera in almonds, pome fruit, avocado, blueberry, citrus, coffee, custard apple, grapevines, kiwifruit, longan, lychee, macadamia, tomatoes, peppers, eggplant and okra.	VL Bee:VL	R4
False Wireworms (*Gonocephalum* spp.) **Wireworm** (*Arachnodima* spp., *Agrypnus* spp.) **Priority: High**								
False Wireworms and Wireworms are rated as a high priority in root vegetables. Larvae attack germinating seeds, the hypocotyl, roots and at the surface of young plants resulting in seedling death and patchy plant stands. The adult beetles can also damage seedlings by chewing at or just above ground level. Bait sampling prior to planting should be used to determine the presence of soil pests. Clean fallows (free from weeds) generally cause pest insect numbers to decline. Infestations of wireworm larvae detected after crop emergence cannot be controlled with baiting or surface spraying. Therefore, this pest must be detected before planting for control actions to be effective.								
1,3-Dichloropropene + Chloropicrin	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, **Wireworms**, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	-	R4
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including *Pythium*, *Phytophthora*, *Sclerotinia*, *Sclerotium*, *Rhizoctonia*, *Verticillium*, *Plasmodiophora*, *Armillaria* and *Fusarium* spp, nematodes, soil insects and weeds. Apply granules to the soil surface and incorporate and seal the soil surface immediately. Do not plant into soil until a positive germination test has been conducted.	-	R4
Fipronil	2B	Contact	7 NG	P-A	ALL	Registered in swede and turnip for control of Diamondback Moth (*Plutella xylostella*). Registered as a broadcast spray to the soil surface and incorporated prior to planting for control of **Wireworm** in potatoes, sweet potatoes and sugarcane.	M Bee:VH	R2
Broflanilide (Cimegra) BASF	30	Contact & Ingestion		P		Registered in brassica vegetables and Chinese cabbage for control of Diamondback Moth. Broadspectrum activity on soil-dwelling pests including **Wireworm**.	H Bee:VH	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Clothianidin + Imidacloprid (Poncho Plus) Bayer	4A	Contact & Ingestion		P		Registered as a seed treatment for control of **Wireworm** in canola, forage brassicas, maize, sweet corn, sorghum and sunflower.	M Bee:M	R2
Vegetable Leafminer (*Liriomyza sativae*) **Serpentine Leafminer** (*Liriomyza huidobrensis*) **Priority: High**								
Vegetable Leafminer and Serpentine Leafminer are rated as a high priority in root vegetables. Dipteran Leafminers (*Liriomyza* spp.) are recent arrivals to Australia which can cause widespread damage to a range of crops. The larvae tunnel through leaf tissue, leading to reduced photosynthesis, leaf death or premature leaf death. They can cause significant economic loss through reduced yields when uncontrolled.								
Abamectin PER96481	6	Ingestion	14 NG	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for suppression of Leaf Miners (*Liriomyza* spp.) including **Vegetable Leaf Miner** (*Liriomyza sativae*) and **Serpentine Leaf Miner** (*Liriomyza huidobrensis*). Apply as a foliar spray when leafminers first appear. Use a retreatment interval of 7-14 days. Maximum of 2 applications per crop.	M Bee:H	R3
Cyromazine (Diptex 150WP) PER81867	17	IGR / Ingestion	7 NG	A	ALL	Permitted in root and tuber vegetables for control of ***Liriomyza*** species, including **Vegetable Leafminer** (*Liriomyza sativa*) and **Serpentine Leafminer** (*Liriomyza huidobrensis*). Apply as a foliar spray, commencing when leafminers first appear. Use a minimum retreatment interval of 7 days. Maximum of 6 applications per crop.	-	R4
Spinetoram (Success Neo) Corteva PER94451	5	Ingestion	3	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of **Liriomyza Leafminers**, including **Vegetable Leafminer** (*Liriomyza sativa*), **Pea Leafminer** / **Serpentine Leafminer** (*Liriomyza huidobrensis*) & **American Serpentine Leafminer** (*Liriomyza trifolii*). Apply as a foliar spray, commencing when leafminers first appear. Use a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	M Bee:H	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinosad (Entrust Organic) Corteva PER96806	5	Ingestion	3 G:14	A	ALL (excl. VIC)	Permitted in root and tuber vegetables for control of Liriomyza Leafminers, including **Vegetable Leafminer** (*Liriomyza sativa*), **Pea Leafminer** / **Serpentine Leafminer** (*Liriomyza huidobrensis*) & **American Serpentine Leafminer** (*Liriomyza trifolii*). Apply as a foliar spray, commencing when leafminers first appear. Use a minimum retreatment interval of 5 days. Maximum of 4 applications per crop, with no more than 2 consecutive applications.	L Bee:L	R4
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	P-A	ALL	Registered in root and tuber vegetables for control of Diamondback Moth, Cabbage White Butterfly, Heliothis, Cluster Caterpillar and Loopers. Permitted for control of ***Liriomyza*** species, including **Vegetable Leafminer** (*Liriomyza sativae*) in brassica vegetables.	M Bee:H	R3
Chlorantraniliprole (Coragen) FMC	28	Ingestion		P		Permitted for control of **Liriomyza Leafminers** in spinach and silverbeet.	L Bee:VL	R4
Cyantraniliprole (Benevia) FMC	28	Ingestion		P		Permitted for use in bulb vegetables, fruiting vegetables (all) and potatoes for control of ***Liriomyza*** species, including **Vegetable Leafminer** (*Liriomyza sativae*), Pea **Leafminer/Serpentine Leafminer** (*Liriomyza huidobrensis*) and **American Serpentine Leafminer** (*Liriomyza trifolii*).	L Bee:L	R4
Isocycloseram (Simodis Plinazolin) Syngenta	30	Ingestion		P		Permitted for control of **Liriomyza Leafminers** in celery, baby leaf spinach, baby leaf lettuce, kale, open leaf lettuce, parsley, coriander, shallots, leek, tomato and capsicum.	H Bee:H	R4
Spirotetramat (Movento) Bayer	23	Ingestion		P		Permitted for control of **Liriomyza Leafminers** in snow peas, sugar snap peas, lettuce, parsley, eggplant, capsicums, chilies, tomatoes, green beans, celery and rhubarb.	M Bee:VL	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Chevron Cutworm (*Diarsia intermixta*) **Priority: High**								
Chevron Cutworm is rated as a high priority in root vegetables. Cutworms are caterpillars that attack seedling crops by chewing through leaves and stems at ground level. Cutworms can be a pest of emerging seedlings, impacting on plant densities. The importance of cutworm has increased since the withdrawal of key chemical control options (i.e. chlorpyrifos and diazinon) in September 2025, and the resulting need to identify suitable replacement chemistry. Bait sampling prior to planting should be used to determine their presence. Clean fallows (free from weeds) generally cause pest insect numbers to decline.								
1,3-Dichloropropene + Chloropicrin	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic Nematodes, Symphylans, **Wireworms**, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	-	R4
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, **Cutworm**, European Earwig, Potato Moth, Rutherglen Bug, Armyworms and Cabbage Moth. Apply as a foliar spray at first sign of pest activity. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R4
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including *Pythium*, *Phytophthora*, *Sclerotinia*, *Sclerotium*, *Rhizoctonia*, *Verticillium*, *Plasmodiophora*, *Armillaria* and *Fusarium* spp, nematodes, soil insects and weeds. Apply granules to the soil surface and incorporate and seal the soil surface immediately. Do not plant into soil until a positive germination test has been conducted.	-	R4
Alpha-Cypermethrin	3A	Contact	1	P-A	ALL	Registered in turnips for control of Cabbage White Butterfly (*Pieris rapae*), Cabbage Moth (*Plutella xylostella*), Cluster Caterpillar (*Spodoptera litura*), Native Budworm (*Helicoverpa punctigera*) and Cotton Bollworm (*Helicoverpa armigera*). Registered for control of **Cutworms** in winter cereals, various pulse crops and grapevines.	VH Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Trichlorfon	1B	Contact	2	P-A	ALL	Registered in vegetables for control of Cabbage White Butterfly, Cabbage Moth, Rutherglen Bug and Green Vegetable Bug. Registered for control of **Cutworms** in strawberries, beans, celery, crucifers, cucurbits, lettuce, peas, potatoes and tomato.	H Bee:H	R3
Bifenthrin (Talstar)	3A	Contact		P		Registered as an in-furrow spray at planting for control of Wireworms in cotton and sugarcane. US registration for control of **Cutworms** in field corn, sweet corn, succulent peas & beans, cilantro, dried beans & peas, tobacco and peanuts.	VH Bee:H	R3
Broflanilide (Cimegra) BASF	30	Contact & Ingestion		P		Registered in brassica vegetables and Chinese cabbage for control of Diamondback Moth. Broadspectrum activity on soil-dwelling pests including **Cutworms**.	H Bee:VH	R4
Chlorantraniliprole (Acelepryn, Coragen) Syngenta, FMC	28	Ingestion		P		Registered for control of **Black Cutworm** in turf. Note that rate in turf is higher than in vegetables.	L Bee:VL	R4
Clothianidin + Imidacloprid (Poncho Plus Seed Treatment) Bayer	4A	Contact & Ingestion		P		Registered for control of **Cutworms** as seed treatment in canola, forage brassicas, maize, sweet corn, sorghum, sunflower and pastures.	M Bee:M	R2
Cyantraniliprole (Benevia) FMC	28	Ingestion		P		Registered for control of various lepidoptera and sucking pests in certain vegetables and strawberries. US registration for control of **Cutworm** in root vegetables, including carrots.	M Bee:VH	R4
Cyantraniliprole + Thiamethoxam (Spinner) Syngenta	28+4A	Contact & Ingestion		P		Registered for control of **Black Cutworm** in turf.	M Bee:VH	R2
Indoxacarb (Provaunt) Syngenta	22A	Ingestion		P		Registered for control of **Black Cutworm** in turf.	L Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Green Peach Aphid (*Myzus persicae*) **Cabbage Aphid** (*Brevicoryne brassicae*) **Priority: Moderate**								
Green Peach Aphid and Cabbage Aphid are rated as a moderate priority in root vegetables. They are sap sucking insects that cause loss of vigour, and in some cases yellowing, stunting or distortion of plant parts. Honeydew secreted by the insects can cause sooty mould to develop on leaves.								
Dimethoate	1B	Contact	14	A	ALL	Registered in turnip for control of **Aphids**, Jassids, Mites, Leafhoppers, Green Vegetable Bug, Thrips and Wingless Grasshopper. Apply as a foliar spray when pests appear. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R3
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, **Aphids**, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a foliar spray when pest is evident. Use a retreatment interval of 14-21 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Petroleum Oil	UN	Contact	NR	A	ALL	Registered in radish for control of **Aphids**, Mites, Thrips and Leafhopper. Apply as a foliar spray as needed. Retreatment interval and maximum number of applications per crop not specified.	VL Bee:L	R4
Pirimicarb (Aphidex)	1A	Contact & Ingestion	2	A	ALL	Registered in radishes, swedes and turnips for control of **Green Peach Aphid**. Apply as a foliar spray as needed. Retreatment interval not specified. Maximum of 2 non-consecutive applications per crop.	VL Bee:VL	R4
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of **Aphids**, Thrips, Mealybug, Two Spotted Mites, Spider Mite and Whitefly. Apply as a foliar spray as need. Use a retreatment interval of 5-7 days. Maximum number of applications per crop not specified.	L Bee:L	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	7	A	ALL	Registered in root and tuber vegetables for control of **Green Peach Aphid**, and suppression of Tomato Potato Psyllid and Rutherglen Bug. Apply as a foliar spray when pest is present. Use a retreatment interval of 7-10 days. Maximum of 4 applications per crop, with no more than 2 consecutive applications.	M Bee:VH	R4
Afidopyropen (Versys) BASF	9D	Ingestion		P		Registered for the control of **Green Peach Aphid** in sweet corn, rhubarb, artichoke, brassica vegetables, celery, cucurbits, fruiting vegetables, strawberry, leafy vegetables and brassica leafy vegetables.	L Bee:L	R4
Cyantraniliprole (Benevia) FMC	28	Ingestion		P		Registered for suppression of **Green Peach Aphid** in fruiting vegetables and potatoes, and control of **Green Peach Aphid** in strawberries.	L Bee:L	R4
Dimpropyridaz (Efficon) BASF	UN	Ingestion		P		Registered for the control of **Green Peach Aphid** in brassica vegetables, leafy vegetables and brassica leafy vegetables.	M Bee:L	R4
Flonicamid (Mainman) UPL	9C	Ingestion		P		Registered for control of **Green Peach Aphid** in canola, cucurbits and potato.	M Bee:L	R4
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact & Ingestion		P		Registered for control of **Green Peach Aphid** in cucurbits, eggplant, peppers, tomatoes, green beans, potatoes and sweet potatoes.	L Bee:VL	R4
Pymetrozine (Chess) Syngenta	9B	Contact & Ingestion		P		Registered for control of **Cabbage Aphid** and **Green Peach Aphid** in brassica vegetables, **Green Peach Aphid** in tomatoes, eggplants, capsicums, lettuce, leafy vegetables, cucurbits, potatoes, stone fruit, almonds, pistachios, beetroot, cut flowers and nursery stock.	L Bee:VL	R3
Spirotetramat (Movento) Bayer	23	Ingestion		P		Registered for control of **Green Peach Aphid** in beans, peas, brassica vegetables, brassica leafy vegetables, celery, rhubarb, cucurbits, eggplant, peppers, tomatoes, herbs, leafy vegetables, lettuce, chicory, endive, radicchio, potatoes and sweet potatoes.	M Bee:VL	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Vegetable Weevil (*Listroderes difficilis*) **White-Fringed Weevil** (*Naupactus leucoloma*) **Priority: Moderate**								
Vegetable Weevil and White-Fringed Weevil are rated as a moderate priority in root vegetables. Vegetable Weevils usually feed on the aerial parts of the crop, although they can feed on roots in some cases. They are a sporadic pest, and they cause damage by tunnelling into leaves and reducing plant vigour. White-Fringed Weevil is a soil-borne pest with the larvae causing devastating damage to roots and tubers. It is important to sample for the presence of White-Fringed Weevil prior to planting to determine the need for insecticide treatments at planting time.								
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, Cutworm, European Earwig, Potato Moth, Rutherglen Bug, Armyworms and Cabbage Moth. Apply as a foliar spray at first sign of pest activity. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R4
Alpha-Cypermethrin	3A	Contact	1	P-A	ALL	Registered in turnips for control of Cabbage White Butterfly (*Pieris rapae*), Cabbage Moth (*Plutella xylostella*), Cluster Caterpillar (*Spodoptera litura*), Native Budworm (*Helicoverpa punctigera*) and Cotton Bollworm (*Helicoverpa armigera*). Registered for control of **Vegetable Weevil** in canola.	VH Bee:H	R3
Fipronil	2B	Contact	7 NG	P-A	ALL	Registered in swede and turnip for control of Diamondback Moth (*Plutella xylostella*). Registered for control of **White-Fringed Weevil** (*Naupactus leucoloma*) in potatoes and sweet potatoes.	M Bee:VH	R2
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of **Weevils** in pome fruit and stone fruit.	L Bee:H	R3
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 table grapes. pome fruit and stone fruit.	M Bee:VH	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cotton Bollworm / Corn Earworm (*Helicoverpa armigera*) **Native Budworm** (*Helicoverpa punctigera*) **Priority: Moderate**								
Helicoverpa is rated as a moderate priority in root vegetables. *Helicoverpa armigera* is regarded as the more serious pest because of its greater capacity to develop resistance to insecticides, broader host range, and persistence in cropping areas from year to year. Larvae feed on leaves but are most damaging when feeding on growing terminals, buds and flowers.								
Alpha-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Cabbage White Butterfly (*Pieris rapae*), Cabbage Moth (*Plutella xylostella*), Cluster Caterpillar (*Spodoptera litura*), **Native Budworm** (*Helicoverpa punctigera*) and **Cotton Bollworm** (*Helicoverpa armigera*). Apply as a foliar spray according to pest incidence. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R3
Bacillus thuringiensis subsp. kurstaki (DiPel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Lepidoptera. Time spraying to coincide with egg hatch. Treatments per season not limited.	VL Bee:VL	R4
Beta-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Diamondback Moth (*Plutella xylostella*), **Native Budworm** (*Helicoverpa punctigera*) and **Cotton Bollworm** (*Helicoverpa armigera*). Apply as a foliar spray according to pest infestation. Retreatment interval and maximum number of applications per crop not specified.	VH Bee:H	R4
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, Cutworm, European Earwig, Potato Moth, Rutherglen Bug, Armyworms and Cabbage Moth. Apply as a foliar spray at first sign of pest activity. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Cabbage Moth (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*) and **Cotton Bollworm** / **Native Budworm** (*Helicoverpa* spp.) Apply as a foliar spray according to pest infestation. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in root and tuber vegetables for control of Diamondback Moth (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*), **Heliothis** (*Helicoverpa* spp.), Cluster Caterpillar (*Spodoptera litura*), Loopers (*Chrysodeixis* spp.) and Cabbage Centre Grub (*Hellula hydralis*). Apply as a foliar spray at first sign of insect infestation. Use a minimum retreatment interval of 7 days. Maximum of 4 applications per crop.	M Bee:H	R3
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in root and tuber vegetables for control of Diamondback Moth (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*), Cluster Caterpillar (*Spodoptera litura*), Potato Moth (*Phthorimaea operculella*) and **Heliothis** (*Helicoverpa* spp.) Apply as a foliar spray once local economic thresholds are reached. Use a retreatment interval of 7-14 days. Maximum of 3 applications per crop.	L-M Bee:L	R4
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, **Caterpillars**, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a foliar spray when pest is evident. Use a retreatment interval of 14-21 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Methomyl PER82428	1A	Contact	7	A	ALL	Permitted in root & tuber vegetables for control of ***Helicoverpa* spp.**, Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug and Thrips including Western Flower Thrips. Apply as a foliar spray when pest first appears. Use a minimum retreatment interval of 7 days. Maximum of 3 applications per crop.	H Bee:H	R2

