Squash

Strategic Agrichemical Review Process (SARP)

July 2021

Hort Innovation
Project – VG18004

Hort Innovation Project Number:
VG18004 – Vegetable Strategic Agrichemical Review Process (SARP) Report Updates

SARP Service Provider:
Vasanthe Vithanage T/A Hortigrow Consulting

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

Date of report:
July 2021

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

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1. Summary

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

(i) Assesses the importance of the diseases, insects and weeds (plant pests) that can affect a horticultural industry;

(ii) Evaluates the availability and effectiveness of fungicides, insecticides and herbicides (pesticides) to control the plant pests;

(iii) Determines any gaps in the pest control strategy and

(iv) Identifies suitable new or alternatives pesticides to address the gaps.

Alternative pesticides should ideally be selected for benefits of:

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

The results of this process will provide the Squash 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
Powdery Mildew	*Podosphaera xanthii*

1.2 Insects and mites

The high priority insect and mite pests are:

Common name	Scientific name
Green Peach Aphid	*Myzus persicae*
Cotton Bollworm / Corn Earworm	*Helicoverpa armigera*
Native Budworm	*Helicoverpa punctigera*
Western Flower Thrips	*Frankliniella occidentalis*
Tomato Thrips	*Frankliniella schultzei*
Plague Thrips	*Thrips imaginis*

1.3 Weeds

The feedback received from the different States did not rank any weeds for the Squash industry. However, a list has been compiled to include common weeds of cucurbits including Squash.

Common Name	Scientific Name
Amaranthus	*Amaranthus* spp.
Grass Weeds	*Poaceae*
Blackberry Nightshade	*Solanum nigrum*
Fat Hen	*Chenopodium album*
Nutgrass	*Cyperus rotundus*
Pigweed	*Portulaca oleracea*
Soursob	*Oxalis pes-capre*

2. The Australian Squash Industry

The Australian Squash industry is a minor horticultural industry. The crop belongs to the cucurbit group which includes winter & summer squash.

Cucurbit production is significant in Australia, with approximately 435,000 tonnes being grown annually from an area of 25,000 hectares. The value of the industry is estimated at $330 million[1]. Cucurbits are grown in all states and seasonal production occurs year-round from the various production regions. Accurate statistics on squash production[2] are not available, although the crop represents a small proportion of the cucurbit industry. The majority is produced in Victoria. The responses for the most recent survey have come only from Victoria.

[1] CUCURBIT PRODUCTION IN AUSTRALIA | International Society for Horticultural Science (ishs.org)

[2] Hort Innovation (2020). Australian Horticulture Statistics Handbook 2018/19. [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 IPM practitioners must strive to implement best management practices and tools to incorporate a pest management regime where strategies work in harmony with each other to achieve the desired effects while posing the least risks.

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

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

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

The results will provide the Squash 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 Squash 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[3] for the Vegetable Industry which covers Squash 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.

[3] 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 Squash as a minor crop. The crop fits within the APVMA Crop Group 011: Fruiting vegetables, Cucurbits (Subgroup 011A-Summer squash; Subgroup 011B-Winter squash). Pesticide use is generally covered under the cucurbit crop group for label registrations and minor use permits.

Therefore, access to minor use permits can be relatively straight forward as long as a reasonable justification is provided in accordance with the APVMA's minor use guidance[4].

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

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

3.3 Methods

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

Hort Innovation Project Reference	Process of Review - Activity
VG16060 - Vegetable Agrichemical Pest Management Needs and Priorities (AUSVEG) - Commenced: 2 May 2017	Engagement and consultation with growers and other relevant stakeholders; Including; Online crop specific surveys, workshops and one on one consultation Nationally. Collation of information collected by commodity on applicable pests, diseases and weeds in order of priority.
MT17019 – Regulatory Support & Co-ordination (AKC)	**Squash 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 MT17019 to highlight the regulatory threats to agrichemicals currently approved for the management of the pests and diseases in Squash as well as current initiatives aimed at addressing identified pest management deficiencies.
VG18004 – Vegetable Strategic Agrichemical Review Process (SARP) Report Updates	**SARP updated via a desktop audit:** Review list of priorities ranked 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 MT17019 Regulatory Support & Co-ordination – AKC consulting. 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 squash
Appendix 2. Products available for control of insects and mites in squash
Appendix 3. Products available for weed control in squash
Appendix 4. Current permits for use in squash
Appendix 5. Squash Maximum Residue Limits (MRLs)
Appendix 6. Squash Agrichemical Regulatory Risk Assessment

4. Diseases, Pests and Weeds of Squash

Resistance management: To manage the risk of resistance development, integrated disease/pest/weed management (IDM/IPM/IWM) strategies should be adopted. The general principle is to integrate diverse chemical and non-chemical strategies; maximise efficacy; not rely on singular tools and rotate between different modes of action. It is always essential to follow all the label instructions. Specific resistance management strategies may apply. These can be found, along with other useful information, on the CropLife Australia website[5].

In chapter 4, information on regulatory risk derived from project MT17019 - Regulatory support and coordination (Appendix 6) has been incorporated.

Some of the suggested options have no overseas MRLs (see Appendix 5). If treated fruit is to be exported nil residues at harvest would be needed for these options.

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.

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

4.1 Diseases of squash

4.1.1 Disease priorities

Common name	Scientific name
High	
Powdery Mildew	*Podosphaera xanthii*
Moderate	
Downy Mildew	*Pseudoperonospora cubensis*
Grey Mould	*Botrytis cinerea*
Gummy Stem Blight	*Didymella bryoniae*
Low	
Alternaria Leaf Blight	*Alternaria cucumerina*
Angular Leaf Spot	*Pseudomonas syringae*
Anthracnose	*Colletotrichum orbiculare*
Bacterial Leaf Spot	*Xanthomonas campestris*
Damping Off	*Pythium* spp., *Phytophthora* spp., *Fusarium* spp., *Rhizoctonia* spp.
Phytophthora Soil Fungus	*Phytophthora* spp.
Rhizoctonia Ground Rot	*Rhizoctonia solani*
Scab	*Cladosporium* spp.
Septoria Spot	*Septoria cucurbitacearum*
Target Leaf Spot	*Cercospora citrulline*
Viruses	Cucumber Green Mottle Mosaic Virus (CGMMV), Squash Mosaic Virus (SqMV) & Zucchini Yellow Mosaic Virus (ZYMV)

The most important disease issue based on the feedback received was Powdery Mildew. Available and potential products for all these diseases are in Section 4.1.2.

Integrated disease management should be used to avoid over-reliance on fungicides or in cases where limited chemical options are available. Good disease management practices include use of good farm hygiene, disease-free planting materials and reduction of moisture in the crop canopy through plant orientation and spacing and use of appropriate irrigation techniques. Soil fumigation may also be useful in preventing disease infection, particularly for soil-borne diseases.

Several viruses can infect cucurbits, including squash, with key differences in how the viruses are transmitted and spread and management options varying accordingly. Cucumber Green Mottle Mosaic Virus is seed-borne and is readily spread by contact within fields. Squash Mosaic

Virus can also be introduced through seed, and secondary infection can occur via leaf-chewing beetles such as 28-spotted ladybird and by mechanical spread by workers and contaminated equipment. Zucchini Yellow Mosaic Virus is spread by many species of aphid with transmission occurring with a very short feeding time.

Management options include the use of clean planting material, general farm hygiene, early detection and disposal of infected seedlings and resistant varieties. Control of insect vectors is usually ineffective due to the rapid transmission of the virus during feeding.

Resistance Management

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

There are several disease strategies that apply to cucurbits on the CropLife website[6], including Powdery Mildew and Downy Mildew.

[6] www.croplife.org.au/resources/programs/resistance-management/

4.1.2 Available and potential products for priority diseases

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

Availability		Regulatory risk (refer to Appendix 6)	
A	Available via either registration or permit approval	R1	Short-term: Critical concern over retaining access
P	Potential - a possible candidate to pursue for registration or permit	R2	Medium-term: Maintaining access of significant concern
P-A	Potential, already approved in the crop for another use	R3	Long-term: Potential issues associated with use - Monitoring required

Withholding Period (WHP) – Number of days from last treatment to harvest (H) or Grazing (G)			
Harvest	H	Not Required when used as directed	NR
Grazing	G	No Grazing Permitted	NG

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Powdery Mildew (*Podosphaera xanthii*) **Priority: High**							
Powdery Mildew was ranked as a high priority in VIC. Powdery Mildew causes a characteristic white, powdery growth on infected plants. Photosynthetic efficiency is reduced in affected leaves and fruit can be scarred and damaged, causing produce to be downgraded. Severe outbreaks can cause defoliation, exposing fruit to sunburn and predisposing them to secondary rots.							
Azoxystrobin (Amistar)	11	Protectant & curative	1	A	ALL	Registered in cucurbits for the control of **Powdery Mildew**, Downy Mildew and Gummy Stem Blight. Commence soon after transplanting and continue till fruit maturity. [Max. no. of applications not specified; 2 sequential applications; re-treatment interval: 7 - 14 d]	-
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protective & curative	3 NG	A	ALL	Registered in cucurbits for the control of Downy Mildew and suppression of **Powdery Mildew**, Gummy Stem Blight and *Sclerotinia* spp. [Max. 2 applications per crop; re-treatment interval: 7 - 14 d]	-
Boscalid + Kresoxim-Methyl (Colliss) BASF	7+11	Protectant & curative	7	A	ALL	Registered in cucurbits for control of **Powdery Mildew**. [Max. 2 applications per crop; re-treatment interval: 7 - 10 d]	-
Bupirimate (Nimrod)	8	Protectant & curative	1	A	ALL	Registered in cucurbits including squash for control of **Powdery Mildew**. [Max. 4 applications per crop; re-treatment interval: 7 d]	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Copper Octanoate	M1	Protectant	1	A	ALL	Registered in cucurbits for control of **Powdery Mildew** and Downy Mildew. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	-
Cyflufenamid (Flute) AgNova	U6	Protectant & curative	1	A	ALL	Registered in cucurbits for control of **Powdery Mildew**. Begin application at first sign of disease. [Max. 2 applications per crop; re-treatment interval: 7 - 10 d]	-
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Contact	1	A	ALL	Registered in cucurbits including squash for control of **Powdery Mildew**. [Max. 4 applications per crop; re-treatment interval: 5-7 d]	-
Metrafenone (Vivando) BASF	U8	Protectant	7	A	ALL	Registered in cucurbits for control of **Powdery Mildew**. [Max. 4 applications per crop; 2 sequential applications; re-treatment interval: 7-10 d]	-
Penthiopyrad (Fontelis) Corteva	7	Protectant	1	A	ALL	Registered in cucurbits including squash (field and protected) for control of Botrytis Grey Mould, **Powdery Mildew**, and Gummy Stem Blight. [Max. no. of applications not specified; 2 sequential applications; re-treatment interval: 7 – 14 d]	-
Proquinazid (Talendo) Corteva	13	Protectant	1	A	ALL	Registered in cucurbits (field grown only) for control of **Powdery Mildew**. [Max. 3 applications per crop; 2 sequential applications; re-treatment interval: 10-14 d]	-
Pyriofenone (Kusabi) AgNova	50	Protectant & Curative	NR	A	ALL	Registered in cucurbits (field grown only) for control of **Powdery Mildew**. [Max. 3 applications per crop; re-treatment interval: 7-10 d].	-
Streptomyces lydicus (Actinovate)	BM 02	Biological	NR	A	ALL	Registered in cucurbits for suppression of **Powdery Mildew.** [Max no of applications and re-treatment intervals not specified]	-
Sulphur	M2	Protectant	NR	A	ALL	Registered in vegetables (field & protected) for control of **Powdery Mildew** and Rust. [Max no of applications not specified; re-treatment interval 14-21 d]	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Tea Tree Oil (Timorex)	46	Protectant	NR	A	ALL	Registered in cucurbits for control of **Powdery Mildew**. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	-
Triadimefon	3	Protectant & curative	1	A	NSW & WA	Registered in cucurbits for control of **Powdery Mildew**. [Max. no. of applications not specified; re-treatment interval: 5-10 d]	R3
Triadimenol (Bayfidan)	3	Protectant & curative	1	A	ALL	Registered in cucurbits for control of **Powdery Mildew**. [Max. 4 applications per crop; re-treatment interval: 5-10 d]	R3
ADM1700F Adama	TBC			P		Fungicide in development from Adama with **Powdery Mildew** activity	-
Bacillus amyloliquefaciens (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for suppression of Bacterial Spot in capsicum, chilli and tomato, Anthracnose and Stem End Rot in avocado and mango, and Botrytis in grapevines and strawberries. Permitted for control of **Powdery Mildew** in eggplant. US registration for control of **Powdery Mildew** in cucurbits, grapes, pome fruit, stone fruit and strawberries.	-
Bacillus amyloliquefaciens strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of Botrytis in grapevines and strawberries. Permitted for suppression of **Powdery Mildew** in nursery stock. US registration for control of **Powdery Mildew** in artichoke, berries, brassica leafy vegetables, bulb vegetables, cucurbits, fruiting vegetables, grapes, hops, leafy vegetables, legume vegetables, pome fruit, stone fruit, sugar beet and tobacco.	-
BLAD (ProBlad Plus)	BM 01	Biological	NR	P		Registered for control of Brown Rot and Blossom Blight in stone fruit. US registration for control of **Powdery Mildew** in cucurbits, fruiting vegetables, grapes, hops, pome fruit and strawberries.	-
Florylpicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, **Powdery Mildew**, Botrytis, Anthracnose, Alternaria, Scab, Monilinia, Rust and *Mycosphaerella* spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of **Powdery Mildew** in almond, Brassica leafy vegetables, cucurbits, grapes, hops, dry and succulent beans, stone fruit and sunflower.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of **Powdery Mildew** in apples. US registration for control of **Powdery Mildew** in artichoke, almond, low growing berry except cranberry, Brassica vegetables, Brassica leafy vegetables, carrot cherry, dill seed, pome fruit, small vine climbing fruit except kiwi fruit, ginseng, herbs, hops, leafy greens, cucurbits, pecan, leafy petioles (including celery fennel (bulb) & rhubarb) fruiting vegetables & root vegetables except sugar beet.	-
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of Alternaria Leaf Spot, Black Spot, Brown Rot Nut Scab, Shot Hole and Rust in almond, Brown Rot in cherries and Husk Spot in macadamia. US registration for control of Alternaria Leaf Blight, **Powdery Mildew**, Anthracnose, Cercospora Leaf Spot, Gummy Stem Blight, Microdochium Blight, Target Leaf Spot and suppression of Downy Mildew in cucurbits.	-
Isofetamid (Kenja) ISK / AgNova	7	Protective & Curative		P		Registered for control of Botrytis Grey Mould in berries. US registration for control of Grey Mould, **Powdery Mildew** and Anthracnose in low-growing berries.	-
NUL3195 Nufarm	TBC			P		Fungicide in development from Nufarm with activity on **Powdery Mildew** and *Botrytis*.	-
Potassium Bicarbonate (EcoCarb)	M2	Curative		P		Registered for control of **Powdery Mildew** in peppers, tomato (glasshouse), cucurbits, grapevine, rose and strawberry.	-
Pydiflumetofen + Difenonazole (Miravis Duo) Syngenta	7+3	Protectant & Curative		P		Application for registration submitted in June 2021 for control of various diseases in cucurbits. US registration for control of **Powdery Mildew** in almonds and stone fruit.	R3
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of Botrytis in berries and grapes, and Botrytis and Sclerotinia in leafy vegetables and potato. US registration for control of **Powdery Mildew** in brassica vegetables cucurbits, fruiting vegetables, grapes, specific leaf petioles, leafy greens, root and tuber vegetables, mustard greens, potato, root vegetables. strawberry and tuberous and corm vegetables.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Downy Mildew (*Peronospora destructor*) **Priority: Moderate**							
Downy Mildew was ranked as a moderate priority in VIC. It is a common disease that is characterised by a white downy fungal growth that develops on the underside of the leaf and is favoured by warm, moist weather. Management options include general farm hygiene, crop rotation, planting space and the use of fungicide applications when conditions favour disease.							
Azoxystrobin (Amistar)	11	Protectant & curative	1	A	ALL	Registered in cucurbits for the control of Powdery Mildew, **Downy Mildew** and Gummy Stem Blight. Commence soon after transplanting and continue till fruit maturity. [Max. no. of applications not specified; 2 sequential applications; re-treatment interval: 7 - 14 d]	-
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protective & curative	3 NG	A	ALL	Registered in cucurbits for the control of **Downy Mildew** and suppression of Powdery Mildew, Gummy Stem Blight and *Sclerotinia* spp. [Max. 2 applications per crop; re-treatment interval: 7 - 14 d]	-
Chlorothalonil (Bravo)	M5	Protectant	1	A	ALL	Registered in cucurbits for control of **Downy Mildew**, Gummy Stem Blight**,** Anthracnose, Alternaria Leaf Blight and Target Leaf Spot and suppression of Belly Rot. [Max. no. of applications not specified; re-treatment interval: 7 - 14 d]	R3
Copper Ammonium Acetate	M1	Protectant	1	A	ALL	Registered in cucurbits for the control of Angular Leaf Spot, Bacterial Leaf Spot and **Downy Mildew**. Apply at first signs of disease. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	-
Copper Octanoate	M1	Protectant	1	A	ALL	Registered in cucurbits for control of Powdery Mildew and **Downy Mildew**. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	-
Copper Oxychloride	M1	Protectant	1	A	ALL	Registered in cucurbits for control of Angular Leaf Spot, Bacterial Leaf Spot, **Downy Mildew**, Anthracnose and Gummy Stem Blight. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	-
Dimethomorph (Acrobat) BASF	40	Protectant	7	A	ALL	Registered in cucurbits for control of **Downy Mildew**, Anthracnose, Gummy Stem Blight, Alternaria Leaf Spot and Septoria Spot. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	**-**

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Dimethomorph + Mancozeb (Acrobat WDG) BASF	40+M3	Protectant	7	A	ALL	Registered in cucurbits for control of **Downy Mildew**. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	R2
Mancozeb	M3	Protectant	7	A	ALL	Registered in cucurbits (field) for control of Alternaria Spot, Anthracnose, **Downy Mildew**, Ring Spot, Gummy Stem Blight, and Septoria Spot. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	R2
Mancozeb + Metalaxyl-M (Ridomil Gold MZ) Syngenta	M3+4	Protectant & Curative	7	A	ALL	Registered in cucurbits (field) for control of **Downy Mildew**. [Max. 4 applications per crop; apply 2 consecutive applications at re-treatment interval of 7-10 d]	R2
Metiram (Polyram) BASF	M3	Protectant	7	A	ALL	Registered in cucurbits for the control of **Downy Mildew** and Gummy Stem Blight. [Max. no. of applications not specified; re-treatment interval: 7 d]	R2
Oxathiapiprolin (Zorvec Enicade) Corteva	49	Protectant	1	A	ALL	Registered in cucurbits for control of **Downy Mildew.** [Max. 3 applications per crop; 2 consecutive; re-treatment interval 7-10 d]	-
Phosphorous Acid	33	Protectant	NR	A	ALL	Registered in cucurbits for the control of **Downy Mildew.** [Max. no. of applications not specified; re-treatment interval 7 d]	-
Propamocarb Hydrochloride + Fluopicolide (Infinito)	28+43	Protectant	1	A	ALL	Registered in cucurbits (field and protected) for the control of **Downy Mildew.** [Max 2 applications per crop; re-treatment interval: 7-10 d]	-
Propineb (Antracol)	M3	Protectant	3	A	ALL	Registered in cucurbits for the control of **Downy Mildew**. [Max. 4 applications per crop; re-treatment interval: 7- d]	R2
Propineb + Oxadixyl (Rebound)	4+M3	Protectant	3	A	ALL	Registered in cucurbits for the control of **Downy Mildew**, Gummy Stem Blight, and Anthracnose. [Max. no. of applications not specified; 2 sequential applications; re-treatment interval: 7 – 10 d]	R2
Zineb	M3	Protectant	7	A	ALL	Registered in cucurbits for the control of **Downy Mildew** and Anthracnose. [Max. no. of applications not specified; re-treatment interval: 7 d]	R2

