Rhubarb

Strategic Agrichemical Review Process (SARP)

June 2021

Hort Innovation
Project - VG18004

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

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

Date of report:
June 2021

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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 Rhubarb industry with sound pesticide usage for the future that the industry can pursue for registration with the manufacturer, or minor-use permits with the Australian Pesticide and Veterinary Medicines Authority (APVMA).

1.1 Diseases

The high priority diseases are:

Common name	Scientific name
Sclerotium Rot	*Sclerotium rolfsii*

1.2 Insects, mites and other pests

The high priority insects, mites and other pests are:

Common name	Scientific name
Broad Mites	*Polyphagotarsonemus latus*

1.3 Weeds

There were no high priority weeds identified, however the following weeds were rated as a moderate priority:

Common Name	Scientific Name
Amaranthus	*Amaranthus* spp.
Cleavers	*Galium aparine L.*
Ryegrass	*Lolium rigidum*
Blackberry Nightshade	*Solanum nigrum*
Brassica Weeds	*Brassica* spp.
Fat Hen	*Chenopodium album*
Grass Weeds	*Poaceae*
Pigweed	*Portulaca oleracea*
Fumitory	*Fumaria* spp.
Nutgrass	*Cyperus rotundus*
Common Sowthistle	*Sonchus oleraceus*

2. The Australian Rhubarb Industry

The Australian Rhubarb industry is a minor horticultural industry.

Rhubarb (*Rheum rhabarbarum*) is an herbaceous perennial and is a cool season crop valued for its long thick, red stems. In Australia, Rhubarb is grown as a specialty crop in all states, mostly near major cities. Production centres on south-east Queensland, predominantly from the Tamborine district, and Western Australia during the winter months. Summer production is centred on the southern states.

Production statistics[1] are not available for Australian Rhubarbs at present.

[1] 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 Rhubarb 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 Rhubarb 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 Rhubarb 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 Rhubarb 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 Rhubarbs 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[2] for the Vegetable Industry which covers Rhubarb outlines key threats to the industry, risk mitigation plans, identification and categorisation of exotic pests and contingency plans. High priority exotic pests have been assessed based on their potential to enter, establish, and spread in Australia (e.g. environmental factors, host range, vectors) and the cost to industry of control measures.

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

3.2 Minor use permits and registration

From a pesticide access perspective, the APVMA classifies Rhubarb as a minor crop. The crop fits within the APVMA crop group Crop Group 017: Stalk and Stem vegetables. 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[3].

Possible justification for future permit applications could be based on:

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

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

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

3.3 Methods

The current update of the Rhubarb 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)	**Rhubarb 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 Rhubarb 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:

6. Appendices:

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

4. Diseases, Pests and Weeds of Rhubarb

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[4].

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.

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

4.1 Diseases of rhubarb

4.1.1 Disease priorities

Common name	Scientific name
High	
Sclerotium Rot	*Sclerotium rolfsii*
Moderate	
Downy Mildew	*Peronospora destructor*
Ascochyta Blight	*Ascochyta rhei*
Crown Rot	*Rhizoctonia* spp., *Phytophthora* spp.
Rust	*Puccinia rhei-undulati*
Viruses	Rhubarb Decline-Associated Closterovirus Cucumber Mosaic Virus Turnip Mosaic Virus Tomato Spotted Wilt Virus
Low	
Ramularia Leaf Spot	*Ramularia rhei*
Alternaria Leaf Blight	*Alternaria cucumerina*
Botrytis Rot	*Botrytis cinerea*

The high priority disease identified based on the recent industry survey was Sclerotium Rot. Available and potential products for all these diseases are in Section 4.1.2.

Some of the diseases that have received moderate to low priority have few options to suppress or control but should be supplemented by management practices that would increase airflow and minimise moisture in the plant canopy. Soil fumigation also helps in preventing some diseases.

Most viruses infecting rhubarb are transmitted by aphids. A key aspect of virus disease management is to accurately identify the virus causing the disease and then implement appropriate management strategies for vectors.

Management that promotes clean planting seed and transplant material, early detection and disposal of infected seedlings will assist to reduce infections, whilst eliminating alternative hosts, crop rotation, cover crops, bio fumigation, farm hygiene and avoiding spread of disease from nursery to field are also important to prevent spread of disease.

Resistance Management

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

There are several disease strategies that apply to various vegetables on the CropLife website[5], including Downy Mildew.