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, swedes and turnips for control of Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, **Helicoverpa**, Cluster Caterpillar and Western Flower Thrips and in root and tuber vegetables for control of Light Brown Apple Moth, Loopers, **Helicoverpa**, Potato Moth and Tomato Potato Psyllid (*Bactericera cockerelli*). Apply as a foliar spray targeting mature eggs and newly hatched larvae. Use a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	M Bee:H	R4
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in radishes, swedes and turnips for control of Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, **Heliothis** and Western Flower Thrips and in root and tuber vegetables for control of Light Brown Apple Moth, Loopers, **Helicoverpa**, Potato Moth and Tomato Potato Psyllid (*Bactericera cockerelli*). Apply as a foliar spray targeting mature eggs and newly hatched larvae. Use a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	L Bee:L	R4
Zeta-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Cabbage Moth (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*) and **Cotton Bollworm** / **Native Budworm** (*Helicoverpa* spp.) Apply as a foliar spray when pest populations indicate. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Clitoria ternatea Extract (Sero-X) Growth Agriculture	-	Biological	NR	P		Registered for control of ***Helicoverpa* spp.** in cotton, lucerne and tomato.	L Bee:VL	R4
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of ***Helicoverpa* spp.** in brassica vegetables, leafy vegetables, Chinese leafy vegetables, fruiting vegetables, celery, cucurbits, sweet corn and pome fruit.	L Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Isocycloseram (Simodis Plinazolin) Syngenta	30	Ingestion		P		Registered for control of various Lepidoptera in brassica vegetables, brassica leafy vegetables, cucurbits and fruiting vegetables.	H Bee:H	R4
Methoxyfenozide (Prodigy) Corteva	18	Insect Growth Regulator		P		Registered for control of various Lepidopteran pests in various crops, including **Native Budworm** in fruiting vegetables.	VL Bee:VL	R4
Nuclear Polyhedrosis Virus of *Helicoverpa armigera* (Vivus Max) AgBiTech	31	Biological	NR	P		Registered for control of **Cotton Bollworm** (*Helicoverpa armigera*) and **Native Budworm** (*Helicoverpa punctigera*) in potatoes, sweet corn, berryfruit, brassica vegetables, celery, cucurbits, fruiting vegetables, leafy vegetables, legume vegetables, ornamentals and pome fruit.	VL Bee:L	R4
Cluster Caterpillar (*Spodoptera litura*) **Priority: Moderate**								
Cluster Caterpillar is rated as a moderate priority in root vegetables. Larvae feed on the leaf surface and can cause extensive leaf loss when the pest is in large numbers.								
Alpha-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Cabbage White Butterfly (*Pieris rapae*), Cabbage Moth (*Plutella xylostella*), **Cluster Caterpillar** (*Spodoptera litura*), Native Budworm (*Helicoverpa punctigera*) and Cotton Bollworm (*Helicoverpa armigera*). Apply as a foliar spray according to pest incidence. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R3
Bacillus thuringiensis subsp. kurstaki (DiPel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Lepidoptera. Time spraying to coincide with egg hatch. Treatments per season not limited.	VL Bee:VL	R4

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, Cabbage White Butterfly, Green Vegetables Bug, Heliothis, Pumpkin Beetle, Leaf Eating Ladybird, Cutworm, European Earwig, Potato Moth, Rutherglen Bug, **Armyworms** and Cabbage Moth. Apply as a foliar spray at first sign of pest activity. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R4
Cypermethrin	3A	Contact	1	A	NSW, SA, TAS, VIC & WA	Registered in turnips for control of **Cluster Caterpillar** (*Spodoptera litura*). Apply as a foliar spray according to pest infestation. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in root and tuber vegetables for control of Diamondback Moth (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*), Heliothis (*Helicoverpa* spp.), **Cluster Caterpillar** (*Spodoptera litura*), Loopers (*Chrysodeixis* spp.) and Cabbage Centre Grub (*Hellula hydralis*). Apply as a foliar spray at first sign of insect infestation. Use a minimum retreatment interval of 7 days. Maximum of 4 applications per crop.	M Bee:H	R3
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in root and tuber vegetables for control of Diamondback Moth (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*), **Cluster Caterpillar** (*Spodoptera litura*), Potato Moth (*Phthorimaea operculella*) and Heliothis (*Helicoverpa* spp.) Apply as a foliar spray once local economic thresholds are reached. Use a retreatment interval of 7-14 days. Maximum of 3 applications per crop.	L-M Bee:L	R4
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, **Caterpillars**, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a foliar spray when pest is evident. Use a retreatment interval of 14-21 days. Maximum number of applications per crop not specified.	VH Bee:H	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Methomyl PER82428	1A	Contact	7	A	ALL	Permitted in root & tuber vegetables for control of *Helicoverpa* spp., Cucumber Moth, **Cluster Caterpillar**, Loopers, Webworm, Rutherglen Bug and Thrips including Western Flower Thrips. Apply as a foliar spray when pest first appears. Use a minimum retreatment interval of 7 days. Maximum of 3 applications per crop.	H Bee:H	R2
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in radishes, swedes and turnips for control of Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, Helicoverpa, **Cluster Caterpillar** and Western Flower Thrips and in root and tuber vegetables for control of Light Brown Apple Moth, Loopers, **Helicoverpa**, Potato Moth and Tomato Potato Psyllid (*Bactericera cockerelli*). Apply as a foliar spray targeting mature eggs and newly hatched larvae. Use a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	M Bee:H	R4
Zeta-Cypermethrin	3A	Contact	1	A	NSW, SA, TAS, VIC & WA	Registered in turnips for control of **Cluster Caterpillar** (*Spodoptera litura*). Apply as a foliar spray when pest populations indicate. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Chlorantraniliprole (Coragen) FMC	28	Ingestion		P		Registered for control of ***Spodoptera* spp.** in brassica vegetables, brassica leafy vegetables and strawberries.	L Bee:VL	R4
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of a broad range of Lepidopteran pests in various vegetables crops.	L Bee:H	R3
Methoxyfenozide (Prodigy) Corteva	18	Insect Growth Regulator		P		Controls a range of **Lepidopteran** pests. Registrations and permits to control Lepidoptera pests in various vegetables including fruiting vegetables and lettuce.	VL Bee:VL	R4
Tebufenozide (Mimic) Corteva	18	Ingestion / IGR		P		Registered for control of various lepidopteran pests in apples, pears, citrus, grapevines, avocado, custard apple, kiwifruit, longan, lychee, macadamia and eucalyptus.	L Bee:L	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Potato Moth (*Phthorimaea operculella*) **Priority: Moderate**								
Potato Moth is rated as a moderate priority in root vegetables. The larvae mine in foliage, stems and tubers of root vegetables. The tops of infested plants can die prematurely leading to reduced yields. Tuber damage leads to loss of yield and marketability. Potato Moth should be managed using an Integrated Pest Management approach. Cultural measures include crop rotation, field hygiene, irrigation management and effective hilling techniques. Parasitic wasps and predators can also play a significant role in controlling populations. Insecticide use plays a relatively minor part in controlling Potato Moth if attention is paid to other control measures.								
Bacillus thuringiensis subsp. kurstaki (DiPel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Lepidoptera. Time spraying to coincide with egg hatch. Treatments per season not limited.	VL Bee:VL	R4
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, Cutworm, European Earwig, **Potato Moth**, Rutherglen Bug, Armyworms and Cabbage Moth. Apply as a foliar spray at first sign of pest activity. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R4
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in root and tuber vegetables for control of Diamondback Moth (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*), Cluster Caterpillar (*Spodoptera litura*), **Potato Moth** (*Phthorimaea operculella*) and Heliothis (*Helicoverpa* spp.) Apply as a foliar spray once local economic thresholds are reached. Use a retreatment interval of 7-14 days. Maximum of 3 applications per crop.	L-M Bee:L	R4
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, **Caterpillars**, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a foliar spray when pest is evident. Use a retreatment interval of 14-21 days. Maximum number of applications per crop not specified.	VH Bee:H	R4

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, swedes and turnips for control of Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, Helicoverpa, Cluster Caterpillar and Western Flower Thrips and in root and tuber vegetables for control of Light Brown Apple Moth, Loopers, Helicoverpa, **Potato Moth** and Tomato Potato Psyllid (*Bactericera cockerelli*). Apply as a foliar spray targeting mature eggs and newly hatched larvae. Use a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	M Bee:H	R4
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in radishes, swedes and turnips for control of Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, Heliothis and Western Flower Thrips and in root and tuber vegetables for control of Light Brown Apple Moth, Loopers, Helicoverpa, **Potato Moth** and Tomato Potato Psyllid (*Bactericera cockerelli*). Apply as a foliar spray targeting mature eggs and newly hatched larvae. Use a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	L Bee:L	R4
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	P-A	ALL	Registered in root and tuber vegetables for control of Diamondback Moth (*Plutella xylostella*), Cabbage White Butterfly (*Pieris rapae*), Heliothis (*Helicoverpa* spp.), Cluster Caterpillar (*Spodoptera litura*), Loopers (*Chrysodeixis* spp.) and Cabbage Centre Grub (*Hellula hydralis*).	M Bee:H	R3
Chlorantraniliprole (Coragen) FMC	28	Ingestion		P		Registered for control of **Potato Moth** (*Phthorimaea operculella*) in potatoes.	L Bee:VL	R4
Cyantraniliprole (Benevia) FMC	28	Ingestion		P		Registered for control of **Potato Moth** (*Phthorimaea operculella*) in potatoes.	M Bee:VH	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of various Lepidoptera in brassica vegetables, leafy vegetables, Chinese leafy vegetables, fruiting vegetables, celery, cucurbits, sweet corn and pome fruit.	L Bee:H	R3
Isocycloseram (Simodis Plinazolin) Syngenta	30	Ingestion		P		Registered for control of various Lepidoptera in brassica vegetables, brassica leafy vegetables, cucurbits and fruiting vegetables.	H Bee:H	R4
Methoxyfenozide (Prodigy) Corteva	18	Insect Growth Regulator		P		Registered for control of various Lepidoptera in almonds, pome fruit, avocado, blueberry, citrus, coffee, custard apple, grapevines, kiwifruit, longan, lychee, macadamia, tomatoes, peppers, eggplant and okra.	VL Bee:VL	R4
Cabbage White Butterfly (*Pieris rapae*) **Priority: Moderate**								
Cabbage White Butterfly is rated as a moderate priority in root vegetables. Larvae are predominantly leaf feeders causing loss of foliage and reduction in crop vigour. The integrated pest management approach used for other lepidopteran pests will assist to provide incidental control of Cabbage White Butterfly.								
Alpha-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of **Cabbage White Butterfly** (*Pieris rapae*), Cabbage Moth (*Plutella xylostella*), Cluster Caterpillar (*Spodoptera litura*), Native Budworm (*Helicoverpa punctigera*) and Cotton Bollworm (*Helicoverpa armigera*). Apply as a foliar spray according to pest incidence. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R3
Bacillus thuringiensis subsp. kurstaki (DiPel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Lepidoptera. Time spraying to coincide with egg hatch. Treatments per season not limited.	VL Bee:VL	R4
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, Cutworm, European Earwig, Potato Moth, Rutherglen Bug, Armyworms and Cabbage Moth. Apply as a foliar spray at first sign of pest activity. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Cabbage Moth (*Plutella xylostella*), **Cabbage White Butterfly** (*Pieris rapae*) and Cotton Bollworm / Native Budworm (*Helicoverpa* spp.) Apply as a foliar spray according to pest infestation. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in root and tuber vegetables for control of Diamondback Moth (*Plutella xylostella*), **Cabbage White Butterfly** (*Pieris rapae*), Heliothis (*Helicoverpa* spp.), Cluster Caterpillar (*Spodoptera litura*), Loopers (*Chrysodeixis* spp.) and Cabbage Centre Grub (*Hellula hydralis*). Apply as a foliar spray at first sign of insect infestation. Use a minimum retreatment interval of 7 days. Maximum of 4 applications per crop.	M Bee:H	R3
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in root and tuber vegetables for control of Diamondback Moth (*Plutella xylostella*), **Cabbage White Butterfly** (*Pieris rapae*), Cluster Caterpillar (*Spodoptera litura*), Potato Moth (*Phthorimaea operculella*) and Heliothis (*Helicoverpa* spp.) Apply as a foliar spray once local economic thresholds are reached. Use a retreatment interval of 7-14 days. Maximum of 3 applications per crop.	L-M Bee:L	R4
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, **Caterpillars**, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a foliar spray when pest is evident. Use a retreatment interval of 14-21 days. Maximum number of applications per crop not specified.	VH Bee:H	R4