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Contact	1	P-A	ALL	Registered in cucurbits including squash for control of Powdery Mildew. Registered for control of **Downy Mildew** in brassica vegetables, bulb vegetables and grapes.	-
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.	-
Cyazofamid (Ranman) ISK	21	Protectant		P		Registered for control of Late Blight and White Blister in potatoes and broccoli. 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.	-
Dimethomorph + Amitoctradin (Zampro) AgNova	40+45	Protectant		P		Registered for control of **Downy Mildew** in grape vines. Hort Innovation project ST17000 is generating data to support a label registration for control of Downy Mildew in cucurbits.	-
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.	-
Mandipropamid (Revus) Syngenta	40	Protectant		P		Registered for control of **Downy Mildew** in grapes and brassica leafy crops. US registration for suppression of **Downy Mildew** in cucurbits and control of Downy Mildew in basil, edible podded bean, brassica vegetables, leafy vegetables, bulb vegetables, fruiting vegetables (except tomatoes), grapes and hops.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Grey Mould (*Botrytis cinerea*) **Priority: Moderate**							
Grey Mould was ranked as a moderate priority in VIC. It can affect plants at most stages of production. Affected fruit become water-soaked and soft and are rapidly covered with a thick grey mould. Other plant parts such as stems can also be affected. *Botrytis* also causes secondary rots on fruit and vegetables in storage or transit and in the marketplace.							
Aureobasidium pullulans (Botector) Nufarm	BM 02	Biological	NR	A		Registered in cucurbits (field & protected) for control of ***Botrytis*** and suppression of *Sclerotinia* spp. [Max. 5 applications per crop; re-treatment interval: 7 – 10 d]	-
Penthiopyrad (Fontelis) Corteva	7	Protectant	1	A	ALL	Registered in cucurbits including squash (field and protected) for control of **Botrytis Grey Mould**, Powdery Mildew, and Gummy Stem Blight. [Max. no. of applications not specified; 2 sequential applications; re-treatment interval: 7 – 14 d]	-
Bacillus amyloliquefaciens (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for suppression of Bacterial Spot in capsicum, chilli and tomato, Anthracnose and Stem End Rot in avocado and mango, and Botrytis in grapevines and strawberries. US registration for control of ***Botrytis*** in artichoke, asparagus, berries, bulb vegetables, fruiting vegetables, grapes, cucurbits, grapes, herbs/spices, legume vegetables, root/tuber and corm vegetables, stone fruit and kiwi.	-
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 ***Botrytis*** in artichoke, asparagus, berries, brassica leafy vegetables, bulb vegetables, fruiting vegetables, grapes, leafy vegetables, legume vegetables, pome fruit, stone fruit and tobacco.	-
BLAD (ProBlad Plus)	BM 01	Biological	NR	P		Registered for control of Brown Rot and Blossom Blight in stone fruit. US registration for control of ***Botrytis*** in fruiting vegetables, grapes, strawberries and ornamentals.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protective & Curative		P		Registered for control of Sclerotinia**,** Botrytis and other diseases in several vegetable crops including leafy vegetables, peas, beans, leafy vegetables & lettuce. US registration for control of ***Botrytis*** in beans (dried & succulent except cowpea), berries, grapes and small fruit vine climbing (except fuzzy kiwifruit), herbs, leafy greens, bulb vegetables, pistachio and fruiting vegetables, and control of Alternaria, Gummy Stem Blight and Powdery Mildew in cucurbits.	R3
DC-126 Bayer	TBC			P		New product from Bayer with ***Botrytis*** activity.	-
Fenpyrazamine (Prolectus) Sumitomo	17	Protectant & Curative		P		Registered for ***Botrytis*** control in grapes. US registration for control of ***Botrytis*** in berries, ginseng, lettuce, pistachio, small fruit vine climbing (except fuzzy kiwifruit) and ornamentals.	-
Florylpicoxamid (Adavelt) Corteva	21	Protective & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, **Botrytis**, Anthracnose, Alternaria, Scab, Monilinia, Rust and *Mycosphaerella* spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of ***Botrytis*** in almond, artichoke, berries, brassica vegetables, Brassica leafy greens, stone fruit, dill seed, pome fruit, small fruit vine climbing (except fuzzy kiwifruit), herbs, hops, leafy greens, cucurbits, pistachio, fruiting vegetables and root vegetables (except sugar beet).	R3
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 ***Botrytis* spp.** in bulb vegetables, leafy vegetables, pome fruit, stone fruit, strawberries and tree nuts, and for control of Alternaria Leaf Blight, Powdery Mildew, Anthracnose, Cercospora Leaf Spot, Gummy Stem Blight, Microdochium Blight, Target Leaf Spot and suppression of Downy Mildew in cucurbits.	-
Isofetamid (Kenja) ISK	7	Protectant		P		Registered for control of ***Botrytis*** in berries***.***	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
NUL3195 Nufarm	TBC			P		New product from Nufarm with ***Botrytis*** activity.	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protective & Curative		P		Registered for control of ***Botrytis*** in berries, grapes and strawberries and control of ***Botrytis*** and *Sclerotinia* in leafy vegetables, lettuce and potatoes. US registration for control of ***Botrytis*** in berries, bulb vegetables, cucurbits, grapes and small fruit vine climbing (except fuzzy kiwifruit), specific leaf petioles, specific leafy greens, pistachio, tuberous and corm vegetables, and suppression of ***Botrytis*** in fruiting vegetables and potatoes.	R3
Gummy Stem Blight (*Didymella bryoniae*) **Priority: Moderate**							
Gummy Stem Blight was ranked as a moderate priority in VIC. The fungus usually attacks stems causing a watery rot at ground level which may spread up the stem and into roots. Infection of the root and stem prevents the flow of water and nutrients, and plants wilt. Management options include use of clean seed and good on-farm hygiene.							
Azoxystrobin (Amistar)	11	Protectant & curative	1	A	ALL	Registered in cucurbits for the control of Powdery Mildew, Downy Mildew and **Gummy Stem Blight**. Commence soon after transplanting and continue till fruit maturity. [Max. no. of applications not specified; 2 sequential applications; re-treatment interval: 7 - 14 d]	-
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protective & curative	3 NG	A	ALL	Registered in cucurbits for the control of Downy Mildew and suppression of Powdery Mildew, **Gummy Stem Blight** and *Sclerotinia* spp. [Max. 2 applications per crop; re-treatment interval: 7 - 14 d]	-
Chlorothalonil (Bravo)	M5	Protectant	1	A	ALL	Registered in cucurbits including squash for control of Downy Mildew, **Gummy Stem Blight,** Anthracnose, Alternaria Leaf Blight and Target Leaf Spot and suppression of Belly Rot. [Max. no. of applications not specified; re-treatment interval: 7 - 14 d]	R3
Copper Oxychloride	M1	Protectant	1	A	ALL	Registered in cucurbits for control of Angular Leaf Spot, Bacterial Leaf Spot, Downy Mildew, Anthracnose and **Gummy Stem Blight**. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	-
Dimethomorph (Acrobat) BASF	40	Protectant	7	A	ALL	Registered in cucurbits for control of Downy Mildew, Anthracnose, **Gummy Stem Blight**, Alternaria Leaf Spot and Septoria Spot. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Dimethomorph + Mancozeb (Acrobat WDG) BASF	40+M3	Protectant	7	A	QLD & NT	Registered in cucurbits for control of Downy Mildew, Anthracnose, **Gummy Stem Blight**, Alternaria Leaf Spot and Septoria Spot. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	R2
Mancozeb	M3	Protectant	7	A	ALL	Registered in cucurbits (field) for control of Alternaria Spot, Anthracnose, Downy Mildew, Ring Spot, **Gummy Stem Blight**, and Septoria Spot. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	R2
Mancozeb + Metalaxyl-M (Ridomil Gold MZ) Syngenta	M3+4	Protectant & Curative	7	A	QLD	Registered in cucurbits (field) for control of Downy Mildew, Anthracnose, **Gummy Stem Blight** and Alternaria Leaf Spot. [Max. 4 applications per crop; apply 2 consecutive applications at re-treatment interval of 7-10 d]	R2
Metiram (Polyram) BASF	M3	Protectant	7	A	ALL	Registered in cucurbits for the control of Downy Mildew and **Gummy Stem Blight**. [Max. no. of applications not specified; re-treatment interval: 7 d]	R2
Penthiopyrad (Fontelis) Corteva	7	Protectant	1	A	ALL	Registered in cucurbits including squash (field and protected) for control of Botrytis Grey Mould, Powdery Mildew, and **Gummy Stem Blight**. [Max. no. of applications not specified; 2 sequential applications; re-treatment interval: 7 – 14 d]	-
Propineb + Oxadixyl (Rebound)	4+M3	Protectant	3	A	ALL	Registered in cucurbits for the control of Downy Mildew, **Gummy Stem Blight**, and Anthracnose. [Max. no. of applications not specified; 2 sequential applications; re-treatment interval: 7 – 10 d]	R2
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 **Gummy Stem Blight** in cucurbits.	-
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protective & Curative		P		Registered for control of Sclerotinia**,** Botrytis and other diseases in several vegetable crops including leafy vegetables, peas, beans, leafy vegetables & lettuce. US registration for control of **Gummy Stem Blight** in cucurbits.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of **Gummy Stem Blight** in cucurbits.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of *Alternaria*, Black Spot and Powdery Mildew in apples, Black Spot in pears, Blossom Blight, Brown Rot, Hull Rot, Shot Hole and Rust in stone fruit, and various leaf diseases in tropical fruits. US registration for control of **Gummy Stem Blight** in cucurbits.	-
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.	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of Botrytis in berries and grapes, and Botrytis and Sclerotinia in leafy vegetables and potato. US registration for control of **Gummy Stem Blight** in cucurbits.	R3
Alternaria Leaf Blight (*Alternaria cucumerina*) **Priority: Low**							
Alternaria was ranked as a low priority in VIC. *Alternaria* species produce various sorts of toxic metabolites during their active growth and causes severe diseases in many plants by limiting their productivity. Crop rotation, removal and burning of plant debris, if infected, and eradication of weed hosts help reduce the inoculum for subsequent plantings of susceptible crops.							
Chlorothalonil (Bravo)	M5	Protectant	1	A	ALL	Registered in cucurbits including squash for control of Downy Mildew, Gummy Stem Blight**,** Anthracnose, **Alternaria Leaf Blight** and Target Leaf Spot and suppression of Belly Rot. [Max. no. of applications not specified; re-treatment interval: 7 - 14 d]	R3
Dimethomorph (Acrobat) BASF	40	Protectant	7	A	ALL	Registered in cucurbits for control of Downy Mildew, Anthracnose, Gummy Stem Blight, **Alternaria Leaf Spot** and Septoria Spot. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	**-**

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Dimethomorph + Mancozeb (Acrobat WDG) BASF	40+M3	Protectant	7	A	QLD & NT	Registered in cucurbits for control of Downy Mildew, Anthracnose, Gummy Stem Blight, **Alternaria Leaf Spot** and Septoria Spot. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	R2
Mancozeb	M3	Protectant	7	A	ALL	Registered in cucurbits (field) for control of **Alternaria Spot**, Anthracnose, Downy Mildew, Ring Spot, Gummy Stem Blight, and Septoria Spot. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	R2
Mancozeb + Metalaxyl-M (Ridomil Gold MZ) Syngenta	M3+4	Protectant & Curative	7	A	QLD	Registered in cucurbits (field) for control of Downy Mildew, Anthracnose, Gummy Stem Blight and **Alternaria Leaf Spot**. [Max. 4 applications per crop; apply 2 consecutive applications at re-treatment interval of 7-10 d]	R2
Bacillus amyloliquefaciens (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for suppression of Bacterial Spot in capsicum, chilli and tomato, Anthracnose and Stem End Rot in avocado and mango, and Botrytis in grapevines and strawberries. 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.	-
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.	-
Florylpicoxamid (Adavelt) Corteva	21	Protective & curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis, Anthracnose, **Alternaria**, Scab, Monilinia, Rust and *Mycosphaerella* spp. Scheduled for JMPR evaluation in 2023.	-
Fluazinam (Shirlan) Syngenta	29	Protective		P		Registered in Brassica vegetables for control of Club Root. US registration for control of ***Alternaria*** in carrots.	-

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 ***Alternaria*** in almond, Brassica leafy greens, bulb vegetables, cucurbits, pistachio, tree nuts and sunflower.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of ***Alternaria***, Black Spot and Powdery Mildew in apples, Black Spot in pears, Blossom Blight, Brown Rot, Hull Rot, Shot Hole and Rust in stone fruit, and various leaf diseases in tropical fruits. US registration for control of ***Alternaria*** in almond, Brassica vegetables, Brassica leafy vegetables, carrot, citrus, pome fruit, small vine climbing fruit except kiwi fruit, leafy greens, cucurbits, tree nuts, fruiting vegetables & root vegetables except sugar beet.	-
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of Alternaria Leaf Spot, Black Spot, Brown Rot Nut Scab, Shot Hole and Rust in almond, Brown Rot in cherries and Husk Spot in macadamia. US registration for control of **Alternaria Leaf Blight**, Powdery Mildew, Anthracnose, Cercospora Leaf Spot, Gummy Stem Blight, Microdochium Blight, Target Leaf Spot and suppression of Downy Mildew in cucurbits.	-
NUL3446 Nufarm	TBC	TBC		P		New active in development from Nufarm with activity on ***Alternaria*** spp.	-
Pydiflumetofen + Difenonazole (Miravis Duo) Syngenta	7+3	Protectant & Curative		P		Application for registration submitted in June 2021 for control of various diseases in cucurbits. US registration for control of ***Alternaria* spp.** in almonds, pistachios, stone fruit and tree nuts.	R3
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of Botrytis in berries and grapes, and Botrytis and Sclerotinia in leafy vegetables and potato. US registration for control of ***Alternaria*** in berries, brassica vegetables, bulb vegetables, carrots, cucurbits, fruiting vegetables, grape and small fruit vine climbing (except fuzzy kiwifruit), specific leaf petioles, specific leafy greens, root and tuber vegetables, lemon and lime, mustard greens, pistachio, potato, root vegetables and tuberous and corm vegetables.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Angular Leaf Spot (*Pseudomonas syringae*) **Priority: Low**							
Angular Leaf Spot was ranked as a low priority in VIC. Symptoms first appear as small, water-soaked spots on leaves, but spread rapidly when in warm and moist conditions.							
Copper Ammonium Acetate	M1	Protectant	1	A	ALL	Registered in cucurbits for the control of **Angular Leaf Spot**, Bacterial Leaf Spot and Downy Mildew. Apply at first signs of disease. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	-
Copper Hydroxide	M1	Protectant	1	A	ALL	Registered in cucurbits for the control of **Angular Leaf Spot** and Bacterial Leaf Spot**.** Apply at first signs of disease. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	-
Copper Oxychloride	M1	Protectant	1	A	ALL	Registered in cucurbits for control of **Angular Leaf Spot**, Bacterial Leaf Spot, Downy Mildew, Anthracnose and Gummy Stem Blight. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	-
Copper as Tribasic Copper Sulfate	M1	Protectant	1	A	ALL	Registered in cucurbits for the control of **Angular Leaf Spot** and Bacterial Leaf Spot**.** Apply at first signs of disease. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	-
Copper as Cuprous Oxide	M1	Protectant	1	A	ALL	Registered in cucurbits for the control of **Angular Leaf Spot** and Bacterial Leaf Spot**.** Apply at first signs of disease. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	-
Bacillus amyloliquefaciens (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for suppression of Bacterial Spot in capsicum, chilli and tomato, Anthracnose and Stem End Rot in avocado and mango, and Botrytis in grapevines and strawberries. US registration for control of ***Pseudomonas* spp.** in berries, cucurbits, fruiting vegetables and stone fruit.	-
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 ***Pseudomonas* spp.** in fruiting vegetables, leafy vegetables, stone fruit, tobacco and tree nuts, and control of Anthracnose, Alternaria Leaf Spot, Downy Mildew, Gummy Stem Blight and Powdery Mildew in cucurbits.	-

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 (***Pseudomonas syringae***), Bacterial Spot, Bacterial Canker and Powdery Mildew. US registration for suppression of ***Pseudomonas* spp.** in cucurbits and tomato.	-
Anthracnose (*Colletotrichum orbiculare*) **Priority: Low**							
Anthracnose was ranked as a low priority in VIC. Can be seed-borne and carries over on crop residue in the soil. It is spread in water droplets and is favoured by warm, humid weather.							
Chlorothalonil (Bravo)	M5	Protectant	1	A	ALL	Registered cucurbits including squash for control of Downy Mildew, Gummy Stem Blight**, Anthracnose**, Alternaria Leaf Blight and Target Leaf Spot and suppression of Belly Rot. [Max. no. of applications not specified; re-treatment interval: 7 - 14 d]	R3
Copper Oxychloride	M1	Protectant	1	A	ALL	Registered in cucurbits for control of Angular Leaf Spot, Bacterial Leaf Spot, Downy Mildew, **Anthracnose** and Gummy Stem Blight. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	-
Dimethomorph (Acrobat) BASF	40	Protectant	7	A	ALL	Registered in cucurbits for control of Downy Mildew, **Anthracnose**, Gummy Stem Blight, Alternaria Leaf Spot and Septoria Spot. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	**-**
Dimethomorph + Mancozeb (Acrobat WDG) BASF	40+M3	Protectant	7	A	QLD & NT	Registered in cucurbits for control of Downy Mildew, **Anthracnose**, Gummy Stem Blight, Alternaria Leaf Spot and Septoria Spot. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	R2
Mancozeb	M3	Protectant	7	A	ALL	Registered in cucurbits (field) for control of Alternaria Spot, **Anthracnose**, Downy Mildew, Ring Spot, Gummy Stem Blight, and Septoria Spot. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	R2
Mancozeb + Metalaxyl-M (Ridomil Gold MZ) Syngenta	M3+4	Protectant & Curative	7	A	QLD	Registered in cucurbits (field) for control of Downy Mildew, **Anthracnose**, Gummy Stem Blight and Alternaria Leaf Spot. [Max. 4 applications per crop; apply 2 consecutive applications at re-treatment interval of 7-10 d]	R2

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Propineb + Oxadixyl (Rebound)	4+M3	Protectant	3	A	ALL	Registered in cucurbits for the control of Downy Mildew, Gummy Stem Blight, and **Anthracnose**. [Max. no. of applications not specified; 2 sequential applications; re-treatment interval: 7 – 10 d]	R2
Zineb	M3	Protectant	7	A	ALL	Registered in cucurbits for the control of Downy Mildew and **Anthracnose**. [Max. no. of applications not specified; re-treatment interval: 7 d]	R2
Aureobasidium pullulans (Botector) Nufarm	BM 02	Biological	NR	P-A		Registered in cucurbits (field & protected) for control of *Botrytis* and suppression of *Sclerotinia* spp. US registration for the control of **Anthracnose** in berries, stone fruit, almond, fruiting vegetables, cucurbits, leafy vegetables, ornamentals and hops.	-
Bacillus amyloliquefaciens (Serenade Opti) Bayer	BM 02	Biological		P		Registered for control of **Anthracnose** in avocado and several tropical fruits. US registration for the control of **Anthracnose** in berries, citrus, fruiting vegetables, herbs/spices, pome fruit, stone fruit and tree nuts.	-
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 **Anthracnose** in artichoke, asparagus, berries, citrus, cucurbits, fruiting vegetables, pome fruit, stone fruit, tobacco, root and tuber vegetables (except sugar beet) and tree nuts.	-
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 **Anthracnose** in grapes and strawberries, and for control of Powdery Mildew in cucurbits.	-
Florylpicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis, **Anthracnose**, Alternaria, Scab, Monilinia, Rust and *Mycosphaerella* spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of **Anthracnose** in almond, cucurbits and tree nuts.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protective & Curative		P		Registered for control of **Anthracnose** and Stem End Rot in tropical and sub-tropical fruit. US registration for control of **Anthracnose** in almond, berries, cherry, citrus, specific cucurbits, tree nuts, tomato and root vegetables (except sugar beet).	-
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of Alternaria Leaf Spot, Black Spot, Brown Rot Nut Scab, Shot Hole and Rust in almond, Brown Rot in cherries and Husk Spot in macadamia. US registration for control of Alternaria Leaf Blight, Powdery Mildew, **Anthracnose**, Cercospora Leaf Spot, Gummy Stem Blight, Microdochium Blight, Target Leaf Spot and suppression of Downy Mildew in cucurbits.	-
Isofetamid (Kenja) ISK / AgNova	7	Protective & Curative		P	ALL	Registered for control of Botrytis Grey Mould in berries. US registration for control of **Anthracnose** in almond, grapes and low-growing berries.	-
Pydiflumetofen + Difenonazole (Miravis Duo) Syngenta	7+3	Protectant & Curative		P		Application for registration submitted in June 2021 for control of various diseases in cucurbits. US registration for control of **Anthracnose** in almonds, stone fruit and tree nuts.	R3
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of Botrytis in berries and grapes, and Botrytis and Sclerotinia in leafy vegetables and potato. US registration for control of **Anthracnose** in berries and tuberous and corm vegetables, suppression of **Anthracnose** in lemons and limes, potato, and control of Alternaria, Cercospora, Gummy Stem Blight, Powdery Mildew, Scab, Septoria, Target Spot, Grey Mould and suppression of Fusarium Wilt in cucurbits.	R3
Bacterial Leaf Spot (*Xanthomonas campestris*) **Priority: Low**							
Bacterial Leaf Spot was ranked as a low priority in VIC. The bacterium may be introduced in seed or in surviving undecomposed crop residue or other host plants. Bacteria spread in water splash during wet, windy weather or by overhead irrigation. It can also disperse on insects, or on people or equipment moving through the crop. Applications of copper may reduce disease spread.							
Copper Ammonium Acetate	M1	Protectant	1	A	ALL	Registered in cucurbits for the control of Angular Leaf Spot, **Bacterial Leaf Spot** and Downy Mildew. Apply at first signs of disease. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Copper Hydroxide	M1	Protectant	1	A	ALL	Registered in cucurbits for the control of Angular Leaf Spot and **Bacterial Leaf Spot.** Apply at first signs of disease. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	-
Copper Oxychloride	M1	Protectant	1	A	ALL	Registered in cucurbits for control of Angular Leaf Spot, **Bacterial Leaf Spot**, Downy Mildew, Anthracnose and Gummy Stem Blight. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	-
Copper as Tribasic Copper Sulfate	M1	Protectant	1	A	ALL	Registered in cucurbits for the control of Angular Leaf Spot and **Bacterial Leaf Spot.** Apply at first signs of disease. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	-
Copper as Cuprous Oxide	M1	Protectant	1	A	ALL	Registered in cucurbits for the control of Angular Leaf Spot and **Bacterial Leaf Spot.** Apply at first signs of disease. [Max. no. of applications not specified; re-treatment interval: 7 - 10 d]	-
Bacillus amyloliquefaciens (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for suppression of **Bacterial Spot** in capsicum, chilli and tomato, Anthracnose and Stem End Rot in avocado and mango, and Botrytis in grapevines and strawberries. US registration for control of ***Xanthomonas* spp.** in fruiting vegetables, root/tuber and corm vegetables and stone fruit.	-
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 ***Xanthomonas* spp.** in citrus, fruiting vegetables, leafy vegetables, stone fruit, root and tuber vegetables and tree nuts, and control of Anthracnose, Alternaria Leaf Spot, Downy Mildew, Gummy Stem Blight and Powdery Mildew in cucurbits.	-
Acibenzolar-S-Methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		Registered in tomatoes for the suppression of Bacterial Speck, Bacterial Spot (***Xanthomonas* spp.**), Bacterial Canker and Powdery Mildew. US registration for suppression of ***Xanthomonas* spp.**in Brassica leafy vegetables, cucurbits, low growing berry, bulb onion, pepper and tomato.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Damping Off (*Pythium* spp., *Phytophthora* spp., *Fusarium* spp., *Rhizoctonia* spp.) **Priority: Low**							
Damping Off was ranked as a low priority in VIC. The disease attacks seedlings at the 1-2 leaf stage, causing water-soaked lesions on the stem and roots. Severe infections can cause stunting and yellowing in older crops.							
1,3-dichloropropene + Chloropicrin (Telone C-35)	8B	Soil fumigant	NR	A	ALL (Restricted use TAS, VIC & SA)	Registered in various crops including 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. [Users may require fumigator license]	-
Dazomet (Basamid)	8F	Soil fumigant	NR	A	ALL	Registered in broadacre seed beds for control of soil fungi (including *Pythium,* ***Phytophthora,*** *Fusarium,* and *Verticillium*), nematodes (cyst and non-cyst forming), soil insects and germinating seeds of weeds.	-
Metalaxyl-M (Ridomil Gold 25G) Syngenta	4	Protectant	7	A	QLD, NSW & WA	Registered in cucurbits for control of **Damping Off**. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	-
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of fungal 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.	-
Streptomyces lydicus (Actinovate)	BM 02	Biological	NR	A	ALL	Registered in cucurbits for suppression of Powdery Mildew and as a seed treatment in vegetables for control of **Fusarium**, **Rhizoctonia** and **Pythium**.	-
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.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Amisulbrom (Amishield 500WG) Nufarm	21	Protectant		P		Registered for control of Clubroot and suppression of **Damping Off** in brassica vegetables, and control of Powdery Scab and suppression of Pink Rot in potatoes.	-
Fludioxonil + Metalaxyl-M (Maxim XL) Syngenta	12+4	Protectant & Curative		P		Registered for control of **Damping Off** in canola, industrial hemp, maize, oilseed mustard, silverbeet, sorghum, spinach and sweet corn.	R3
Fludioxonil + Metalaxyl-M + Azoxystrobin (Dynasty Seed Treatment) Syngenta	12+4 +11	Protectant & Curative		P		Registered for control of **Damping Off** in cotton.	R3
Fludioxonil + Sedaxane (Vibrance Premium Seed Treatment) Syngenta	12+7	Protectant & Curative		P		Registered in potatoes for control of Black Scurf (***Rhizoctonia***), Silver Surf, Black Rot, Gangrene and Fusarium Dry Rot and suppression of Scab. Hort innovation is conducting research for use in beetroot to control ***Rhizoctonia***.	R3
NUL3163 Nufarm	TBC			P		New active in development from Nufarm with activity on ***Fusarium***, ***Pythium*** & ***Rhizoctonia*.**	-
Thiophanate-Methyl + Etridiazole (Banrot)	1+14	Protectant		P		Registered in container grown ornamentals and in ground bedding plants as a post plant soil drench for control of ***Pythium, Phytophthora, Rhizoctonia*** and *Thielaviopsis*.	-
Thiram + Thiabendazole (P-Pickel T)	1+M3	Protectant		P		Registered in field & garden peas for control of Black Spot (*Mycosphaerella pinodes*) & Seedling Root Rots (***Fusarium, Pythium*** & *Macrofomina* spp.). Use as a liquid seed dressing.	R2