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

4.1.2 Available and potential products for priority diseases

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

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

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Sclerotium Rot (*Sclerotium rolfsii*) **Priority: High**							
Sclerotium Rot was ranked as a high priority in QLD and as a low priority in VIC & TAS. *Sclerotium rolfsii* is a common soil-borne fungus infecting a wide range of vegetable, ornamental and field crops. It is most active during warm, wet weather in tropical and subtropical regions. The disease causes rots of the lower stem, roots & crown.							
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Soil fumigant	NR	A	ALL	Registered in various crops including vegetables for control of plant parasitic Nematodes, Symphylans, Wireworms, **soil borne diseases** and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	-
Dazomet (Basamid)	8F	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.	-
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protectant & Curative		P		Registered for suppression of White Rot (*Sclerotium cepivorum*) in bulb vegetables.	-
Fludioxonil + Metalaxyl-M + Azoxystrobin	12+4+ 11	Protectant & Curative		P		Registered as a seed dressing for control of **Crown Rot (*Sclerotium rolfsii*)** in peanuts.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Procymidone (Sumisclex)	2	Protectant		P		Registered for control of White Rot (*Sclerotium cepivorum*) in onions.	-
Quintozene (Terrachlor)	14	Protectant		P		Registered for control of ***Sclerotium rolfsii*** in apple seedlings, peanuts and tomato.	-
Downy Mildew (*Peronospora destructor*) **Priority: Moderate**							
Downy Mildew was ranked as a high priority in VIC, as a moderate priority in and QLD and as a low priority in TAS. 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.							
Copper	M1	Protectant	1	A	ALL	Registered in rhubarb for control of Phytophthora Crown Rot and **Downy Mildew**. [Max. no. of applications not specified; re-treatment interval: 14 d]	-
Mancozeb + Metalaxyl-M (Ridomil Gold MZ) Syngenta	M3+4	Protectant & Curative	14	A	ALL	Registered in rhubarb for control of **Downy Mildew**. [max. 2 applications per crop; re-treatment interval 7-10 d]	R2
Phosphorous Acid PER86805	33	Protectant & Curative	1 NG	A	ALL (excl. VIC)	Permitted for use in rhubarb for control of **Downy Mildew**. Apply as required when conditions favour disease development [Max. 5 applications per crop; re-treatment interval 7-14 d]	-
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 **Downy Mildew** in basil, brassica leafy vegetables, nursery stock and poppy.	-
Dimethomorph (Acrobat) BASF	40	Protectant		P		Registered for control of **Downy Mildew** in cucurbits, grapes, lettuce, onions and poppy.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Dimethomorph + Amitoctradin (Zampro) AgNova	40+45	Protectant		P		Registered for control of **Downy Mildew** in grapes.	-
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 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.	-
Oxathiapiprolin (Zorvec Enicade) Corteva	49	Protectant		P		Registered for control of **Downy Mildew** in bulb vegetables, brassica vegetables, cucurbits, leafy vegetables and poppies.	-
Propamocarb Hydrochloride + Fluopicolide (Infinito) Bayer	28+43	Protectant		P		Registered for control of **Downy Mildew** in brassica vegetables, bulb vegetables, cucurbits, leafy vegetables poppy and potato.	-
Ascochyta Blight (*Ascochyta rhei*) **Priority: Moderate**							
Ascochyta Leaf Blight was ranked as a moderate priority in VIC, QLD & TAS. The crop may be infected by Ascochyta Blight from two major sources: Sowing infected seed and spores produced on stubble from the previous year. Good on-farm sanitation is recommended.							
Chlorothalonil (Bravo)	M5	Protective	7	A	ALL	Registered in rhubarb for control of **Ascochyta Blight.** [Max. no. of applications not specified; re-treatment interval: 10 - 14 d]	R3
Copper	M1	Protectant	1	P-A	ALL	Registered in rhubarb for control of Phytophthora Crown Rot and Downy Mildew. Registered for control of **Ascochyta Blight** in peas.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Mancozeb	M3	Protectant	7	P-A	ALL	Registered in rhubarb for control of Rust. Registered for control of **Ascochyta Blight** in broad beans, faba bean, chickpeas, field peas, lentils, vetch, lupins and beans.	R2
Azoxystrobin+ Tebuconazole (Veritas) Adama	3+11	Protectant		P		Registered in faba beans and broad beans for control of **Ascochyta Blight,** Chocolate Spot, Cercospora Leaf Spot & Rust.	R3
Prothioconazole + Bixafen (Aviator XPro) Bayer	3+7	Protectant		P		Registered in field peas for control of Black Spot complex (*Mycosphaerella pinodes*, ***Ascochyta pisi*** and *Phoma medicaginis* var. *pinodella*).	R3
Thiram + Thiabendazole (P-Pickel T)	M3+1	Protectant		P		Registered in field and garden peas as a seed dressing for control of Black Spot (*Mycosphaerella pinodes*, ***Ascochyta pisi*** and *Phoma medicaginis* var. *pinodella*) and seedling root rots (*Fusarium* spp., *Pythium* spp. and *Macrophomina phaseolina*).	R2
Crown Rot (*Rhizoctonia* spp., *Phytophthora* spp.) **Priority: Moderate**							
Crown Rot was ranked as a moderate priority in VIC & QLD and as a low priority in TAS. 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 and the use of resistant varieties. Good on-farm sanitation is recommended.							
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Soil fumigant	NR	A	ALL	Registered in various crops including vegetables for control of plant parasitic Nematodes, Symphylans, Wireworms, **soil borne diseases** and suppression of weeds. Restricted chemical. ***For use by professional and registered fumigators only.***	-
Copper	M1	Protectant	1	A	ALL	Registered in rhubarb for control of **Phytophthora Crown Rot** and Downy Mildew. [Max. no. of applications not specified; re-treatment interval: 14 d]	-
Dazomet (Basamid)	8F	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.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Streptomyces lydicus (Actinovate)	BM 02	Biological	NR	A	ALL	Registered 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.	-
Chlorothalonil (Bravo) Syngenta	M5	Protectant	7	P-A	ALL	Registered in rhubarb for control of Ascochyta Blight. Registered for control of Belly Rot (*Rhizoctonia solani*) in cucurbits.	R3
Mancozeb + Metalaxyl-M (Ridomil Gold MZ) Syngenta	M3+4	Protectant & Curative	14	P-A	ALL	Registered in rhubarb for control of Downy Mildew. Registered for control of Root Rot (*Phytophthora nicotianae*) in strawberries.	R2
Phosphorous Acid PER86805	33	Protectant & Curative	1 NG	P-A	ALL (excl. VIC)	Permitted for use in rhubarb for control of Downy Mildew. Registered for control of Phytophthora Root Rot in avocado, citrus, macadamia, ornamentals and pineapples.	-
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.	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
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.	-
NUL3163 Nufarm	TBC			P		New active in development from Nufarm with activity on *Fusarium, Pythium &* ***Rhizoctonia*.**	-
Oxathiapiprolin (Zorvec Enicade) Corteva	49	Protectant				Registered in bulb vegetables, brassica vegetables, cucurbits, leafy vegetables, brassica leafy vegetables and poppies for control of Downy Mildew. US registration for control of ***Phytophthora* spp.** in cucurbits, fruiting vegetables, ginseng, tuberous and corm vegetables and tobacco.	-
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*.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Rust (*Puccinia rhei-undulati*) **Priority: Moderate**							
Rust was ranked as a moderate priority in VIC & QLD and as a low priority in TAS. Rusts are plant diseases caused by pathogenic fungi which are essentially parasitic in their behaviour. Although not fatal, they can severely limit growth & fruiting ability.							
Mancozeb	M3	Protectant	7	A	ALL	Registered in rhubarb for control of **Rust.** Apply at first signs of infection. [Max no. of applications not specified; re-treatment interval 10 d]	R2
Sulphur	M2	Protectant	NR	A	ALL	Registered in vegetables for control of Powdery Mildew and **Rust**. Apply from seedling stage onwards. [Max. no. of applications not specified; re-treatment interval 7-14 d]	-
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 various types of **Rust** in tree nuts, stone fruit and bulb vegetables.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered in apples for control of Powdery Mildew, Black Spot and *Alternaria*. US registration for control of **Rust** in leafy petioles (including celery, fennel (bulb) & rhubarb) almond, carrot, cherry, & root vegetables except sugar beet.	-
Viruses (Rhubarb Declined-Associated Closterovirus, Cucumber Mosaic Virus, Turnip Mosaic Virus, And Tomato Spotted Wilt Virus) **Priority: Moderate**							
Viruses were ranked as a moderate priority in QLD, and as a low priority in VIC and TAS. Viruses are transmitted by several aphid species in a non-persistent manner. A key aspect of virus disease management is to accurately identify the virus causing the disease and then implement appropriate management strategies. Keeping weeds that act as hosts and insects that transmit the virus in check seem to be the best options available to control these viral diseases.							

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Ramularia Leaf Spot (*Ramularia rhei*) **Priority: Low**							
Ramularia Leaf Spot was ranked as a moderate priority in TAS and as a low priority in VIC & QLD. Ramularia is a pathogenic fungus known to produce toxic metabolites that contribute to symptom development in the host. It can infect most parts of the plant and can be economically damaging. Good on-farm sanitation is recommended.							
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 **Ramularia Leaf Spot** in artichoke.	-
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered in apples for control of Powdery Mildew, Black Spot and *Alternaria*. US registration for suppression of **Ramularia Leaf Spot** in globe artichoke.	-
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 **Ramularia Leaf Spot** in strawberries.	-
Propiconazole + Benzovindiflupyr (Elatus) Syngenta	3+7	Protectant & Curative		P		Registered in barley for control of **Ramularia Leaf Spot**.	R3
Alternaria Leaf Blight (*Alternaria cucumerina*) **Priority: Low**							
Alternaria was ranked as a low priority in VIC, QLD & TAS. Alternaria-species produce toxic metabolites during their active growth and causes severe diseases limiting crop productivity. Use of resistant varieties & disease-free or treated seed are recommended. Adequate nitrogen fertiliser generally reduces the rate of infection by Alternaria. 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) Syngenta	M5	Protectant	7	P-A	ALL	Registered in rhubarb for control of Ascochyta Blight. Registered for control of **Alternaria Leaf Blight** in carrots and cucurbits and ***Alternaria* spp.** in leeks, shallots, potato and tomatoes.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Mancozeb + Metalaxyl-M (Ridomil Gold MZ) Syngenta	M3+4	Protectant & Curative	14	P-A	ALL	Registered in rhubarb for control of Downy Mildew. Registered for control of **Alternaria Leaf Spot** in cucurbits.	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.	-
Dimethomorph (Acrobat) BASF	40	Protectant		P		Registered for control of **Alternaria Leaf Spot** in cucurbits.	-
Dimethomorph + Mancozeb (Acrobat WDG) BASF	40+M3	Protectant		P		Registered for control of **Alternaria Leaf Spot** in cucurbits.	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. 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.	-
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