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, swedes and turnips for control of Diamondback Moth, **Cabbage White Butterfly**, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, Helicoverpa, Cluster Caterpillar and Western Flower Thrips. Apply as a foliar spray targeting mature eggs and newly hatched larvae. Use a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	M Bee:H	R4
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in radishes, swedes and turnips for control of Diamondback Moth, **Cabbage White Butterfly**, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, Heliothis and Western Flower Thrips and in root and tuber vegetables for control of Light Brown Apple Moth, Loopers, Helicoverpa, Potato Moth and Tomato Potato Psyllid (Bactericera cockerelli). Apply as a foliar spray targeting mature eggs and newly hatched larvae. Use a retreatment interval of 7-14 days. Maximum of 4 applications per crop.	L Bee:L	R4
Trichlorfon	1B	Contact	2	A	ALL	Registered in vegetables for control of **Cabbage White Butterfly**, Cabbage Moth, Rutherglen Bug and Green Vegetable Bug. Apply as a foliar spray when pests are first seen. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	H Bee:H	R3
Zeta-Cypermethrin	3A	Contact	1	A	ALL	Registered in turnips for control of Cabbage Moth (*Plutella xylostella*), **Cabbage White Butterfly** (*Pieris rapae*) and Cotton Bollworm / Native Budworm (*Helicoverpa* spp.) Apply as a foliar spray when pest populations indicate. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of various Lepidoptera in brassica vegetables, leafy vegetables, Chinese leafy vegetables, fruiting vegetables, celery, cucurbits, sweet corn and pome fruit.	L Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Isocycloseram (Simodis Plinazolin) Syngenta	30	Ingestion		P		Registered for control of various Lepidoptera in brassica vegetables, brassica leafy vegetables, cucurbits and fruiting vegetables.	H Bee:H	R4
Methoxyfenozide (Prodigy) Corteva	18	Insect Growth Regulator		P		Registered for control of various Lepidoptera in almonds, pome fruit, avocado, blueberry, citrus, coffee, custard apple, grapevines, kiwifruit, longan, lychee, macadamia, tomatoes, peppers, eggplant and okra.	VL Bee:VL	R4
Root-Knot Nematode (*Meloidogyne* spp.) **Priority: Moderate**								
Root-Knot Nematode is rated as a moderate priority in root vegetables. Root Knot Nematodes are microscopic soil-borne pests that attack roots and tubers. Infested plants show varying degrees of stunting, yellowing of leaves and wilting. Affected tubers have blisters or swellings, leading to a reduction in quality size and number of tubers. Cultural measures such as crop rotation and good field hygiene are critical components of nematode management.								
1,3-Dichloropropene + Chloropicrin	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic **Nematodes**, Symphylans, Wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	-	R4
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including *Pythium*, *Phytophthora*, *Sclerotinia*, *Sclerotium*, *Rhizoctonia*, *Verticillium*, *Plasmodiophora*, *Armillaria* and *Fusarium* spp, **nematodes**, soil insects and weeds. Apply granules to the soil surface and incorporate and seal the soil surface immediately. Do not plant into soil until a positive germination test has been conducted.	-	R4
Fluazaindolizine (Salibro Reklemel) Corteva	N-UN	Contact	NR	A	ALL	Registered in root & tuber vegetables for control of **Root-Knot Nematode** (*Meloidogyne* spp.) Apply either pre-plant incorporated or as an in-furrow application at planting. Maximum of 1 application per crop.	-	R4
Fluopyram (Velum Prime) Bayer	N-3	Contact	NR	A	ALL	Registered in root and tuber vegetables for control of **Root-Knot Nematode** (*Meloidogyne* spp.) and Root Lesion Nematode (*Pratylenchus* spp.) Apply as an in-furrow spray at planting.	L Bee:L	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of **Plant Parasitic Nematodes**, weed seeds, and various fungal diseases. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	-	R4
Abamectin (Tervigo) Syngenta	N-2	Contact		P		Registered for control of **Root-Knot Nematode** (*Meloidogyne* spp.) in fruiting vegetables, cucurbits, potato and sweet potato.	M Bee:H	R3
Cadusafos (Rugby)	1B	Contact		P		Registered for control of Nematodes in banana, citrus, ginger, sugar cane, tobacco and tomato.	H Bee:H	R4
Cyclobutrifluram (Vaniva Tymirium) Syngenta	N-3	Contact		P		Registered for control of **Root-Knot Nematode** in fruiting vegetables and cucurbits.	L Bee:L	R4
Fenamiphos (Nemacur)	1B	Contact		P		Registered for control of Nematodes in aloe vera and bananas.	H Bee:H	R3
Fluensulfone (Nimitz) Adama	-	Contact		P		Registered for control of **Root-Knot Nematode** (*Meloidogyne* spp.) in cucurbits, tomatoes, capsicum, chilli, eggplant, okra, carrots, potatoes, sweet potatoes and sugar cane.	L Bee:L	R4
Oxamyl (Vydate) Corteva	1A	Contact		P		Registered for control of Nematodes in bananas, capsicum, tomatoes and sweet potatoes.	H Bee:H	R4
Terbufos (Counter)	1B	Contact		P		Registered for control of Burrowing Nematode and Spiral Nematode in bananas.	H Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Two-Spotted Mite (*Tetranychus urticae*) **Tomato Russet Mite** (*Aculops lycopersici*) **European Red Mite** (*Panonychus ulmi*) **Priority: Low**								
Mites are rated as a low priority in root vegetables. Mites are small arachnids that are difficult to identify with the naked eye. They inhabit the underside of leaves, preferring near the leaf veins. An integrated pest management approach should be used, particularly the preservation of beneficial species that will effectively keep mite populations in check.								
Dimethoate	1B	Contact	14	A	ALL	Registered in turnip for control of Aphids, Jassids, **Mites**, Leafhoppers, Green Vegetable Bug, Thrips and Wingless Grasshopper. Apply as a foliar spray when pests appear. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R3
Petroleum Oil	UN	Contact	NR	A	ALL	Registered in radish for control of Aphids, **Mites**, Thrips and Leafhopper. Apply as a foliar spray as needed. Retreatment interval and maximum number of applications per crop not specified.	VL Bee:L	R4
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of Aphids, Thrips, Mealybug, **Two Spotted Mites**, Spider Mite and Whitefly. Apply as a foliar spray as need. Use a retreatment interval of 5-7 days. Maximum number of applications per crop not specified.	L Bee:L	R4
Propargite	12C	Contact	7	A	ALL	Registered in vegetables for control of **Two-Spotted Mites** and Spider Mites. Apply as a foliar spray when pests appear. Retreatment interval and maximum number of applications per crop not specified.	M Bee:L	R3
Sulphur	UN	Contact	NR	A	ALL	Registered in vegetables for control of **Mites.** Apply as a foliar spray when pest is first seen. Use a retreatment interval of 14-21 days. Maximum number of applications per crop not specified.	-	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Abamectin PER96481	6	Ingestion	14 NG	P-A	ALL (excl. VIC)	Permitted in root and tuber vegetables for suppression of Leaf Miners (*Liriomyza* spp.) including Vegetable Leaf Miner (*Liriomyza sativae*) and Serpentine Leaf Miner (*Liriomyza huidobrensis*). Registered for control of various mite species in apples, pears, citrus, hops, tomatoes, strawberries and ornamentals.	M Bee:H	R3
Acequinocyl (Kanemite) UPL	20B	Contact & Ingestion		P		Registered for control of **Two-Spotted Mite** in pome fruit and stone fruit.	L Bee:L	R4
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	R4
Cyflumetofen (Danisaraba) BASF	25A	Contact		P		Registered for control of **Two Spotted Mite** (*Tetranychus urticae*) in pome fruit, almond, citrus, grapes, strawberries, fruiting vegetables and ornamentals.	L Bee:L	R4
Etoxazole (Paramite) Sumitomo	10B	Contact		P		Registered for control of **Two-Spotted Mite** in pome fruit, stone fruit, almonds and grapes.	L Bee:VL	R4
Isocycloseram (Simodis Plinazolin) Syngenta	30	Ingestion		P		Registered for control of **Two Spotted Mite** in cucurbits and fruiting vegetables.	H Bee:H	R4
Orange Oil (Prev-Am) Oro Agri	-	Contact		P		Registered for control of **Two Spotted Mite** in fruiting vegetables, cucurbits, legume vegetables, berries, apples, citrus and pawpaw.	VL Bee:VL	R4
Spiromesifen (Interrupt) Bayer	23	Ingestion		P		Registered for control of **Two Spotted Mite** in pome fruit and stone fruit.	M Bee:VL	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Western Flower Thrips (*Frankliniella occidentalis*) **Plague Thrips** (*Thrips imaginis*) **Onion Thrips** (*Thrips tabaci*) **Priority: Low**								
Thrips are rated as a low priority in root vegetables. Thrips are a sucking and rasping pest that are difficult to control with insecticides. Cultural measures including field hygiene, as well as avoiding disruptive insecticide early season to preserve beneficials and crop monitoring are important measures to support strategic insecticide controls.								
Dimethoate	1B	Contact	14	A	ALL	Registered in turnip for control of Aphids, Jassids, Mites, Leafhoppers, Green Vegetable Bug, **Thrips** and Wingless Grasshopper. Apply as a foliar spray when pests appear. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R3
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs, Whitefly, **Thrips** and Leafhoppers. Suitable for organic growers. Apply as a foliar spray when pest is evident. Use a retreatment interval of 14-21 days. Maximum number of applications per crop not specified.	VH Bee:H	R4
Methomyl PER82428	1A	Contact	7	A	ALL	Permitted in root & tuber vegetables for control of *Helicoverpa* spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug and **Thrips** including **Western Flower Thrips**. Apply as a foliar spray when pest first appears. Use a minimum retreatment interval of 7 days. Maximum of 3 applications per crop.	H Bee:H	R2
Petroleum Oil	UN	Contact	NR	A	ALL	Registered in radish for control of Aphids, Mites, **Thrips** and Leafhopper. Apply as a foliar spray as needed. Retreatment interval and maximum number of applications per crop not specified.	VL Bee:L	R4
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of Aphids, **Thrips**, Mealybug, Two Spotted Mites, Spider Mite and Whitefly. Apply as a foliar spray as need. Use a retreatment interval of 5-7 days. Maximum number of applications per crop not specified.	L Bee:L	R4

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, swedes and turnips for control of Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, Helicoverpa, Cluster Caterpillar and **Western Flower Thrips**. Apply 3 consecutive foliar sprays at a retreatment interval of either 3-5 days at temperatures above 20°C or 6-12 day intervals when temperatures are less than 20°C.	M Bee:H	R4
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in radishes, swedes and turnips for control of Diamondback Moth, Cabbage White Butterfly, Cabbage Cluster Caterpillar, Cabbage Centre Grub, Loopers, Heliothis and **Western Flower Thrips** and in root and tuber vegetables for control of Light Brown Apple Moth, Loopers**, Helicoverpa**, Potato Moth and Tomato Potato Psyllid (*Bactericera cockerelli*). Apply 3 consecutive foliar sprays at a retreatment interval of either 3-5 days at temperatures above 20°C or 6-12 day intervals when temperatures are less than 20°C.	L Bee:L	R4
Acetamiprid + Pyriproxyfen (Trivor) Adama	4A+7C	Ingestion / IGR		P		Registered for control of Kellys Citrus Thrips in citrus.	M Bee:H	R2
Cyantraniliprole (Benevia) FMC	28	Ingestion		P		Registered for suppression of **Onion Thrips** in bulb vegetables, suppression of **Western Flower Thrips** in fruiting vegetables and cucurbits, suppression of **Plague Thrips** in potatoes, and suppression of **Onion Thrips**, Plague Thrips and **Western Flower Thrips** in strawberries.	M Bee:VH	R4
Diafenthiuron + Cyantraniliprole (Minecto Forte) Syngenta	12A+28	Ingestion & Contact		P		Registered for control of various pests including suppression of **Western Flower Thrips**, Tomato Thrips and **Plague Thrips** in cucurbits and fruiting vegetables.	M Bee:VH	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Isocycloseram (Simodis) Syngenta	30	Ingestion		P		Registered for control of Diamond Back Moth, Cabbage White Butterfly and suppression of Heliothis in brassica vegetables and brassica leafy vegetables, suppression of **Onion Thrips** and **Plague Thrips** in bulb vegetables, control of Two Spotted Mite and Cucumber Moth and suppression of Broad Mite, Bean Red Spider Mite, **Western Flower Thrips**, Tomato Thrips, Melon Thrips, **Plague Thrips** and Heliothis in cucurbits, and control of Two Spotted Mite and Broad Mite and suppression of Tomato Russet Mite, **Western Flower Thrips**, Tomato Thrips, Melon Thrips, **Plague Thrips** and Heliothis in fruiting vegetables.	H Bee:VH	R4
Black Field Cricket (*Teleogryllus commodus*) **Australian Mole Cricket** (*Gryllotalpa australis*) **Priority: Low**								
Black Field Cricket and Australian Mole Cricket are rated as a low priority. They are a soil-borne pest that cause direct feeding damage to tubers, making them unsaleable. Control options are limited.								
1,3-Dichloropropene + Chloropicrin	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of plant parasitic **Nematodes**, Symphylans, Wireworms, soil borne diseases (including *Fusarium* and *Verticillium* wilts, *Rhizoctonia, Pythium*) and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	-	R4
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Pre-plant fumigant in seed beds for control of soil fungi including *Pythium*, *Phytophthora*, *Sclerotinia*, *Sclerotium*, *Rhizoctonia*, *Verticillium*, *Plasmodiophora*, *Armillaria* and *Fusarium* spp, **nematodes**, soil insects and weeds. Apply granules to the soil surface and incorporate and seal the soil surface immediately. Do not plant into soil until a positive germination test has been conducted.	-	R4
Fipronil	2B	Contact	7 NG	P-A	ALL	Registered in swede and turnip for control of Diamondback Moth (*Plutella xylostella*). Registered for control of **Mole Cricket** in potatoes.	M Bee:VH	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Broflanilide (Cimegra) BASF	30	Contact & Ingestion		P		Registered in brassica vegetables and Chinese cabbage for control of Diamondback Moth. Broadspectrum activity on soil-dwelling pests although specific effect on crickets is currently unknown.	H Bee:VH	R4
Rutherglen Bug (*Nysius vinitor*) **Priority: Low**								
Rutherglen Bug is rated as a low priority pest in root vegetables. They breed up on weeds adjacent to cropping areas. It is important to monitor crops for eggs and nymphs by regular field scouting. Large numbers can cause significant feeding damage to foliage by sucking the sap and depleting the crop of nutrients. Growers should anticipate potential migrations of pests from one finishing crop to another emerging one. Rutherglen Bugs can be controlled by removing the weeds they use as hosts and by ploughing a deep furrow around the emerging crop, preventing wingless nymphs from migrating from weeds or harvested crops.								
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, Cutworm, European Earwig, Potato Moth, **Rutherglen Bug**, Armyworms and Cabbage Moth. Apply as a foliar spray at first sign of pest activity. Retreatment interval and maximum number of applications per crop not specified.	H Bee:H	R4
Methomyl PER82428	1A	Contact	7	A	ALL	Permitted in root & tuber vegetables for control of *Helicoverpa* spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, **Rutherglen Bug** and Thrips including Western Flower Thrips. Apply as a foliar spray when pest first appears. Use a minimum retreatment interval of 7 days. Maximum of 3 applications per crop.	H Bee:H	R2
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	7	A	ALL	Registered in root and tuber vegetables for control of Green Peach Aphid, and suppression of Tomato Potato Psyllid and **Rutherglen Bug**. Apply as a foliar spray when pest is present. Use a retreatment interval of 7-10 days. Maximum of 4 applications per crop, with no more than 2 consecutive applications.	M Bee:VH	R4

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Trichlorfon	1B	Contact	2	A	ALL	Registered in vegetables for control of Cabbage White Butterfly, Cabbage Moth, **Rutherglen Bug** and Green Vegetable Bug. Apply as a foliar spray when pests are first seen. Use a retreatment interval of 7-10 days. Maximum number of applications per crop not specified.	H Bee:H	R3
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact & Ingestion	7	P-A	ALL	Registered in potatoes for control of Green Peach Aphid (*Myzus persicae*) and Silverleaf Whitefly (*Bemisia tabaci*). Registered for control of Macadamia Lace Bug in macadamia, Fruit Spotting Bugs in macadamia, tropical & sub-tropical fruits, inedible peel (excluding bananas, pineapple), and Olive Lace Bug in olives.	L Bee:VL	R4

4.3 Weeds in Root Vegetables

4.3.1 Weed priorities

Common Name	Scientific Name
High	
Annual Ryegrass	*Lolium rigidum*
Wild Radish	*Raphanus raphanistrum*
Amaranthus	*Amaranthus* spp.
Moderate	
Flaxleaf Fleabane	*Conyza bonariensis*
Nutgrass	*Cyperus rotundus*
Chickweed	*Stellaria media*
Blackberry Nightshade	*Solanum nigrum*
Fat Hen	*Chenopodium album*
Stinging Nettle	*Urtica* spp.
Fumitory	*Fumaria* spp.
Sowthistle	*Sonchus oleraceus*

The high priority weed issues identified were Annual Ryegrass, 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 (1 and 2) and moderate resistance risk (0, 3, 4, 5, 6, 9, 10, 12, 13, 14, 15, 22, 27, 31 and 34) herbicide modes of action are available on the CropLife Australia webpage[8].