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Phytophthora Soil Fungus (*Phytophthora* spp.) **Priority: Low**							
Phytophthora Soil Fungus was ranked as a low priority in VIC. A soil-borne disease that is widespread in most regions, it enters through the roots and the leaves of affected plants show yellowing, curling and eventually wither and decay. Cultural controls recommended including crop rotation, improving drainage and the use of resistant varieties.							
1,3-dichloropropene + Chloropicrin (Telone C-35)	8B	Soil fumigant	NR	A	ALL (Restricted use TAS, VIC & SA)	Registered in various crops including 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. [Users may require fumigator license]	-
Dazomet (Basamid)	8F	Soil fumigant	NR	A	ALL	Registered in broadacre seed beds for control of soil fungi (including *Pythium,* ***Phytophthora,*** *Fusarium,* and *Verticillium*), nematodes (cyst and non-cyst forming), soil insects and germinating seeds of weeds.	-
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of fungal 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.	-
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.	-
Streptomyces lydicus (Actinovate)	BM 02	Biological	NR	P-A	ALL	Registered in cucurbits for suppression of Powdery Mildew and as a seed treatment in vegetables for control of Fusarium, Rhizoctonia and Pythium. Registered for control of **Phytophthora** in strawberries and tomato.	-
Metalaxyl-M (Ridomil Gold 25G) Syngenta	4	Protectant	7	P-A	QLD, NSW & WA	Registered in cucurbits (field & protected) for control of Damping Off. Registered for control of **Phytophthora Root Rot** in avocado and macadamia.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Oxathiapiprolin (Zorvec Enicade) Corteva	49	Protectant	1	P-A	ALL	Registered in cucurbits for control of Downy Mildew. US registration for control of ***Phytophthora* spp.** in cucurbits, fruiting vegetables, ginseng, tuberous and corm vegetables and tobacco.	-
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 **Phytophthora Root Rot** in brassica leafy vegetables, citrus, cucurbits, corn, fruiting vegetables, legume vegetables, oilseeds, soybean, strawberries and root and tuber vegetables.	-
Fosetyl-Aluminium (Aliette) Bayer	33	Protectant		P		Registered for control of ***Phytophthora* spp.** in apples, peaches, avocados & pineapples.	-
Mandipropamid (Revus) Syngenta	40	Protectant		P		Registered for control of Downy Mildew in Asian leafy vegetables, brassica leafy vegetables, grapes, leafy vegetables, poppy oilseed, rocket, silverbeet and spinach. US registration for control of ***Phytophthora* spp.** in citrus, ginseng and potatoes, and suppression of Phytophthora spp. in cucurbits and fruiting vegetables.	-
Thiophanate-Methyl + Etridiazole (Banrot)	1+14	Protectant		P		Registered in container grown ornamentals and in ground bedding plants as a post plant soil drench for control of *Pythium,* ***Phytophthora,*** *Rhizoctonia* and *Thielaviopsis*.	-
Rhizoctonia Ground Rot (*Rhizoctonia solani*) **Priority: Low**							
Rhizoctonia Ground Rot was ranked as a low priority in VIC. A common soil-borne disease, the symptoms can vary from water-soaked cankers in stems and roots to damaged fruit that is growing near the ground.							
1,3-dichloropropene + Chloropicrin (Telone C-35)	8B	Soil fumigant	NR	A	ALL (Restricted use TAS, VIC & SA)	Registered in various crops including 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. [Users may require fumigator license]	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Chlorothalonil (Bravo)	M5	Protectant	1	A	ALL	Registered in cucurbits including squash for control of Downy Mildew, Gummy Stem Blight**,** Anthracnose, Alternaria Leaf Blight and Target Leaf Spot and suppression of **Belly Rot (*Rhizoctonia solani*)**. [Max. no. of applications not specified; re-treatment interval: 7 - 14 d]	R3
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of fungal 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.	-
Streptomyces lydicus (Actinovate)	BM 02	Biological	NR	A	ALL	Registered in cucurbits for suppression of Powdery Mildew and as a seed treatment in vegetables for control of Fusarium, **Rhizoctonia** and Pythium.	-
Bacillus amyloliquefaciens Strain QST 713 (Serenade Prime Soil Ameliorant & Biofungicide) Bayer	BM 02	Biological	NR	P-A	ALL	Registered in vegetables for application to soil to improve bioavailability of soil resources to horticultural crops.	-
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 ***Rhizoctonia* spp.** in artichoke, asparagus, brassica leafy vegetables, bulb vegetables, cucurbits, corn, fruiting vegetables, leafy vegetables, legume vegetables, oilseeds, soybean, strawberries and root and tuber vegetables.	-
Fludioxonil + Metalaxyl-M (Maxim XL) Syngenta	12+4	Protectant & Curative		P		Registered for the control of **Rhizoctonia Rot** in Canola seedlings and for control of Damping Off in canola, industrial hemp, maize, oilseed mustard, silverbeet, sorghum, spinach and sweet corn.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fludioxonil + Sedaxane (Vibrance Premium Seed Treatment) Syngenta	12+7	Protectant & Curative		P		Registered in potatoes for control of Black Scurf (***Rhizoctonia***), Silver Surf, Black Rot, Gangrene and Fusarium Dry Rot and suppression of Scab. Hort innovation is conducting research for use in beetroot to control ***Rhizoctonia***.	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 ***Rhizoctonia*** in cucurbits and for suppression of ***Rhizoctonia*** in Brassica leafy vegetables.	R3
NUL3163 Nufarm	TBC			P		New active in development from Nufarm with activity on *Fusarium, Pythium* & ***Rhizoctonia*.**	-
Penflufen+ Trifloxystrobin (Evergol Extend) Bayer	7+11	Protectant		P		Registered for control of ***Rhizoctonia* spp.** in canola, forage brassicas, pastures and cotton.	-
Thiophanate-Methyl + Etridiazole (Banrot)	1+14	Protectant		P		Registered in container grown ornamentals and in ground bedding plants as a post plant soil drench for control of *Pythium, Phytophthora,* ***Rhizoctonia*** and *Thielaviopsis*.	-
Scab (*Cladosporium* spp.) **Priority: Low**							
Scab was ranked as a low priority in VIC. Good on-farm sanitation is recommended.							
Azoxystrobin (Amistar)	11	Protectant & curative	1	P-A	ALL	Registered in cucurbits for the control of Powdery Mildew, Downy Mildew and Gummy Stem Blight. Registered for control of ***Cladosporium*** in passionfruit and Rubus.	-
Copper	M1	Protectant	1	P-A	ALL	Registered in cucurbits for control of Angular Leaf Spot, Bacterial Leaf Spot, Downy Mildew, Anthracnose and Gummy Stem Blight. Registered for control of **Scab (*Cladosporium carpophilum*)** in stone fruit.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Mancozeb	M3	Protectant	7	P-A	ALL	Registered in cucurbits (field) for control of Alternaria Spot, Anthracnose, Downy Mildew, Ring Spot, Gummy Stem Blight, and Septoria Spot. Registered for control of **Scab (*Cladosporium carpophilum*)** in stone fruit.	R2
Penthiopyrad (Fontelis) Corteva	7	Protectant	1	P-A	ALL	Registered in cucurbits (field and protected) for control of Botrytis Grey Mould, Powdery Mildew, and Gummy Stem Blight. Registered for control of **Scab (*Cladosporium carpophilum*)** in stone fruit.	-
Florylpicoxamid (Adavelt) Corteva	21	Protective & curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis, Anthracnose, Alternaria, **Scab**, Monilinia, Rust and *Mycosphaerella* spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of ***Cladosporium* spp.** in almond, bulb vegetables, stone fruit and tree nuts, and control of Powdery Mildew, Alternaria Leaf Spot, Gummy Stem Blight, Belly Rot and Anthracnose in cucurbits.	R3
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of ***Cladosporium* spp.** in almonds. US registration for control of **Scab** in stone fruit and tree nuts, and for control of Alternaria Leaf Blight, Powdery Mildew, Anthracnose, Cercospora Leaf Spot, Gummy Stem Blight, Microdochium Blight, Target Leaf Spot and suppression of Downy Mildew in cucurbits.	-
Pydiflumetofen + Difenonazole (Miravis Duo) Syngenta	7+3	Protectant & Curative		P		Application for registration submitted in June 2021 for control of various diseases in cucurbits. US registration for control of **Scab** in stone fruit and tree nuts.	R3
Septoria Spot (*Septoria cucurbitacearum*) **Priority: Low**							
Septoria Spot was ranked as a low priority in VIC. Septoria Spot is favoured by cool and wet conditions. It tends to occur mostly in autumn and winter. The fungus survives in several ways: it can survive on the old leaves removed at harvest, on weeds, and as spores on seed. The use of drip irrigation is recommended rather than sprinklers.							
Dimethomorph (Acrobat) BASF	40	Protectant	7	A	ALL	Registered in cucurbits for control of Downy Mildew, Anthracnose, Gummy Stem Blight, Alternaria Leaf Spot and **Septoria Spot**. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	**-**

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Dimethomorph + Mancozeb (Acrobat WDG) BASF	40+M3	Protectant	7	A	QLD & NT	Registered in cucurbits for control of Downy Mildew, Anthracnose, Gummy Stem Blight, Alternaria Leaf Spot and **Septoria Spot**. [Max. 4 applications per crop; re-treatment interval: 7-10 d]	R2
Copper	M1	Protectant	1	P-A	ALL	Registered in cucurbits for control of Angular Leaf Spot, Bacterial Leaf Spot, Downy Mildew, Anthracnose and Gummy Stem Blight. Registered for control of **Septoria Spot** in citrus, passionfruit, blackcurrant, flowers, parsnips and tomatoes.	-
Florylpicoxamid (Adavelt) Corteva	21	Protective & Curative		P		New active in development from Corteva with activity on **Septoria**, Powdery Mildew, Botrytis, Anthracnose, Alternaria, Scab, Monilinia, Rust and *Mycosphaerella* spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protective		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of **Septoria Spot** in dry and succulent beans and pistachio, and for control of Powdery Mildew, Alternaria Leaf Spot Gummy Stem Blight, Belly Rot and Anthracnose in cucurbits.	R3
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of Alternaria Leaf Spot, Black Spot, Brown Rot Nut Scab, Shot Hole and Rust in almond, Brown Rot in cherries and Husk Spot in macadamia. US registration for control of **Septoria Spot** in leafy vegetables, and for control of Alternaria Leaf Blight, Powdery Mildew, Anthracnose, Cercospora Leaf Spot, Gummy Stem Blight, Microdochium Blight, Target Leaf Spot and suppression of Downy Mildew in cucurbits.	-
Pydiflumetofen + Difenonazole (Miravis Duo) Syngenta	7+3	Protectant & Curative		P		Application for registration submitted in June 2021 for control of various diseases in cucurbits. US registration for control of ***Septoria* spp.** in pistachios and tree nuts.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Target Leaf Spot (*Cercospora citrulline*) **Priority: Low**							
Target Leaf Spot was ranked as a low priority in VIC. This disease is seed borne and can survive in crop trash. Disease free seeds and seedlings are essential for preventing the spread of this disease.							
Chlorothalonil (Bravo)	M5	Protectant	1	A	ALL	Registered in cucurbits including squash for control of Downy Mildew, Gummy Stem Blight**,** Anthracnose, Alternaria Leaf Blight and **Target Leaf Spot** and suppression of Belly Rot (*Rhizoctonia solani*). [Max. no. of applications not specified; re-treatment interval: 7 - 14 d]	R3
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Contact	1	P-A	ALL	Registered in cucurbits including squash for control of Powdery Mildew. Registered for control of **Cercospora Leaf Spot** in celery.	-
Mancozeb	M3	Protectant	7	P-A	ALL	Registered in cucurbits (field) for control of Alternaria Spot, Anthracnose, Downy Mildew, Ring Spot, Gummy Stem Blight, and Septoria Spot. Registered for control of **Cercospora Leaf Spot** in carrots, spinach, silverbeet and beetroot.	R2
Zineb	M3	Protectant	7	P-A	ALL	Registered in cucurbits for the control of Downy Mildew and Anthracnose. Registered for the control of **Cercospora Leaf Spot** in bananas, beets, carrots, cauliflower, cabbages and celery**.**	R2
Florylpicoxamid (Adavelt) Corteva	21	Protective & curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis, Anthracnose, Alternaria, Scab, Monilinia, Rust and *Mycosphaerella* spp. Activity on **Cercospora** unknown. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protective		P		Registered for control of Yellow Sigatoka, Leaf Speckle and Cordana Leaf Spot in bananas. US registration for control of ***Cercospora* spp.** in Brassica leafy vegetables and okra, and for control of Powdery Mildew, Alternaria Leaf Spot Gummy Stem Blight, Belly Rot and Anthracnose in cucurbits.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of *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 **Cercospora** in Brassica vegetables, Brassica leafy vegetables, carrot and leaf petioles.	-
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 **Cercospora** in cucurbits, leafy vegetables and root vegetables (except sugar beet).	-
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.	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of Botrytis in berries and grapes, and Botrytis and Sclerotinia in leafy vegetables and potato. US registration for control of **Cercospora** in brassica vegetables, carrots, cucurbits, specific leaf petioles, root and tuber vegetables, mustard greens (suppression), root vegetables and watercress.	R3
Viruses - Cucumber Green Mottle Mosaic Virus (CGMMV), Squash Mosaic Virus (SqMV) & Zucchini Yellow Mosaic Virus (ZYMV) **Priority: Low**							
Viruses were ranked as a low priority in VIC. Several viruses can infect cucurbits, including squash, with key differences in how the viruses are transmitted and spread and management options varying accordingly. Cucumber Green Mottle Mosaic Virus is seed-borne and is readily spread by contact within fields. Squash Mosaic Virus can also be introduced through seed, and secondary infection can occur via leaf-chewing beetles such as 28-spotted ladybird and by mechanical spread by workers and contaminated equipment. Zucchini Yellow Mosaic Virus is spread by many species of aphid with transmission occurring with a very short feeding time. Management options include the use of clean planting material, general farm hygiene, early detection and disposal of infected seedlings and resistant varieties. Control of insect vectors is usually ineffective due to the rapid transmission of the virus during feeding.							

4.2 Insect and mite pests of squash

4.2.1 Insect and mite pest priorities

Common name	Scientific name
High	
Green Peach Aphid	*Myzus persicae*
Cotton Bollworm / Corn Earworm	*Helicoverpa armigera*
Native Budworm	*Helicoverpa punctigera*
Western Flower Thrips	*Frankliniella occidentalis*
Tomato Thrips	*Frankliniella schultzei*
Plague Thrips	*Thrips imaginis*
Moderate	
Two-Spotted Mite	*Tetranychus urticae*
Rutherglen Bug	*Nysius vinitor*
Silverleaf Whitefly	*Bemisia tabaci*
Greenhouse Whitefly	*Trialeurodes vaporariorum*
Low	
Cucumber Fly	*Bactrocera cucumis*
28-Spotted Potato Ladybird Beetle	*Henosepilachna vigintisexpunctata*
Pumpkin Beetle	*Aulacophora hilaris*
Ants	Formicidae
Cucumber Moth	*Diaphania indica*
Fungus Gnats	*Bradysia* spp., Sciaridae
Green Vegetable Bug	*Nezara viridula*
Mealybug	Pseudococcidae
Jassids / Leafhoppers	Cicadellidae
Wingless Grasshopper	*Phaulacridium vittatum*

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

Unknown priority	
Fall Armyworm	*Spodoptera frugiperda*
Tomato Potato Psyllid	*Bactericera cockerelli*
Tomato Red Spider Mite	*Tetranychus evansi*
Vegetable Leafminer	*Liriomyza sativae*
Pea Leaf Miner/Serpentine Leaf Miner	*Liriomyza huidobrensis*
American Serpentine Leaf miner	*Liriomyza trifolii*

The three highest priority insect pests identified by the survey are Green Peach Aphids, *Helicoverpa* spp. and Western Flower Thrips. Available and potential products for all these insects and mites are in Section 4.2.2.

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

There are several insecticide management strategies that apply to squash on the CropLife website[7], including Silverleaf Whitefly, Mites, Thrips & Aphids.

Further development and extension of IPM strategies and best management practices that can be implemented in the management of sucking insects and mites in squash may be warranted.