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 ***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 + 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
Botrytis Rot (*Botrytis cinerea*) **Priority: Low**							
Botrytis Rot was ranked as a low priority in VIC, QLD & TAS. *Botrytis* spp. which causes Grey Mould can affect plants at most stages of production. Affected parts get rapidly covered with a thick grey mould. *Botrytis* also causes secondary rots on vegetables in storage or transit and in the marketplace							
Chlorothalonil (Bravo) Syngenta	M5	Protectant	7	P-A	ALL	Registered in rhubarb for control of Ascochyta Blight. Registered for control of ***Botrytis*** in globe artichoke, peppers, endive, radish, tomatoes, beans, lentils, ornamentals and grapes.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Aureobasidium pullulans (Botector) Nufarm	BM 02	Biological		P		Registered for control of ***Botrytis*** in berries, fruiting vegetables and grapes.	-
Bacillus amyloliquefaciens (Serenade Opti) Bayer	BM 02	Biological		P		Registered for control of ***Botrytis*** in grapes and strawberries. US registration for control of **Grey Mould** in artichoke, fruiting vegetables, grapes, legume vegetables, root/tuber and corm vegetables, stone fruit and strawberries.	-
Bacillus amyloliquefaciens strain MBI 600 (Serifel) BASF	BM 02	Biological		P		Registered for control of ***Botrytis*** in grapes and strawberries. Registered for control of Anthracnose, Alternaria, ***Botrytis***, Powdery Mildew and Ramularia Leaf Spot in rhubarb.	-
BLAD (ProBlad Plus)	BM 01	Biological		P		Registered for control of Brown Rot and Blossom Blight in stone fruit. US registration for control of **Grey Mould** in fruiting vegetables, grapes, strawberries and ornamentals.	-
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protective & Curative		P		Registered for control of ***Botrytis*** in capsicum, cucumber, cut flowers, grapes, green beans, green peas, lettuce, nursery stock and ornamentals, onions, alliums and strawberries.	R3
Fenhexamid (Teldor) Bayer	13	Protective		P		Registered for control of ***Botrytis*** in grapes and strawberries.	-
Fenpyrazamine (Prolectus) Sumitomo	17	Protectant & Curative		P		Registered for control of ***Botrytis*** in grapes.	-
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, Brassica leafy greens, bulb vegetables, grapes, hops, pistachio and stone fruit.	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 in pome fruit, stone fruit, almonds and tropical and sub-tropical fruit for the control of various diseases, including Powdery Mildew, Anthracnose and Alternaria. US registration for control of ***Botrytis*** in globe artichoke, berries, brassica vegetables, brassica leafy greens, cherries, dill, fruit small vine climbing (except fuzzy kiwifruit), herbs, hops, leafy greens, melons and tomatoes, and control of Early Blight, Late Blight, Rust, Powdery Mildew and suppression of Rhizoctonia Bottom Rot in rhubarb.	-
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 & Curative		P		Registered for control of ***Botrytis*** in berries***.***	-
NUL3195 Nufarm	TBC			P		Fungicide in development from Nufarm with activity on Powdery Mildew and ***Botrytis***.	-
Penthiopyrad (Fontelis) Corteva	7	Protectant		P		Registered for control of ***Botrytis*** in bulb vegetables, cucurbits, fruiting vegetables, leafy vegetables and strawberries.	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative		P		Registered for control of ***Botrytis*** in berries, grapes and strawberries and control of ***Botrytis*** and *Sclerotinia* in leafy vegetables, lettuce and potatoes.	R3

4.2 Insects, mites and other pests of rhubarb

4.2.1 Insects, mites and other pest priorities

Common name	Scientific name
High	
Broad Mites	*Polyphagotarsonemus latus*
Moderate	
Green Peach Aphid	*Myzus persicae*
Melon Aphid	*Aphis gossypii*
Cotton Bollworm / Corn Earworm	*Helicoverpa armigera*
Native Budworm	*Helicoverpa punctigera*
Cutworms	*Agrotis spp.*
Jassids	Cicadellidae
Snails and Slugs	Gastropoda
Low	
Earwigs	Dermaptera
Black Field Cricket	*Teleogryllus commodus*
Wingless Grasshopper	*Phaulacridium vittatum*
Onion Thrips	*Thrips tabaci*
Plague Thrips	*Thrips imaginis*
Spotted Vegetable Weevil	*Desiantha diversipes,*
Vegetable Weevil	*Listroderes difficilis*

Other non-ranked pests and new incursions of an exotic pest which pose a potential threat.

New Pest to Australia (unknown priority)	
Fall Armyworm	*Spodoptera frugiperda*
Vegetable Leafminer	*Liriomyza sativae*
Pea Leafminer / Serpentine Leafminer	*Liriomyza huidobrensis*
American Serpentine Leafminer	*Liriomyza trifolii*

Broad Mites were identified as high priority pests in the recent survey. Available and potential products for these pests are listed 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.

Resistance Management
There are several insecticide management strategies that apply to various vegetables on the CropLife website[6], including 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 rhubarb may be warranted.

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

4.2.2 Available and potential products for priority insects, mites and other pests

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

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

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Broad Mites (*Polyphagotarsonemus latus*) **Priority: High**								
Broad Mites were ranked as a high priority in QLD and as a low priority in VIC & TAS. Broad Mites damage the outer cells of the leaf as they feed on the plant sap. The leaves become distorted, bronze coloured, stiff, and rolled under at the margins. Predatory mites can control Broad Mites. Avoid planting new crops downwind from those infested with mites, as the mites will spread with the wind.								
Abamectin	6	Contact	7	A	ALL	Registered in rhubarb for control of **Broad Mites**. [Max. 2 applications per crop; re-treatment interval 14 d]	M Bee:H	-
Dimethoate	1B	Contact	7	A	ALL	Registered in rhubarb for control of Aphids, Jassids, **Mites**, Leafhoppers, Green Vegetable Bug, Thrips and Wingless Grasshoppers.	H Bee:H	R1
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	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Bifenazate (Acramite) UPL	20D	Contact		P		Registered for control of Mites including Bryobia Mite, Two-Spotted Mite, Carmine Mite and European Red Mite in almonds, pome fruit, fruiting vegetables, cucurbits, stone fruit, pawpaw and strawberries.	L Bee:H	-
Etoxazole (Paramite) Sumitomo PER82460	10B	Contact		P		Registered for control of Mites including Bryobia Mite, Two-Spotted Mite, Strawberry Spider Mite, Oriental Spider Mite, Bean Spider Mite and European Red Mite in almonds, bananas, pome fruit, fruiting vegetables, stone fruit, grapes and citrus.	L Bee:VL	-
Hexythiazox (Calibre) Nufarm PER14765	10A	Contact & Ingestion		P		Registered for control of Mites including Carmine Mite and European Red Mite in apples, ornamentals, pears, stone fruit and strawberries.	L Bee:L	-
Petroleum Oil	UN	Contact		P		Registered for control of Broad Mite in citrus.	VL 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 generating data to support a label registration for control of **Broad Mites** in rhubarb and artichoke.	M Bee:VL	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2020/21 for Thrips, Bugs, **Mites** and Caterpillars.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Green Peach Aphid (*Myzus persicae*) **Melon Aphid** (*Aphis gossypii*) **Priority: Moderate**								
Aphids were ranked as a moderate priority in VIC, QLD, SA & TAS. Aphids suck on sap, causing loss of vigour, and in some cases yellowing, stunting or distortion of plant parts. Honeydew (unused sap) secreted by the insects can cause sooty mould to develop on leaves. Aphids can also be vectors (carriers) for viruses.								
Afidopyropen (Versys) BASF	9D	Ingestion	1	A	ALL	Registered in rhubarb for control of Cabbage Aphid, Lettuce Aphid, **Green Peach Aphid** and **Cotton/Melon Aphid** 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	-
Dimethoate	1B	Contact	7	A	ALL	Registered in rhubarb for control of **Aphids**, Jassids, Mites, Leafhoppers, Green Vegetable Bug, Thrips and Wingless Grasshoppers.	H Bee:H	R1
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, **Aphids**, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bees:H	-
Imidacloprid (Confidor) PER14212	4A	Contact & Ingestion	14	A	ALL (excl. VIC)	Permitted for use in rhubarb for control of **Aphids**. [Max. no. of applications per crop and re-treatment interval not specified]	M Bee:M	R2
Permethrin (Ambush) PER13441	3A	Contact	2	A	ALL (excl. VIC)	Permitted for use in rhubarb for control of **Green Peach Aphid**, Green Looper, Light Brown Apple Moth & Helicoverpa. [Max 3 of applications per crop; re-treatment interval 7 d]	VH Bee:H	-

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	-
Spirotetramat (Movento 240 SC) Bayer	23	Ingestion	3	A	ALL	Registered in rhubarb for control of Western Flower Thrips, Tomato Thrips, Plague Thrips, **Green Peach Aphid** and **Cotton Aphid**. [Max 2 applications per crop; re-treatment interval 7 d]	M Bee:VL	-
Emulsifiable Botanical Oil (Eco-Oil)	-	Contact	NR	P-A	ALL	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.	-	-
Flonicamid (Mainman) UPL	9C	Ingestion		P		Registered for control of **Aphids** in cucurbits, potatoes, apples, pears and cotton.	M Bee:L	-
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of **Aphids** in alfalfa, brassica leafy vegetables, berries, citrus, clover, cucurbits, fruiting vegetables, hop, leafy vegetables, legume vegetables, pome fruit, root vegetables, stone fruit, taro, tree nuts, tropical & sub-tropical fruit, tuberous and corm vegetables and turnip greens.	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