[8] https://www.croplife.org.au/resources/programs/resistance-management

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)**	
***	High resistance risk	R1	Short-term risk: Critical concern over retaining access < 1 year
		R2	Medium-term risk: Maintaining access of significant concern <2-5 years
**	Moderate resistance risk	R3	Long-term: Potential issues associated with use - Monitoring required < 5 years
		R4	No current risk / concerns
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
Annual Ryegrass (*Lolium rigidum*) **Priority: High**							
Annual Ryegrass is rated as a high priority in root vegetables. Annual Ryegrass is the most serious grass weed of southern Australia with distribution that is gradually extending north. Populations 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.							
Clethodim (Select) PER82459	1***	Radish & Parsnip / Post-Emergent	Permitted in radish and parsnip for control of grass weeds including **Annual Ryegrass**. Apply as a post-emergent spray when weeds are at 2-leaf to fully tillered stage. Maximum of 1 application per crop.	28	A	ALL	R3
Fluazifop-P (Fusilade)	1***	Swede & Turnip / Post-Emergent	Registered in swede and turnip for control of grass weeds including **Annual Ryegrass**. Apply as a post-emergent spray to young, actively growing weeds. Maximum of 1 application per crop.	49 G:49	A	ALL	R3

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Fluazifop-P (Fusilade) PER82556	1***	Parsnip / Post–Emergent / Grass Selective	Permitted in parsnip for control of grass weeds including **Annual Ryegrass**. Apply as a post-emergent spray to actively growing weeds at the 3 to 5 leaf stage. Maximum of 1 application per crop.	49	A	ALL (excl. VIC)	R3
Fluazifop-P (Fusilade) PER81244	1***	Swede & Turnip / Post-Emergent	Permitted in swede and turnip for control of grass weeds including **Annual Ryegrass**. Apply as a post-emergent spray to young, actively growing weeds. Maximum of 1 application per crop.	49 G:49	A	ALL (excl. VIC)	R3
Glyphosate (Roundup)	9**	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 (Gramoxone)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Propachlor (Ramrod) PER11441	15**	Radish, Swede & Turnip / Pre-Emergent / Post-Transplant	Permitted in radish, swede and turnip for control of grass and broadleaf weeds including **Annual Ryegrass**. Apply to the soil surface prior to wed or seeded-crop emergence. Some moisture either rain or sprinkler irrigation is required soon after application to activate the product.	NR	A	ALL (excl. VIC)	R4
Quizalofop-P-Ethyl	1***	Radish / Post-Emergent Grass Selective	Registered in radish for control of grass weeds including **Annual Ryegrass**. Apply as a post emergent spray when weeds are actively growing. Maximum number of applications per crop not specified.	21	A	ALL	R4
Sethoxydim (Sertin)	1***	Swede / Post-Emergent	Registered in swede for control of grass weeds including **Annual Ryegrass**. Apply as a post emergent spray when the majority of target weeds are in the 3-leaf stage. Repeat application when weed regrowth is in the 3-leaf stage to obtain suppression for growing life of the crop.	42	A	TAS	R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Trifluralin	3**	Swedes, Turnips & Parsnips / Pre-Plant / Pre-Emergent	Registered in swedes, turnips and parsnips for control of grass weeds including **Annual Ryegrass**. Apply as a broadcast spray to the soil surface between 4 weeks prior and just before sowing. Must be incorporated into the soil within 4 hours using either a rotary hoe or disc technique. Maximum of 1 application per crop.	NR NG	A	ALL	R4
Aclonifen (Emerger) Bayer	32**		Bayer is expected to seek registration for pre-emergent control of grass and broadleaf weeds in various crops. Registered in Europe for use in potatoes, legume vegetables and cereals.		P		R4
Dimethenamid-P (Outlook)	15**		Registered for pre-emergent control of grass and broadleaf weeds in sweet corn, beans, peas, pumpkins and kabocha.		P		R4
Ethyl Dipropylthiocarbamate (Eptam)	15**		Registered for control of **Annual Ryegrass** in beans, potatoes, maize and sweet corn.		P		R4
Metobromuron (Soleto) GroChem	5**		Registered for suppression of **Annual Ryegrass** in potatoes.		P		R4
Metribuzin	5**		Registered for control of **Annual Ryegrass** in peas, potatoes and tomatoes.		P		R4
Napropamide (Devrinol)	0**		Registered for control of **Annual Ryegrass** in almonds, grapevines, stone fruit, tomatoes and canola.		P		R4
Nonanoic Acid (Beloukha)	-		Registered for control of **Annual Ryegrass** in non-crop areas, turf, orchards & vineyards, fallow and forestry.		P		R4
Norflurazon (Zoliar) AgNova	12**		Registered for control of **Annual Ryegrass** in citrus, grapes, nuts, stone & pome fruits.		P		R4
Prosulfocarb + S-Metolachlor (Boxer Gold)	15**		Registered for control of **Annual Ryegrass** in potatoes.		P		R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in brassica vegetables, brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		R4
Wild Radish (*Raphanus raphanistrum*) **Priority: High**							
Wild Radish is rated as a high priority in root vegetables. Wild Radish populations 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.							
Glyphosate (Roundup)	9**	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	5**	Parsnips / Pre-Emergent	Registered in parsnips for control of annual grass and broadleaf weeds including **Wild Radish**. Apply as a broadcast soil application immediately after planting but before crop emerges. Sufficient moisture is required either by irrigation or rainfall within 3-4 days of application to carry the product into the soil profile.	NR	A	ALL	R4
Paraquat (Gramoxone)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Pendimethalin (Stomp)	3**	Radish & Parsnip	Registered in radish and parsnip for control of grass and broadleaf weeds including **Wild Radish**. Apply to the soil as a single application within 2 days of sowing.	NR	A	ALL	R4
Prometryn PER12048	5**	Parsnip / Early Post-Emergent	Permitted in parsnip for control of broadleaf weeds including **Wild Radish**. Apply early post emergent when weeds are young and actively growing. Maximum of 1 application per crop.	NR NG	A	ALL (excl. VIC)	R4
Flumioxazin (Chateau) Sumitomo	14**		Registered for control of **Wild Radish** in grapes, pome fruit, stone fruit, citrus, nut trees, olives, avocados and berries.		P		R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Metobromuron (Soleto) GroChem	5**		Registered for control of **Wild Radish** in potatoes.		P		R4
Metribuzin	5**		Registered for control of **Wild Radish** in peas, potatoes and tomatoes.		P		R4
Norflurazon (Zoliar) AgNova	12**		Registered for control of **Wild Radish** in citrus, grapes, almonds, pome fruit and stone fruit.		P		R4
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		R4
Amaranthus (*Amaranthus* spp.) **Priority: High**							
Amaranthus is rated as a high priority in root vegetables. It is a short-lived annual weed that can pose a problem every year as it is a prolific seed producer. Herbicide control can be effective, but application timing is critical to ensure small weeds are targeted.							
Glyphosate (Roundup)	9**	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	5**	Parsnips / Pre-Emergent	Registered in parsnips for control of annual grass and broadleaf weeds including **Amaranth**. Apply as a broadcast soil application immediately after planting but before crop emerges. Sufficient moisture is required either by irrigation or rainfall within 3-4 days of application to carry the product into the soil profile.	NR	A	ALL	R4
Paraquat (Gramoxone)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Prometryn PER12048	5**	Parsnip / Early Post-Emergent	Permitted in parsnip for control of broadleaf weeds including **Amaranth**. Apply early post emergent when weeds are young and actively growing. Maximum of 1 application per crop.	NR NG	A	ALL (excl. VIC)	R4
Trifluralin	3**	Swedes, Turnips & Parsnips / Pre-Plant / Pre-Emergent	Registered in swedes, turnips and parsnips for control of grass weeds including **Amaranth**. Apply as a broadcast spray to the soil surface between 4 weeks prior and just before sowing. Must be incorporated into the soil within 4 hours using either a rotary hoe or disc technique. Maximum of 1 application per crop.	NR NG	A	ALL	R4
Clomazone	13**		Registered for suppression of **Amaranth** in cucumber, pumpkins, kabocha squash, rockmelons, watermelon, zucchini, green beans, navy beans, poppies, potatoes and tobacco.		P		R4
Dimethenamid-P (Outlook)	15**		Registered for pre-emergent control of grass and broadleaf weeds in sweet corn, beans, peas, pumpkins and kabocha.		P		R4
Ethofumesate (Tramat)	15**		Registered for control of grass and broadleaf weeds, including **Amaranth** in beet crops, oilseed poppy and onions.		P		R4
Ethyl Dipropylthiocarbamate (Eptam)	15**		Registered for control of **Amaranth** in beans, potatoes, maize and sweet corn.		P		R4
Fluroxypyr (Starane)	4**		Registered for control of broadleaf weeds, including **Amaranth** in sorghum, maize, sweet corn and millet.		P		R4
Glufosinate-Ammonium (Basta) BASF	10**		Registered for control of grass and broadleaf weeds including **Amaranthus** in berries, tomatoes, beans and fallow.		P		R3
Metobromuron (Soleto) GroChem	5**		Registered for control of **Amaranth** in potatoes.		P		R4
Prosulfocarb + S-Metolachlor (Boxer Gold)	15**		Registered for control of **Redroot Amaranth** in potatoes.		P		R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		R4
Flaxleaf Fleabane (*Conyza bonariensis*) **Priority: Moderate**							
Flaxleaf Fleabane is rated as a moderate priority in root vegetables. Flaxleaf Fleabane seeds prolifically and can germinate year-round. It is difficult to control with herbicides, and a continuous program is required to manage it in cropping fields.							
Glyphosate (Roundup)	9**	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 (Gramoxone)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Propachlor (Ramrod) PER11441	15**	Radish, Swede & Turnip / Pre-Emergent / Post-Transplant	Permitted in radish, swede and turnip for control of grass and broadleaf weeds including **Fleabane**. Apply to the soil surface prior to wed or seeded-crop emergence. Some moisture either rain or sprinkler irrigation is required soon after application to activate the product.	NR	A	ALL (excl. VIC)	R4
Flumioxazin (Chateau)	14**		Registered for residual control of grass and broadleaf weeds, including **Fleabane**, in grapevines, pome fruit, stone fruit, citrus, tree nuts, olives, avocados and blueberries.		P		R4
Saflufenacil (Sharpen) BASF	14**		Registered for control of **Flaxleaf Fleabane** in citrus, pome fruit & almonds.		P		R4
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in brassica vegetables, brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Nutgrass (*Cyperus rotundus*) **Priority: Moderate**							
Nutgrass is rated as a moderate priority in root vegetables. It 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)	9**	General Pre-Crop Spray	Registered for control of grass and broadleaf weeds as a pre-crop spray or fallow spray.	NR	A	ALL	R3
Ethyl Dipropylthiocarbamate (Eptam)	15**		Registered for control of **Nutgrass** in potatoes.		P		R4
Norflurazon (Zoliar) AgNova	12**		Registered for control of **Nutgrass** in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		R4
Chickweed (*Stellaria media*) **Priority: Moderate**							
Chickweed is rated as a moderate priority in root vegetables. It is a low growing, winter annual weed that can continue growing all through summer. It is critical to target weed control to before flowering.							
Glyphosate (Roundup)	9**	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	5**	Parsnips / Pre-Emergent	Registered in parsnips for control of annual grass and broadleaf weeds including **Chickweed**. Apply as a broadcast soil application immediately after planting but before crop emerges. Sufficient moisture is required either by irrigation or rainfall within 3-4 days of application to carry the product into the soil profile.	NR	A	ALL	R4
Paraquat (Gramoxone)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Pendimethalin (Stomp)	3**	Radish & Parsnip	Registered in radish and parsnip for control of grass and broadleaf weeds including **Chickweed**. Apply to the soil as a single application within 2 days of sowing.	NR	A	ALL	R4
Prometryn PER12048	5**	Parsnip / Early Post-Emergent	Permitted in parsnip for control of broadleaf weeds including **Chickweed**. Apply early post emergent when weeds are young and actively growing. Maximum of 1 application per crop.	NR NG	A	ALL (excl. VIC)	R4
Propachlor (Ramrod) PER11441	15**	Radish, Swede & Turnip / Pre-Emergent / Post-Transplant	Permitted in radish, swede and turnip for control of grass and broadleaf weeds including **Chickweed**. Apply to the soil surface prior to wed or seeded-crop emergence. Some moisture either rain or sprinkler irrigation is required soon after application to activate the product.	NR	A	ALL (excl. VIC)	R4
Chloridazon (Pyramin) BASF / AgNova	5**		Registered for control of **Chickweed** in fodder beet, red beet, silver beet, baby leaf spinach and baby leaf beet.		P		R4
Ethofumesate (Tramat)	15**		Registered for control of **Chickweed** in beet crops.		P		R4
Norflurazon (Zoliar) AgNova	12**		Registered for control of **Chickweed** in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		R4
Oxyfluorfen (Goal)	14**		Registered for control of **Chickweed** in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		R4
Phenmedipham (Betanal) Bayer	5**		Registered for control of **Chickweed** in beetroot, fodder beet and silverbeet**.**		P		R3
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of **Chickweed** in Brassica vegetables.		P		R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Blackberry Nightshade (*Solanum nigrum*) **Priority: Moderate**							
Blackberry Nightshade is rated as a moderate priority in root vegetables. It is a prolific perennial, broadleaf weed that is widely adapted and difficult to eradicate, mainly due to its long-term seed viability. Herbicide control is effective but requires timely application and avoidance of seed set over several years to bring the soil seed bank down.							
Glyphosate (Roundup)	9**	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	5**	Parsnips / Pre-Emergent	Registered in parsnips for control of annual grass and broadleaf weeds including **Blackberry Nightshade**. Apply as a broadcast soil application immediately after planting but before crop emerges. Sufficient moisture is required either by irrigation or rainfall within 3-4 days of application to carry the product into the soil profile.	NR	A	ALL	R4
Paraquat (Gramoxone)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Pendimethalin (Stomp)	3**	Radish & Parsnip	Registered in radish and parsnip for control of grass and broadleaf weeds including suppression of **Blackberry Nightshade**. Apply to the soil as a single application within 2 days of sowing.	NR	A	ALL	R4
Prometryn PER12048	5**	Parsnip / Early Post-Emergent	Permitted in parsnip for control of broadleaf weeds including **Blackberry Nightshade**. Apply early post emergent when weeds are young and actively growing. Maximum of 1 application per crop.	NR NG	A	ALL (excl. VIC)	R4
Aclonifen (Emerger) Bayer	32**	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. **Blackberry Nightshade** is listed as moderately susceptible at a high rate.		P		R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Clomazone	13**		Registered for control of **Blackberry Nightshade** in cucumber, pumpkins, kabocha squash, rockmelons, watermelon, zucchini, green beans, navy beans, poppies, potatoes and tobacco.		P		R4
Cyanazine	5**		Registered for control of **Blackberry Nightshade** in peas, onions, potatoes and sweet corn.		P		R3
Dimethenamid-P (Outlook) BASF	15**		Registered for control of grass and broadleaf weeds, including **Blackberry Nightshade** in sweet corn, beans, peas, pumpkins and kabocha.		P		R4
Ethyl Dipropylthiocarbamate (Eptam)	15**		Registered for control of **Blackberry Nightshade** in beans, potatoes, maize and sweet corn.		P		R4
Fluroxypyr (Starane) Corteva	4**		Registered for control of **Blackberry Nightshade** in non-crop areas and pastures.		P		R4
Metobromuron (Soleto) GroChem	5**		Registered for control of **Blackberry Nightshade** in potatoes.		P		R4
Norflurazon (Zoliar) AgNova	12**		Registered for control of various grass and broadleaf weeds, including **Blackberry Nightshade** in citrus, grapes, almonds, pome fruit and stone fruit.		P		R4
Oxyfluorfen (Goal)	14**		Registered for control of various grass and broadleaf weeds, including **Blackberry Nightshade**, in fruit and nut trees, vines, brassica vegetables, coffee, duboisia, pyrethrum, tobacco and tropical & subtropical fruit.		P		R4
Prosulfocarb + S-Metolachlor (Boxer Gold)	15**		Registered for control of **Blackberry Nightshade** in potatoes.		P		R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
S-Metolachlor (Dual Gold)	15**		Registered for control of grass and broadleaf weeds in brassica vegetables, brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		R4
Fat Hen (*Chenopodium album*) **Priority: Moderate**							
Fat Hen is rated as a moderate priority in root vegetables. It is a fast-growing, annual broadleaf weed that germinates from spring to autumn. Herbicide control can be difficult, and it is critical to target weed control to early growth stages.							
Glyphosate (Roundup)	9**	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	5**	Parsnips / Pre-Emergent	Registered in parsnips for control of annual grass and broadleaf weeds including **Fat Hen**. Apply as a broadcast soil application immediately after planting but before crop emerges. Sufficient moisture is required either by irrigation or rainfall within 3-4 days of application to carry the product into the soil profile.	NR	A	ALL	R4
Paraquat (Gramoxone)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Pendimethalin (Stomp)	3**	Radish & Parsnip	Registered in radish and parsnip for control of grass and broadleaf weeds including **Fat Hen**. Apply to the soil as a single application within 2 days of sowing.	NR	A	ALL	R4
Prometryn PER12048	5**	Parsnip / Early Post-Emergent	Permitted in parsnip for control of broadleaf weeds including **Fat Hen**. Apply early post emergent when weeds are young and actively growing. Maximum of 1 application per crop.	NR NG	A	ALL (excl. VIC)	R4
Propachlor (Ramrod) PER11441	15**	Radish, Swede & Turnip / Pre-Emergent / Post-Transplant	Permitted in radish, swede and turnip for control of grass and broadleaf weeds including **Fat Hen**. Apply to the soil surface prior to wed or seeded-crop emergence. Some moisture either rain or sprinkler irrigation is required soon after application to activate the product.	NR	A	ALL (excl. VIC)	R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Aclonifen (Emerger) Bayer	32**	Pre-Emergence	Bayer is expected to seek registration for pre-emergent control of grass and broadleaf weeds in various vegetable crops. Registered in Europe for use in potatoes, legume vegetables and cereals. **Fat Hen** is listed as susceptible.		P		R4
Clomazone	13**		Registered for control of **Fat Hen** in cucumber, pumpkins, kabocha squash, rockmelons, watermelon, zucchini, green beans, navy beans, poppies, potatoes and tobacco.		P		R4
Ethofumesate (Tramat)	15**		Registered for control of grass and broadleaf weeds, including **Fat Hen** in beet crops, oilseed poppy and onions.		P		R4
Ethyl Dipropylthiocarbamate (Eptam)	15**		Registered for control of **Fat Hen** in beans, potatoes, maize and sweet corn.		P		R4
Glufosinate-Ammonium (Basta) BASF	10**		Registered for control of grass and broadleaf weeds including **Fat Hen** in berries, tomatoes, beans and fallow.		P		R3
Metobromuron (Soleto) GroChem	5**		Registered for control of **Fat Hen** in potatoes.		P		R4
Metribuzin	5**		Registered for control of **Fat Hen** in peas, potatoes and tomatoes.		P		R4
Norflurazon (Zoliar) AgNova	12**		Registered for control of grass and broadleaf weeds including **Fat Hen** in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		R4
Oxyfluorfen (Goal)	14**		Registered for control of grass and broadleaf weeds, including **Fat Hen** in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		R4
Prosulfocarb + S-Metolachlor (Boxer Gold)	15**		Registered for control of **Fat Hen** in potatoes.		P		R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		R4
Stinging Nettle (*Urtica* spp.) **Priority: Moderate**							
Stinging Nettle is rated as a moderate priority in root vegetables. This is a soft herb whose leaves are sparsely covered with rigid, stinging hairs. Herbicide control options are limited.							
Glyphosate (Roundup)	9**	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	5**	Parsnips / Pre-Emergent	Registered in parsnips for control of annual grass and broadleaf weeds including **Stinging Nettle**. Apply as a broadcast soil application immediately after planting but before crop emerges. Sufficient moisture is required either by irrigation or rainfall within 3-4 days of application to carry the product into the soil profile.	NR	A	ALL	R4
Paraquat (Gramoxone)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Pendimethalin (Stomp)	3**	Radish & Parsnip	Registered in radish and parsnip for control of grass and broadleaf weeds including **Annual Nettles**. Apply to the soil as a single application within 2 days of sowing.	NR	A	ALL	R4
Propachlor (Ramrod) PER11441	15**	Radish, Swede & Turnip / Pre-Emergent / Post-Transplant	Permitted in radish, swede and turnip for control of grass and broadleaf weeds including **Stinging Nettle**. Apply to the soil surface prior to wed or seeded-crop emergence. Some moisture either rain or sprinkler irrigation is required soon after application to activate the product.	NR	A	ALL (excl. VIC)	R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Oxyfluorfen (Goal)	14**		Registered for control of **Stinging Nettle** in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		R4
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of **Stinging Nettle** in Brassica vegetables and beans.		P		R4
Fumitory (*Fumaria* spp.) **Priority: Moderate**							
Fumitory is rated as a moderate priority. Fumitory is an aggressive and competitive weed which develops a highly persistent seed bank. Requires ongoing management using an integrated weed management approach.							
Glyphosate (Roundup)	9**	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 (Gramoxone)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Pendimethalin (Stomp)	3**	Radish & Parsnip	Registered in radish and parsnip for control of grass and broadleaf weeds including suppression of **Fumitory**. Apply to the soil as a single application within 2 days of sowing.	NR	A	ALL	R4
Prometryn PER12048	5**	Parsnip / Early Post-Emergent	Permitted in parsnip for control of broadleaf weeds including **Fumitory**. Apply early post emergent when weeds are young and actively growing. Maximum of 1 application per crop.	NR NG	A	ALL (excl. VIC)	R4
Trifluralin	3**	Swedes, Turnips & Parsnips / Pre-Plant / Pre-Emergent	Registered in swedes, turnips and parsnips for control of grass weeds including **Fumitory**. Apply as a broadcast spray to the soil surface between 4 weeks prior and just before sowing. Must be incorporated into the soil within 4 hours using either a rotary hoe or disc technique. Maximum of 1 application per crop.	NR NG	A	ALL	R4
Dimethenamid-P (Outlook)	15**		Registered for control of grass and broadleaf weeds, including **Fumitory** in sweet corn, beans, peas, pumpkins and kabocha.		P		R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Ethofumesate (Tramat)	15**		Registered for control of grass and broadleaf weeds, including **Fumitory** in beet crops, oilseed poppy and onions.		P		R4
Metobromuron (Soleto) GroChem	5**		Registered for control of **Fumitory** in potatoes.		P		R4
Metribuzin	5**		Registered for control of **Fumitory** in peas, potatoes and tomatoes.		P		R4
Oxyfluorfen (Goal)	14**		Registered for control of **Fumitories** in onions.		P		R4
Prosulfocarb + S-Metolachlor (Boxer Gold)	15**		Registered for control of **Fumitory** in potatoes.		P		R4
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in brassica vegetables, brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		R4
Sowthistle (*Sonchus oleraceus*) **Priority: Moderate**							
Sowthistle is rated as a moderate priority in root vegetables. Sowthistle is prolific and widespread in all regions, and it is also prone to development of herbicide resistance. Timely herbicide control can be effective provided that weeds are targeted when they are young and actively growing.							
Glyphosate (Roundup)	9**	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	5**	Parsnips / Pre-Emergent	Registered in parsnips for control of annual grass and broadleaf weeds including **Sowthistle**. Apply as a broadcast soil application immediately after planting but before crop emerges. Sufficient moisture is required either by irrigation or rainfall within 3-4 days of application to carry the product into the soil profile.	NR	A	ALL	R4
Paraquat (Gramoxone)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR G:7	A	ALL	R1
Pendimethalin (Stomp)	3**	Radish & Parsnip	Registered in radish and parsnip for control of grass and broadleaf weeds including **Sowthistle**. Apply to the soil as a single application within 2 days of sowing.	NR	A	ALL	R4
Prometryn PER12048	5**	Parsnip / Early Post-Emergent	Permitted in parsnip for control of broadleaf weeds including **Sowthistle**. Apply early post emergent when weeds are young and actively growing. Maximum of 1 application per crop.	NR NG	A	ALL (excl. VIC)	R4
Propachlor (Ramrod) PER11441	15**	Radish, Swede & Turnip / Pre-Emergent / Post-Transplant	Permitted in radish, swede and turnip for control of grass and broadleaf weeds including **Sowthistle**. Apply to the soil surface prior to wed or seeded-crop emergence. Some moisture either rain or sprinkler irrigation is required soon after application to activate the product.	NR	A	ALL (excl. VIC)	R4
Cyanazine	5**		Registered for control of **Sowthistle** in peas, onions, potatoes and sweet corn.		P		R3
Glufosinate-Ammonium (Basta) BASF	10**		Registered for control of grass and broadleaf weeds including **Sowthistle** in berries, tomatoes, beans and fallow.		P		R3
Isoxaben (Gallery) Corteva	29**		Registered for control of **Sowthistle** in non-crop, forests, fencelines, tree fruit & nut orchards, vineyards, nursery & amenity tree plantings.		P		R4
Metobromuron (Soleto) GroChem	5**		Registered for control of **Sowthistle** in potatoes.		P		R4
Metribuzin	5**		Registered for control of **Sowthistle** in peas, potatoes and tomatoes.		P		R4
Napropamide (Devrinol)	0**		Registered for control of **Sowthistle** in almonds, grapevines, stone fruit, tomatoes and canola.		P		R4
Nonanoic Acid (Beloukha)	-		Registered for control of **Sowthistle** in non-crop areas, turf, orchards & vineyards, fallow and forestry.		P		R4