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

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Green Peach Aphid (*Myzus persicae*) **Priority: High**								
Aphids, especially Green Peach Aphid, were ranked as a high priority in VIC. Aphids suck on sap, causing 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. Green Peach Aphid is a vector for Zucchini Yellow Mosaic Virus.								
Afidopyropen (Versys) BASF	9D	Ingestion	1	A	ALL	Registered in cucurbits for the control of **Green Peach Aphid**, Cabbage Aphid, Currant Lettuce Aphid and Cotton/Melon Aphids and suppression of Silverleaf Whitefly. [Max. 2 applications per crop; re-treatment interval 14 d]	L Bee:L	-
Beauveria bassiana (Velifer) BASF	UNF	Biological	NR	A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including: Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, **Green Peach Aphid** & Two-Spotted Spider Mites. [Max. 3 application per crop; re-treatment interval 3-14 d]	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Diafenthiuron + Cyantraniliprole (Minecto Forte) Syngenta	12A+28	Contact & Ingestion	1	A	ALL	Registered in cucurbits and fruiting vegetables (field only) for control of Silverleaf Whitefly, Heliothis, Potato Moth, Cucumber Moth, Cluster Caterpillar, **Green Peach Aphid,** Two-Spotted Mite and suppression of Western Flower Thrips, Tomato Thrips & Plague Thrips [Max. 2 applications per crop; do not apply consecutive applications; re-treatment interval 28 d].	M Bee:VH	-
Flonicamid (Mainman) UPL	9C	Ingestion	1	A	ALL	Registered in cucurbits for control of **Green Peach Aphid**, Melon Aphid, and Silverleaf Whitefly. [Max. 3 applications per crop; re-treatment interval 14 d]	M Bee:L	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, **Aphids**, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Imidacloprid (formulations suitable for foliar application 200SC, 350SC)	4A	Contact & Ingestion	1	A	ALL	Registered in cucurbits for control of **Green Peach Aphid** as a foliar treatment. [Max. no. of applications & re-treatment intervals not specified. Do not use consecutive applications]	M Bee:M	R2
Maldison	1B	Contact	3	A	ALL	Registered in vegetables including cucurbits for control of **Aphid**, Green Vegetable Bug, Jassid, Leafhopper, Rutherglen Bug, Redlegged Earth Mite (excl. TAS) & 28-Spotted Ladybird (excl. TAS) [Apply at first sight of infestation: max no. of applications not specified]	H Bee:H	R3
Petroleum Oil	UN	Contact	1	A	ALL	Registered in cucurbits (field & protected) for control of **Aphids**, Mites, Thrips and Leafhopper. [Max. 4 applications per season; re-treatment intervals not specified]	VL Bee:L	-
Pirimicarb (Aphidex)	1A	Contact & Ingestion	2	A	ALL	Registered in cucurbits for control of **Aphids.** [Max. no. of applications not specified; re-treatment 5-10 d]	VL Bee:VL	R3
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of **Aphids**, Thrips, Mealybug, Two-Spotted Mites, Spider Mite and Whitefly. Apply when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Pymetrozine (Chess) Syngenta	9B	Ingestion	3	A	ALL	Registered in cucurbits (field and protected) for control of Melon Aphid, **Green Peach Aphid,** Potato Aphid and Cowpea Aphid; and for suppression of Silverleaf Whitefly and Greenhouse Whitefly. [Max. 2 applications per crop; re-treatment interval 7 d]	L Bee:VL	R3
Spirotetramat (Movento 240 SC) Bayer	23	Ingestion	1	A	ALL	Registered in cucurbits for the control of Silverleaf Whitefly, **Green Peach Aphid** and Cotton Aphid. [Max 3 applications per crop; re-treatment interval 7 d]	M Bee:VL	-
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	1	A	ALL	Registered in cucurbits (field grown only) for control of **Green Peach Aphid**, Melon Aphid and Greenhouse Whitefly and suppression of Rutherglen Bug. Do not use if honeybees are foraging. [Max. no. of applications not specified; re-treatment interval 7-10 d]	M Bee:VH	-
Cyantraniliprole (Benevia) FMC	28	Ingestion	1	P-A	ALL	Registered in cucurbits for the control of Melon Aphid, Silverleaf Whitefly, Cotton Bollworm, Cucumber Moth, Native Budworm & suppression of Western Flower Thrips. Registered for control of **Green Peach Aphid** in strawberries and suppression of **Green Peach Aphid** in fruiting vegetables and potatoes.	M Bee:VH	-
Emulsifiable Botanical Oil (Eco-Oil)	-	Contact		P-A		Registered in vegetables for control of Greenhouse Whitefly. Registered for control of Aphids in tomatoes, cucumbers, capsicums, strawberries and ornamentals.	L Bee:L	-
Dimpropyridaz (Axalion) BASF	TBC			P		BASF has applied for registration in leafy vegetables, brassica vegetables and fruiting vegetables, including cucurbits to control Whitefly, Aphids and **Thrips**. Pending regulatory approvals, first market introduction in Australia is expected by late 2022 or early 2023.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of **Green Peach Aphid** in cucurbits. Bayer has a pending label registration with the APVMA and if approved, Sivanto will be registered late 2021 in cucurbits for control of Silverleaf Whitefly, Greenhouse Whitefly, **Green Peach Aphid** & Cotton Aphid.	L Bee:VL	-
Novaluron + Acetamiprid (Cormoran) Adama	15+4A	Contact & Ingestion		P		Registered for control of **Green Peach Aphid** in stone fruit.	M Bee:M	R2
Cotton Bollworm / Corn Earworm (*Helicoverpa armigera*) **Native Budworm** (*Helicoverpa punctigera*) **Priority: High**								
Helicoverpa was ranked as a high priority in VIC. *Helicoverpa armigera* is generally regarded as the more serious pest because of its greater capacity to develop resistance to insecticides, broader host range, and persistence in cropping areas from year to year. Larvae feed on leaves but are most damaging when feeding on growing terminals, buds, flowers & fruit. Damage also occurs through bud/fruit shedding and reduced quality.								
Bacillus thuringiensis subsp. kurstaki (DiPel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Caterpillars, including ***Helicoverpa* spp.** [Apply a minimum of 2 sprays, 3 d apart; re-treatment interval 3-5 d]	VL Bee:L	-
Bifenthrin (Talstar)	3A	Contact	1	A	QLD, NSW, NT & WA	Registered in cucurbits (field grown only) for control of **Native Budworm**, **Corn Earworm**, Cucumber Moth and Silverleaf Whitefly. Target larvae < 5 mm in length. [Max. 2 applications per crop; re-treatment interval not specified]	VH Bee:H	R3
Chlorantraniliprole (Coragen) FMC	28	Ingestion	1	A	ALL	Registered in cucurbits for the control of **Cotton Bollworm**, **Native Budworm** and Cucumber Moth. [Max. 3 applications per crop, no more than 2 consecutive; re-treatment interval 5 d]	L Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cyantraniliprole (Benevia) FMC	28	Ingestion	1	A	ALL	Registered in cucurbits for the control of Melon Aphid, Silverleaf Whitefly, **Cotton Bollworm**, Cucumber Moth, **Native Budworm** & suppression Of Western Flower Thrips. [Max. 2 applications per crop; re-treatment interval 7-10 d]	M Bee:VH	-
Diafenthiuron + Cyantraniliprole (Minecto Forte) Syngenta	12A+28	Contact & Ingestion	1	A	ALL	Registered in cucurbits and fruiting vegetables. (field only) for control of Silverleaf Whitefly, **Heliothis**, Potato Moth, Cucumber Moth, Cluster Caterpillar, Green Peach Aphid, Two-Spotted Mite and suppression of Western Flower Thrips, Tomato Thrips & Plague Thrips [Max. 2 applications per crop; do not apply consecutive applications; re-treatment interval 28 d].	M Bee:VH	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in cucurbits (field & protected) for control of **Heliothis**, Cluster Caterpillar and Cucumber Moth. [Max. 4 applications per crop; re-treatment interval 7 d]	M Bee:H	-
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in cucurbits for the control of ***Helicoverpa* spp.** and Cucumber Moth. [Max. 3 applications per crop; re-treatment interval 7-14 d]	L-M Bee:L	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, **Caterpillars**, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Helicoverpa NPV (Vivus Max) AgBiTech	31	Biological	NR	A	ALL	Registered in cucurbits for control of ***Helicoverpa* spp.** Effective on larvae of <7 mm. [Max no. of applications not specified; re-treatment interval 2-3 d]	VL Bee:L	-
Indoxacarb (Avatar eVo) FMC	28	Ingestion	3 NG	A	ALL	Registered in cucurbits (field) for control of **Cotton Bollworm**, **Native Budworm** and Cluster Caterpillar. [Max. 3 applications per crop, no more than 2 consecutive; min. re-treatment interval 7 d]	M Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Methomyl (Lannate) PER82428	1A	Contact	3	A	ALL	Permitted for use in cucurbits including squash (field) for control of ***Helicoverpa* spp.**, Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug and Thrips including Western Flower Thrips. [Max. 6 applications per season; re-treatment intervals not specified]	VL Bee:L	-
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in cucurbits including squash (field & protected) for control of ***Helicoverpa***, Cucumber Moth & Western Flower Thrips. [Max 4 applications per crop; re-treatment interval: 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in cucurbits (field & protected) for control of Cucumber Moth, ***Helicoverpa*** & Western Flower Thrips. [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-
Broflanilide (Vedira) BASF	30	Contact & Ingestion		P		Pending registration as an ant bait. It also has potential uses as a seed treatment for the control of Wireworms, and a foliar treatment for the control of chewing pests in various crops.	-	-
Clitoria ternatea Extract (Sero-X) Growth Agriculture	-	Biological	NR	P		Registered in cotton for control of ***Helicoverpa* spp.**, Green Mirids and Silverleaf Whitefly and in brassica leafy vegetables for control of Diamondback Moth. Label extension has been submitted seeking to add new uses for control of Silverleaf Whitefly and Thrips in brassicas and cucurbits.	L Bee VL	-
Indoxacarb + Novaluron (Plemax) Adama	22A+15	Contact & Ingestion		P		Registered for the control of various Lepidoptera, including ***Helicoverpa* spp.** in brassica vegetables, leafy vegetables and fruiting vegetables.	M Bee:H	R3
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on **Lepidoptera**, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for control of Thrips, Bugs, Mites and **Caterpillars**.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Western Flower Thrips (*Frankliniella occidentalis*) **Tomato Thrips** (*Frankliniella schultzei*) **Plague Thrips** (*Thrips imaginis*) **Priority: High**								
Western Flower Thrips were ranked as a high priority in VIC and other thrips were rated as a moderate priority. Growers find it difficult to distinguish between thrips species in the field and that all thrips are managed the same. Thrips cause direct feeding damage to foliage and fruit by piercing and rasping leaves. This damage can lead to yield loss. Thrips are vectors for many viruses including Tomato Spotted Wilt Virus. MT16009 IPM Project Recommends: The use of predatory thrips, mites & bug releases, control flowering weeds, mulch and use of certified seed.								
Beauveria bassiana (Velifer) BASF	UNF	Biological	NR	A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including: **Western Flower Thrips**, **Onion Thrips**, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites. [Max. 3 application per crop; re-treatment interval 3-14 d]	L Bee:L	-
Cyantraniliprole (Benevia) FMC	28	Ingestion	1	A	ALL	Registered in cucurbits for the control of Melon aphid, Silverleaf Whitefly, Cotton Bollworm, Cucumber Moth, Native Budworm & suppression of **Western Flower Thrips**. [Max. 2 applications per crop; re-treatment interval 7-10 d]	M Bee:VH	-
Diafenthiuron + Cyantraniliprole (Minecto Forte) Syngenta	12A+28	Contact & Ingestion	1	A	ALL	Registered in cucurbits and fruiting vegetables (field only) for control of Silverleaf Whitefly, Heliothis, Potato Moth, Cucumber Moth, Cluster Caterpillar, Green Peach Aphid**,** Two-Spotted Mite and suppression of **Western Flower Thrips**, **Tomato Thrips** & **Plague Thrips**. [Max. 2 applications per crop; do not apply consecutive applications; re-treatment interval 28 d].	M Bee:VH	-
Diazinon	1B	Contact	14 G:14	A	ALL (excl. TAS)	Registered in cucurbits for control of **Thrips**. [Max no. of applications and re-treatment interval not specified]	H Bee:VH	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs, Whitefly, **Thrips** and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Methomyl (Lannate) PER82428	1A	Contact	3	A	ALL	Permitted for use in cucurbits including squash (field) for control of *Helicoverpa* spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug and Thrips including **Western Flower Thrips**. [Max. 6 applications per season; re-treatment intervals not specified]	VL Bee:L	-
Petroleum Oil	UN	Contact	1	A	ALL	Registered in cucurbits (field & protected) for control of Aphids, Mites, **Thrips** and Leafhopper. [Max. 4 applications per season; re-treatment intervals not specified]	VL Bee:L	-
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of Aphids, **Thrips**, Mealybug, Two-Spotted Mites, Spider Mite and Whitefly. Apply when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in cucurbits including squash (field & protected) for control of *Helicoverpa*, Cucumber Moth & **Western Flower Thrips**. [Max 4 applications per crop; re-treatment interval: 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in cucurbits (field & protected) for control of Cucumber Moth, *Helicoverpa* & **Western Flower Thrips**. [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-
Spirotetramat (Movento 240 SC) Bayer	23	Ingestion	1	P-A	A	Registered in cucurbits for control of Cotton Aphid, Green Peach Aphid & Silverleaf Whitefly. Registered for control of **Western Flower Thrips** and **Tomato Thrips** in green beans, control of **Western Flower Thrips**, **Tomato Thrips** and **Plague Thrips** in celery and rhubarb, herbs, bulb vegetables, and control of **Western Flower Thrips** in lettuce.	M Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Dimpropyridaz (Axalion) BASF	TBC			P		BASF has applied for registration in leafy vegetables, brassica vegetables and fruiting vegetables, including cucurbits to control Whitefly, Aphids and **Thrips**. Pending regulatory approvals, first market introduction in Australia is expected by late 2022 or early 2023.	-	-
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for suppression of **Thrips** in berries, citrus, fruiting vegetables, tropical and subtropical fruit, and control of Leafhoppers, Aphids, Squash Bug and Whitefly in cucurbits. Bayer has a pending label registration with the APVMA and if approved, Sivanto will be registered late 2021 in cucurbits for control of Silverleaf Whitefly, Greenhouse Whitefly, Green Peach Aphid & Cotton Aphid.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and **Thrips**.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for **Thrips**, Bugs, Mites and Caterpillars	-	-
Two-Spotted Mite (*Tetranychus urticae*) **Priority: Moderate**								
Two-Spotted Mite was ranked as a moderate priority in VIC. Mites feed on aerial parts of the plant causing loss of vigour and yield and may impact on fruit quality. Predatory mites (*Phytoseiulus persimilis*) can be released to assist with an IPM approach.								
Abamectin	6	Contact	3	A	ALL	Registered in squash for control of **Two-Spotted Mite**. [Max 2 applications per crop; re-treatment interval 28 d]	M Bee:H	-
Beauveria bassiana (Velifer) BASF	UNF	Biological	NR	A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including: Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & **Two-Spotted Spider Mites**. [Max. 3 application per crop; re-treatment interval 3-14 d]	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Bifenazate (Acramite) UPL	20D	Contact	1	A	ALL	Registered in cucurbits for control of **Two-Spotted Mite** and Bryobia Mite. [Max. 1 application per season]	L Bee:H	-
Diafenthiuron + Cyantraniliprole (Minecto Forte) Syngenta	12A+28	Contact & Ingestion	1	A	ALL	Registered in cucurbits and fruiting vegetables (field only) for control of Silverleaf Whitefly, Heliothis, Potato Moth, Cucumber Moth, Cluster Caterpillar, Green Peach Aphid, **Two-Spotted Mite** and suppression of Western Flower Thrips, Tomato Thrips & Plague Thrips [Max. 2 applications per crop; do not apply consecutive applications; re-treatment interval 28 d].	M Bee:VH	-
Etoxazole (Paramite) Sumitomo PER82460	10B	Contact	7	A	ALL (excl. VIC)	Permitted for use in cucurbits including squash (field & protected) for control of **Two-Spotted Mite** and Tomato Red Spider Mite. [Max. 1 application per crop]	L Bee:VL	-
Hexythiazox (Calibre) Nufarm PER14765	10A	Contact & Ingestion	3	A	ALL (excl. VIC)	Permitted for use in cucurbits including squash (field & protected) for control of Tomato Russet Mite, Broad Mite, Tomato Red Mite and **Two Spotted Mite**. [Max. 1 application per crop]	L Bee:L	-
Petroleum Oil	UN	Contact	1	A	ALL	Registered in cucurbits (field & protected) for control of Aphids, **Mites**, Thrips and Leafhopper. [Max. 4 applications per season; re-treatment intervals not specified]	VL Bee:L	-
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of Aphids, Thrips, Mealybug, **Two-Spotted Mites**, Spider Mite and Whitefly. Apply when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Propargite (Omite)	12C	Contact	7	A	ALL	Registered in vegetables (field & protected) for control of **Two Spotted Mite**. Apply at first appearance and repeat as necessary. [Max no. of applications per crop and re-treatment interval not specified]	M Bee:L	R3
Sulphur	UN	Contact	NR	A	VIC, TAS, SA & WA	Registered in vegetables (field & protected) for control of **Two-Spotted Mite**. [Max no. of applications not specified; re-treatment interval 14-21 d]	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Acequinocyl (Kanemite) UPL	20B	Contact & Ingestion		P		Registered for control of Two-Spotted Mite in pome and stone fruit. Canadian registration for control of **Two-Spotted Spider Mite** and **Spruce Spider Mites** in greenhouse ornamentals, and **Two-Spotted Spider Mite** in Greenhouse tomato, pepper, eggplant & cucumber.	L Bee:L	-
Cyflumetofen (Danisaraba) BASF	25A	Contact		P		BASF is seeking registration in Australia for the control of Spider Mites in various crops.	L Bee:L	-
Spiromesifen (Oberon) Bayer	23	Ingestion		P		Australian Registration pending for control of **Mites** in various vegetables crops, including cucurbits. Hort Innovation project ST19020 is undertaking data generation for a new label registration to control **Two-Spotted Mite** in cucurbits.	M Bee:VL	-
Rutherglen Bug (*Nysius vinitor*) **Priority: Moderate**								
Rutherglen Bug was ranked as a moderate priority in VIC. They breed on weeds, moving to available crops or weeds when hosts die off. It is important to monitor crops for eggs and nymphs by regular field scouting. Repeated influxes of migrating adults can make repeat insecticide applications necessary. Large numbers can cause significant feeding damage to foliage by sucking the sap and depleting the crop of nutrients.								
Maldison	1B	Contact	3	A	ALL	Registered in vegetables including cucurbits for control of Aphid, Green Vegetable Bug, Jassid, Leafhopper, **Rutherglen Bug**, Redlegged Earth Mite (excl. TAS) & 28-Spotted Ladybird (excl. TAS) [Apply at first sight of infestation: max no. of applications not specified]	H Bee:H	R3
Methomyl (Lannate) PER82428	1A	Contact	3	A	ALL	Permitted for use in cucurbits including squash (field) for control of *Helicoverpa* spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, **Rutherglen Bug** and Thrips including Western Flower Thrips. [Max. 6 applications per season; re-treatment intervals not specified]	VL Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	1	A	ALL	Registered in cucurbits (field grown only) for control of Green Peach Aphid, Melon Aphid and Greenhouse Whitefly and suppression of **Rutherglen Bug**. Do not use if honeybees are foraging. [Max. no. of applications not specified; re-treatment interval 7-10 d]	M Bee:VH	-
Trichlorfon (Lepidex)	1B	Contact	2	A	ALL	Registered in vegetables for control of Green Vegetable Bug and **Rutherglen Bug**. Apply at first sight of infestation. [Max no. of applications not specified; re-treatment interval 7-10 d]	H Bee:H	R2
Flonicamid (Mainman) UPL	9C	Ingestion	1 NG	P-A	ALL	Registered in cucurbits for control of Aphids and Silverleaf Whitefly; Aphids in potatoes; Aphids and Mealybugs in apples and pears; Aphids and Mirids in cotton. US registration for control of Aphids, Plant Bugs and Greenhouse Whitefly in cucurbits.	M Bee:L	-
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of Leafhoppers, Aphids, Squash Bug and Whitefly in cucurbits. Bayer has a pending label registration with the APVMA and if approved, Sivanto will be registered late 2021 in cucurbits for control of Silverleaf Whitefly, Greenhouse Whitefly, Green Peach Aphid & Cotton Aphid.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, **Bugs**, Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC	TBC		P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips, **Bugs**, Mites and Caterpillars.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Silverleaf Whitefly *(Bemisia tabaci)* **Greenhouse Whitefly** *(Trialeurodes vaporariorum)* **Priority: Moderate**								
Whiteflies were ranked as a moderate priority in VIC. High reproduction rate and short generation time results in large numbers that can retard plants through feeding damage. A significant problem is Silverleaf Whitefly's ability to develop resistance very quickly when insecticides are used repeatedly.								
Afidopyropen (Versys) BASF	9D	Ingestion	1	A	ALL	Registered in cucurbits for the control of Green Peach Aphid, Cabbage Aphid, Currant Lettuce Aphid and Cotton/Melon Aphids and suppression of **Silverleaf Whitefly**. [Max. 2 applications per crop; re-treatment interval 14 d]	L Bee:L	-
Beauveria bassiana (Velifer) BASF	UNF	Biological	NR	A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including: Western Flower Thrips, Onion Thrips, **Greenhouse Whitefly**, **Silverleaf Whitefly**, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites. [Max. 3 application per crop; re-treatment interval 3-14 d]	L Bee:L	-
Bifenthrin (Talstar)	3A	Contact	1	A	QLD, NSW, NT & WA	Registered in cucurbits (field grown only) for control of Native Budworm, Corn Earworm, Cucumber Moth and **Silverleaf Whitefly**. Adult insects should be targeted. [Max. 2 applications per crop; re-treatment interval not specified]	VH Bee:H	R3
Buprofezin (Applaud) Corteva PER82467	16	Ingestion / IGR	3	A	ALL (excl. VIC)	Permitted for use in cucurbits (field & protected) for control of **Greenhouse Whitefly**, Sweet Potato Whitefly and **Silverleaf Whitefly**. [Max. 2 applications per crop; re-treatment interval 14 d]	L Bee:L	-
Chlorpyrifos (Lorsban)	1B	Contact	5	A	NSW, WA & ACT	Registered in cucurbits for control of **Whiteflies**. [Max. no. of applications not specified; re-treatment interval 10-14 d]	H Bee:H	R1