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Petroleum Oil	UN	Contact		P		Registered for control of **Aphids** in cotton, tree nuts, stone fruit and ornamentals.	VL Bee:L	-
Pymetrozine (Chess) Syngenta	9B	Ingestion		P		Registered for control of **Aphids** in brassica vegetables, fruiting vegetables, sweet corn, lettuce, leafy vegetables, cucurbits, potatoes, stone fruit, almons and pistachios, beetroot, celery, cut flowers and nursery stock.	L Bee:VL	R3
Sulfoxaflor (Transform) Corteva	4C	Contact and Ingestion		P		Registered for control of **Aphids** in cucurbits, fruiting vegetables, sweet corn, leafy vegetables, root and tuber vegetables, brassica vegetables, strawberries, pome fruit, stone fruit and tree nuts.	M Bee:VH	-
Cotton Bollworm / Corn Earworm (*Helicoverpa armigera*) **Native Budworm** (*Helicoverpa punctigera*) **Priority: Moderate**								
Helicoverpa was ranked as a moderate priority in VIC, QLD & TAS. *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	-
Chlorantraniliprole (Coragen) FMC	28	Ingestion	3	A	ALL	Registered in rhubarb control of ***Helicoverpa* spp**. [Max. 3 applications per crop; 2 consecutive; re-treatment interval 7 d]	L Bee:VL	-
Diazinon	1B	Contact	14 G:14	A	ALL	Registered in rhubarb for control of Cutworms and **Caterpillars**. Spray as necessary. [max no. of applications and re-treatment interval not specified]	H Bee:H	R3
Flubendiamide (Belt) Bayer	28	Ingestion	1	A	ALL	Registered in rhubarb for control of **Heliothis**. [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 Bees:H	-
Helicoverpa NPV (Gemstar)	31	Biological	NR	A	ALL	Registered in rhubarb for control of ***Helicoverpa* spp.** Effecive on larvae of <7 mm. [Max no. of applications not specified; re-treatment interval 2-3 d]	VL Bee:L	-
Permethrin (Ambush) PER13441	3A	Contact	2	A	ALL (excl. VIC)	Permitted for use in rhubarb for control of Green peach aphid, Green looper, Light Brown apple moth & **Native Budworm**. [Max 3 of applications per crop; re-treatment interval 7 d]	VH Bee:H	-
Spinetoram (Success Neo) Corteva	5	Ingestion	1	A	ALL	Registered in rhubarb for control of **Helicoverpa.** [Max no. of applications not specified; re-treatment interval: 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	1 G:14	A	ALL	Registered in stalk & stem vegetables including rhubarb and rhubarb for control of **Helicoverpa**. [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		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	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion		P		Registered for control of ***Helicoverpa* spp.** in brassica vegetables, fruiting vegetables, leafy vegetables, brassica leafy vegetables, legume vegetables, lettuce, root and tuber vegetables, strawberries and sweet corn.	M Bee:H	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of ***Helicoverpa* spp.** in brassica vegetables, celery, Chinese leafy vegetables, leafy vegetables, solanaceous fruit and sweet corn.	M Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on **Lepidoptera**, Bugs, Beetles/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.	-	-
Cutworms (*Agrotis* spp.) **Priority: Moderate**								
Cutworms were ranked as a moderate priority in VIC & TAS and as a low priority in QLD. Cutworms are caterpillars that attack seedling crops by chewing through leaves and stems at ground level. This frequently results in loss of whole plants which has a significant impact on production. If insecticide control is required, application should be made late afternoon to evening to coincide with when the larvae are feeding. MT16009 IPM Project Recommends: Predatory wasps, rotation, and early insecticide applications.								
Chlorpyrifos (Lorsban)	1B	Contact	NR	A	ALL	Registered in rhubarb for control of **Cutworms**. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Diazinon	1B	Contact	14 G:14	A	ALL	Registered in rhubarb for control of **Cutworms** and Caterpillars. Spray as necessary. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R3
Jassids (*Cicadellidae*) **Priority: Moderate**								
Jassids were ranked as a moderate priority in QLD and as a low priority in VIC & TAS. Adult and nymph leafhoppers suck sap and inject toxins. Some leafhopper species transmit diseases such as viruses and phytoplasmas. Perimeter sprays may be an option to minimise vector transmission.								
Dimethoate	1B	Contact	7	A	ALL	Registered in rhubarb for control of Aphids, **Jassids**, Mites, **Leafhoppers**, Green Vegetable Bug, Thrips and Wingless Grasshoppers. Do not apply after commencement of flowering. [Max. no. of applications per crop and re-treatment interval not specified]	H Bee:H	R1
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and **Leafhoppers**. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Buprofezin (Applaud) Corteva	16	Ingestion / IGR		P		Registered for control of **Leafhopper** in citrus.	L Bee:L	-
Flonicamid (Mainman) UPL	29	Ingestion		P		Registered for control of Green Mirids in cotton, Aphids in cucurbits and mealybugs in apples and pears. US registration for control of Plant Bugs in brassica vegetables, brassica leafy greens, cucurbits, fruiting vegetables, leaf petiole vegetables, leafy greens, tuberous and corm vegetables, root vegetables (except sugar beet), pome fruit, stone fruit, tree nuts, berries, legume vegetables and alfalfa.	M Bee:L	-
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of **Leafhoppers** in alfalfa, brassica leafy vegetables, cucurbits, fruiting vegetables, leafy vegetables, legume vegetables, peanuts, small fruit vine climbing (except fuzzy kiwifruit), taro, tuberous and corm vegetables and turnip greens.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		Product in development from Nufarm with activity on Caterpillars, Fruit Flies, **Bugs**, Beetles and Thrips.	-	-
Petroleum Oil	UN	Contact		P		Registered for control of Mango Plant Hopper in mango.	VL Bee:L	-
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion		P		Registered for control of Rutherglen Bug in cucurbits, fruiting vegetables, leafy vegetables, root and tuber vegetables and brassica vegetables, control of Green Mirid in strawberries, and control of Fruit-Spotting Bugs in avocado, citrus, macadamia, Lace Bug in macadamia, and Apple Dimpling Bug in pome fruit and stone fruit. US registration for control of **Leafhoppers** in berries, pome fruit and root and tuber vegetables.	M Bee:VH	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is p for 2020/21 for Thrips, **Bugs**, Mites and Caterpillars.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Slugs and Snails (Gastropoda) **Priority: Moderate**								
Slugs and Snails were ranked as a high priority in TAS and as a moderate priority in VIC & QLD. They are active after dusk when chemical treatments can be most effective.								
Iron EDTA Complex	-	Contact and Ingestion	NR	A	ALL	Registered in all plants for the control of **Snails** and **Slugs**. Spread pellets evenly on ground. [Max no. of applications and re-treatment not specified]	-	-
Metaldehyde	-	Contact and Ingestion	7	A	ALL	Registered in vegetables for the control of **Snails** and **Slugs**. Spread pellets evenly on ground. [Max no. of applications and re-treatment not specified]	-	-
Methiocarb (Mesurol)	1A	Contact and Ingestion	NR	A	ALL	Registered in vegetables for control of **Snails** and **Slugs**. [Max no. of applications and re-treatment not specified]	-	R2
Earwigs (*Dermaptera*) **Priority: Low**								
Earwigs were ranked as a low priority in VIC, QLD & TAS. Although the adults have wings, they seldom fly and are mainly spread by human activity. In recent years, these earwigs have caused significant damage to broadacre and horticultural crops. It is important to monitor crops for eggs and nymphs by regular field scouting. Target sprays against mature eggs and nymphs before pests become entrenched.								
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	-
Chlorpyrifos (Lorsban)	1B	Contact	NR	P-A	ALL	Registered in rhubarb for control of Cutworms. Registered for control of European Earwig in stone fruit.	H Bee:H	R1
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of **Earwigs** in grapes.	M Bee:H	R3

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Black Field Cricket (*Teleogryllus commodus*) **Priority: Low**								
Black Field Crickets were ranked as a low priority in VIC, QLD & TAS. They have a voracious appetite and can cause severe damage to foliage if the numbers get high. Damage is limited to feeding on newly established plants and reducing plant populations.								
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in field crops for control of **soil borne pests**. Leave soil undisturbed for 14 d after treatment. ***For use by professional and registered fumigators only.***	-	-
Chlorpyrifos (Lorsban)	1B	Contact	NR	A	QLD	Registered in rhubarb for control of **Field Crickets** and **Mole Crickets**. [max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Dazomet (Basamid)	8F	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.	-	
Fipronil (Regent)	2B	Contact		P		Registered for control of **Mole Crickets** in potatoes.	M Bee:H	R3
Wingless Grasshopper (*Phaulacridium vittatum*) **Priority: Low**								
Wingless Grasshopper was ranked as a low priority in VIC, QLD & TAS. They have a voracious appetite and can cause severe damage to foliage if the numbers get high. Damage is limited to feeding on newly established plants and reducing plant populations.								
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Soil fumigant	NR	A	ALL	Registered in field crops for control of **soil borne pests**. Leave soil undisturbed for 14 d after treatment. ***For use by professional and registered fumigators only.***	-	-
Chlorpyrifos (Lorsban)	1B	Contact	NR	A	NSW, VIC & TAS	Registered in rhubarb for control of **Wingless Grasshoppers**. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Dimethoate	1B	Contact	7	A	ALL	Registered in rhubarb for control of Aphids, Jassids, Mites, Leafhoppers, Green Vegetable Bug, Thrips and **Wingless Grasshoppers**. Do not apply after commencement of flowering. [Max. no. of applications per crop and re-treatment interval not specified]	H Bee:H	R1