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Norflurazon (Zoliar) AgNova	12**		Registered for control of grass and broadleaf weeds including **Sowthistle** in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		R4
Oxyfluorfen (Goal)	14**		Registered for control of grass and broadleaf weeds, including **Sowthistle** in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		R4
S-Metolachlor (Dual Gold) Syngenta	15**		Registered for control of grass and broadleaf weeds in Brassica vegetables, Brassica leafy vegetables, sweet potatoes, spring onions, shallots, spinach, silverbeet, rhubarb, culinary herbs and beans.		P		R4

5. References

5.1 Information:

Australian Pesticide and Veterinary Medicines Authority	www.apvma.gov.au
APVMA Chemical review	https://apvma.gov.au/chemicals-and-products/chemical-review/listing
MRL Databases (DAFF)	https://www.agriculture.gov.au/agriculture-land/farm-food-drought/food/nrs/databases
APVMA Permit search	https://productsearch.apvma.gov.au/permits
APVMA Product search	https://productsearch.apvma.gov.au/products
AUSVEG	https://ausveg.com.au
Cotton Pest Management Guide 2025-26	https://www.cottoninfo.com.au/publications/cotton-pest-management-guide
CropLife Australia (resistance management)	https://www.croplife.org.au/resources/programs/resistance-management/
Hort Innovation	www.horticulture.com.au

5.2 Abbreviations and Definitions:

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

5.3 Acknowledgements:

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

6. Appendices:

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

Appendix 1. Products available for disease control in root vegetables

Active Ingredient (Trade Name)	Chemical group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
1,3-dichloropropene + Chloropicrin	8B	Vegetables / Soil Fumigant	Plant parasitic nematodes, symphylans, wireworms, Soil Borne diseases (including *Fusarium*, *Verticillium* wilts, *Rhizoctonia*, & *Pythium*). *For use by professional and registered fumigators only.*	ALL	NR	R4
Azoxystrobin (Amistar)	11	Horseradish	White Blister Rust (*Albugo candida*) Downy Mildew	ALL	7	R4
		Radish	White Blister Rust (*Albugo candida*)			
Boscalid (Filan) BASF	7	Root & Tuber Vegetables	Sclerotinia Rot (*Sclerotinia minor*, *S. sclerotorium*)	ALL	7	R4
Chlorothalonil (Bravo)	M5	Radish	Grey Mould (*Botrytis cinerea*)	ALL	1	R2
Chlorothalonil (Bravo) PER82895	M5	Parsnip	Early Blight (*Cercospora apii*) Septoria Leaf Spot (*Septoria apiicola*)	ALL (excl. VIC)	7	R2
		Radish	Alternaria (*Alternaria* spp.) Downy Mildew (*Peronospora parasitica*) Grey Leaf Spot (*Stemphylium solani*) White Rust (*Albugo candida*)		1 NG	
Copper	M1	Parsnip	Leaf Spot (*Septoria* spp.)	ALL	1	R4
Copper PER14038	M1	Horseradish	White Blister Rust	ALL (excl. VIC)	1	R4
Copper Hydroxide + Metalaxyl (Ridomil Gold Plus) Syngenta	M1+4	Radish, Swede & Turnip	White Blister (*Albugo candida*) Downy Mildew	ALL	7	R4