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cyantraniliprole (Benevia) FMC	28	Ingestion	1	A	ALL	Registered in cucurbits for the control of Melon Aphid, **Silverleaf Whitefly**, Cotton Bollworm, Cucumber Moth, Native Budworm & suppression Of Western Flower Thrips. [Max. 2 applications per crop; re-treatment interval 7-10 d]	M Bee:VH	-
Diafenthiuron + Cyantraniliprole (Minecto Forte) Syngenta	12A+28	Contact & Ingestion	1	A	ALL	Registered in cucurbits and fruiting vegetables. (field only) for control of **Silverleaf Whitefly**, Heliothis, Potato Moth, Cucumber Moth, Cluster Caterpillar, Green Peach Aphid**,** Two-Spotted Mite and suppression of Western Flower Thrips, Tomato Thrips & Plague Thrips [Max. 2 applications per crop; do not apply consecutive applications; re-treatment interval 28 d].	M Bee:VH	-
Emulsifiable Botanical Oil (Eco-Oil)	-	Contact	NR	A	ALL	Registered in vegetables for control of **Greenhouse Whitefly.** [Max. 3 applications per crop; re-treatment interval 27-56 d]	L Bee:L	-
Flonicamid (Mainman) UPL	9C	Ingestion	1	A	ALL	Registered in cucurbits for control of Green Peach Aphid, Melon Aphid and **Silverleaf Whitefly**. [Max. 3 applications per crop; re-treatment interval 14 d]	M Bee:L	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs, **Whitefly**, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Imidacloprid (formulations suitable for soil application 350SC, 750WG)	4A	Contact & Ingestion	NR	A	ALL	Registered in cucurbits for control of **Silverleaf Whitefly** as a soil application. Applied either as sub-surface trickle irrigation injection 5-7 days after planting or as a furrow spray not earlier than 5 days pre-plant. [Max. 1 application per crop]	M Bee:M	R2
Petroleum Oil PER12221	UN	Contact	1	A	ALL (excl. VIC)	Permitted for use in cucurbits for control of **Greenhouse Whitefly** and **Silverleaf Whitefly**. [Max. no. of applications and re-treatment intervals not specified]	VL Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of Aphids, Thrips, Mealybug, Two-Spotted Mites, Spider Mite and **Whitefly**. Apply when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Pymetrozine (Chess) Syngenta	9B	Ingestion	3	A	ALL	Registered in cucurbits (field and protected) for control of Melon Aphid, Green Peach Aphid, Potato Aphid and Cowpea Aphid; and for suppression of **Silverleaf Whitefly** and **Greenhouse Whitefly**. [Max. 2 applications per crop; re-treatment interval 7 d]	L Bee:VL	R3
Pyriproxyfen (Admiral) Sumitomo	7C	Ingestion / IGR	1 NG	A	ALL	Registered in cucurbits for control of **Silverleaf Whitefly** biotype B) and Greenhouse Whitefly. [Max. 2 applications per season; re-treatment interval 14 d]	VL Bee:L	-
Spirotetramat (Movento 240 SC) Bayer	23	Ingestion	1	A	ALL	Registered in cucurbits for the control of **Silverleaf Whitefly**, Green Peach Aphid and Cotton Aphid. [Max 3 applications per crop; re-treatment interval 7 d]	M Bee:VL	-
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	1	A	ALL	Registered in cucurbits (field grown only) for control of Green Peach Aphid, Melon Aphid and **Greenhouse Whitefly** and suppression of Rutherglen Bug. Do not use if honeybees are foraging. [Max. no. of applications not specified; re-treatment interval 7-10 d]	M Bee:VH	-
Clitoria ternatea Extract (Sero-X) Growth Agriculture	-	Biological	NR	P		Registered for control of *Helicoverpa* spp., Green Mirids and **Silverleaf Whitefly** in cotton and for control of Diamondback Moth in brassica leafy vegetables.	L Bee:VL	-
Dimpropyridaz (Axalion) BASF	TBC			P		BASF has applied for registration in leafy vegetables, brassica vegetables and fruiting vegetables, including cucurbits to control **Whitefly**, Aphids and Thrips. Pending regulatory approvals, first market introduction in Australia is expected by late 2022 or early 2023.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of **Whitefly** in cucurbits. Bayer has a pending label registration with the APVMA and if approved, Sivanto will be registered late 2021 in cucurbits for control of **Silverleaf Whitefly**, **Greenhouse Whitefly**, Green Peach Aphid & Cotton Aphid.	L Bee:VL	-
NUL3145 Nufarm	TBC			P		New product from Nufarm with activity on Scale, Nematodes, Mealybug and **Whitefly**.	-	-
Cucumber Fly (*Bactrocera cucumis*) **Priority: Low**								
Cucumber Fly was ranked as a low priority in VIC. *Bactrocera* spp. usually attacks fruits and cause rots and discolouration. Eggs are laid close to the surface inside the fruit with small, discoloured patches developing because of the stings.								
Alpha-Cypermethrin PER80138	3A	Contact	1	A	ALL (excl. VIC)	Permitted for use in cucurbits (field) for control of **Cucumber Fruit Fly**. [Max. 3 applications per crop; 2 sequential; re-treatment interval 7 d]	VH Bee:H	-
Clothianidin (Samurai) PER80101	4A	Contact & Ingestion	7 NG	A	ALL	Permitted for use in cucurbits (field) for control of **Cucumber Fruit Fly**. [Max. 2 applications per crop; re-treatment interval 7 d]	M Bee:VH	R2
Spinosad (Naturalure) Corteva	5	Ingestion	NR	A	ALL	Registered in vegetables for control of **Fruit Fly** as a bait spray. [Max. no. of applications not specified; re-treatment interval 7 d]	L Bee:L	-
Acetamiprid + Pyriproxyfen (Trivor) Adama	4A+7C	Contact & Ingestion / IGR		P		Registered for suppression of Queensland Fruit Fly and Mediterranean Fruit Fly in avocado, citrus and mango.	M Bee:M	R2
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, **Fruit Fly** and Thrips.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
28-Spotted Potato Ladybird Beetle (*Henosepilachna vigintisexpunctata*) **Priority: Low**								
28-Spotted Potato Ladybird ranked as a low priority in VIC. The larvae graze the under surface, leaving the upper surface intact whereas the adults feed on both sides of the leaf, often making holes as they chew. Ladybirds are also a vector for the spread of Squash Mosaic Virus.								
Maldison	1B	Contact	3	A	ALL	Registered in vegetables including cucurbits for control of Aphid, Green Vegetable Bug, Jassid, Leafhopper, Rutherglen Bug, Redlegged Earth Mite (excl. TAS) & **28-Spotted Ladybird** (excl. TAS) [Apply at first sight of infestation: max no. of applications not specified]	H Bee:H	R3
Spinosad (Entrust Organic) Corteva	5	Contact and ingestion	3 G:14	P-A	ALL	Registered in cucurbits for control of Cucumber Moth, Helicoverpa & Western Flower Thrips. US registration for control of various beetles in asparagus, brassica leafy vegetables, bulb vegetables, ornamentals, root and tuber vegetables, spices and fruiting vegetables.	L Bee:L	-
Cyantraniliprole + Thiamethoxam (Spinner) Syngenta	4A+28	Contact & Ingestion		P		Registered for control of Cutworms, Armyworms, African Black Beetle larvae, Argentinian Scarab larvae and Stem Weevil larvae in turf. Canadian registration for control of various beetles in potatoes, leafy vegetables and brassica vegetables.	M Bee:VH	R2
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered in Australia in multiple crops for various insect pests such as **Beetles**, Weevils & Lepidoptera. Hort Innovation has several projects underway towards assisting registration in minor crops.	M Bee:VH	-
Pumpkin Beetle (*Aulacophora hilaris*) **Priority: Low**								
Pumpkin Beetle was ranked as a low priority in VIC. Adults feed on leaves and seedlings are particularly susceptible. The damage to young plants can delay crop maturity. Damage also occurs to flowers and small fruit.								
Maldison	1B	Contact	3	A	SA, NSW, VIC, WA & NT	Registered in cucurbits for control of **Pumpkin Beetle**. [Max. no. of applications and re-treatment interval not specified]	H Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinosad (Entrust Organic) Corteva	5	Contact and ingestion	3 G:14	P-A	ALL	Registered in cucurbits for control of Cucumber Moth, Helicoverpa & Western Flower Thrips. US registration for control of various beetles in asparagus, brassica leafy vegetables, bulb vegetables, ornamentals, root and tuber vegetables, spices and fruiting vegetables.	L Bee:L	-
Cyantraniliprole + Thiamethoxam (Spinner) Syngenta	4A+28	Contact & Ingestion		P		Registered for control of Cutworms, Armyworms, African Black Beetle larvae, Argentinian Scarab larvae and Stem Weevil larvae in turf. Canadian registration for control of various beetles in potatoes, leafy vegetables and brassica vegetables.	M Bee:VH	R2
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on **Lepidoptera**, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered in Australia in multiple crops for various insect pests such as **Beetles**, Weevils & Lepidoptera. Hort Innovation has several projects underway towards assisting registration in minor crops.	M Bee:VH	-
Ants (Formicidae) **Priority: Low**								
Ants were ranked as a low priority in VIC. Chewing mouth parts can damage tender parts of the plants including flowers. This can lead to secondary fungal infections which can affect the yield and quality of crop.								
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of **Ants**, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Broflanilide (Vedira) BASF	30	Contact & Ingestion		P		Pending registration as an **Ant** bait.	H Bee:VH	-
Metaflumizone (Siesta Ant Bait) BASF	22B	Ingestion		P		Pending registration as an **Ant** bait.	M Bee:M	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Pyriproxyfen (Distance Ant Bait) Sumitomo	7C	IGR / Bait		P		Registered in fruit crops for control of invasive and nuisance **Ants**.	VL Bee L	-
Cucumber Moth (*Diaphania indica*) **Priority: Low**								
Cucumber Moth was ranked as a low priority in VIC. Larvae damage the crop by rolling the leaves with silken threads and eating the leaves between the veins. They will also attack flowers and reduce fruit set. Fruit quality can be impacted by feeding damage which leads to fungal rots.								
Bifenthrin (Talstar)	3A	Contact	1	A	QLD, NSW, NT & WA	Registered in cucurbits (field grown only) for control of Native Budworm, Corn Earworm, **Cucumber Moth** and Silverleaf Whitefly. Adult insects should be targeted. [Max. 2 applications per crop; re-treatment interval not specified]	VH Bee:H	R3
Chlorantraniliprole (Coragen) FMC	28	Ingestion	1	A	ALL	Registered in cucurbits for the control of Cotton Bollworm, Native Budworm and **Cucumber Moth**. [Max. 3 applications per crop, no more than 2 consecutive; re-treatment interval 5 d]	L Bee:VL	-
Cyantraniliprole (Benevia) FMC	28	Ingestion	1	A	ALL	Registered in cucurbits for the control of Melon Aphid, Silverleaf Whitefly, Cotton Bollworm, **Cucumber Moth**, Native Budworm & suppression Of Western Flower Thrips. [Max. 2 applications per crop; re-treatment interval 7-10 d]	M Bee:VH	-
Diafenthiuron + Cyantraniliprole (Minecto Forte) Syngenta	12A+28	Contact & Ingestion	1	A	ALL	Registered in cucurbits and fruiting vegetables. (field only) for control of Silverleaf Whitefly, Heliothis, Potato Moth, **Cucumber Moth**, Cluster Caterpillar, Green Peach Aphid**,** Two-Spotted Mite and suppression of Western Flower Thrips, Tomato Thrips & Plague Thrips [Max. 2 applications per crop; do not apply consecutive applications; re-treatment interval 28 d].	M Bee:VH	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	A	ALL	Registered in cucurbits (field & protected) for control of Heliothis, Cluster Caterpillar and **Cucumber Moth**. [Max. 4 applications per crop; re-treatment interval 7 d]	M Bee:H	-
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in cucurbits for the control of *Helicoverpa* spp. and **Cucumber Moth**. [Max. 3 applications per crop; re-treatment interval 7-14 d]	L-M Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, **Caterpillars**, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Methomyl (Lannate) PER82428	1A	Contact	3	A	ALL	Permitted in cucurbits including squash (field) for control of *Helicoverpa* spp., **Cucumber Moth**, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug and Thrips including Western Flower Thrips. [Max. 6 applications per season; re-treatment intervals not specified]	VL Bee:L	-
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in cucurbits (field & protected) for control of *Helicoverpa*, **Cucumber Moth** & Western Flower Thrips. [Max 4 applications per crop; re-treatment interval: 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in cucurbits (field & protected) for control of **Cucumber Moth**, *Helicoverpa* & Western Flower Thrips. [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-
Indoxacarb (Avatar eVo) FMC	28	Ingestion	3 NG	P-A	ALL	Registered in cucurbits (field) for control of Cotton Bollworm, Native Budworm and Cluster Caterpillar.	M Bee:H	R3
Indoxacarb + Novaluron (Plemax) Adama	22A+15	Contact & stomach		P		Registered for control of various Lepidoptera in brassica vegetables, leafy vegetables and fruiting vegetables.	L Bee:H	R3
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on **Lepidoptera**, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for control of Thrips, Bugs, Mites and **Caterpillars**.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Fungus Gnats (*Bradysia* spp., Sciaridae) **Priority: Low**								
Fungus Gnats were ranked as a low priority in VIC. They are small, mosquito-like flies which are a common problem in nurseries and greenhouses where propagation material and seedlings are being grown.								
Bacillus thuringiensis (Vertobac)	11A	Biological	NR	P		Permitted for control of **Fungus Gnats** in capsicums (protected situations only).	VL L-Bees	-
Green Vegetable Bug (*Nezara viridula*) **Priority: Low**								
Green Vegetable Bug were ranked as a low priority in VIC. They use their long, thin mouthpart to suck nutrients from the aerial parts of the plant and emit a foul smell when disturbed to deter predators. Nymphs are attacked by ants, spiders & predatory bugs. It is important to monitor crops for eggs and nymphs of pest species by regular field scouting.								
Maldison	1B	Contact	3	A	ALL	Registered in vegetables including cucurbits for control of Aphid, **Green Vegetable Bug**, Jassid, Leafhopper, Rutherglen Bug, Redlegged Earth Mite (excl. TAS) & 28-Spotted Ladybird (excl. TAS) [Apply at first sight of infestation: max no. of applications not specified]	H Bee:H	R3
Trichlorfon (Lepidex)	1B	Contact	2	A	ALL	Registered in vegetables for control of **Green Vegetable Bug** and Rutherglen Bug. Apply at first sight of infestation. [Max no. of applications not specified; re-treatment interval 7-10 d]	H Bee:H	R2
Flonicamid (Mainman) UPL	9C	Ingestion	1 NG	P-A	ALL	Registered in cucurbits for control of Aphids and Silverleaf Whitefly; Aphids in potatoes; Aphids and Mealybugs in apples and pears; Aphids and Mirids in cotton. US registration for control of Aphids, Plant Bugs and Greenhouse Whitefly in cucurbits.	M Bee:L	-
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	1	P-A	ALL	Registered in cucurbits (field grown only) for control of Green Peach Aphid, Melon Aphid and Greenhouse Whitefly and suppression of Rutherglen Bug. US registration for suppression of **Stink Bugs** in succulent, edible podded and dry beans.	M Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of Leafhoppers, Aphids, Squash Bug and Whitefly in cucurbits. Bayer has a pending label registration with the APVMA and if approved, Sivanto will be registered late 2021 in cucurbits for control of Silverleaf Whitefly, Greenhouse Whitefly, Green Peach Aphid & Cotton Aphid.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, **Bugs**, Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips, **Bugs**, Mites and Caterpillars.	-	-
Mealybug (Pseudococcidae) **Priority: Low**								
Mealybug were ranked as a low priority in VIC. They are small sap-sucking insects that are covered with a white mealy coating. Mealybugs excrete honey dew which ants like to feed on and also provides a perfect medium for sooty mould growth.								
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 when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Buprofezin (Applaud) Corteva PER82467	16	Ingestion / IGR	3	P-A	ALL (excl. VIC)	Permitted for use in cucurbits (field & protected) for control of Greenhouse Whitefly, Sweet Potato Whitefly and Silverleaf Whitefly. Registered for control of **Mealybug** in citrus, cotton, custard apple, grapes, passionfruit, pear and persimmon.	L Bee:L	-
Flonicamid (Mainman) UPL	9C	Ingestion	1 NG	P-A	ALL	Registered in cucurbits for control of Aphids and Silverleaf Whitefly. Registered for control of **Mealybugs** in apples and pears.	M Bee:L	-
Spirotetramat (Movento 240 SC) Bayer	23	Ingestion	1	P-A	A	Registered in cucurbits for control of Cotton Aphid, Green Peach Aphid & Silverleaf Whitefly. Registered for control of **Mealybugs** in citrus, cotton, grapes, mango, passionfruit, pome fruit and stone fruit.	M Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	1	P-A	ALL	Registered in cucurbits (field grown only) for control of Green Peach Aphid, Melon Aphid and Greenhouse Whitefly and suppression of Rutherglen Bug. Registered for control of **Mealybugs** in citrus, cotton, grapes, nashi pear and pome fruit.	M Bee:VH	-
Acetamiprid + Pyriproxyfen (Trivor) Adama	4A+7C	Contact & Ingestion / IGR		P		Registered for control of **Mealybugs** in citrus, grapes and macadamia.	M Bee:M	R2
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of Leafhoppers, Aphids, Squash Bug and Whitefly in cucurbits. Bayer has a pending label registration with the APVMA and if approved, Sivanto will be registered late 2021 in cucurbits for control of Silverleaf Whitefly, Greenhouse Whitefly, Green Peach Aphid & Cotton Aphid.	L Bee:VL	-
NUL3145 Nufarm	TBC			P		New product from Nufarm with activity on Scale, Nematodes, Mealybug and **Whitefly**.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips, **Bugs**, Mites and Caterpillars.	-	-
Jassids / Leafhoppers (Cicadellidae) **Priority: Low**								
Jassids and Leafhoppers were ranked as a low priority in VIC. Adult and nymph leafhoppers suck sap and inject toxins into the plant. Some leafhopper species transmit diseases such as viruses and phytoplasmas. Perimeter sprays may assist to minimise vector transmission.								
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and **Leafhoppers**. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Maldison	1B	Contact	3	A	ALL	Registered in vegetables including cucurbits for control of Aphid, Green Vegetable Bug, **Jassid**, **Leafhopper**, Rutherglen Bug, Redlegged Earth Mite (excl. TAS) & 28-Spotted Ladybird (excl. TAS) [Apply at first sight of infestation: max no. of applications not specified]	H Bee:H	R3
Petroleum Oil	UN	Contact	1	A	ALL	Registered in cucurbits (field & protected) for control of Aphids, Mites, Thrips and **Leafhopper**. [Max. 4 applications per season; re-treatment intervals not specified]	VL Bee:L	-
Buprofezin (Applaud) Corteva PER82467	16	Ingestion / IGR	3	P-A	ALL (excl. VIC)	Permitted for use in cucurbits (field & protected) for control of Greenhouse Whitefly, Sweet Potato Whitefly and Silverleaf Whitefly. Registered for control of **Leafhopper** in citrus.	L Bee:L	-
Sulfoxaflor (Transform) Corteva	4C	Contact and Ingestion	1	P-A	ALL	Registered in cucurbits (field grown only) for control of Green Peach Aphid, Melon Aphid and Greenhouse Whitefly and suppression of Rutherglen Bug. US registration for control of **Leafhoppers** in berries, pome fruit and root and tuber vegetables.	M Bee:H	-
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of **Leafhoppers** in cucurbits. Bayer has a pending label registration with the APVMA and if approved, Sivanto will be registered late 2021 in cucurbits for control of Silverleaf Whitefly, Greenhouse Whitefly, Green Peach Aphid & Cotton Aphid.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, **Bugs**, Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips, **Bugs**, Mites and Caterpillars.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Wingless Grasshopper (*Phaulacridium vittatum*) **Priority: Low**								
Wingless Grasshopper was ranked as a low priority in VIC. They have a voracious appetite and can cause severe damage to foliage if the numbers get high. Damage is limited to feeding on newly established plants and reducing plant populations.								
Fall Armyworm (*Spodoptera frugiperda*) **Priority: Unknown**								
Fall armyworm was not ranked as a pest in squash. It is an exotic pest that is considered a potential threat that could affect most vegetable crops if allowed to spread. It is important to monitor crops for eggs and larvae of pest species by regular field scouting. Target sprays against mature eggs and newly hatched larvae before pests become entrenched.								
Chlorantraniliprole (Coragen) FMC PER89259	28	Ingestion	1	A	ALL (excl. VIC)	Permitted for use in fruiting vegetables including cucurbits (field) for control of **Fall Armyworm**. [Max. 3 applications per crop; 2 consecutive; re-treatment interval 7 d]	L Bee:VL	-
Emamectin (Proclaim Opti) Syngenta PER89263	6	Ingestion	3 NG	A	ALL (excl. VIC)	Permitted for use in cucurbits (field & protected cropping) for control of **Fall Armyworm**. [Max 4 applications per crop; re-treatment interval: 7 d]	M Bee:H	-
Methomyl (Lannate) PER89293	1A	Contact	3	A	ALL (excl. VIC)	Permitted for use in fruiting vegetables including cucurbits (field only) for control of **Fall Armyworm**.[Max. 6 application per crop; re-treatment interval 7 d]	H Bee:H	R2
Spinetoram (Success Neo) Corteva PER89241	5	Ingestion	3	A	ALL (excl. VIC)	Permitted for use in fruiting vegetables including cucurbits (field) for control of **Fall Armyworm**. [Max. 4 applications per crop; re-treatment interval 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva PER89870	5	Ingestion	3 G:14	A	ALL (excl. VIC)	Permitted for use in cucurbits (field & protected cropping) for control of **Fall Armyworm**. [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Indoxacarb (Avatar eVo) FMC	28	Ingestion	3 NG	P-A	ALL	Registered in cucurbits (field) for control of Cotton Bollworm, Native Budworm and Cluster Caterpillar. Permitted for control of **Fall Armyworm** in broccoli, brussels sprouts, cabbage (closed head varieties only), cauliflower, celery, capsicum, eggplant, peppers tomato (field or trellis), leafy vegetables and chinese leafy vegetables.	M Bee:H	R3
Amorphous Silica (Abrade) Grow Choice	-	Contact		P		Registered for control of *Spodoptera* spp. in fruiting vegetables and permitted for (PER90841) control of **Fall Armyworm** in sweet corn.	L Bee:L	-
Broflanilide (Vedira) BASF	30	Contact & Ingestion		P		Registration submitted concurrently in Australia, Canada, USA, and Mexico as a soil application and seed treatment against chewing insects such as ants, cockroaches and ***Spodoptera* spp.** BASF are seeking registrations in amenity turf initially, then potential horticultural crops thereafter.	H Bee:VH	-
Magnet Insect Attractant Technology	-	Attractant		P		Permitted for control of **Fall Armyworm** in cotton, cereal grains, sweet corn, pastures & oilseeds**.**	-	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on **Lepidoptera**, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
Spodoptera frugiperda Multiple Nucleopolyhedrovirus (Fawligen) AgBiTech	31	Biological		P		Permitted for control of **Fall Armyworm** in legume vegetables, root & tuber vegetables & sweet corn.	VL Bee:L	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips, Bugs, Mites and **Caterpillars**.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered in Australia in multiple crops for various insect pests such as Beetles, Weevils & **Lepidoptera**. Hort Innovation has several projects underway towards assisting registration in minor crops. Indonesia registration for control of Liriomyza Leafminers and **Fall Armyworm** in vegetable crops.	M Bee:VH	-
Tomato Potato Psyllid (*Bactericera cockerelli*) **Priority: Unknown**								
Tomato potato psyllid was not ranked as a pest in squash. It is an exotic pest that is considered a potential threat that could affect most vegetable crops if allowed to spread.								
Cyantraniliprole (Benevia) FMC PER84805	28	Ingestion	1 NG	A	ALL (excl. VIC)	Permitted for use in fruiting vegetables (field) for control of **Tomato Potato Psyllid**. [Max. 2 application per crop; re-treatment interval 7-10 d]	M Bee:VH	-
Sulfoxaflor (Transform) Corteva PER84743	4C	Contact & Ingestion	1	A	ALL (excl. VIC)	Permitted for use in in fruiting vegetables (field) for control of **Tomato Potato Psyllid**. [Max. 4 applications per crop; 2 consecutive; re-treatment interval 7-10 d]	M Bee:VH	-
Abamectin	6	Contact	3	P-A	ALL	Registered in squash for control of Two-Spotted Mite. Registered for control of Tomato Potato Psyllid in cut flowers, fruiting vegetables and nursery stock.	M Bee:H	-
Spinetoram (Success Neo) Corteva	5	Ingestion	1	P-A	ALL	Registered in cucurbits for the control of Cucumber Moth, *Helicoverpa* spp. and Western Flower Thrips**.** Permitted for control of **Tomato Potato Psyllid** in fruiting vegetables and root/tuber vegetables.	M Bee:H	-
Spirotetramat (Movento 240 SC) Bayer	23	Ingestion	1	P-A	A	Registered in cucurbits for control of Cotton Aphid, Green Peach Aphid & Silverleaf Whitefly. Permitted for control of **Tomato Potato Psyllid** in potato, sweet potato, tomato, capsicum, chilli, pepper and eggplant.	M Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spiromesifen (Oberon) Bayer	23	Ingestion		P		Australian registration pending for control of Mites in various vegetables crops, including cucurbits. US registration for control of **Tomato Potato Psyllid** in tuberous and corm vegetables. Hort Innovation project ST19020 is undertaking data generation for a new label registration to control Two-Spotted Mite in cucurbits.	M Bee:VL	-
Tomato Red Spider Mite (*Tetranychus evansi*) **Priority: Unknown**								
Tomato red spider mite was not ranked as a pest in squash. Other industry sources indicate that it could be a potential threat.								
Abamectin PER14722	6	Contact	3	A	ALL (excl. VIC)	Permitted for use in cucurbits (field & protected) for control of **Tomato Red Spider Mite**. [Max 2 applications per crop; re-treatment interval 28 d]	M Bee:H	-
Etoxazole (Paramite) Sumitomo PER82460	10B	Contact	7	A	ALL (excl. VIC)	Permitted for use in cucurbits (field & protected) for control of Two-Spotted Mite and **Tomato Red Spider Mite**. [Max. 1 application per crop]	L Bee:VL	-
Hexythiazox (Calibre) Nufarm PER14765	10A	Contact & Ingestion	3	A	ALL (excl. VIC)	Permitted for use in cucurbits (field & protected) for control of Tomato Russet Mite, Broad Mite, **Tomato Red Mite** and Two Spotted Mite. [Max. 1 application per crop]	L Bee:L	-
Petroleum Oil	UN	Contact	1	A	ALL	Registered in cucurbits (field & protected) for control of Aphids, **Mites**, Thrips and Leafhopper. [Max. 4 applications per season; re-treatment intervals not specified]	VL Bee:L	-
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables for control of Aphids, Thrips, Mealybug, Two-Spotted Mites, **Spider Mite** and Whitefly. Apply when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Propargite (Omite)	12C	Contact	7	A	QLD & WA	Registered in vegetables (field & protected) for control of **Spider Mite**. Apply at first appearance and repeat as necessary. [Max no. of applications per crop and re-treatment interval not specified]	M Bee:L	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Beauveria bassiana (Velifer) BASF	UNF	Biological	NR	P-A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including: Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites.	L Bee:L	-
Cyflumetofen (Danisaraba) BASF	25A	Contact		P		BASF is seeking registration in Australia for the control of Spider Mites in various crops.	L Bee:L	-
Spiromesifen (Oberon) Bayer	23	Ingestion		P		Australian registration pending for control of **Mites** in various vegetable crops, including cucurbits. Hort Innovation project ST19020 is undertaking data generation for a new label registration to control Two-Spotted Mite in cucurbits.	M Bee:VL	-
SYNFOI21 Syngenta	New			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips, Bugs, **Mites** and Caterpillars.	-	-
Leafminers (*Liriomyza* spp.) **Priority: Unknown**								
Leaf miner was not ranked as a pest in squash. Dipteran Leaf miners (*Liriomyza* spp.) are exotic pests that have recently been detected and become problematic in Australia. For example, the Serpentine Leafminer was first detected in the Sydney area in October 2020 and has since been found in crops in SE Qld. As a group they are destructive pests and can cause significant economic loss through reduced yields and quality when uncontrolled.								
Abamectin PER81876	4C	Contact & Ingestion	7 NG	A	ALL (excl. VIC)	Permitted for use in fruiting vegetables including cucurbits (field) for suppression of **Leafminers** including **Vegetable Leafminer** and **Serpentine Leafminer**. [Max. 2 application per crop; re-treatment interval 7-14 d]	M Bee:H	-
Cyantraniliprole (Benevia) FMC PER90387	28	Ingestion	1 NG	A	ALL (excl. VIC)	Permitted for use in fruiting vegetables (field) for control of **Liriomyza Leafminers**. [Max. 2 application per crop; re-treatment interval 7 d]	M Bee:VH	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cyromazine (Diptex 150 WP) PER81867	17	Insect Growth Regulator	7 NG	A	ALL	Permitted for use in fruiting vegetables including cucurbits for control of ***Liriomyza*** species, including: **Vegetable Leafminer** and **Serpentine Leafminer**. [Max. 6 applications per crop; re-treatment interval 7 d]	-	-
Spinosad (Entrust Organic) Corteva PER90928	5	Ingestion	3	A	ALL (excl. VIC)	Permitted for use in cucurbits for control of ***Liriomyza*** species, including **Vegetable Leafminer**, **Pea Leafminer / Serpentine Leafminer** and **American Serpentine Leafminer**. [Max. 6 applications per crop; re-treatment interval 7 d]	L Bee:L	-
Chlorantraniliprole (Coragen) FMC	28	Ingestion	1	P-A	ALL	Registered in cucurbits for the control of Cotton Bollworm, Native Budworm and Cucumber Moth. Permitted for control of **Liriomyza Leafminers** in spinach and silverbeet.	L Bee:VL	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3 NG	P-A	ALL	Registered in cucurbits (field & protected) for control of Heliothis, Cluster Caterpillar and Cucumber Moth. Permitted for control of ***Liriomyza*** species, including **Vegetable Leafminer** in Brassica vegetables.	M Bee:H	-
Spinetoram (Success Neo) Corteva	5	Ingestion	1	P-A	ALL	Registered in cucurbits for the control of Cucumber Moth, *Helicoverpa* spp. and Western Flower Thrips**.** Permitted for control of **Liriomyza Leafminers** in snow peas, sugar snap peas and green beans.	M Bee:H	-
Spirotetramat (Movento 240 SC) Bayer	23	Ingestion	1	P-A	ALL	Registered in cucurbits for control of Cotton Aphid, Green Peach Aphid & Silverleaf Whitefly. Permitted for control of **Liriomyza Leafminers** in snow peas, sugar snap peas, lettuce, parsley, eggplant, capsicum, chilli, tomato, green beans, celery and rhubarb.	M Bee:VL	-
Tetraniliprole (Vayego 200 SC) Bayer	28	Ingestion		P		Registered in Australia in multiple crops for various insect pests such as Beetles, Weevils & Lepidoptera. Hort Innovation has several projects underway towards assisting registration in minor crops. Indonesia registration for control of **Liriomyza Leafminers** and Fall Armyworm in vegetable crops.	M Bee:VH	-