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of **Wingless Grasshopper** in grapes.	M Bee:M	R3
Fenitrothion	1B	Contact		P		Registered for the control of a range of grasshoppers and locusts. in cabbage.	H Bee:H	-
Onion Thrips (*Thrips tabaci*) **Plague Thrips** (*Thrips imaginis*) **Priority: Low**								
Thrips were ranked as a low priority in VIC, QLD & TAS. It can be difficult to distinguish between thrips species in the field. Thrips cause direct feeding damage to foliage by piercing and rasping leaves. This damage can lead to yield loss. They are also a vector for plant viruses. It is important to use different insecticide modes of action to prevent the development of resistance. MT16009 IPM Project Recommends: The use of predatory thrips, mites & bug releases, control flowering weeds, mulch and use of certified seed. There is reported resistance to commonly used insecticides.								
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	-
Dimethoate	1B	Contact	7	A	ALL	Registered in rhubarb for control of Aphids, Jassids, Mites, Leafhoppers, Green Vegetable Bug, **Thrips** and Wingless Grasshoppers. Do not apply after commencement of flowering. [Max. no. of applications per crop and re-treatment interval not specified]	H Bee:H	R1
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs, Whitefly, **Thrips** and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
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
Spirotetramat (Movento 240 SC) Bayer	23	Ingestion	3	A	ALL	Registered in rhubarb for control of Western Flower Thrips, Tomato Thrips, **Plague Thrips**, Green Peach Aphid and Cotton Aphid. [Max 2 applications per crop; re-treatment interval 7 d]	M Bee:VL	-
Spinetoram (Success Neo) Corteva	5	Ingestion	1	P-A	ALL	Registered in rhubarb for control of Helicoverpa. Registered for control of Thrips in bananas, brassica vegetables, cucurbits, fruiting vegetables, leafy vegetables, legume vegetables, ornamentals, berries and macadamias.	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	1 G:14	P-A	ALL	Registered in stalk & stem vegetables including rhubarb for control Helicoverpa. Registered for control of Thrips in bananas, brassica vegetables, cucurbits, fruiting vegetables, leafy vegetables, legume vegetables, ornamentals, berries, pome fruit, stone fruit and tropical & sub-tropical fruit.	L Bee:L	-
Cyantraniliprole (Benevia) FMC	28	Ingestion		P		Registered for suppression of **Thrips** in bulb vegetables, fruiting vegetables, cucurbits, potatoes and strawberries.	M Bee:VH	-
Diafenthiuron + Cyantraniliprole (Minecto Forte) Syngenta	12A+28	Contact & Ingestion		P		Registered for suppression of **Thrips** in cucurbits and fruiting vegetables.	M Bee:VH	-
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.	-	-
Flonicamid (Mainman) ISK/UPL	29	Ingestion		P		Registered for control of Aphids, Mealybug and Silverleaf Whitefly in various crops including pome fruit, cucurbits and potatoes. US registration for control of **Thrips** in greenhouse peppers, and control of Aphids, Plant Bugs and Greenhouse Whitefly in cucurbits. ST17000 is generating data to support a minor use permit for **Thrips** control in bulb vegetables.	M Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Flupyradifurone (Sivanto Prime) Bayer	4D	Contact and 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.	L Bee:L	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and **Thrips**.	-	-
Petroleum Oil	UN	Contact		P		Registered for control of **Thrips** in asparagus, beans, beet, corn, cucurbits, peppers, radish, squash and tomatoes.	VL Bee:L	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2020/21 for **Thrips**, Bugs, Mites and Caterpillars.	-	-
Spotted Vegetable Weevil (*Desiantha diversipes*) **Vegetable Weevil** (*Listroderes difficilis*) **Priority: Low**								
Vegetable weevils were ranked as a low priority in VIC, QLD & TAS. Weevils can cause damage by tunnelling into leaves and reducing plant vigour. MT16009 IPM Project Recommends: Control broadleaf weed hosts (e.g. marshmallow) in the season prior to planting.								
Chlorpyrifos (Lorsban)	1B	Contact	NR	A	NSW	Registered in rhubarb for control of **Weevils**. [Max no. of applications and re-treatment interval not specified]	H Bee:H	R1
Indoxacarb (Avatar eVo) FMC	22A	Ingestion		P		Registered for control of **Weevils** in pome and stone fruits.	M Bee:M	R3
NUL3445 Nufarm	TBC			P		Product in development from Nufarm with activity on Caterpillars, Fruit Flies, Bugs, **Beetles** and Thrips.	-	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered for control of various insect pests such as Fruit Fly, Carpophillus Beetles, **Weevils** & Lepidoptera in almonds, macadamias, pomefruit, and stonefruit. Hort Innovation project ST17000 is generating data to support a label extension for control of Lepidoptera in stalk and stem vegetables.	M Bee:VH	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Fall Armyworm (*Spodoptera frugiperda*) **Priority: Unknown**								
Fall Armyworm was not ranked as a pest in rhubarb. 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	3 G:7	A	ALL (excl. VIC)	Permitted for use in stalk and stem vegetables for control of **Fall Armyworm**. [Max. 3 applications per crop; 2 consecutive; re-treatment interval 7 d]	L Bee:VL	-
Spinetoram (Success Neo) Corteva PER89241	5	Ingestion	1	A	ALL (excl. VIC)	Permitted for use in stalk and stem vegetables for control of **Fall Armyworm**. [Max. 4 applications per crop; re-treatment interval 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva PER89870	5	Ingestion	1 G:14	A	ALL (excl. VIC)	Permitted for use in stalk and stem vegetables (field & protected cropping) for control of **Fall Armyworm**. [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-
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	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion		P		Permitted for control of **Fall Armyworm** in brassica vegetables, root and tuber vegetables, leafy vegetables, brassica leafy vegetables, sweet corn, strawberries, lettuce, cucurbits, legume vegetables, fruiting vegetables, grapes, celery and blueberries.	M Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Indoxacarb (Avatar eVo) FMC	28	Ingestion		P		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
Magnet Insect Attractant Technology PER89398	-	Attractant		P		Permitted for control of **Fall Armyworm** in cotton, cereal grains, sweet corn, pastures & oilseeds**.**	-	-
Methomyl (Lannate)	1A	Contact		P		Permitted for control of **Fall Armyworm** in pome fruit, berries, citrus, stone fruit, ornamentals, mango, persimmon, grapes, brassica vegetables, fruiting vegetables, sweet corn, legume vegetables, root and tuber vegetables, macadamia, turf, shallots, spring onions, cucurbits, lettuce, avocado and celery.	H Bee:H	R2
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**.	-	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered in Australia in multiple crops for various insect pests such as Beetles, Weevils & **Lepidoptera**. Hort Innovation project ST17000 is generating data to support a label extension for control of Lepidoptera in stalk and stem vegetables. Indonesia registration for control of Liriomyza Leafminers and **Fall Armyworm** in vegetable crops.	M Bee:VH	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Leafminers (*Liriomyza* spp.) **Priority: Unknown**								
Vegetable Leafminer was not ranked as a pest in rhubarb. Dipteran Leafminers (*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	6	Contact	7 NG	A	ALL (excl. VIC)	Permitted for use in rhubarb (field only) for suppression of **Liriomyza Leafminers** (*Liriomyza* spp.) including Vegetable & Serpentine Leafminer. [Max. 2 applications per crop; re-treatment interval 7-14 d]	M Bee:H	-
Cyromazine (Diptex 150 WP) PER81867	17	Insect Growth Regulator	7 NG	A	ALL	Permitted for use in stalk and stem vegetables for control of ***Liriomyza*** species, including: **Vegetable Leafminer** (*Liriomyza sativa*) and **Serpentine Leafminer** (*Liriomyza huidobrensis*). [Max. 6 applications per crop; re-treatment interval 7 d]	-	-
Spinetoram (Success Neo) Corteva PER91155	5	Ingestion	3	A	ALL (excl. VIC)	Permitted for use in stalk and stem vegetables for control of ***Liriomyza*** species, including **Vegetable Leafminer**, **Pea Leafminer / Serpentine Leafminer** and **American Serpentine Leafminer**. [Max. 4 applications per crop; re-treatment interval 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva PER90928	5	Ingestion	1 G:14	A	ALL (excl. VIC)	Permitted for use in stalk and stem vegetables for control of ***Liriomyza*** species, including: **Vegetable Leafminer** (*Liriomyza sativa*), **Pea Leafminer** / **Serpentine Leafminer** (*Liriomyza huidobrensis*) & **American Serpentine Leafminer** (*Liriomyza trifolii*). [Max. 4 applications per crop; re-treatment interval 4 d]	L Bee:L	-
Spirotetramat (Movento 240 SC) Bayer PER88640	23	Ingestion	3	A	ALL (excl. VIC)	Permitted for use in rhubarb (field only) for control of **Liriomyza Leafminers** (*Liriomyza* spp.) [Max. 2 applications per crop; re-treatment interval 7 d]	M Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Chlorantraniliprole (Coragen) FMC	28	Ingestion	3 G:7	P-A	ALL	Registered in stalk and stem vegetables for control of Helicoverpa. Permitted for use in Spinach & Silverbeet for control of Cabbage Leafminer (***Liriomyza* sp.**)	L Bee:VL	-
Cyantraniliprole (Benevia) FMC	28	Ingestion		P		Permitted for control of **Liriomyza Leafminers** in bulb vegetables, fruiting vegetables and potatoes.	M Bee:VH	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion		P		Permitted for control of ***Liriomyza*** species, including **Vegetable Leafminer** in Brassica vegetables.	M Bee:H	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered in Australia in multiple crops for various insect pests such as Beetles, Weevils & Lepidoptera. Hort Innovation project ST17000 is generating data to support a label extension for control of Lepidoptera in stalk and stem vegetables. Indonesia registration for control of **Liriomyza Leafminers** and Fall Armyworm in vegetable crops.	M Bee:VH	-