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 *Pythium*, *Phytophthora*, *Sclerotinia*, *Sclerotium*, *Rhizoctonia*, *Verticillium*, *Plasmodiophora*, *Armillaria* and *Fusarium* spp.	ALL	NR	R4
Iodine	-	Root Crops	Post-Harvest Sanitiser – Bacteria and Fungi	ALL	NR	R4
Mancozeb PER80538	M3	Radish, Swede & Turnip	Cercospora Leaf Spot Alternaria 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	*Pythium* spp. *Phytopthora* spp.	ALL (excl. VIC)	7	R2
Metalaxyl-M (Apron)	4	Radish / Seed Dressing	Downy Mildew	QLD, NSW & TAS	NR	R4
Metalaxyl-M (Ridomil Gold) PER14695	4	Parsnips	*Phytophthora* spp. *Pythium* spp.	ALL (excl. VIC)	NR NG	R4
Metham Sodium	-	Food Crops / Pre-Plant Fumigant	Fungal diseases including *Rhizoctonia*, *Pythium*, *Fusarium*, *Phytophthora*, *Verticillium*, *Sclerotinia* and Club Root of crucifers Nematodes	ALL	NR	R4
Penthiopyrad (Fontelis) Corteva	7	Root and tuber vegetables	Early Blight (*Alternaria* spp.) Powdery Mildew (*Erysiphe* spp.)	ALL	7	R4
Phosphorous Acid PER14184	33	Parsnips	Damping Off	ALL (excl. VIC)	1	R4

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	R4
Pydiflumetofen + Difenoconazole (Miravis Duo) Syngenta	7+3	Root Vegetables	Early Blight / Target Spot (*Alternaria* spp.) Powdery Mildew (*Erysiphe* spp., *Oidium* spp.) Cercospora Leaf Spot (*Cercospora* spp.)	ALL	7 NG	R3
Streptomyces lydicus WYEC108 (Actinovate) Novozymes Bioag	BM 02	Vegetables / Seed Treatment	*Fusarium* *Rhizoctonia* *Pythium*	ALL	NR	R4
Sulphur	M2	Vegetables	Powdery Mildew Rust	ALL	NR	R4
Tebuconazole (Folicur)	3	Radish	Sclerotinia Rot (*Sclerotinia* spp.)	ALL	35 NG	R4
Triadimenol (Bayfidan)	3	Parsnip, Radish, Swede & Turnip	Powdery Mildew	ALL	7 NG	R3

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

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
1,3-dichloropropene + Chloropicrin	8B	Vegetables / Soil fumigant	Plant Parasitic Nematodes, Symphylans, Wireworms, soil borne diseases and suppression of weeds. *For use by professional and registered fumigators only.*	ALL	NR	R4
Abamectin PER96481	6	Root & Tuber vegetables	Suppression of Leaf Miners (*Liriomyza* spp.) including: Vegetable Leaf Miner (*Liriomyza sativae*) Serpentine Leaf Miner (*Liriomyza huidobrensis*)	ALL (excl. VIC)	14 NG	R3
Alpha-Cypermethrin	3A	Turnips	Cabbage White Butterfly (*Pieris rapae*) Cabbage Moth (*Plutella xylostella*) Cluster Caterpillar (*Spodoptera litura*) Native Budworm (*Helicoverpa punctigera*) Cotton Bollworm (*Helicoverpa armigera*)	ALL	1	R3
Bacillus thuringiensis subsp. kurstaki (DiPel)	11A	Vegetables	Lepidoptera	ALL	NR	R4
Beta-Cypermethrin	3A	Turnips	Diamondback Moth (*Plutella xylostella*) Native Budworm (*Helicoverpa punctigera*) Cotton Bollworm (*Helicoverpa armigera*)	ALL	1	R4

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
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	R4
Cypermethrin	3A	Turnips	Cabbage Moth (*Plutella xylostella*) Cabbage White Butterfly (*Pieris rapae*) Cotton Bollworm / Native Budworm (*Helicoverpa* spp.)	ALL	1	R4
			Cluster Caterpillar (*Spodoptera litura*)	NSW, SA, TAS, VIC & WA		
Cyromazine (Diptex 150WP) PER81867	17	Root & Tuber vegetables	Lyriomyza Leaf Miners including: Vegetable Leaf Miner (*Liriomyza sativae*) Serpentine Leaf Miner (*Liriomyza huidobrensis*)	ALL	7 NG	R4
Dimethoate	1B	Turnip	Aphids Jassids / Leafhoppers Mites Green Vegetable Bug Thrips Wingless Grasshopper	ALL	14	R3

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Emamectin (Proclaim Opti) Syngenta	6	Root & Tuber Vegetables	Diamondback Moth (*Plutella xylostella*) Cabbage White Butterfly (*Pieris rapae*) Heliothis (*Helicoverpa* spp.) Cluster Caterpillar (*Spodoptera litura*) Loopers (*Chrysodeixis* spp.) Cabbage Centre Grub (*Hellula hydralis*)	ALL	3 NG	R3
Emulsifiable Botanical Oils (Eco-Oil)	-	Vegetables	Greenhouse Whitefly	ALL	NR	R4
Fipronil	2B	Swede & Turnip	Diamondback Moth (*Plutella xylostella*)	ALL	7 NG	R2
Fluazaindolizine (Salibro Reklemel) Corteva	N-UN	Root & Tuber Vegetables	Root Knot Nematode (*Meloidogyne* spp.)	ALL	NR	R4
Flubendiamide (Belt) Bayer	28	Root & Tuber Vegetables	Diamondback Moth (*Plutella xylostella*) Cabbage White Butterfly (*Pieris rapae*) Cluster Caterpillar (*Spodoptera litura*) Potato Moth (*Phthorimaea operculella*) Heliothis (*Helicoverpa* spp.)	ALL	1	R4
Fluopyram (Velum Prime) Bayer	N-3	Root & Tuber Vegetables	Root Knot Nematode (*Meloidogyne* spp.) Root Lesion Nematode (*Pratylenchus* spp.)	ALL	NR	R4
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Vegetables	Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers.	ALL	1	R4
Iron EDTA Complex	-	All plants	Snails & Slugs	ALL	NR	R4
Lambda-Cyhalothrin (Karate Zeon) PER11949	3A	Radish	Vegetable Loopers Diamondback Moth	ALL (excl. VIC)	2	R4
Metaldehyde	-	Vegetables	Snails & Slugs	ALL	7	R4

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Metaldehyde + Fipronil (Transcend) Imtrade	2B	Swedes & Turnips	European Earwigs Portugese Millipedes Slaters Snails & Slugs	ALL	7 NG	R2
Metham Sodium	-	Soil Fumigant	Nematodes, weed seeds & various fungal diseases	ALL	NR	R4
Methiocarb (Mesurol)	1A	Vegetables	Snails & Slugs	ALL	NR	R2
Methomyl PER82428	1A	Radish, Swede & Turnip	*Helicoverpa* spp. Cucumber Moth Cluster Caterpillar Loopers Webworm Rutherglen Bug Thrips, including Western Flower Thrips	ALL	7 NG	R2
Petroleum Oil	UN	Radish	Aphids Mites Thrips Leafhopper	ALL	1	R4
Pirimicarb (Aphidex)	1A	Radishes, Swede & Turnip	Cabbage Aphid Green Peach Aphid	ALL	2	R4
Potassium Salts of Fatty Acids (Natrasoap)	-	Vegetables	Aphids Thrips Mealybug Two Spotted Mites Spider Mite Whitefly	ALL	NR	R4
Propargite (Omite)	12C	Vegetables	Two-Spotted Mites Spider Mites	ALL	7	R3

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Spinetoram (Success Neo) Corteva	5	Radishes, Swedes & Turnips	Diamondback Moth Cabbage White Butterfly Cabbage Cluster Caterpillar Cabbage Centre Grub Loopers Helicoverpa Cluster Caterpillar Western Flower Thrips	ALL	3	R4
		Root & Tuber Vegetables	Light Brown Apple Moth Loopers Helicoverpa Potato Moth Tomato Potato Psyllid (*Bactericera cockerelli*)			
Spinetoram (Success Neo) Corteva PER94451	5	Root & Tuber Vegetables	Leaf Miners (*Liriomyza* spp.) including: Vegetable Leaf Miner (*Liriomyza sativae*) Pea Leaf Miner/Serpentine Leaf Miner (*Liriomyza huidobrensis*) American Serpentine Leaf Miner (*Liriomyza trifolii*)	ALL (excl. VIC)	3	R4
Spinosad (Entrust Organic) Corteva	5	Radish, Swede & Turnip	Diamondback Moth Cabbage White Butterfly Cabbage Cluster Caterpillar Cabbage Centre Grub Loopers Heliothis Western Flower Thrips	ALL	3 G:14	R4
		Root & Tuber Vegetables	Light Brown Apple Moth Loopers Heliothis Potato Moth			

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Spinosad (Entrust Organic) Corteva PER89870	5	Root & Tuber Vegetables	Fall Armyworm (*Spodoptera frugiperda*)	ALL (excl. VIC)	3 G:14	R4
Spinosad (Entrust Organic) Corteva PER96806	5	Root & Tuber Vegetables	Leaf Miners (*Liriomyza* spp.) including: Vegetable Leaf Miner (*Liriomyza sativae*) Pea Leaf Miner/Serpentine Leaf Miner (*Liriomyza huidobrensis*) American Serpentine Leaf Miner (*Liriomyza trifolii*)	ALL (excl. VIC)	3 G:14	R4
Spodoptera frugiperda Multiple Nucleopolyhedrovirus (Fawligen) AgBiTech PER90820	31	Root & Tuber Vegetables	Fall Armyworm (*Spodoptera frugiperda*)	ALL	NR	R4
Spodoptera frugiperda Multiple NPV (Spodivir Plus) Organic Crop Protectants PER91477	31	Root & Tuber Vegetables	Fall Armyworm (*Spodoptera frugiperda*)	ALL	NR	R4
Sulfoxaflor (Transform) Corteva	4C	Root & Tuber Vegetables	Green Peach Aphid Suppression of: Tomato Potato Psyllid Rutherglen Bug	ALL	7	R4
Sulphur	UN	Vegetables	Mites	ALL	NR	R4
Trichlorfon	1B	Vegetables	Cabbage White Butterfly Cabbage Moth Green Vegetable Bug Rutherglen Bug	ALL	2	R3

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Zeta-Cypermethrin	3A	Turnips	Cabbage Moth (*Plutella xylostella*) Cabbage White Butterfly (*Pieris rapae*) Cotton Bollworm / Native Budworm (*Helicoverpa* spp.)	ALL	1	R4
			Cluster Caterpillar (*Spodoptera litura*)	NSW, SA, TAS, VIC & WA		

Appendix 3. Products available for weed control in root vegetables

Active ingredient (Trade Name)	Chemical group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory risk
1,3-dichloropropene + Chloropicrin	8B	Vegetables / Soil Fumigant	Plant Parasitic Nematodes, Symphylans, Wireworms, soil borne diseases and suppression of weeds. *For use by professional and registered fumigators only.*	NR	ALL	R4
Clethodim (Select) PER82459	1***	Radish & Parsnip / Post-Emergent	Grass weeds, including Annual Ryegrass.	28	ALL	R3
Fluazifop-P (Fusilade)	1***	Swede & Turnip / Post-Emergent	Grass Weeds, including Annual Ryegrass	49 G:49	ALL	R3
Fluazifop-P (Fusilade) PER82556	1***	Parsnip / Post–Emergent / Grass Selective	Grass Weeds, including Annual Ryegrass	49	ALL (excl. VIC)	R3
Fluazifop-P (Fusilade) PER81244	1***	Swede & Turnip / Post-Emergent	Grass Weeds, including Annual Ryegrass	49 G:49	ALL (excl. VIC)	R3
Glyphosate (Roundup)	9**	General Pre-Crop Spray	Grass & Broadleaf Weeds	NR	ALL	R3
Linuron	5**	Parsnips / Pre-Emergent	Annual Grass & Broadleaf Weeds, including Wild Radish, Amaranth, Chickweed, Blackberry Nightshade, Fat Hen, Stinging Nettle and Sowthistle.	NR	ALL	R4
Paraquat (Gramoxone)	22**	General Pre-Crop Spray	Annual Grass & Broadleaf Weeds	NR G:7	ALL	R1
Paraquat + Diquat (SpraySeed)	22**	General Pre-Crop Spray	Annual Grass & Broadleaf Weeds	NR G:7	ALL	R1
Pendimethalin (Stomp)	3**	Radish & Parsnip	Grass & Broadleaf Weeds, including Sowthistle, Wild Radish, Chickweed, Fat Hen, and suppression of Blackberry Nightshade, Annual Nettles and Fumitory	NR	ALL	R4

Active ingredient (Trade Name)	Chemical group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory risk
Prometryn PER12048	5**	Parsnip / Early Post-Emergent	Broadleaf Weeds, including Amaranth, Blackberry Nightshade, Chickweed, Fumitory, Fat Hen, Sowthistle and Wild Radish and suppression of Annual Ryegrass.	NR NG	ALL (excl. VIC)	R4
Propachlor (Ramrod) PER11441	15**	Radish, Swede & Turnip / Pre-Emergent / Post-Transplant	Grass & Broadleaf Weeds, including Annual Ryegrass, Chickweed, Fat Hen, Fleabane, Milk Thistle and Stinging Nettle.	NR	ALL (excl. VIC)	R4
Quizalofop-P-Ethyl	1***	Radish / Post-Emergent Grass Selective	Grass Weeds, including Annual Ryegrass	21	ALL	R4
Sethoxydim (Sertin)	1***	Swede / Post-Emergent	Grass Weeds, including Ryegrass	42	TAS	R4
Trifluralin	3**	Swedes, Turnips & Parsnips / Pre-Plant / Pre-Emergent	Grass & Broadleaf Weeds, including Annual Ryegrass, Fumitory and Amaranthus.	NR NG	ALL	R4

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

Appendix 4. Current permits for use in root vegetables

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER81867 Version 3	Cyromazine (Diptex 150 WP) / Root & Tuber Vegetables / Liriomyza Leaf Miners	02-Dec-19	30-Sep-26	Hort Innovation
PER82459 Version 2	Clethodim (Select) / Radish & Parsnip / Grass Weeds	19-Apr-17	30-Sep-26	Hort Innovation
PER91477 Version 4	*Spodoptera frugiperda* Multiple NPV (Spodivir Plus) / Root & Tuber Vegetables / Fall Armyworm	03-Nov-21	31-Mar-27	Andermatt Group AG
PER90820 Version 4	*Spodoptera frugiperda* Multiple Nucleopolyhedrovirus (Fawligen) / Root & Tuber Vegetables / Fall Armyworm	30-Mar-21	31-Mar-27	AgBiTech
PER14045 Version 4	Mancozeb + Metalaxyl-M (Ridomil Gold MZ) / Parsnips / Pythium & Phytophthora	01-Apr-13	31-Mar-27	Hort Innovation
PER81244 Version 4	Fluazifop-P (Fusilade) / Swede & turnip / Annual Grass Weeds	01-Jul-16	30-Apr-27	Hort Innovation
PER94451	Spinetoram (Success Neo) / Root & Tuber Vegetables / Liriomyza Leafminers	05-Jul-24	31-Jul-27	Hort Innovation
PER14958 Version 3	Dimethomorph (Acrobat) & Mancozeb / Radish / Downy Mildew & Alternaria Leaf Spot	21-Dec-14	31-Oct-27	Hort Innovation
PER82556 Version 2	Fluazifop-P (Fusilade) / Parsnip / Grass Weeds	16-Apr-14	30-Nov-27	Hort Innovation
PER14038 Version 3	Copper / Horseradish / White Blister Rust	01-Apr-13	30-Jun-28	Hort Innovation
PER96481	Abamectin / Root & Tuber Vegetables / Liriomyza Leafminers	08-Aug-25	31-Jul-28	Hort Innovation
PER82428 Version 5	Methomyl / Radish, Swede & Turnip / *Helicoverpa* spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug & Thrips including Western Flower Thrips	22-Apr-16	31-Jan-29	Hort Innovation
PER14695 Version 5	Metalaxyl-M (Ridomil Gold) / Parsnip / Pythium spp., Phytophthora spp.	01-May-14	31-Mar-29	Hort Innovation
PER11441 Version 4	Propachlor (Ramrod) / Radish, Swede, Turnip / Grass & Broadleaf Weeds	27-May-09	31-Jul-29	Hort Innovation