4.3 Weeds in squash

4.3.1 Weed priorities

Weed priorities are not available for Squash. However, a list has been compiled to include common weeds of cucurbits including Squash for which registered chemicals are available.

Common Name	Scientific Name
Amaranthus	*Amaranthus* spp.
Grass Weeds	*Poaceae*
Blackberry Nightshade	*Solanum nigrum*
Fat Hen	*Chenopodium album*
Nutgrass	*Cyperus rotundus*
Pig Weed	*Portulaca oleracea*
Soursob	*Oxalis pes-capre*

Management options include herbicides mentioned in section 4.3.2 below, Appendix 3 or by various management practices such as soil fumigation, pre-crop spraying, spot spraying, or using mechanical devices.

For weed management, some growers transplant seedlings to plastic mulch beds, with drip irrigation. 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. All the herbicides registered/permitted are either pre-emergent herbicides or early post-emergent herbicides. Most weeds can be controlled with currently available herbicides.

Resistance management
Of the weeds listed in the table above there are confirmed cases of resistance in Australia for Awnless Barnyard Grass (Group M at more than 200 sites), Feather Top Rhodes Grass (Group M at 4 sites) and Blackberry Nightshade (Group L at 2 sites).

Specific resistance management strategies for high resistance risk (A and B) and moderate resistance risk (C, D, F, G, I, J, K, L, M, N, Q and Z) herbicide modes of action are available on the CropLife Australia webpage[8].

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

4.3.2 Available and potential products for weed control

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

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

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Amaranthus (*Amaranthus spp.*) **Priority: Unknown**							
Amaranthus was not given any priority ranking at the recent survey. It is a short-lived annual weed that can pose a problem every year due to prolific production of seed.							
Clomazone	Q**	Cucurbits / Pre-emergent residual	Registered in cucurbits for control of various broadleaf weeds, including Amaranthus.	NR	A	ALL	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Amaranthus.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Amaranthus.	1 G:1	A	ALL	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of various grass and broadleaf weeds including Amaranthus in lettuce.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including Amaranthus in sweet corn, beans, peas, pumpkins and kabocha.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Phenmedipham (Betanal) Bayer	C**		Registered for control of grass and broadleaf weeds including Amaranthus in silverbeet and beetroot.		P		R3
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including Amaranthus in berries, tomatoes, beans and fallow.		P		R3
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including suppression of Amaranthus in Brassica vegetables, culinary herbs, rhubarb, spinach, silverbeet, spring onions, beans, sweet corn, sweet potato and fallow.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Amaranthus in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Grass Weeds (*Poaceae*) **Priority: Unknown**							
Grass Weeds were not ranked as priority. They can compete aggressively in-crop, particularly as the crop is establishing ground cover.							
Fluazifop-P Butyl (Fusilade)	A***	Cucurbits / Selective post-emergent	Registered as a selective post-emergence application in cucurbits for control of grass weeds.	21	A	ALL	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	1 G:1	A	ALL	R3
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds in sweet corn, beans, peas, pumpkins and kabocha.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds in berries, tomatoes, beans and fallow.		P		R3
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds in Brassica vegetables, culinary herbs, rhubarb, spinach, silverbeet, spring onions, beans, sweet corn, sweet potato and fallow.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
Propachlor (Ramrod) Nufarm	K**		Registered for control of broadleaf and grass weeds including **Fat Hen** in Brassica vegetables		P		R3
Blackberry Nightshade (*Solanum nigrum*) **Priority: Unknown**							
Blackberry Nightshade was not given any priority ranking at the recent survey. Prolific weed that is widely adapted and difficult to eradicate, mainly due to its long-term seed viability.							
Clomazone	Q**	Cucurbits / Pre-emergent residual	Registered in cucurbits for control of various broadleaf weeds, including **Blackberry Nightshade**.	NR	A	ALL	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Blackberry Nightshade**.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Blackberry Nightshade**.	1 G:1	A	ALL	R3
Aclonifen (Emerger) Bayer	H**	Pre-Emergence	Bayer is expected to seek registration for pre-emergent control of grass and broadleaf weeds in various vegetable crops. Registered in Europe for use in potatoes, legume vegetables and cereals. **Blackberry Nightshade** is listed as moderately susceptible at a high rate.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Chloridazon (Pyramin) BASF	C**		Registered for control of various grass and broadleaf weeds including **Blackberry Nightshade** in fodder beet, red beet and silver beet.		P		-
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of various grass and broadleaf weeds including **Blackberry Nightshade** in lettuce.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including **Blackberry Nightshade** in sweet corn, beans, peas, pumpkins and kabocha.		P		-
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including **Blackberry Nightshade** in Brassica vegetables, culinary herbs, rhubarb, spinach, silverbeet, spring onions, beans, sweet corn, sweet potato and fallow.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including **Blackberry Nightshade** in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including **Blackberry Nightshade** in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Phenmedipham (Betanal) Bayer	C**		Registered for control of grass and broadleaf weeds including **Blackberry Nightshade** in silverbeet and beetroot.		P		R3
Fat Hen (*Chenopodium album*) **Priority: Unknown**							
Fat Hen was not given any priority ranking at the recent survey. Herbicide control can be difficult and targeting weeds at early growth stages is critical.							
Clomazone	Q**	Cucurbits / Pre-emergent residual	Registered in cucurbits for control of various broadleaf weeds, including **Fat Hen**.	NR	A	ALL	-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Fat Hen**.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Fat Hen**.	1 G:1	A	ALL	R3
Aclonifen (Emerger) Bayer	H**	Pre-Emergence	Bayer is expected to seek registration for pre-emergent control of grass and broadleaf weeds in various vegetable crops. Registered in Europe for use in potatoes, legume vegetables and cereals. **Fat Hen** is listed as susceptible.		P		-
Bentazone (Basagran) BASF	C**		Registered in beans for control of several broad leaf weeds including **Fat hen**. [Max no. of applications and re-treatment interval not specified]		P		-
Chloridazon (Pyramin) BASF	C**		Registered for control of various grass and broadleaf weeds including **Fat Hen** in fodder beet, red beet and silver beet.		P		-
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of various grass and broadleaf weeds including **Fat Hen** in lettuce.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including **Fat Hen** in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including **Fat Hen** in berries, tomatoes, beans and fallow.		P		R3
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including **Fat Hen** in Brassica vegetables, culinary herbs, rhubarb, spinach, silverbeet, spring onions, beans, sweet corn, sweet potato and fallow.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including **Fat Hen** in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including **Fat Hen** in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Phenmedipham (Betanal) Bayer	C**		Registered for control of grass and broadleaf weeds including **Fat Hen** in silverbeet and beetroot.		P		R3
Propachlor (Ramrod) Nufarm	K**		Registered for control of broadleaf and grass weeds including **Fat Hen** in Brassica vegetables		P		R3
Nutgrass (*Cyperus rotundus*) **Priority: Unknown**							
Nutgrass was not given any priority ranking at the recent survey. Prefers damp, water-logged soils but can survive for years underground during dry times. Herbicide options are limited and unreliable. Improve soil drainage if possible.							
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Nutgrass**.	NR	A	ALL	R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of **Nutgrass** in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
Pigweed (*Portulaca oleracea*) **Priority: Unknown**							
Pigweed was not given any priority ranking at the recent survey. Summer growing weed that competes aggressively in-crop and can be difficult to control with herbicides.							
Clomazone	Q**	Cucurbits / Pre-emergent residual	Registered in cucurbits for control of various broadleaf weeds, including **Pigweed**.	NR	A	ALL	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Pigweed**.	NR	A	ALL	R3

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Pigweed**.	1 G:1	A	ALL	R3
Chloridazon (Pyramin) BASF	C**		Registered for control of various grass and broadleaf weeds including **Pigweed** in fodder beet, red beet and silver beet.		P		-
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of various grass and broadleaf weeds including **Pigweed** in lettuce.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including **Pigweed** in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including **Pigweed** in berries, tomatoes, beans and fallow.		P		R3
S-Metolachlor (Dual Gold) Syngenta	K**		Registered for control of grass and broadleaf weeds including suppression of **Pigweed** in Brassica vegetables, culinary herbs, rhubarb, spinach, silverbeet, spring onions, beans, sweet corn, sweet potato and fallow.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including **Pigweed** in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including **Pigweed** in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Phenmedipham (Betanal) Bayer	C**		Registered in silverbeet and beetroot for control of a range of weeds, including, Blackberry nightshade, Cape weed, Chickweed, Fat hen, **Pigweed** and Amaranthus. Apply when weeds are at 2-leaf stage. [Max no of applications and re-treatment interval not specified]		P		R3
Propachlor (Ramrod) Nufarm	K**		Registered for control of broadleaf and grass weeds including **Pigweed** in Brassica vegetables		P		R3
Soursob (*Oxalis pes-capre*) **Priority: Unknown**							
Soursob was not given any priority ranking at the recent survey. Low growing, highly competitive weed that is difficult to control with herbicides.							
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Soursob**.	NR	A	ALL	R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including suppression of **Soursob** in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including **Soursob** in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-

5. References

5.1 Information:

AgChem Access Priority Access Forum	https://www.agrifutures.com.au/national-rural-issues/agvet-chemicals/
Australian Pesticide and Veterinary Medicines Authority	www.apvma.gov.au
APVMA Chemical review	https://apvma.gov.au/chemicals-and-products/chemical-review/listing
APVMA MRLs	www.legislation.gov.au/Details/F2021C00380
APVMA Permit search	https://productsearch.apvma.gov.au/permits
APVMA Product search	https://productsearch.apvma.gov.au/products
AUSVEG	https://ausveg.com.au
Codex MRL database	http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/
Cotton Pest Management Guide 2018-19	https://www.cottoninfo.com.au/publications/cotton-pest-management-guide
CropLife Australia (resistance management)	https://www.croplife.org.au/resources/programs/resistance-management/
Growcom – Infopest Database	www.infopest.com.au
Hort Innovation	www.horticulture.com.au

5.2 Abbreviations and Definitions:

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

5.3 Acknowledgements:

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

6. Appendices:

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

Appendix 1. Products available for disease control in squash

Active Ingredient (Trade Name)	Chem. group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
1,3-dichloropropene + Chloropicrin (Telone C-35)	8B	Field crops / Fumigant	Plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases (including Fusarium and Verticillium Wilts, Rhizoctonia, Pythium) & suppression of weeds.	ALL (Restricted use TAS, VIC & SA)	NR	-
Aureobasidium pullulans (Botector) Nufarm	BM 02	Cucurbits (field & protected)	*Botrytis* and suppression of Sclerotinia	ALL	NR	-
Azoxystrobin (Amistar)	11	Cucurbits (field)	Powdery Mildew, Downy Mildew, and Gummy Stem Blight	ALL	1	-
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Cucurbits	Downy Mildew and suppression of Powdery Mildew, Gummy Stem Blight and *Sclerotinia* spp.	ALL	3 NG	-
Boscalid + Kresoxim-Methyl (Colliss) BASF	7+11	Cucurbits	Powdery Mildew	ALL	7	-
Bupirimate (Nimrod)	8	Cucurbits including squash	Powdery Mildew	ALL	1	-
Chlorothalonil (Bravo)	M5	Cucurbits including squash	Downy Mildew, Gummy Stem Blight, Anthracnose, Alternaria Leaf Blight, Target Leaf Spot and suppression of Belly Rot	ALL	1	R3
Copper Ammonium Acetate	M1	Cucurbits (field & protected)	Angular Leaf Spot, Bacterial Leaf Spot and Downy Mildew	ALL	1	-
Copper Hydroxide	M1	Cucurbits (field & protected)	Angular Leaf Spot, Bacterial Leaf Spot	ALL	1	-
Copper Octanoate	M1	Cucurbits (field & protected)	Powdery Mildew and Downy Mildew	ALL	1	-
Copper Oxychloride	M1	Cucurbits (field & protected)	Angular Leaf Spot, Bacterial Leaf Spot, Downy Mildew, Anthracnose, Gummy Stem Blight	ALL	1	-

Active Ingredient (Trade Name)	Chem. group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
Copper as Tribasic Copper Sulfate	M1	Cucurbits (field & protected)	Angular Leaf Spot, Bacterial Leaf Spot	ALL	1	-
Copper as Cuprous Oxide	M1	Cucurbits (field & protected)	Angular Leaf Spot, Bacterial Leaf Spot	ALL	1	-
Cyflufenamid (Flute) AgNova	U6	Cucurbits (field & protected)	Powdery Mildew (*Podosphaera xanthii*)	ALL	1	-
Dazomet (Basamid)	8F	Vegetables	Soil fungi (including *Pythium, Phytophthora, Fusarium,* and *Verticillium*), nematodes (cyst and non-cyst forming), soil insects and germinating seeds of weeds	ALL	NR	-
Dimethomorph (Acrobat) BASF	40	Cucurbits (field & protected)	Downy Mildew, Anthracnose, Gummy Stem Blight, Alternaria Leaf Spot, and Septoria Spot.	QLD & NT	7	-
Dimethomorph + Mancozeb (Acrobat WDG) BASF	40+M3	Cucurbits	Downy Mildew	ALL	7	R2
			Anthracnose, Gummy Stem Blight, Alternaria Leaf Spot, Septoria Spot	QLD & NT		
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Cucurbits (field & protected)	Powdery Mildew *(Sphaerotheca spp.*)	ALL	1	-
Iodine	M	Cucurbits / Sanitiser / Post-Harvest Dip	Bacteria & Fungi	ALL	NR	-
Mancozeb	M3	Cucurbits (field)	Alternaria Spot, Anthracnose, Downy Mildew, Ring Spot, Gummy Stem Blight, and Septoria Spot	ALL	7	R2
Mancozeb + Metalaxyl-M (Ridomil Gold MZ) Syngenta	M3+4	Cucurbits (field)	Downy Mildew	ALL	7	R2
			Anthracnose, Gummy Stem Blight, and Alternaria Leaf Spot	QLD		
Metalaxyl-M (Ridomil Gold 25G) Syngenta	4	Cucurbits (field & protected)	Damping Off (*Pythium* and *Phytophthora* spp.)	NSW, QLD & WA	7	-

Active Ingredient (Trade Name)	Chem. group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
Metham Sodium	-	General pre-plant soil fumigation	Fungal diseases including *Rhizoctonia*, *Pythium*, *Fusarium*, *Phytophthora*, *Verticillium*, *Sclerotinia* and Club Root of crucifers.	ALL	NR	-
Metiram (Polyram) BASF	M3	Cucurbits (field & protected)	Downy Mildew and Gummy Stem Blight	ALL	7	R2
Metrafenone (Vivando) BASF	U8	Cucurbits (field & protected)	Powdery Mildew (*Podosphaera xanthii*)	ALL	7	-
Oxathiapiprolin (Zorvec Enicade) Corteva	U15	Cucurbits (field and protected)	Downy Mildew	ALL	1	-
Penthiopyrad (Fontelis) Corteva	7	Cucurbits (field and protected)	Grey Mould, Powdery Mildew, and Gummy Stem Blight	ALL	1	-
Phosphorous Acid	33	Cucurbits (field)	Downy Mildew	ALL	NR	-
Propamocarb Hydrochloride + Fluopicolide (Infinito) Bayer	28+43	Cucurbits (field & protected)	Downy Mildew	ALL	1	-
Propineb (Antracol)	M3	Cucurbits (field & protected)	Downy Mildew	ALL	3	R2
Propineb + Oxadixyl (Rebound)	M3+4	Cucurbits (field)	Downy Mildew, Anthracnose, and Gummy Stem Blight	ALL	3	R2
Proquinazid (Talendo) Corteva	13	Cucurbits (field)	Powdery Mildew	ALL	1	-
Pyriofenone (Kusabi) AgNova	50	Cucurbits (protected)	Powdery Mildew	ALL	NR	-

Active Ingredient (Trade Name)	Chem. group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
Streptomyces lydicus (Actinovate)	BM 02	Cucurbits (field & protected)	Suppression of Powdery Mildew	ALL	NR	-
		Vegetables / Seed Treatment	Fusarium, Rhizoctonia, Pythium			
Sulphur	UN	Vegetables (field & protected)	Powdery Mildew, Rust, Tomato Russet Mite, Bean Spider Mite	VIC, TAS, SA, WA & NSW	NR	-
			Powdery Mildew, Rust, Tomato Russet Mite	QLD		
Tea Tree Oil (Timorex)	46	Cucurbits (field & protected)	Powdery Mildew	ALL	NR	-
Triadimefon	3	Cucurbits (field)	Powdery Mildew	NSW & WA	1	R3
Triadimenol (Bayfidan)	3	Cucurbits (field)	Powdery Mildew	ALL	1	R3
Zineb	M3	Cucurbits (field)	Downy Mildew & Anthracnose	ALL	7	R2

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

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
1,3-dichloropropene + Chloropicrin (Telone C-35)	8B	Field crops / Fumigant	Plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases (including Fusarium and Verticillium Wilts, Rhizoctonia, Pythium) & suppression of weeds.	ALL (Restricted use TAS, VIC & SA)	NR	-
Abamectin	6	Squash (field)	Two-Spotted Mite	ALL	3	-
Abamectin (Tervigo) Syngenta	6	Cucurbits (field & protected)	Root-Knot Nematode	ALL	NR	-
Abamectin PER14722	6	Squash (field & protected)	Tomato Red Spider Mite	ALL (excl. VIC)	3 G:3	-
Abamectin PER81876	6	Fruiting vegetables – Cucurbits (field)	Vegetable Leaf Miner (suppression only)	ALL (excl. VIC)	7 NG	-
Afidopyropen (Versys) BASF	9D	Cucurbits (field)	Green Peach Aphid, Cabbage Aphid, Currant Lettuce Aphid and Cotton/Melon Aphid; suppression of Silverleaf Whitefly	ALL	1	-
Alpha-Cypermethrin PER80138	3A	Cucurbit vegetables (field)	Cucumber Fruit Fly	ALL (excl. VIC)	1	-
Bacillus thuringiensis subsp. kurstaki (Dipel)	11A	Vegetables (field & protected)	Armyworm, Cotton Bollworm, Native Budworm, Cabbage Moth, Cabbage White Butterfly, Green Looper, Lightbrown Apple Moth, Pear Looper, Soybean Looper, Vine Moth, and Tobacco Looper	ALL	NR	-
Beauveria bassiana (Velifer) BASF	UNF	Protected vegetables & ornamentals	Suppression of various pests including: Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites	ALL	NR	-

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
Bifenazate (Acramite) UPL	20D	Cucurbits (field)	Two-Spotted Mite and Bryobia Mite	ALL	3	-
Bifenthrin (Talstar)	3A	Cucurbit vegetables (field)	Native Budworm, Corn Earworm, Cucumber Moth, and Silverleaf Whitefly Biotype B	ALL	1	R3
Bifenthrin (Talstar) PER82374	3A	Cucurbits (field)	Brown Marmorated Stink Bug & Yellow Spotted Stink Bug	ALL	1	R3
Buprofezin (Applaud) Corteva PER82467	16	Cucurbits (field & protected)	Greenhouse Whitefly, Sweet Potato Whitefly, and Silverleaf Whitefly	ALL (excl. VIC)	3	-
Chlorantraniliprole (Coragen) FMC	28	Cucurbits (field & protected)	Cotton Bollworm, Native Budworm, and Cucumber Moth	ALL	1	-
Chlorantraniliprole (Coragen) FMC PER89259	28	Fruiting vegetables including cucurbits (field)	Fall Armyworm (*Spodoptera frugiperda*)	ALL (excl. VIC)	1	-
Chlorpyrifos (Lorsban)	1B	Cucurbits (field & protected)	Whitefly	NSW, WA & ACT	5	R1
Clothianidin (Samurai) Sumitomo PER80101	4A	Cucurbit vegetables (field & protected)	Cucumber Fruit Fly	ALL	7 NG	R2
Cyantraniliprole (Benevia) FMC	28	Cucurbits (field)	Melon Aphid, Silverleaf Whitefly, Cotton Bollworm, Cucumber Moth, Native Budworm, and Western Flower Thrips (suppression only)	ALL	1	-
Cyantraniliprole (Benevia) FMC PER84805	28	Fruiting vegetables (field)	Tomato Potato Psyllid	ALL (excl. VIC)	1 NG	-