4.3 Weeds in rhubarb

4.3.1 Weed priorities

Common Name	Scientific Name
Moderate	
Amaranthus	*Amaranthus* spp.
Cleavers	*Galium aparine L.*
Ryegrass	*Lolium rigidum*
Blackberry Nightshade	*Solanum nigrum*
Brassica Weeds	*Brassica* spp.
Fat Hen	*Chenopodium album*
Grass Weeds	*Poaceae*
Pigweed	*Portulaca oleracea*
Fumitory	*Fumaria* spp.
Nutgrass	*Cyperus rotundus*
Common Sowthistle	*Sonchus oleraceus*

No weeds were identified as high priority weeds in the recent survey, however several weeds were considered to be a moderate priority. Management practices available include soil fumigation, herbicides or mechanical removal.

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 start the crop with a clean paddock.

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[7].

[7] 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: Moderate**							
Amaranthus was ranked as a high priority in TAS and as a moderate priority in VIC and QLD. It is a short-lived annual weed that can pose a problem every year as they are prolific seed producers.							
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
MCPA PER13152	I**	Rhubarb	Permitted for use in rhubarb for control of broadleaf weeds, including **Amaranth**. Apply at crown dormancy.	NR	A	ALL	-
S-Metolachlor (Dual Gold)	K**	Rhubarb / Pre-emergent	Registered in rhubarb for control of grass and broadleaf weeds including **Amaranth**. [Max 1 applications per crop]	NR	A	ALL	-
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

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
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		-
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
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		-
Cleavers (*Galium aparine L.*) **Priority: Moderate**							
Cleavers were ranked as a high priority in TAS. Germination occurs mainly in Autumn. The cuticle has an amorphous wax which makes penetration by most herbicides difficult. A competitive weed and targeting weeds at early growth stages is critical.							
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Cleavers**.	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 **Cleavers**.	1 G:1	A	ALL	R3
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of **Cleavers** in pyrethrum.		P		R3

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		-
Ryegrass (*Lolium rigidum*) **Priority: Moderate**							
Ryegrass was ranked as a high priority in only TAS. Populations of Annual ryegrass are prone to herbicide resistance so integrated weed management and rotation of herbicide modes of action are important aspects of a long-term control strategy. It is important to use alternate, broad-spectrum products in non-crop periods.							
Clethodim (Select) PER82459	A***	Rhubarb / Post-emergent	Permitted for use in rhubarb for control of various grass weeds as per product label. Spot spray grass weeds as a post-emergence application.	63	A	ALL	R3
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Ryegrass**.	NR	A	ALL	R3
S-Metolachlor (Dual Gold)	K**	Rhubarb / Pre-emergent	Registered in rhubarb for control of grass and broadleaf weeds including **Ryegrass**. [Max 1 applications per crop]	NR	A	ALL	-
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of various grass and broadleaf weeds including **Ryegrass** in lettuce.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds, including suppression of **Annual Ryegrass** in beans.		P		-
S-Metolachlor+ Prosulfocarb (Boxer Gold) Syngenta	J+K**		Registered for control of **Ryegrass** in potatoes. Hort Innovation is generating data to support a label registration in carrots.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds, including **Annual Ryegrass** in asparagus, citrus, grapes, nuts, stone and pome fruits.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including **Ryegrass** in various crops and fallow situations. Compatible with glyphosate and diquat/paraquat.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Blackberry Nightshade (*Solanum nigrum*) **Priority: Moderate**							
Blackberry Nightshade was ranked as a moderate priority in VIC, QLD & TAS. Prolific weed that is widely adapted and difficult to eradicate, mainly due to its long-term seed viability. Managing this weed would be possible using various management practices such as soil fumigation, pre-crop spraying, spot spraying, or using mechanical devices.							
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
S-Metolachlor (Dual Gold)	K**	Rhubarb / Pre-emergent	Registered in rhubarb for control of grass and broadleaf weeds including **Blackberry Nightshade**. [Max 1 applications per crop]	NR	A	ALL	-
Aclonifen (Emerger) Bayer	H**	Pre-Emergence	Bayer is expected to seek registration for pre-emergent control of grass and broadleaf weeds in various vegetable crops. Registered in Europe for use in potatoes, legume vegetables and cereals. **Blackberry Nightshade** is listed as moderately susceptible at a high rate.		P		-
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		-
Clomazone	Q**		Registered as a pre-emergence residual application for control of various broadleaf weeds, including **Blackberry Nightshade**, in cucurbits, beans, poppies and potatoes.		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		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including **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
Brassica Weeds (*Brassica* spp.) **Priority: Moderate**							
Brassica Weeds were ranked as a moderate priority in VIC, QLD & TAS. They are Winter growing weeds that compete aggressively with crops and runs to seed quickly. Weeds include wild turnip (*Brassica tournefortii*), charlock (*Sinapis arvensis*), turnip weed (*Rapistrum rugosum*) & garden radish (*Raphanus sativus*). Confirmed Wild radish herbicide resistance in Australia*** Populations (mostly in WA) have developed resistance to herbicides in the mode-of-action (MOA) Groups B, C, F and I. Group B resistance is the most common, followed by Group F.							
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Brassica Weeds**.	NR	A	ALL	R3
MCPA PER13152	I**	Rhubarb	Permitted for use in rhubarb for control of broadleaf weeds, including **Turnip Weed, Wild Radish** and **Wild Turnip**. Apply at crown dormancy.	NR	A	ALL	-
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Brassica Weeds**.	1 G:1	A	ALL	R3
Flumetsulam (Broadstrike)	B***		Registered for control of broadleaf weeds including **Wild Radish** and **Wild Turnip** in cereals and pulse crops.		P		-
Metribuzin	C**		Registered for control of grass and broadleaf weeds, including **Wild Radish** and **Wild Turnip** in peas (not snow peas).		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds, including **Wild Radish** and **Wild Turnip** in asparagus, citrus, grapes, nuts, stone and 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 **Wild Radish** in various crops and fallow situations. Compatible with glyphosate and diquat/paraquat.		P		-
Fat Hen (*Chenopodium album*) **Priority: Moderate**							
Fat Hen was ranked as a moderate priority in VIC, QLD & TAS. Herbicide control can be difficult and targeting weeds at early growth stages is critical.							
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
MCPA PER13152	I**	Rhubarb	Permitted for use in rhubarb for control of broadleaf weeds, including **Fat Hen**. Apply at crown dormancy.	NR	A	ALL	-
S-Metolachlor (Dual Gold)	K**	Rhubarb / Pre-emergent	Registered in rhubarb for control of grass and broadleaf weeds including **Fat Hen**. [Max 1 applications per crop]	NR	A	ALL	-
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		-
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		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Clomazone	Q**		Registered as a pre-emergence residual application for control of various broadleaf weeds, including **Fat Hen**, in cucurbits, beans, poppies and potatoes.		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		-
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
Grass Weeds (*Poaceae*) **Priority: Moderate**							
Grass Weeds were ranked as a moderate priority in VIC, QLD & TAS. Managing grass weeds would be possible by various management practices such as soil fumigation, pre-crop spraying, spot spraying or using mechanical devices. Populations of Annual ryegrass are prone to herbicide resistance so integrated weed management and rotation of herbicide modes of action are important aspects of a long-term control strategy.							
Clethodim (Select) PER82459	A***	Rhubarb / Post-emergent	Permitted for use in rhubarb for control of various grass weeds as per product label. Spot spray grass weeds as a post-emergence application.	63	A	ALL	R3
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
S-Metolachlor (Dual Gold)	K**	Rhubarb / Pre-emergent	Registered in rhubarb for control of grass and broadleaf weeds. [Max 1 applications per crop]	NR	A	ALL	-
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
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of various grass and broadleaf weeds including **Ryegrass** in lettuce.		P		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds, including suppression of **Annual Ryegrass** in beans.		P		-
S-Metolachlor+ Prosulfocarb (Boxer Gold) Syngenta	J+K**		Registered for control of **Ryegrass** in potatoes. Hort Innovation is generating data to support a label registration in carrots.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds, including **Annual Ryegrass** in asparagus, citrus, grapes, nuts, stone and pome fruits.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including **Ryegrass** in various crops and fallow situations. Compatible with glyphosate and diquat/paraquat.		P		-
Pigweed (*Portulaca oleracea*) **Priority: Moderate**							
Pigweed was ranked as a moderate priority in VIC, QLD & TAS. Summer growing weed that competes aggressively in-crop and can be difficult to control with herbicides. Managing this weed would be possible by various management practices such as soil fumigation, pre-crop spraying, spot spraying or using mechanical devices.							
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
S-Metolachlor (Dual Gold)	K**	Rhubarb / Pre-emergent	Registered in rhubarb for control of grass and broadleaf weeds including **Pigweed**. [Max 1 applications per crop]	NR	A	ALL	-
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		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of various grass and broadleaf weeds including **Pigweed** in lettuce.		P		-
Clomazone	Q**		Registered as a pre-emergence residual application for control of various broadleaf weeds, including **Pigweed**, in cucurbits, beans, poppies and potatoes.		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
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		-
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