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER11949 Version 5	Lambda-Cyhalothrin (Karate) / Radish / Loopers & Diamondback Moth	01-Apr-10	30-Nov-29	Hort Innovation
PER14184 Version 4	Phosphorous Acid / Parsnip / Damping Off	01-Jul-13	31-Mar-30	Hort Innovation
PER12048 Version 5	Prometryn / Parsnip / Broadleaf Weeds	09-May-12	30-Apr-30	Hort Innovation
PER82895 Version 3	Chlorothalonil (Bravo) / Radish & Parsnip / Early Blight, Septoria Leaf Spot, Downy Mildew, Grey Leaf Spot, Alternaria & White Rust	04-Aug-17	31-May-30	Hort Innovation
PER80538 Version 2	Mancozeb / Radish, Swede & Turnip/ Cercospora, Alternaria & White Blister	01-Apr-15	31-Mar-30	Hort Innovation
PER13695 Version 4	Potassium Bicarbonate (Ecocarb) / Parsnip, Radish, Swede & Turnip / Powdery Mildew	31-Oct-12	30-Jun-30	Hort Innovation
PER89870 Version 3	Spinosad (Entrust Organic) / Root & Tuber vegetables / Fall Armyworm	21-Jul-20	31-Oct-30	Hort Innovation
PER96806	Spinosad (Entrust Organic) / Root & Tuber Vegetables / Liriomyza Leaf Miners	5-May-26	30-May-31	Hort Innovation

Appendix 5. Root Vegetables Maximum Residue Limits (MRLs)

CODEX commodity groupings of root and tuber vegetables and subgroups:

VR 0075	Root & tuber vegetables
VR 0583	Horseradish
VR 0588	Parsnip
VR 0494	Radish
VR 0497	Swede
VR 0506	Garden Turnip
VR 4571	Turnip
VR 2070	Root vegetables
VR 2071	Tuberous & corm vegetables
	Vegetables

Note: Root vegetables are not regularly exported from Australia. Available information indicates that in the absence specific limits in legislation the most countries defer to Codex, followed by EU MRL standards, or apply a 0.01ppm default value. Food exported to New Zealand from Australia may be legally sold if it complies with Australian requirements. MRLs and legislation are subject to change; the values presented should not be relied on.

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
2,2-DPA		Vegetables	*0.1	-
Abamectin	VR0075	Root & tuber vegetables	*0.01	-
Afidopyropen	VR2071	Tuberous & corm vegetables	-	*0.01
Aldrin and Dieldrin	VR0075	Root & tuber vegetables	E0.1	E0.1
Azoxystrobin	VR0075	Root & tuber vegetables {except potato; sugar beet}	-	1
	VR0583	Horseradish	0.5	-
	VR0494	Radish	0.5	-
Bifenthrin	VR0075	Root & tuber vegetables	-	0.05
Bixafen	VR0075	Root & tuber vegetables	-	0.06
Boscalid	VR0075	Root & tuber vegetables	1	2
Broflanilide	VR2071	Tuberous & corm vegetables	-	0.04
Carbaryl	VR0497	Swede	2	-
	VR0506	Garden Turnip	2	1
Chlorantraniliprole	VR0075	Root & tuber vegetables {except potato}	T0.5	-
	VR0075	Root & tuber vegetables {except carrot; radish}	-	0.02
	VR0494	Radish	-	0.5
Chlordane		Vegetables {except fruiting vegetables, cucurbits; sugar beet}	E0.02	-

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Chlorothalonil	VR0075	Root & tuber vegetables {except horseradish}	-	0.3
		Vegetables {except asparagus; brussels sprouts; carrot; celery; fennel, bulb; fruiting vegetables, cucurbits; galangal, greater; galangal, lesser; garlic; peas; leafy vegetables; leek; onion, bulb; potato; pulses; spring onion; tomato}	T7	-
	VR0583	Horseradish	-	1
Chlorpyrifos	VR0497	Swede	T0.3	-
		Vegetables {except asparagus; brassica vegetables; cassava; celery; leek; peppers, sweet [capsicum]; potato; swede; sweet potato; taro; tomato}	T*0.01	-
Clothianidin	VR0075	Root & tuber vegetables	-	0.2
Cyantraniliprole	VR0075	Root & tuber vegetables {except potato}	-	0.05
Cyclaniliprole	VR2071	Tuberous & corm vegetables	-	*0.01
Cycloxydim	VR0497	Swede	-	0.2
Cyhalothrin (includes lambda-cyhalothrin)	VR0075	Root & tuber vegetables	-	*0.01
	VR0494	Radish	*0.01	-
Cypermethrins (including alpha- and zeta-cypermethrin)	VR0075	Root & tuber vegetables {except sugar beet}	-	*0.01
	VR0494	Radish	T0.05	-
Cyprodinil	VR0494	Radish	-	0.3
	VR0588	Parsnip	-	0.7
Cyromazine	VR0075	Root & tuber vegetables	T1	-
DDT		Vegetables	E1	-
Deltamethrin	VR0494	Radish	-	*0.01
Diazinon		Vegetables	0.7	-
Dicofol		Vegetables {except cucumber; gherkin; tomato}	5	-
Difenoconazole	VR0075	Root & tuber vegetables {except celeriac}	0.5	-
	VR0494	Radish	-	0.7
Dimethoate	VR0506	Garden Turnip	*0.2	-
Dimethomorph	VR0494	Radish	T0.3	-
Diquat		Vegetables {except beans; broad bean; lupin (dry); onion, bulb; peas; potato; soya bean (dry); sugar beet}	*0.05	-
Dithiocarbamates	VR0588	Parsnip	T1	-
	VR0494	Radish	T1	-
	VR0497	Swede	T1	-
	VR0506	Garden Turnip	T1	-
EPTC		Vegetables	*0.04	-
Emamectin	VR0075	Root & tuber vegetables {except potato}	*0.01	-
Ethoprofos	VR0506	Garden Turnip	-	*0.02

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Fipronil	VR0497	Swede	0.1	-
	VR0506	Garden Turnip	0.1	-
Flonicamid	VR0494	Radish	-	0.4
Fluazaindolizine	VR0075	Root & tuber vegetables	0.3	-
	VR2070	Root vegetables {except carrot}	-	0.04
	VR2071	Tuberous & corm vegetables	-	0.2
Fluazifop-p-butyl	VR0075	Root & tuber vegetables {except Potato; Sweet potato; Taro; Yam bean; Yams}	1	-
	VR0497	Swede	-	4
	VR0506	Garden Turnip	-	4
Flubendiamide	VR0075	Root & tuber vegetables {except potato}	0.2	-
Fludioxonil	VR0494	Radish	-	0.3
Fluensulfone	VR0075	Root & tuber vegetables	2	3
	VR0494	Radish	-	4
	VR0497	Swede	-	4
	VR0506	Garden Turnip	-	4
	VR0583	Horseradish	-	4
	VR0588	Parsnip	-	4
Fluopyram	VR0075	Root & tuber vegetables {except sweet potato}	0.2	-
Flupyradifurone	VR0075	Root & tuber vegetables {except potato}	-	0.7
Fluxapyroxad	VR0494	Radish	-	0.2
	VR0588	Parsnip	-	1
	VR2071	Tuberous & corm vegetables {except potato}	-	0.03
Glyphosate	VR0075	Root & tuber vegetables	*0.1	-
Heptachlor		Vegetables {except carrot; soya bean (dry); tomato}	E0.05	-
Imidacloprid	VR0075	Root & tuber vegetables	-	0.5
Inorganic Bromide		Vegetables {except peppers, sweet [capsicum]}	20	-
Kresoxim-Methyl	VR4571	Turnip	-	*0.05
Lindane		Vegetables	E2	-
Linuron	VR0588	Parsnip	0.05	-
		Vegetables {except carrot, celeriac; celery; leek; parsnip}	*0.05	-
Malathion	VR0506	Garden Turnip	-	0.2
Mefentrifluconazole	VR2070	Root vegetables {except sugar beet}	-	0.5
	VR2071	Tuberous & corm vegetables	-	0.05
Metalaxyl		Vegetables {except asparagus; beetroot; bulb vegetables [alliums]; fruiting vegetables, cucurbits; leafy vegetables; peppers; podded pea (young pods) [snow and sugar snap peas]; tomato}	T0.1	-
Metaldehyde		Vegetables	1	-
Metconazole	VR2071	Tuberous & corm vegetables	-	*0.04
Methomyl	VR0075	Root & tuber vegetables	1	-
Methoxyfenozide	VR0494	Radish	-	0.4

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Methyl Bromide		Vegetables {except cucumber; peppers}	T*0.05	-
Myclobutanil	VR0075	Root & tuber vegetables	-	0.06
Omethoate	VR0506	Garden Turnip	*0.1	-
Oxamyl	VR0588	Parsnip	-	*0.01
Oxathiapiprolin	VR2071	Tuberous & corm vegetables	-	0.04
Paraquat	VR0075	Root & tuber vegetables	-	0.05
		Vegetables {except potato, pulses}	*0.05	-
Pendimethalin	VR0075	Root & tuber vegetables {except carrot}	*0.05	-
Penthiopyrad	VR0075	Root & tuber vegetables {except potato}	2	-
	VR0494	Radish	-	3
Permethrin	VR0583	Horseradish	-	0.5
Phosphine	VR0075	Root & tuber vegetables	T*0.01	-
Phosphorous acid	VR0075	Root & tuber vegetables {except potato}	T100	-
Piperonyl Butoxide	VR0075	Root & tuber vegetables { except carrot}	-	0.5
		Vegetables	8	-
Pirimicarb	VR0075	Root & tuber vegetables	-	0.05
		Vegetables {except celeriac; celery; leafy vegetables; onion, welsh; pulses; shallot; spring onion; sweet corn (corn-on-the-cob)}	T*0.05	-
Prometryn		Vegetables	*0.1	-
Propachlor	VR0494	Radish	*0.02	-
	VR0497	Swede	*0.02	-
	VR0506	Garden Turnip	*0.02	-
Propamocarb	VR0494	Radish	-	1
Propargite		Vegetables	3	-
Propiconazole	VR0494	Radish	T0.2	-
Pydiflumetofen	VR0075	Root & tuber vegetables {except potato}	0.3	-
	VR2070	Root vegetables	-	0.3
	VR2071	Tuberous & corm vegetables	-	0.1
Pyraclostrobin	VR2070	Root vegetables {except sugar beet}	-	0.5
	VR2071	Tuberous & corm vegetables	-	*0.02
Pyrethrins	VR0075	Root & tuber vegetables	-	*0.05
		Vegetables	1	-
Quizalofop-ethyl	VR0494	Radish	*0.02	-
Quizalofop-P-tefuryl	VR0494	Radish	*0.02	-
Sethoxydim	VR0075	Root & tuber vegetables	1	-
Spinetoram	VR0075	Root & tuber vegetables	0.02	-
Spinosad	VR0075	Root & tuber vegetables	0.02	-
Sulfoxaflor	VR0075	Root & tuber vegetables {except potato}	0.05	-
	VR0075	Root & tuber vegetables {except carrot}	-	0.03
Tebuconazole	VR0494	Radish	T0.3	-
		Beetroot leaves	T2	-
Tetraniliprole	VR2071	Tuberous & corm vegetables	*0.01	0.02
Thiamethoxam	VR0075	Root & tuber vegetables	T0.7	0.3

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Triadimenol	VR0588	Parsnip	0.2	-
	VR0494	Radish	0.2	-
	VR0497	Swede	0.2	-
	VR0506	Garden Turnip	0.2	-
Trichlorfon		Vegetables {except beetroot; brussels sprouts; cape gooseberry; cauliflower; celery; egg plant, thai; leafy vegetables; pepino; peppers; pulses (dry); sweet corn (corn-on-the-cob)}	0.2	-
Trifloxystrobin	VR0494	Radish	-	0.08
Trifluralin	VR0588	Parsnip	0.5	-
		Vegetables {except carrot; parsnip; fennel, bulb; galangal, greater}	0.05	-

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 2023. Compilation 12. Prepared 29 November 2025. CODEX MRLs: CODEX Alimentarius International Food Standards database (March 2026), http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/

Appendix 6: Root Vegetable Agrichemical Regulatory Risk Assessment

Root Vegetable
Agrichemical Regulatory
Risk Assessment

May 2026

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

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

The effects of the above are greater regulatory pressure placed on the availability and use of individual chemicals or chemical groups. Consequently, 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 root vegetables (horseradish, radish, parsnip, swede and turnip) in Australia, as well as current initiatives aimed at identifying and addressing pest management deficiencies.

R0	Use no longer approved
R1	Short-term: Critical concern over retaining access < 1 year
R2	Medium-term: Maintaining access of significant concern <2-5 years
R3	Long-term: Potential issues associated with use – Monitoring required < 5 years
R4	No current risk/concerns

INSECTICIDES/MITICIDES/NEMATICIDES - Insect and other pests

Blue text = new APVMA approved uses

Active Constituent	MoA Group	Pest	Risks and Comments
ABAMECTIN	6	Western flower thrips (Chicory)	Australia: APVMA nominated for reconsideration and spray drift assessment. Permit PER96481 Expiry date: 31/07/2028 Canada: Re-evaluation finalised. Label amendments to mitigate risks to human health and environment (July, 2025)
ALPHA-CYPERMETHRIN	3A	Cluster caterpillar (Radish, Swede and Turnip) Cabbage white butterfly (Radish, Swede and Turnip) *Helicoverpa* (Radish, Swede and Turnip) Redlegged earth mite (Radish) Australian plague locust (Turnips) Diamondback moth (Turnips) Spur-throated locust (Turnips) Permit PER14457 for the control of Redlegged earth mite (Chicory).	Australia: APVMA nominated for reconsideration after 2029. Permit PER14457 (Chicory) Expiry date: 31/03/2029 EU: Not approved
Bacillus thuringiensis	11A	Lepidopteran larvae	Australia: No current concerns.