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
Cyantraniliprole (Benevia) FMC PER90387	28	Fruiting vegetables (field)	Liriomyza Leafminers	ALL (excl. VIC)	1 NG	-
Cyromazine (Diptex 150 WP) PER81867	17	Cucurbits	*Liriomyza* spp. including Vegetable & Serpentine Leafminer	ALL	7 NG	-
Diafenthiuron + Cyantraniliprole (Minecto Forte) Syngenta	12A+28	Cucurbits (field)	Silverleaf Whitefly (*Bemisia tabaci*), Melon Aphid (*Aphis gossypii*), Cotton Bollworm (*Helicoverpa armigera*), Native Budworm (*Helicoverpa punctigera*), Cucumber Moth (*Diaphania indica*), Cluster Caterpillar (*Spodoptera litura*), Green Peach Aphid (*Myzus persicae*), Two-Spotted Mite (*Tetranychus urticae*) Suppression of: Western Flower Thrips (*Frankliniella occidentalis*), Tomato Thrips (*Frankliniella schultzei*), Plague Thrips (*Thrips imaginis*)	ALL	1	-
Diazinon	1B	Cucurbits (field)	Thrips	QLD, NSW, VIC, SA & WA	14	R3
Emamectin (Proclaim Opti) Syngenta	6	Cucurbits (field & protected)	Heliothis, Cluster Caterpillar, Cucumber Moth	ALL	3 NG	-
Emamectin (Proclaim Opti) Syngenta PER89263	6	Cucurbits (field & protected)	Fall Armyworm (*Spodoptera frugiperda*)	ALL (excl. VIC)	3	-
Emulsifiable Botanical Oil (Eco-Oil)	-	Vegetables	Greenhouse Whitefly	ALL	NR	-

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
Etoxazole (Paramite) Sumitomo PER82460	10B	Cucurbits including squash (field & protected)	Two-Spotted Mite and Tomato Red Spider Mite	ALL (excl. VIC)	7	-
Flonicamid (Mainman) UPL	9C	Cucurbits (field & protected)	Green Peach Aphid, Melon Aphid, & Silverleaf Whitefly	ALL	1 NG	-
Flubendiamide (Belt) Bayer	28	Cucurbits (field & protected)	*Helicoverpa* spp. & Cucumber Moth	ALL	1	-
Fluensulfone (Nimitz) Adama	UN	Cucurbits / Transplanted Crops Only	Root-Knot Nematode	ALL	NR	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Vegetables(field)	Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers	ALL	1	-
Helicoverpa NPV (Vivus Max) AgBiTech	31	Cucurbits (field & protected)	Cotton Bollworm, Corn Earworm, Tobacco Budworm and Native Budworm	ALL	NR	-
Hexythiazox (Calibre) Nufarm PER14765	10A	Cucurbits including squash (field & protected)	Tomato Russet Mite, Broad Mite, Tomato Red Mite, and Two-Spotted Mite	ALL	3	-
Imidacloprid (formulations suitable for foliar application 200SC, 350SC)	4A	Cucurbits (field) / Foliar Application	Green Peach Aphid	ALL	1 NG	R2
Imidacloprid (formulations suitable for soil application 350SC, 750WG)	4A	Cucurbits (field) / Soil Application	Silverleaf Whitefly including biotype B	ALL	NR	R2

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
Indoxacarb (Avatar eVo) FMC	22A	Cucurbits (field)	Cotton Bollworm, Native Budworm, Cluster Caterpillar	ALL	3 NG	R3
Maldison	1B	Cucurbits	Pumpkin Beetle	NSW, ACT, VIC, SA & WA	3	R3
		Vegetables	Aphid, Green Vegetable Bug, Jassid, Leafhopper, Rutherglen Bug, Redlegged Earth Mite (excl. TAS), 28-Spotted Ladybird (excl. TAS)	ALL		
Methomyl (Lannate) PER82428	1A	Cucurbits (field)	*Helicoverpa* spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug, Thrips including Western Flower Thrips	ALL	3	R2
Methomyl (Lannate) PER89293	1A	Fruiting vegetables including cucurbits (field)	Fall Armyworm (*Spodoptera frugiperda*)	ALL	3	R2
Nucleopolyhedro virus of *Helicoverpa armigera* NPV (Vivus Max)	31	Cucurbits including squash	*Helicoverpa* spp.	ALL	NR	-
Petroleum Oil	UN	Cucurbits (field)	Aphids, Mites, Thrips, and Leafhopper	ALL	1	-
			Silverleaf Whitefly	QLD		
Petroleum Oil PER12221	UN	Cucurbits (field & protected)	Greenhouse Whitefly, Sweet Potato White Fly, Silverleaf Whitefly biotype B, and Whitefly biotype Q	ALL (excl. VIC)	1	-
Pirimicarb (Aphidex)	1A	Cucurbits	Aphids	ALL	2	R3
Potassium Salts of Fatty Acids (Natrasoap)	-	Cucurbits (field & protected)	Aphids, Thrips, Mealybug, Two Spotted Mites, Spider Mite, and Whitefly	ALL	1	-
Propargite (Omite)	12C	Vegetables (field & protected)	Two-Spotted Mite	ALL	7	R3
			Spider Mite	QLD & WA		

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
Pymetrozine (Chess) Syngenta	9B	Cucurbits (field & protected)	Melon Aphid, Green Peach Aphid, Potato Aphid and Cowpea Aphid; and for suppression of Silverleaf Whitefly and Greenhouse Whitefly	ALL	3	R3
Pyriproxyfen (Admiral) Sumitomo	7C	Cucurbits (field & protected)	Silverleaf Whitefly biotype B	ALL	1 NG	-
Spinetoram (Success Neo) Corteva	5	Cucurbits (field & protected)	Cucumber Moth, *Helicoverpa* Spp. & Western Flower Thrips	ALL	3	-
Spinetoram (Success Neo) Corteva PER89241	5	Cucurbits (field)	Fall Armyworm (*Spodoptera frugiperda*)	ALL (excl. VIC)	3	-
Spinosad (Naturalure) Corteva	5	Fruit trees, vegetables & ornamentals	Fruit Fly	ALL	NR	-
Spinosad (Entrust Organic) Corteva	5	Cucurbits (field & protected)	Cucumber Moth, Helicoverpa & Western Flower Thrips	ALL	3 G:14	-
Spinosad (Entrust Organic) Corteva PER89870	5	Cucurbits (field & protected)	Fall Armyworm (*Spodoptera frugiperda*)	ALL (excl. VIC)	3 G:14	-
Spinosad (Entrust Organic) Corteva PER90928	5	Cucurbits (field & protected)	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	-
Spirotetramat (Movento) Bayer	23	Cucurbits (field and protected)	Cotton Aphid, Green Peach Aphid, and Silverleaf Whitefly biotype B	ALL	1	-
Sulfoxaflor (Transform) Corteva	4C	Cucurbits (field grown only)	Green Peach Aphid, Melon Aphid, Greenhouse Whitefly and suppression of Rutherglen Bug	ALL	1	-

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
Sulfoxaflor (Transform) Corteva PER84743	4C	Fruiting vegetables (field)	Tomato Potato Psyllid	ALL (excl. VIC)	1 NG	-
Sulphur	UN	Vegetables (field & protected)	Powdery Mildew, Rust, Tomato Russet Mite, Bean Spider Mite	VIC, TAS, SA, WA & NSW	NR	-
			Two-Spotted Mite	VIC, TAS, SA & WA		
			Powdery Mildew, Rust, Tomato Russet Mite	QLD		
Trichlorfon (Lepidex)	1B	Vegetables (field & protected)	Cabbage White Butterfly, Cabbage Moth, Green Vegetable Bug, and Rutherglen Bug	ALL	2	R2

Appendix 3. Products available for weed control in squash

Active ingredient (Trade Name)	Chem Group	Situation / Crop	Comment / Use / Weed	WHP (days)	States	Regulatory risk
Clomazone	Q**	Cucurbits / Pre-emergent residual	Apple of Peru, Blackberry Nightshade, Fat Hen, Pig Weed, Potato Weed, and Amaranth	NR	ALL	-
Fluazifop-P Butyl (Fusilade)	A***	Cucurbits / Grass selective post-emergent	Grass weeds	21	ALL	-
Glyphosate (Roundup)	M**	General seed bed preparation	Grass and broadleaf weeds as a pre-crop spray	NR	ALL	R3
Paraquat + Diquat (SpraySeed)	L**	General seed bed preparation	Grass and broadleaf weeds as a pre-crop spray	NR	ALL	R3

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

Appendix 4. Current permits for use in squash

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER14722 Version 3	Abamectin / Capsicum, Squash & zucchini (field & protected) / Tomato red spider mite	17-Feb-15	31-Jul-25	Hort Innovation
PER81876 Version 3	Abamectin / Cucurbits (field) / Vegetable leaf miner (suppression only)	24-Jun-16	30-Apr-24	Hort Innovation
PER80138 Version 2	Alpha-cypermethrin / Cucurbit vegetables (field) / Cucumber fruit fly	26-Feb-15	31-Mar-25	Hort Innovation
PER82467 Version 3	Buprofezin (Applaud) / Cucurbits (field and protected) / Greenhouse whitefly, sweet potato whitefly, and silverleaf whitefly	07-Jul-17	30-Jun-25	Hort Innovation
PER89259	Chlorantraniliprole (Coragen) / Cucurbits (field) / Fall Armyworm	06-Mar-20	31-Mar-23	Hort Innovation
PER80101 Version 3	Clothianidin (Samurai) / Cucurbit vegetables (field and protected) / Cucumber fruit fly	10-Nov-15	30-Sep-23	Hort Innovation
PER84805	Cyantraniliprole (Benevia) / Fruiting vegetables (field) / Tomato potato psyllid	06-Dec-17	31-Dec-22	Hort Innovation
PER90387	Cyantraniliprole (Benevia) / Fruiting vegetables (field) / Liriomyza Leafminers	03-Dec-20	31-Dec-23	Hort Innovation
PER81867 Version 2	Cyromazine (Diptex 150 WP) / Cucurbits (field & protected) / Liriomyza spp. including Vegetable & Serpentine Leafminer	2-Dec-19	30-Nov-23	Hort Innovation
PER89263	Emamectin (Proclaim Opti) / Various crops including Cucurbits (field & protected) / Fall Armyworm	10-Mar-20	31-Mar-23	Hort Innovation
PER82460 Version 2	Etoxazole (Paramite) / Cucurbits (field & protected) / two-spotted mite & red spider mite	26-Jul-17	31-Jul-23	Hort Innovation
PER14765 Version 4	Hexythiazox (Calibre) / Cucurbit vegetables (field & protected) / Tomato spider mite, Twospotted mite, Broad mite, Tomato russet mite	21-Feb-15	30-Sep-23	Hort Innovation

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER82428 Version 4	Methomyl (Marlin) / Squash / *Helicoverpa* spp., Cucumber moth, Cluster caterpillar, Loopers, Webworm, Rutherglen bug & Thrips including Western flower thrips	22-Apr-16	31-Mar-24	Hort Innovation
PER89293	Methomyl (Lannate-L) / Fruiting vegetables including cucurbits (field) / Fall Armyworm	10-Apr-20	30-Apr-23	Hort Innovation
PER12221 Version 4	Petroleum oil / Cucurbits (field & protected) / Greenhouse whitefly & Silverleaf whitefly	29-Jun-12	30-Nov-22	Hort Innovation
PER89241	Spinetoram (Success Neo and Delegate) / Various Crops including Cucurbits (field) / Fall Armyworm	06-Mar-20	31-Mar-23	Hort Innovation
PER89870	Spinosad (Entrust Organic) / Various Crops including Cucurbits (field & protected cropping) / Fall Armyworm	21-Jul-20	31-Jul-23	Hort Innovation
PER90928	Spinosad (Entrust Organic) / Cucurbits including cucumber, melon, squash, zucchini (field & protected) / Leaf Miners	23-Apr-21	30-Apr-24	Hort Innovation
PER84743	Sulfoxaflor (Transform) / Fruiting vegetables (field) / Tomato potato psyllid	24-Oct-17	31-Oct-22	Hort Innovation

Appendix 5. Squash Maximum Residue Limits (MRLs)

CODEX commodity groupings of fruiting vegetables (011) and subgroups:

VC 0431 Squash, Summer
VC 0433 Squash, Winter
VC 0045 Fruiting vegetables, cucurbits
- Vegetables

Note: Currently production of all squash is for the Australian market and no exports are recorded. Available information indicates that in the absence specific limits in legislation the most countries defers to Codex, followed by EU MRL standards or applies 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
1,3 -Dichloropropene	-	Soil fumigant / MRLs not required	NR	
2,2 DPA	-	Vegetables	*0.1	-
2,4-D	-		NA	NA
Abamectin	VC0431	Squash, Summer	T0.5	-
Acibenzolar-S-methyl	VC0431	Squash, Summer	T0.5	-
Afidopyropen	VC0045	Fruiting vegetables, cucurbits	0.7	0.7
Aldrin and Dieldrin	VC0045	Fruiting vegetables, cucurbits	E0.1	E0.1
Azoxystrobin	VC0045	Fruiting vegetables, cucurbits	2	1
Benalaxyl	VC0045	Fruiting vegetables, cucurbits	0.2	-
Bensulide	VC0045	Fruiting vegetables, cucurbits	*0.1	-
Bifenazate	VC0045	Fruiting vegetables, cucurbits	-	0.5
Bifenthrin	VC0045	Fruiting vegetables, cucurbits	1	
Boscalid	VC0045	Fruiting vegetables, cucurbits	0.5	3
Bromide ion	VC0431	Squash, summer	-	200
Bupirimate	VC0045	Fruiting vegetables, cucurbits	1	
Buprofezin	VC0045	Fruiting vegetables, cucurbits	T2	0.7
Carbaryl	VC0045	Fruiting vegetables, cucurbits	*0.01	-
Carbendazim	VC0431	Squash, Summer	-	0.5
Chlorantraniliprole	VC0045	Fruiting vegetables, cucurbits	0.2	0.3
Chlordane	VC0045	Fruiting vegetables, cucurbits	E0.05	-
Chloropicrin		Soil fumigant / MRLs not required	NR	
Chlorothalonil	VC0431	Squash, Summer	-	3
	VC0045	Fruiting vegetables, cucurbits	5	-
Chlorpyrifos	-	Vegetables	T*0.01	-
Chlorthal-dimethyl	-	Vegetables	5	-
Clomazone	VC0045	Fruiting vegetables, cucurbits	*0.05	-
Clothianidin	VC0045	Fruiting vegetables, cucurbits	T0.5	*0.02
Cyantraniliprole	VC0045	Fruiting vegetables, cucurbits	0.5	0.3
Cyazofamid	VC0045	Fruiting vegetables, cucurbits	-	0.09
Cyflufenamid	VC0045	Fruiting vegetables, cucurbits	0.1	-
Cyhalothrin (includes lambda-cyhalothrin)	VC0045	Fruiting vegetables, cucurbits	-	0.05
	VC0424	Cucumber	T0.05	-

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Cypermethrins (including alpha- and zeta- cypermethrin)	VC0045	Fruiting vegetables, cucurbits	T0.3	0.07
Cyprodinil	VC0045	Fruiting vegetables, cucurbits	-	0.5
Cyromazine	VC0431	Squash, Summer	-	2
	VC0045	Fruiting vegetables, cucurbits	T0.7	
Dazomet		Soil fumigant / MRLs not required	NR	
Deltamethrin	VC0045	Fruiting vegetables, cucurbits	-	0.2
Diazinon	VC0431	Squash, Summer	-	0.05
	-	Vegetables	0.7	-
Diafenthiuron	VC0045	Fruiting vegetables, cucurbits	0.5	
Dichlobenil	VC0045	Fruiting vegetables, cucurbits	-	*0.01
Dicofol		Vegetables (some exceptions)	5	
Difenoconazole	VC0431	Squash, Summer	-	0.2
Dimethomorph	VC0045	Fruiting vegetables, cucurbits	0.5	0.5
Dinocap	VC0045	Fruiting vegetables, cucurbits	-	*0.05
Dinotefuran	VC0045	Fruiting vegetables, cucurbits	-	0.5
Diquat	-	Vegetables	*0.05	-
Dimethenamid			NA	
Dimethoate	VC0431	Squash, Summer	0.7	-
Dinocap	VC0431	Squash, Summer	-	0.07
Dithiocarbamates	VC0431	Squash, Summer	-	1
	VC0433	Squash, Winter		0.1
	VC0045	Fruiting vegetables, cucurbits	2	-
Emamectin benzoate	VC0045	Fruiting vegetables, cucurbits	0.01	0.007
Endosulfan	VC0431	Squash, Summer	-	0.5
Endrin	VC0045	Fruiting vegetables, cucurbits	-	E0.05
EPTC	-	Vegetables	*0.04	-
Etoxazole	VC0045	Fruiting vegetables, cucurbits	T0.1	-
Etridiazole	-	Vegetables	0.2	-
Famoxadone	VC0431	Squash, Summer	-	0.2
Fenamidone	VC0045	Fruiting vegetables, cucurbits	-	0.2
Fenbuconazole	VC0431	Squash, Summer	-	0.05
Fenhexamid	VC0431	Squash, Summer	-	1
Fenpyroximate	VC0431	Squash, Summer	-	0.06
Flonicamid	VC0045	Fruiting vegetables, cucurbits	0.7	0.2
Fluazifop-p-butyl	VC0045	Fruiting vegetables, cucurbits	0.1	-
Flubendiamide	VC0045	Fruiting vegetables, cucurbits	0.2	0.2
Fludioxonil	VC0045	Fruiting vegetables, cucurbits	-	0.5
Fluensulfone	VC0431	Squash, Summer	-	0.7
	VC0045	Fruiting vegetables, cucurbits	0.5	0.7
Flumioxazin	VC0045	Fruiting vegetables, cucurbits	-	*0.02
Fluopicolide	VC0045	Fruiting vegetables, cucurbits	0.5	0.5
Flupyradifurone	VC0431	Squash, Summer	-	0.2
Flutriafol	VC0045	Fruiting vegetables, cucurbits	-	0.3
Fluxapyroxad	VC0045	Fruiting vegetables, cucurbits	-	0.2
Fosetyl Al	VC0431	Squash, Summer	-	70
Glyphosate	VC0045	Fruiting vegetables, cucurbits	*0.1	-

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Heptachlor	-	Vegetables	E0.05	-
Hexythiazox	VC0045	Fruiting vegetables, cucurbits	T0.05	0.05
Hydrogen peroxide		MRLs not required	NR	
Imidacloprid	VC0431	Squash, Summer	-	1
	VC 0045	Fruiting vegetables, cucurbits	0.2	-
Indoxacarb	VC 0045	Fruiting vegetables, cucurbits	-	0.5
Inorganic bromide	-	Vegetables	20	-
Kresoxim-Methyl	VC0045	Fruiting vegetables, cucurbits	0.05	-
Lindane	-	Vegetables	E2	-
Linuron	-	Vegetables	*0.05	-
Maldison	VC0045	Fruiting vegetables, cucurbits (except cucumber)	2	
Mancozeb	VC0045	Fruiting vegetables, cucurbits	2	-
Mandipropamid	VC0431	Squash, Summer	-	0.2
Meptyldinocap	VC0431	Squash, Summer	-	0.07
Metalaxyl	VC0431	Squash, Summer	-	0.2
	VC0433	Squash, Winter		0.2
	VC0045	Fruiting vegetables, cucurbits	0.2	-
Metaldehyde	-	Vegetables	1	-
Metham sodium	VC0045	Fruiting vegetables, cucurbits	2	-
Methiocarb	-	Vegetables	0.1	-
Metiram	VC0045	Fruiting vegetables, cucurbits	2	-
Methomyl	VC0045	Fruiting vegetables, cucurbits	0.1	0.1
Methoxyfenozide	VC0045	Fruiting vegetables, cucurbits	3	0.3
Metrafenone	VC0424	Fruiting vegetables, cucurbits	0.2	0.5
Metolachlor	VC0045	Fruiting vegetables, cucurbits	*0.05	-
Myclobutanil	VC0045	Fruiting vegetables, cucurbits	-	0.2
Novaluron	VC0045	Fruiting vegetables, cucurbits	-	0.2
Omethoate	-	Vegetables	2	-
Oxadixyl	VC0045	Fruiting vegetables, cucurbits	0.5	-
Oxamyl	VC0431	Squash, Summer	-	0.04
Oxathiapiprolin	VC0045	Fruiting vegetables, cucurbits	0.2	-
Paraffinic oil		MRLs not required	NR	
Paraquat	VC0045	Fruiting vegetables, cucurbits	-	0.02
	-	Vegetables	*0.05	-
Penconazole	VC0431	Squash, Summer	-	0.06
Penthiopyrad	VC0045	Fruiting vegetables, cucurbits	1	0.5
Permethrin	VC0431	Squash, Summer	-	0.5
	VC0433	Squash, Winter		0.5
Peroxy acetic acid		MRLs not required	NR	
Petroleum oil		MRLs not required	NR	
Phosphorous acid	VC0045	Fruiting vegetables, cucurbits	T100	-
Piperonyl Butoxide	VC0045	Fruiting vegetables, cucurbits	-	1
	-	Vegetables	8	-
Pirimicarb	VC0045	Fruiting vegetables, cucurbits	-	1
	-	Vegetables	1	-
Potassium salts of fatty acids		MRLs not required	NR	