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Fumitory (*Fumaria* spp.) **Priority: Moderate**							
Fumitory was ranked as a moderate priority in VIC and QLD. It is a strongly competitive weed with highly persistent seeds making it an ongoing problem every year. Managing these would be possible using herbicides mentioned in Appendix 3 or by various management practices such as soil fumigation, pre-crop spraying, spot spraying, or using mechanical devices.							
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Fumitory**.	NR	A	ALL	R3
MCPA PER13152	I**	Rhubarb	Permitted for use in rhubarb for control of broadleaf weeds, including **Fumitories**. Apply at crown dormancy.	NR	A	ALL	-
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Fumitory**.	1 G:1	A	ALL	R3
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including **Fumitory** in berries, tomatoes, beans and fallow.		P		R3
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Nutgrass (*Cyperus rotundus*) **Priority: Moderate**							
Nutgrass was ranked as a moderate priority in VIC and QLD. Prefers damp, water-logged soils but can survive for years underground during dry times. Herbicide options are limited and unreliable. Improve soil drainage if possible.							
Glyphosate (Roundup)	M**	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		-

Active ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Common Sowthistle (*Sonchus oleraceus*) **Priority: Moderate**							
Common Sowthistle was ranked as a moderate priority in TAS. Spring to autumn are the best times to control Thistle. Spraying at early stages of growth is the most effective.							
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including **Sowthistle**.	NR	A	ALL	R3
S-Metolachlor (Dual Gold)	K**	Rhubarb / Pre-emergent	Registered in rhubarb for control of grass and broadleaf weeds including **Sowthistle**. [Max 1 applications per crop]	NR	A	ALL	-
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of various grass and broadleaf weeds including **Sowthistle** in lettuce.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including **Sowthistle** in asparagus, citrus, grapes, nuts, stone & pome fruits.		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 rhubarb
Appendix 2. Products available for control of insects, mites and other pests in rhubarb
Appendix 3. Products available for weed control in rhubarb
Appendix 4. Current permits for use in rhubarb
Appendix 5. Rhubarb Maximum Residue Limits (MRLs)
Appendix 6. Rhubarb Agrichemical Regulatory Risk Assessment

Appendix 1. Products available for disease control in rhubarb

Active Ingredient (Trade Name)	Chem. group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	General fumigant	Plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases (including Fusarium and Verticillium Wilts, Rhizoctonia, Pythium) and suppression of weeds. *For use by professional and registered fumigators only*	ALL	NR	-
Chlorothalonil (Bravo)	M5	Rhubarb	Ascochyta Blight	ALL	7	R3
Copper	M1	Rhubarb	Phytophthora Crown Rot and Downy Mildew	ALL	1	-
Dazomet (Basamid)	8F	Fumigant / Vegetables	Soil fungi (including *Pythium, Phytophthora, Fusarium,* and *Verticillium*), Nematodes, soil insects and weeds.	ALL	NR	-
Mancozeb	M3	Rhubarb	Rust	ALL	7	R2
Mancozeb + Metalaxyl-M (Ridomil Gold MZ)	M3+4	Rhubarb	Downy Mildew	ALL	14	R2
Phosphorous Acid PER86805	33	Rhubarb	Downy Mildew	ALL (excl. VIC)	1 NG	-
Streptomyces lydicus (Actinovate)	BM 02	Vegetables / Seed Treatment	Fusarium, Rhizoctonia, Pythium	ALL	NR	-
Sulphur	M2	Vegetables	Powdery Mildew and Rust	ALL	NR	-

Appendix 2. Products available for control of insects, mites and other pests in rhubarb

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
1,3-Dichloropropene + Chloropicrin (Telone C-35)	-	Field crops	Soil borne pests. *For use by professional and registered fumigators only.*	ALL	NR	-
Abamectin	6	Rhubarb	Broad mites	ALL	7 NG	-
Abamectin PER81876	6	Rhubarb	Suppression of Leafminers including Vegetable & Serpentine Leafminer.	ALL (excl. VIC)	7 NG	-
Afidopyropen (Versys) BASF	9D	Artichoke, rhubarb & celery	Cabbage Aphid, Lettuce Aphid, Green Peach Aphid and Cotton/Melon Aphid and suppression of Silverleaf Whitefly.	ALL	1	-
Bacillus thuringiensis subsp. Kurstaki (DiPel)	11A	Vegetables	Caterpillars including *Helicoverpa* spp.	ALL	NR	-
Beauveria bassiana (Velifer) BASF	UNF	Protected vegetables and ornamentals	Suppression of various pests including: Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites.	ALL	NR	-
Chlorantraniliprole (Coragen) FMC	28	Rhubarb	*Helicoverpa* spp.	ALL	3 G:7	-
Chlorantraniliprole (Coragen) FMC PER89259	28	Stalk & Stem Vegetables	Fall Armyworm (*Spodoptera frugiperda*)	ALL (excl. VIC)	3 G:7	-
Chlorpyrifos (Lorsban)	1B	Rhubarb	Cutworms	ALL	NR	R1
			Wingless Grasshoppers	NSW, VIC & TAS		
			Field Crickets and Mole Crickets	QLD		
			Weevils	NSW		