Active Constituent	MoA Group	Pest	Risks and Comments
Beauveria bassiana	-	Suppression of: Western Flower Thrips Onion Thrips Greenhouse Whitefly Silverleaf Whitefly Sweet Potato Whitefly	Australia: No current concerns.
CARBARYL	1A	Spur-throated locust (Swede & Turnip) Green vegetable bug (Swede & Turnip) Armyworms (Swede & Turnip) Cabbage white butterfly (Swede & Turnip) Cutworms (Swede & Turnip) Diamondback moth (Swede & Turnip) Leafeating ladybirds (Swede & Turnip) Potato moth (Swede & Turnip) Pumpkin beetle (Swede & Turnip) Vegetable weevil (Swede & Turnip)	Australia: Codex – being considered for periodic review EU: Not approved Canada: In re-evaluation
CHLORPYRIFOS	1B	--	Australia: The chemical review was completed in September 2024. Most uses in horticultural crops were removed. After 30 September 2025, products with previously approved labels must not be supplied. The only remaining approved use is in Brassica crops as specified on current labels. EU: Not approved Canada: Cancelled
CYANTRANILIPROLE	28	Leafminers	Australia: No current concerns. Permit PER93849 Expiry date: 31/12/2026
CYPERMETHRIN	3A	Helicoverpa spp. Cabbage white butterfly Cabbage moth Cluster caterpillar (Turnips)	Australia: No current concerns. EU: Approved, candidate for substitution.

Active Constituent	MoA Group	Pest	Risks and Comments
CYROMAZINE	17	Permit PER81867 for the control of Leaf miners	Australia: No current concerns. Permit PER81867 Expiry date: 30/09/2026 EU: Not approved
DIAZINON	1B	--	Australia: APVMA made a Final Decision on 2024. After 10 September 2025, crop uses are no longer approved. Codex: All MRLs deleted
DIMETHOATE	1B	African black beetle (Swedes & Turnips) Aphids (Turnip) Green vegetable bug (Turnip) Jassids (Turnip) Leafhoppers (Turnip) Mites (Turnip) Redlegged earth mite (Turnip) Spur-throated locust (Turnip) Thrips (Turnip)	Australia: APVMA: Chemical Review prioritised to be commenced by 2029.
EMAMECTIN	6	Cabbage white butterfly Cluster caterpillar Diamondback moth (Cabbage moth) Helicoverpa Loopers	Australia: APVMA Nominated for targeted spray drift reconsideration EU: Approved, candidate for substitution.
EMULSIFIABLE BOTANICAL OILS	--	Greenhouse Whitefly	Australia: No current concerns.
FIPRONIL	2B	Diamondback moth (Swedes & Turnips)	Australia: APVMA: Proposed Regulatory decision was expected by April 2026. APVMA is now advising by end of 2026 at the earliest. Permit PER89402 Expiry date: 30/04/2027 Codex MRL: 0.002 mg/kg EU: Not approved

Active Constituent	MoA Group	Pest	Risks and Comments
FLUBENDIAMIDE	28	Cabbage white butterfly Cluster caterpillar Diamondback moth (Cabbage moth) *Helicoverpa* Potato moth	Australia: No current concerns. EU: Not approved
IMIDACLOPRID	4A	Currant lettuce aphid (Chicory)	Australia: APVMA: Neonicotinoids chemical review has been delayed. The proposed regulatory decision unlikely before 2027. Codex MRL: 0.5 mg/Kg EU: Not approved Canada: Very few uses allowed in greenhouses and seed treatment.
IRON EDTA COMPLEX	-	Snails	Australia: No current concerns
LAMBDA-CYHALOTHRIN	3A	Diamondback moth (Radish) Vegetable Loopers (Radish)	Australia: No current concerns. Permit PER11949 Expiry date: 30/11/2029 Codex MRL: 0.01 mg/Kg EU: Approved, candidate for substitution.
METALDEHYDE	-	Snails and slugs	Australia: No current concerns Canada: In re-evaluation
METHOMYL	1A	Permit PER82428 for the control of: Helicoverpa spp. Cucumber moth Cluster caterpillar Loopers Webworm Rutherglen bug Thrips including Western Flower Thrips	Australia: APVMA reconsideration. Was to start 2026. APVMA to publish a new Chemical Review priority list by mid 2026. Permit PER82428 Expiry date: 31/01/2029 EU: Not approved Canada: In re-evaluation
PARAFFINIC OIL	UNM	Aphids, Mites, Thrips, Leafhopper	Australia: No current concerns.
PETROLEUM OIL	UN	Aphids Mites Thrips Leafhopper	Australia: No current concerns. EU: Not approved

Active Constituent	MoA Group	Pest	Risks and Comments
PIRIMICARB	1A	Cabbage aphid (Radish, Swede and Turnip) Green peach aphid (Radish, Swede and Turnip)	Australia: No current concerns. Codex MRL: 0.05 mg/Kg EU: Approved, candidate for substitution. Canada: Cancelled
PYMETROZINE	9B	Currant lettuce aphid (Chicory)	Australia: APVMA nominated for reconsideration and spray drift assessment. EU: Not approved Canada: Cancelled
SPINETORAM	5	Helicoverpa Cluster caterpillar Western flower thrips Permit PER94451 for the control of Leaf miners	Australia: No current concerns. Permit PER94451 Expiry date: 31/07/2027 EU: Not approved Canada: In re-evaluation
SPINOSAD	5	Lightbrown apple moth Loopers Heliothis Permit PER89870 for the control of Fall Armyworm Permit PER94331 for the control of Dipteran leaf miners	Australia: No current concerns. Permit PER89870 Expiry date: 01/10/2030 Permit PER96806 Expiry date: 30/05/2031 Canada: In re-evaluation
SPIROTETRAMAT	23	Brown thistle aphid (Chicory) Currant lettuce aphid (Chicory) Green peach aphid (Chicory) Green peach aphid	Australia: No current concerns. EU: Not approved Canada: In re-evaluation
SPODOPTERA FRUGIPERDA NPV	--	Fall Armyworm	Australia: No current concerns. Permit PER90820 Expiry date: 31/03/2027 Permit PER91477 Expiry date: 31/03/2027
SULFOXAFLOR	4C	Green peach aphid	Australia: No current concerns. Codex MRL: 0.03 mg/Kg

Active Constituent	MoA Group	Pest	Risks and Comments
TRICHLORFON	1B	Green vegetable bug Rutherglen bug Cabbage white butterfly Cabbage moth	Australia: APVMA nominated for reconsideration after 2029. EU: Not approved Canada: Cancelled

FUNGICIDES – Disease Control

Blue text = new APVMA approved uses

Active Constituent	MoA Group	Pest	Risks and Comments
AZOXYSTROBIN	11	White blister (Horseradish & Radish) Downy mildew (Horseradish)	Australia: No current concerns. Codex MRL: 1 mg/Kg UK: Withdrawn (2029). Canada: In re-evaluation
BOSCALID	7	Sclerotinia rot	Australia: No current concerns. Codex MRL: 2 mg/Kg Canada: In re-evaluation
CHLOROTHALONIL	M5	Grey mould (Radish) Permit PER82895 for the control of: Early Blight and Septoria Leaf Spot (Parsnips) Alternaria, Downy Mildew and Grey Leaf Spot (Radish)	Australia: APVMA reconsideration. Prioritised to be commenced by 2028. Permit PER82895 (Parsnips, radish) Expiry date: 31/05/2030 Codex MRL: 0.3 mg/Kg EU: Not approved Canada: In re-evaluation USA: Under Registration Review (scheduled)
COPPER	M1	White blister Leaf spot Bacterial blight (Parsnips) Leaf spots (Parsnips) Septoria leaf spot (Parsnips) Downy mildew (Radish, Swede & Turnip) Black rot (Turnips) Peppery leaf spot (Turnips) Ring spot (Turnips)	Australia: No current concerns.

Active Constituent	MoA Group	Pest	Risks and Comments
DIFENOCONAZOLE	3	Powdery Mildew (Chicory)	Australia: APVMA nominated for reconsideration after 2029. Permit PER87973 (chicory) Expiry date: 30/06/2030 Codex MRL: 0.7 mg/Kg (Radish) EU: Approved, candidate for substitution. Canada: In re-evaluation
DIMETHOMORPH	40	PER14958 (Chicory, radish) for the control of Downy mildew, and Alternaria Leaf Spot	Australia: No current concerns. Permit PER14958 (Chicory, radish) Expiry date: 31/10/2027 EU: Not approved Canada: In re-evaluation
IODINE	M	Post harvest sanitizer	Australia: No current concerns. Canada: Cancelled
IPRODIONE	2	Permit PER81589 for the control of Sclerotinia Rot and Grey mould (Chicory)	Australia: No current concerns. Permit PER81589 (Chicory) Expiry date: 31/03/2031 EU: Not approved USA: Under Registration Review (scheduled)
MANCOZEB	M3	Permit PER80538 for the control of: Cercospora Leaf Spot, Alternaria and White Blister (radish, swede and turnip) Anthracnose and Septoria (Chicory) Permit PER14958 for the control of Downy mildew, and Alternaria Leaf Spot (Chicory, radish).	Australia: APVMA reconsideration. Prioritised to be commenced by 2027. Permit PER80538 (Radish, swede, turnip, chicory) Expiry date: 31/05/2030 Permit PER14958 (Chicory, radish) Expiry date: 31/10/2027 EU: Not approved USA: Under Registration Review (scheduled)

Active Constituent	MoA Group	Pest	Risks and Comments
MANCOZEB | METALAXYL	M3 + 4	Permit PER14045 for the control of: Anthracnose (Chicory) Pythium spp. (Parsnips) Phytophthora spp. (Parsnips)	MANCOZEB Australia: APVMA reconsideration. Prioritised to be commenced by 2027. Permit PER80538 (Radish, swede, turnip, chicory) Expiry date: 31/05/2030 Permit PER14958 (Chicory, radish) Expiry date: 31/10/2027 EU: Not approved USA: Under Registration Review (scheduled) METALAXYL Australia: No current concerns. EU: Approved, candidate for substitution. Canada: In re-evaluation
METALAXYL-M	4	Downy mildew (Radish - seed treatment) Pythium Spp. and Phytophthora Spp. (Parsnips)	Australia: No current concerns. Permit PER14695 (Parsnips) Expiry date: 31/03/2029
PENTHIOPYRAD	7	Alternaria leaf spot Powdery mildew	Australia: No current concerns. EU: Not approved
PHOSPHOROUS (PHOSPHONIC) ACID	P07 (33)	Permit PER14184 for the control of Damping off (Parsnips) Permit PER11951 for the control of Downy mildew (Chicory)	Australia: No current concerns. Permit PER14184 (Parsnips) Expiry date: 31/03/2030 Permit PER11951 Expiry date: 28/02/2030
POTASSIUM BICARBONATE	M2	Permit PER13695 for the control of Powdery mildew (Parsnip, Radish, Swede, Turnip)	Australia: No current concerns. Permit PER13695 (Parsnip, Radish, Swede, Turnip) Expiry date: 30/06/2030 Canada: In re-evaluation
PROPICONAZOLE	3	Permit PER14479 for the control of: Leaf Spot (Chicory) Rust (Chicory) Septoria leaf sp (Chicory)	Australia: APVMA nominated for reconsideration and spray drift assessment. Permit PER14479 (Chicory) Expiry date: 31/08/2029 EU: Not approved Canada: In re-evaluation USA: Under Registration Review (scheduled)

Active Constituent	MoA Group	Pest	Risks and Comments
PYDIFLUMETOFEN | DIFENOCONAZOLE	7 + 3	Early blight Powdery mildew Cercospora leaf spot	PYDIFLUMETOFEN Australia: No current concerns. Codex MRL: 0.3 mg/Kg EU: Pending Canada: In re-evaluation DIFENOCONAZOLE Australia: APVMA nominated for reconsideration after 2029. Permit PER87973 (Chicory) Expiry date: 30/06/2030 EU: Approved, candidate for substitution. Canada: In re-evaluation
TEBUCONAZOLE	3	Sclerotinia rot (Chicory & Radish)	Australia: APVMA: Removed from nomination list - maintain watching brief EU: Approved, candidate for substitution. Canada: In re-evaluation USA: Under Registration Review (scheduled)
TRIADIMENOL	3	Powdery Mildew (Parsnips, radish, swede, turnip)	Australia: APVMA nominated for reconsideration after 2029. EU: Not approved Canada: Cancelled
TRIFLOXYSTROBIN	11	Permit PER14494 for the control of powdery mildew (Chicory)	Australia: No current concerns. Permit PER14494 (Chicory) Expiry date: 31/08/2027 Canada: In re-evaluation

HERBICIDES – Weed Control

Blue text = new APVMA approved uses

Active Constituent	MoA Group	Risks and Comments
CLETHODIM	1	Australia: No current concerns. Permit PER82459 (Radish, parsnips, Chicory) Expiry date: 30/09/2026 Permit PER13788 (Parsnip) Expiry date: 31/01/2028
DIQUAT	22	Australia: APVMA: Currently under review. Publication of the final regulatory decision **is expected in Mid 2026**. EU: Not approved
FLUAZIFOP-P PRESENT AS THE BUTYL ESTER	1	Australia: APVMA Nominated for targeted spray drift reconsideration Permit PER82556 Expiry date: 30/11/2027 Permit PER81244 (Chicory, swede, turnip) Expiry date: 30/04/2027 Canada: Cancelled
LINURON	5	Australia: No current concerns. Permit PER95892 Expiry date: 31/01/2029 EU: Not approved
PARAQUAT	22	Australia: APVMA: Currently under review. Publication of the final regulatory decision **is expected in Mid 2026**. Candidate chemical recommended to be listed to Rotterdam Convention. Codex MRL: 0.05 mg/Kg EU: Not approved Canada: Cancelled USA: Restricted use
PENDIMETHALIN	3	Australia: No current concerns. EU: Approved, candidate for substitution. Canada: In re-evaluation USA: Under Registration Review (scheduled)
PHENMEDIPHAM	5	Australia: No current concerns. Permit PER81241 (Chicory) Expiry date: 31/03/2028

Active Constituent	MoA Group	Risks and Comments
PROMETRYN	5	Australia: No current concerns. Permit PER12048 (Parsnip) Expiry date: 30/04/2030 EU: Not approved
PROPACHLOR	15	Australia: No current concerns. Permit PER11441 Expiry date: 31/07/2029 EU: Not approved
QUIZALOFOP-P-ETHYL	1	Australia: No current concerns.
SETHOXYDIM	1	Australia: No current concerns. EU: Not approved Canada: Phase-Out
TRIFLURALIN	3	Australia: No current concerns. Permit PER13788 (Parsnip) Expiry date: 31/01/2028 EU: Not approved Canada: In re-evaluation USA: Under Registration Review (scheduled)

FUMIGANTS – Mixed Function

Blue text = new APVMA approved uses

Active Constituent	Use	Risks and Comments
1,3-DICHLOROPROPENE	Control of soil borne diseases, plant parasitic Nematodes, Symphylans and Wireworms	Australia: No current concerns. EU: Pending Canada: Cancelled
CHLOROPICRIN	Control of soil borne diseases, plant parasitic Nematodes, Symphylans and Wireworms	Australia: No current concerns. EU: Not approved USA: Restricted use
CHLOROPICRIN + 1,3-DICHLOROPROPENE	Control of soil borne diseases, plant parasitic Nematodes, Symphylans and Wireworms	CHLOROPICRIN Australia: No current concerns. EU: Not approved USA: Restricted use 1,3-DICHLOROPROPENE Australia: No current concerns. EU: Pending Canada: Cancelled
ETHANEDINITRILE	Soil borne pathogens, nematodes and weeds	Australia: No current concerns.
METHAM PRESENT AS SODIUM SALT	Germinating weeds and soil-borne fungus diseases	Australia: No current concerns.
METHYL BROMIDE	Disinfestation of fruit and vegetables	Australia: Permit PER96144 Expiry date: 31/01/2031 PER96144 for the control of Disinfestation treatment of commodities EU: Not approved Canada: Remaining pre-plant soil fumigation uses were cancelled (June 2025) USA: Restricted use

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