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Prometryn	-	Vegetables	*0.1	-
Propamocarb	VC0045	Fruiting vegetables, cucurbits	5	5
Propargite	-	Vegetables	3	-
Propazine	-	Vegetables	*0.1	-
Propineb	VC0045	Fruiting vegetables, cucurbits	2	-
Proquinazid	VC0045	Fruiting vegetables, cucurbits	0.2	-
Prothioconazole	VC0045	Fruiting vegetables, cucurbits	-	0.2
Pydiflumetofen	VC0045	Fruiting vegetables, cucurbits	T0.5	-
Pymetrozine	VC0045	Fruiting vegetables, cucurbits	1	-
Pyraclostrobin	VC0045	Fruiting vegetables, cucurbits		0.5
Pyrethrins	VC0045	Fruiting vegetables, cucurbits	-	*0.05
	-	Vegetables	1	-
Pyriofenone	VC0045	Fruiting vegetables, cucurbits	0.7	-
Pyriproxyfen	VC0431	Squash, Summer	-	0.04
	VC0045	Fruiting vegetables, cucurbits	0.2	0.04
Quizalofop-ethyl			NA	NA
Rotenone		MRLs not required	NR	
Sethoxydim	VC0045	Fruiting vegetables, cucurbits	*0.1	-
Spinetoram	VC0045	Fruiting vegetables, cucurbits	0.05	-
Spinosad	VC0045	Fruiting vegetables, cucurbits	0.2	0.2
Spirotetramat	VC0045	Fruiting vegetables, cucurbits	2	0.2
Sulfoxaflor	VC0045	Fruiting vegetables, cucurbits	0.5	0.5
Sulphur		MRLs not required	NR	
Tebuconazole	VC0431	Squash, Summer	-	0.2
Thiacloprid	VC0431	Squash, Summer	-	0.3
	VC0433	Squash, Winter		0.2
Thiamethoxam	VC0045	Fruiting vegetables, cucurbits	T1	0.5
Triadimefon	VC0045	Fruiting vegetables, cucurbits	0.2	0.2
Triadimenol	VC0045	Fruiting vegetables, cucurbits	0.5	0.2
Trichlorfon	-	Vegetables	0.1	-
Trifloxystrobin	VC0045	Fruiting vegetables, cucurbits	-	0.3
Trifluralin	-	Vegetables	0.05	-
Zineb	VC0045	Fruiting vegetables, cucurbits	2	-
Zoxamide	VC0045	Fruiting vegetables, cucurbits	-	2

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)
NR - Uses of substances where MRLs are not necessary / required.
NA – MRLs are not in place.
T =Temporary MRL
E = The MRL is based on extraneous residues

Sources: APVMA MRLs: Agricultural and Veterinary Chemicals Code (MRL Standard) Instrument 2019. Compilation 4. Prepared 26 April 2021. CODEX MRLs: CODEX Alimentarius International Food Standards database (February 2020), http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/

Appendix 6: Squash Agrichemical Regulatory Risk Assessment

Squash
Agrichemical Regulatory
Risk Assessment

October 2020

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

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

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

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

Squash Agrichemical Regulatory Risk Assessment

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

Problem	Active Constituents	Chemical Group	Comment	Activities
INSECT AND MITE PESTS				
Ants	Chlorpyrifos	**1B**	APVMA: Currently under review. Potential issues w.r.t. environmental loading and worker exposure EU: Proposed cancellation of use Canada: proposed cancellation of most uses. USA: EPA decision to allow continued use	
	Pyrethrins	**3A**		
Aphids				
Aphids	Malathion/Maldison	**1B**	APVMA: Under review: chemistry Codex: Re-evaluation scheduled for 2022/23	
	Paraffinic / Petroleum oil	**-**		
	Pirimicarb	**1A**	Codex - JMPR Periodic re-evaluation 2022/23	
	Pyrethrins	**3B**		
Brown sowthistle aphid	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered[i] USA: Re-registration with new risk mitigation measures	
Cabbage aphid	Afidopyropen	**9D**		
	Chlorantraniliprole +thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	

Problem	Active Constituents	Chemical Group	Comment	Activities
Cotton / melon aphid	Afidopyropen	**9D**		
	Cyantraniliprole	**28**		
	Diafenthiuron + cyantraniliprole	**12A + 28**	Diafenthiuron Codex: No MRLs EU: No authorisation in place	
	Flonicamid	**29**		
	Pymetrozine	**9B**	EU: Being phased out Codex: No registrant support	
	Spirotetramat	**23**		
	Sulfoxaflor	**4C**	USA: Pollinator concerns	
Cowpea aphid	Pymetrozine	**9B**	EU: Being phased out Codex: No registrant support	
Currant lettuce aphid	Afidopyropen	**9D**		
Green peach aphid	Afidopyropen	**9D**		
	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Diafenthiuron + cyantraniliprole	**12A + 28**	Diafenthiuron Codex: No MRLs EU: No authorisation in place	
	Flonicamid	**29**		
	Imidacloprid	**4A**	APVMA: Under review Canada: Under review EU: Removal of all field uses USA: Re-registration with new risk mitigation measures	
	Pymetrozine	**9B**	EU: Being phased out Codex: No registrant support	
	Spirotetramat	**23**		
	Sulfoxaflor	**4C**	USA: Pollinator concerns	
Potato aphid	Pymetrozine	**9B**	EU: Being phased out Codex: No registrant support	

Problem	Active Constituents	Chemical Group	Comment	Activities
Beetles				
Cucurbit stem borer	Carbaryl	**1A**	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled 2020 EU: deregistered	
Leaf eating ladybirds	Carbaryl	**1A**		
28-spotted potato ladybird	Carbaryl	**1A**		
	Malathion/Maldison	**1B**	APVMA: Under review: chemistry Codex: Re-evaluation scheduled for 2022/23	
Pumpkin beetle	Carbaryl	**1A**	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled 2020 EU: deregistered	
	Malathion/Maldison	**1B**	APVMA: Under review: chemistry Codex: Re-evaluation scheduled for 2022/23	
Caterpillars/Lepidoptera				
Armyworms	*Bacillus thuringiensis*	**11A**		
	Carbaryl	**1A**	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled 2020 EU: deregistered	
Cabbage cluster caterpillar	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
Cabbage white butterfly	Chlorantraniliprole + thiamethoxam	**4A + 28**		
	Bacillus thuringiensis	**11A**		
	Pyrethrins	**3A**		
Cabbage-centre grub	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	

Problem	Active Constituents	Chemical Group	Comment	Activities
Caterpillars	Bifenthrin	**3A**	Canada: Subject to phase-out until 31/12/2020 EU: No authorisation in place	
	Diazinon	**1B**	EU: Deregistered Codex - To be reviewed by 2020/21.	
	Pyrethrins	**3A**		
	Spinetoram	**5**		
Cluster caterpillar	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Diafenthiuron + cyantraniliprole	**12A + 28**	Diafenthiuron Codex: No MRLs EU: No authorisation in place	
	Emamectin benzoate	**6**	EU: Candidate for substitution	
	Flubendiamide	**28**		
	Methomyl (PER82428)	**1A**	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
Cucumber moth	Beta-cyfluthrin	**3A**	EU: Non-renewal of approval	
	Bifenthrin	**3A**	Canada: Subject to phase-out until 31/12/2020 EU: No authorisation in place	
	Chlorantraniliprole	**28**		
	Cyantraniliprole	**28**		
	Diafenthiuron + cyantraniliprole	**12A + 28**	Diafenthiuron Codex: No MRLs EU: No authorisation in place	
	Emamectin benzoate	**6**	EU: Candidate for substitution	
	Methomyl (PER82428)	**1A**	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
	Spinetoram	**5**		
	Spinosad	**5**		

Problem	Active Constituents	Chemical Group	Comment	Activities
Cutworms	Carbaryl	**1A**	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled 2020 EU: deregistered	
	Diazinon	**1B**	EU: Deregistered Codex - To be reviewed by 2020/21.	
	Trichlorfon	**1B**	APVMA: nominated for review Codex: No MRLs EU: deregistered US: No MRLs	
Diamondback (Cabbage) moth	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Pyrethrins	**3A**		
Fall armyworm	Chlorantraniliprole (PER89259)	**28**		
	Emamectin benzoate (PER89263)	**6**	EU: Candidate for substitution	
	Methomyl (PER89293)	**1A**	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
	Spinetoram (PER89241)	**5**		
	Spinosad (PER89870)	**5**		

Problem	Active Constituents	Chemical Group	Comment	Activities
Helicoverpa species Native Budworm (*H. punctigera*) Corn earworm/Cotton bollworm (*H. armigera*)	Beta-cyfluthrin	**3A**	EU: Non-renewal of approval	
	Bifenthrin	**3A**	Canada: Subject to phase-out until 31/12/2020 EU: No authorisation in place	
	Bacillus thuringiensis	**11A**		
	Carbaryl	**1A**	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled 2020 EU: deregistered	
	Chlorantraniliprole	**28**		
	Cyantraniliprole	**28**		
	Diafenthiuron + cyantraniliprole	**12A + 28**	Diafenthiuron Codex: No MRLs EU: No authorisation in place	
	Emamectin benzoate	**6**	EU: Candidate for substitution	
	Flubendiamide	**28**		
	Helicoverpa NPV	**31**		
	Methomyl (PER82428)	**1A**	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
	Spinetoram	**5**		
	Spinosad	**5**		

Problem	Active Constituents	Chemical Group	Comment	Activities
Loopers	*Bacillus thuringiensis*	**11A**		
	Methomyl (PER82428)	**1A**	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
Lucerne leaf roller	Chlorantraniliprole	**28**		
Moths	Bifenthrin	**3A**	Canada: Subject to phase-out until 31/12/2020 EU: No authorisation in place	
Potato moth (Leafminer)	Carbaryl	**1A**	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled 2020 EU: deregistered	
	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
Soybean looper	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
Tomato grub	Emamectin benzoate	**6**	EU: Candidate for substitution	
Webworms	Methomyl (PER82428)	**1A**	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	

Problem	Active Constituents	Chemical Group	Comment	Activities
Fruit fly				
Cucumber fly	Alpha-cypermethrin (PER80138)	**3A**	EU: Proposed restricted authorisation & Candidate for substitution	
	Clothianidin (PER80101)	**4A**	APVMA: Under review Canada: Proposal to cancel foliar use in orchards strawberries and turf EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures[ii]	
Grasshoppers/Locusts				
Australian plague locust Migratory locust	Chlorpyrifos (PER11843)	**1B**	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure. EU: Proposed cancellation of use Canada: proposed cancellation of most uses. USA: EPA decision to allow continued use	
	Malathion/Maldison (PER11843)	**1B**	APVMA: Under review: chemistry Codex: Re-evaluation scheduled for 2022/23	
Field crickets	Chlorpyrifos	**1B**	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure. EU: Proposed cancellation of use Canada: proposed cancellation of most uses. USA: EPA decision to allow continued use	
Mole crickets	Chlorpyrifos	**1B**		
Spur-throated locust	Chlorpyrifos (PER11843)	**1B**		
	Malathion/Maldison (PER11843)	**1B**	APVMA: Under review: chemistry Codex: Re-evaluation scheduled for 2022/23	
Wingless grasshopper	Carbaryl	**1A**	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled 2020 EU: deregistered	

Problem	Active Constituents	Chemical Group	Comment	Activities
Jassids/Plant bugs				
Brown marmorated stink bug	Bifenthrin (PER82374)	**3A**	Canada: Subject to phase-out until 31/12/2020 EU: No authorisation in place	
Green vegetable bug	Carbaryl	**1A**	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled 2020 EU: deregistered	
	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Malathion/Maldison	**1B**	APVMA: Under review: chemistry Codex: Re-evaluation scheduled for 2022/23	
Jassids	Malathion/Maldison	**1B**	APVMA: Under review: chemistry Codex: Re-evaluation scheduled for 2022/23	
Leafhoppers	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Malathion/Maldison	**1B**	APVMA: Under review: chemistry Codex: Re-evaluation scheduled for 2022/23	
	Paraffinic / Petroleum oil			
	Pyrethrins	**3A**		
Psyllids (Lerps)	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	

Problem	Active Constituents	Chemical Group	Comment	Activities
Rutherglen bug	Carbaryl	**1A**	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled 2020 EU: deregistered	
	Malathion/Maldison	**1B**	APVMA: Under review: chemistry Codex: Re-evaluation scheduled for 2022/23	
	Methomyl (PER82428)	**1A**	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
Vegetable leafhopper	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
Yellow spotted stink bug	Bifenthrin (PER82374)	**3A**	Canada: Subject to phase-out until 31/12/2020 EU: No authorisation in place	
Mealybug/Scale insects				
Mealybugs	Chlorpyrifos	**1B**	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure EU: Proposed cancellation of use Canada: proposed cancellation of most uses. USA: EPA decision to allow continued use	
	Pyrethrins	**3A**		
Scale insects	Pyrethrins	**3A**		
Mites				
Broad mite	Hexythiazox (PER14765)	**10A**	Codex: No MRLs	
Bryobia mite	Bifenazate	**20D**	EU: Proposed non-renewal	
Mites	Bifenthrin	**3A**	Canada: Subject to phase-out until 31/12/2020 EU: No authorisation in place	
	Paraffinic / Petroleum oil			
Redlegged earth mite	Malathion/Maldison	**1B**	APVMA: Under review: chemistry Codex: Re-evaluation scheduled for 2022/23	
Tomato red spider mite	Abamectin (PER14722)	**6**		
	Etoxazole (PER82460)	**10B**	EU: Uses restricted to greenhouse ornamentals only & Candidate for substitution	
	Hexythiazox (PER14765)	**10A**	Codex: No MRLs	

Problem	Active Constituents	Chemical Group	Comment	Activities
Tomato russet mite	Hexythiazox (PER14765)	**10A**	Codex: No MRLs	
Two-spotted (Red spider) mite	Abamectin (PER14722)	**6**		
	Bifenazate	**20D**	EU: Proposed non-renewal	
	Diafenthiuron + cyantraniliprole	**12A + 28**	Diafenthiuron Codex: No MRLs EU: No authorisation in place	
	Etoxazole (PER82460)	**10B**	EU: Uses restricted to greenhouse ornamentals only & Candidate for substitution	
	Hexythiazox (PER14765)	**10A**	Codex: No MRLs	
Thrips				
Onion (Cotton seedling) thrips	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
Plague thrips	Diafenthiuron + cyantraniliprole	**12A + 28**	Diafenthiuron Codex: No MRLs EU: No authorisation in place	
Thrips	Diazinon	**1B**	EU: Deregistered Codex - To be reviewed by 2020/21.	
	Methomyl (PER82428)	**1A**	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
	Paraffinic / Petroleum oil	**-**		
	Pyrethrins	**3A**		
Tomato thrips	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Diafenthiuron + cyantraniliprole	**12A + 28**	Diafenthiuron Codex: No MRLs EU: No authorisation in place	

Problem	Active Constituents	Chemical Group	Comment	Activities
Western flower thrips	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Cyantraniliprole	**28**		
	Diafenthiuron + cyantraniliprole	**12A + 28**	Diafenthiuron Codex: No MRLs EU: No authorisation in place	
	Methomyl (PER82428)	**1A**	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
	Spinetoram	**5**		
	Spinosad	**5**		
Whitefly				
Cotton (Sweet Potato) whitefly	Buprofezin (PER82467)	**16**	EU: In the process of deleting MRLs	
Greenhouse whitefly	Buprofezin (PER82467)	**16**	EU: In the process of deleting MRLs	
	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Petroleum oil	**-**		
	Pymetrozine	**9B**	EU- Being phased out Codex: No registrant support	
	Sulfoxaflor	**4C**		

Problem	Active Constituents	Chemical Group	Comment	Activities
Silverleaf (Poinsettia) whitefly	Afidopyropen	**9D**		
	Bifenthrin	**3A**	Canada: Subject to phase-out until 31/12/2020 EU: No authorisation in place	
	Buprofezin (PER82467)	**16**	EU: In the process of deleting MRLs	
	Diafenthiuron + cyantraniliprole	**12A + 28**	Diafenthiuron Codex: No MRLs EU: No authorisation in place	
	Chlorantraniliprole + thiamethoxam	**4A + 28**	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses EU: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Cyantraniliprole	**28**		
	Flonicamid	**29**		
	Imidacloprid	**4A**	APVMA: Under review Canada: Under review EU: Removal of all field uses USA: Re-registration with new risk mitigation measures	
	Paraffinic / Petroleum oil			
	Pymetrozine	**9B**	EU- Being phased out Codex: No registrant support	
	Pyriproxyfen	**7C**	EU: Authorisation renewal process underway	
	Spirotetramat	**23**		

Problem	Active Constituents	Chemical Group	Comment	Activities
Whitefly	Bifenthrin	**3A**	Canada: Subject to phase-out until 31/12/2020 EU: No authorisation in place	
	Chlorpyrifos	**1B**	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure EU: Proposed cancellation of use Canada: proposed cancellation of most uses. USA: EPA decision to allow continued use	
	Pyrethrins	**3A**		
Other				
Earwig	Pyrethrins	**3A**		
European earwig	Carbaryl	**1A**	Canada: Review recently completed, retained but with a large number of uses deleted Codex: Toxicology review scheduled 2020 EU: deregistered	
Leafminer fly	Cyromazine (PER81867)	**17**	EU: Authorisation expired 31/12/2019	
Pear and cherry slug	Imidacloprid	**4A**	APVMA: Under review Canada: Under review EU: Removal of all field uses USA: Re-registration with new risk mitigation measures	
Vegetable leafminer	Abamectin	**6**		
Nematodes				
Root-knot nematodes	Abamectin	**6**		

Problem	Active Constituents	Chemical Group	Comment	Activities
DISEASES				
Alternaria leaf blight	Benalaxyl	**4**	EU: Proposed non-renewal of authorisation	
	Chlorothalonil	**M5**	APVMA - Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Authorisation not renewed[iii].	
	Dimethomorph	**40**		
	Mancozeb	**M3**	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Metalaxyl/metalaxyl-M	**4**	EU: Metalaxyl candidate for substitution Metalaxyl-M restricted use approval	
Angular leaf spot	Copper	**M1**	EU: Candidate for substitution	
	Mancozeb	**M3**	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
Anthracnose	Chlorothalonil	**M5**	APVMA - Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Authorisation not renewed	
	Copper	**M1**	EU: Candidate for substitution	
	Dimethomorph	**40**		
	Mancozeb	**M3**	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Propineb	**M3**	APVMA - Nominated for review EU: No authorisation in place Codex - To be reviewed 2022/23	
	Zineb	**M3**	APVMA - Nominated for review Codex - To be reviewed 2022/23 EU: No authorisation in place	

Problem	Active Constituents	Chemical Group	Comment	Activities
Bacterial spot	Copper	**M1**	EU: Candidate for substitution	
Bactericide	Iodine	**M**		
Damping off	Metalaxyl / Metalaxyl-M	**4**	EU: Metalaxyl candidate for substitution Metalaxyl-M restricted use approval	
Downy mildew	Azoxystrobin	**11**		
	Benalaxyl	**4**	EU: Proposed non-renewal of authorisation	
	Chlorothalonil	**M5**	APVMA - Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Authorisation not renewed	
	Copper	**M1**	EU: Candidate for substitution	
	Dimethomorph	**40**		
	Fluopicolide + propamocarb HCl	**28 + 43**		
	Mancozeb	**M3**	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Metiram	**M3**	APVMA - Nominated for review Canada: Proposed cancelling of foliar uses Codex - To be reviewed 2022/23	
	Propineb	**M3**	APVMA - Nominated for review EU: No authorisation in place Codex - To be reviewed 2022/23	
	Zineb	**M3**	APVMA - Nominated for review Codex - To be reviewed 2022/23 EU: No authorisation in place	
	Metalaxyl / metalaxyl-M	**4**	EU: Metalaxyl candidate for substitution Metalaxyl-M restricted use approval	
	Oxadixyl	**4**	EU: No authorisation in place	
	Oxathiapiprolin	**49**		
	Phosphorous acid	**33**		
Fungi	Iodine (Po)	**M**		

Problem	Active Constituents	Chemical Group	Comment	Activities
Grey mould	Penthiopyrad	**7**		
Gummy stem blight	Azoxystrobin	**11**		
	Azoxystrobin + oxathiapiprolin	**11 + 49**		
	Benalaxyl	**4 + M3**	EU: Proposed non-renewal of authorisation	
	Chlorothalonil	**M5**	APVMA - Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Authorisation not renewed	
Gummy stem blight	Copper	**M1**	EU: Candidate for substitution	
	Dimethomorph	**40**		
	Mancozeb	**M3**	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Metiram	**M3**	APVMA - Nominated for review Canada: Proposed cancelling of foliar uses Codex - To be reviewed 2022/23	
	Propineb	**M3**	APVMA - Nominated for review EU: No authorisation in place Codex - To be reviewed 2022/23	
	Metalaxyl / metalaxyl-M	**4**	EU: Metalaxyl candidate for substitution Metalaxyl-M restricted use approval	
	Oxadixyl	**4**	EU: No authorisation in place	
	Penthiopyrad	**7**		
Leaf diseases/spots	Copper	**M1**	EU: Candidate for substitution	
Phytophthora soil fungus (Dieback)	Metalaxyl	**4**	EU: Metalaxyl candidate for substitution	

Problem	Active Constituents	Chemical Group	Comment	Activities
Powdery mildew	Azoxystrobin	**11**		
	Boscalid + kresoxim-methyl	**7 + 11**		
	Bupirimate	**8**		
	Chlorothalonil	**M5**	APVMA - Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Authorisation not renewed	
	Copper	**M1**	EU: Candidate for substitution	
	Cyflufenamid	**U6**		
	Hydrogen peroxide +peroxyacetic acid	**M**		
	Mancozeb	**M3**	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Melaleuca oil	**-**		
	Metrafenone	**U8**		
	Penthiopyrad	**7**		
	Proquinazid	**13**		
	Pyriofenone	**50**		
	Streptomyces lydicus	**BM02**		
	Triadimenol	**3**	APVMA - Nominated for review EU: No authorisation in place	
Rhizoctonia ground rot	Chlorothalonil	**M5**	APVMA - Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Authorisation not renewed	
Sclerotinia rot	Azoxystrobin + oxathiapiprolin	**11 + 49**		
Septoria spot	Dimethomorph	**40**		
	Mancozeb	**M3**	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
Target leafspot	Chlorothalonil	**M5**	APVMA - Nominated for review Canada: Review recently completed; continued use considered acceptable EU: Authorisation not renewed	

Problem	Active Constituents	Chemical Group	Comment	Activities
WEEDS				
Broadleaf weeds and grasses	Clomazone	**Q**		
	Dimethenamid-P (Kabocha)	**K**		
	Fluazifop-P	**A**		
Plant growth regulator				
Compactness (seedlings)	Paclobutrazol			

MT17019: Regulatory support and coordination. This multi-industry project has been funded by Hort Innovation using industry research and development levies and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

[i] Use of thiamethoxam limited to permanent greenhouses and that the resulting crop stays its entire life cycle within a permanent greenhouse, so that it is not replanted outside

[ii] Clothianidin: Berry fruit, fruiting vegetables, ornamentals, pome fruit, turf Reduction in yearly total rate

[iii] Chlorothalonil - Withdrawal authorisations by 20 November 2019. Max period of grace: 20 May 2020. Commission Implementing Regulation (EU) 2019/677 https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32019R0677&from=EN