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
Cyromazine (Diptex 150 WP) PER81867	17	Stalk and Stem Vegetables / Field & Protected	*Liriomyza* spp. including Vegetable & Serpentine Leafminer	ALL	7 NG	-
Diazinon	1B	Rhubarb	Cutworms and Caterpillars	ALL	14 G:14	R3
Dimethoate	1B	Rhubarb	Aphids, Jassids, Mites, Leafhoppers, Green Vegetable Bug, Thrips and Wingless Grasshoppers	ALL	7	R1
Emulsifiable Botanical Oils (Eco-Oil)	-	Vegetables	Greenhouse Whitefly	ALL	NR	-
Ethyl Formate		Rhubarb / Post-Harvest Fumigant	Detritus Moth	ALL	NR	-
Flubendiamide (Belt) Bayer	28	Rhubarb	Heliothis	ALL	1	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Vegetables	Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers.	ALL	1	-
Helicoverpa NPV (Gemstar)	-	Stalk & stem vegetables	Corn Earworm, Native Budworm	ALL	NA	-
Imidacloprid (Confidor) PER14212	4A	Rhubarb	Aphids	ALL (excl. VIC)	14	R2
Iron EDTA Complex	-	Plants in general	Snails & Slugs	ALL	NR	-
Metaldehyde	-	Vegetables	Snails & Slugs	ALL	7	
Methiocarb (Mesurol)	1A	Vegetables	Snails & Slugs	ALL	NR	R2
Permethrin (Ambush) PER13441	3A	Rhubarb	Green Looper, Light Brown Apple Moth and Native Budworm and suppression of Green Peach Aphid	ALL (excl. VIC)	2	-

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
Potassium Salts of Fatty Acids (Natrasoap)	-	Vegetables	Aphids, Thrips, Mealybug, Two-Spotted Mites, Spider Mite and White Fly	ALL	NR	-
Propargite (Omite)	12C	Vegetables	Two- Spotted Mite	ALL	7	R3
			Spider Mite	QLD & WA		
Spinetoram (Success Neo) Corteva	5	Rhubarb	*Helicoverpa* spp.	ALL	1	-
Spinetoram (Success Neo) Corteva PER89241	5	Stalk & Stem Vegetables	Fall Armyworm (*Spodoptera frugiperda*)	ALL (excl. VIC)	1	-
Spinetoram (Success Neo) Corteva PER91155	5	Stalk and Stem Vegetables	Vegetable Leafminer (*Liriomyza sativae*), Pea Leafminer / Serpentine Leafminer (*Liriomyza huidobrensis*) American Serpentine Leafminer (*Liriomyza trifolii*).	ALL (excl. VIC)	1	-
Spinosad (Entrust Organic) Corteva	5	Stalk & Stem vegetables	Helicoverpa	ALL	1 G:14	-
Spinosad (Entrust Organic) Corteva PER89870	5	Stalk & Stem Vegetables (field & protected cropping)	Fall Armyworm (*Spodoptera frugiperda*)	ALL (excl. VIC)	1 G:14	-
Spinosad (Entrust Organic) Corteva PER90928	5	Stalk & Stem Vegetables	*Liriomyza* species, including: Vegetable Leafminer (*Liriomyza sativa*), Pea Leafminer / Serpentine Leafminer (*Liriomyza huidobrensis*) & American Serpentine Leafminer (*Liriomyza trifolii*).	ALL (excl. VIC)	1 G:14	-
Spirotetramat (Movento 240 SC) Bayer	23	Rhubarb (Field only)	Western Flower Thrip, Tomato Thrips, Plague Thrips, Green Peach Aphid & Cotton Aphid	ALL	3	-

Active Ingredient (Trade Name)	Chem. group	Situation	Pests / Comments	States	WHP	Regulatory risk
Spirotetramat (Movento) Bayer PER88640	23	Rhubarb (field only)	Liriomyza Leafminers (*Liriomyza* spp.)	ALL (excl. VIC)	3	-
Sulphur	M2	Vegetables	Powdery Mildew, Rust, Tomato Russet Mite and Two-Spotted Mite	ALL	NR	-
Trichlorfon (Lepidex)	1B	Vegetables	Cabbage White Butterfly, Cabbage Moth, Rutherglen Bug, Green Vegetable Bug	ALL	2	R2

Appendix 3. Products available for weed control in rhubarb

Active ingredient (Trade Name)	Chem. Group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory risk
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Vegetables / Soil fumigant	Plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases and suppression of weeds. *For use by professional and registered fumigators only.*	NR	ALL	-
Clethodim (Select) PER82459	A***	Rhubarb / Post-Emergent / field only	Grass Weeds	63	ALL	R3
Glyphosate (Roundup)	M**	Field crops / General seed bed preparation and knockdown	Grass and broadleaf weeds as a pre-crop spray.	NR	ALL	R3
MCPA PER13152	I**	Rhubarb	Broadleaf Weeds including Amaranth, Fat Hen, Fumitories, Turnip Weed, Wild Radish and Wild Turnip	NR	ALL	-
S-Metolachlor (Dual Gold)	K**	Rhubarb / Pre-emergent	Grass and broadleaf weeds including Blackberry nightshade, Fat hen, Amaranth, Pigweed, Ryegrass and Sow thistle	NR	ALL	-
Paraquat + Diquat (SpraySeed)	L**	Field crops / Fallow / Direct drilling / General knockdown	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 rhubarb

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER81876 Version 4	Abamectin / Celery & Rhubarb / Leafminer including Vegetable & Serpentine Leafminer	24-Jun-16	30-Apr-24	Hort Innovation
PER89259	Chlorantraniliprole (Coragen) / Stalk & Stem Vegetables / Fall Armyworm	06-Mar-20	31-Mar-23	Hort Innovation
PER82459	Clethodim (Select) / Rhubarb / Various Grass Weeds	19-Apr-17	30-Sep-21	Hort Innovation
PER81867 Version 2	Cyromazine (Diptex 150 WP) / Stalk & Stem Vegetables / *Liriomyza* spp. including Vegetable & Serpentine Leafminer	2-Dec-19	30-Nov-23	Hort Innovation
PER14212 Version 2	Imidacloprid (Confidor) / Rhubarb / Aphids	31-Oct-13	31-Dec-22	Hort Innovation
PER13152 Version 3	MCPA / Rhubarb / Broadleaf Weeds	04-Dec-11	30-Sep-21	Hort Innovation
PER13441 Version 2	Permethrin (Ambush) / Rhubarb / Green Peach Aphid, Green Looper, Light Brown Apple Moth and Budworms	11-Apr-12	31-Mar-27	Hort Innovation
PER86805	Phosphorous Acid / Rhubarb / Downy Mildew	21-Jan-19	31-Jan-24	Hort Innovation
PER89241	Spinetoram (Success Neo) / Stalk & Stem Vegetables / Fall Armyworm	06-Mar-20	31-Mar-23	Hort Innovation
PER91155	Spinetoram (Success Neo) / Stalk & Stem Vegetables / Leafminers	09-Jun-21	30-Jun-24	Hort Innovation
PER89870	Spinosad (Entrust Organic) / Stalk and Stem Vegetables (field & protected cropping) / Fall Armyworm	21-Jul-20	31-Jul-23	Hort Innovation
PER90928	Spinosad (Entrust Organic) / Stalk and Stem Vegetables (field & protected cropping) / Vegetable Leafminer (*Liriomyza sativa*), Serpentine Leafminer (*Liriomyza huidobrensis*) & American Serpentine Leafminer (*Liriomyza trifolii*)	23-Apr-21	30-Apr-24	Hort Innovation
PER88640	Spirotetramat (Movento) / Rhubarb / Liriomyza Leafminers (*Liriomyza* spp.)	18-May-20	31-May-23	Hort Innovation

Appendix 5. Rhubarb Maximum Residue Limits (MRLs)

CODEX commodity grouping of Stalk and Stem Vegetables (017):

VS 0627 Rhubarb
VS 0078 Stalk and Stem Vegetables
Vegetable

Note: Currently production of all Rhubarb is for the Australian market and no exports are recorded. Available information indicates that in the absence specific limits in legislation the most countries defer to Codex, followed by EU MRL standards or 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	VS 0627	Rhubarb	T0.05	-
Afidopyropen			NA	NA
Boscalid	VV 0078	Stalk and stem vegetables	-	30
Chlorantraniliprole	VS 0627	Rhubarb	5	-
Chlordane		Vegetables	E0.02	
Chloropicrin		Soil fumigant / MRLs not required	NR	
Chlorothalonil	VS 0627	Rhubarb	-	7
		Vegetables	T7	
Chlorpyrifos		Vegetables	T*0.01	
Chlorthal-dimethyl		Vegetables	5	
Clethodim	VS 0627	Rhubarb	0.1	
Clothianidin	VS 0078	Stalk and stem vegetables	-	0.04
Cyromazine	VS 0078	Stalk and stem vegetables	T7	
DDT		Vegetables	E1	
Diazinon		Vegetables	0.7	
Dicofol		Vegetables	5	
Dimethoate	VS 0627	Rhubarb	0.7	-
Diquat		Vegetables	*0.05	
Dithiocarbamates	VS 0627	Rhubarb	2	-
EPTC		Vegetables	*0.04	
Flubendiamide	VS 0078	Stalk and stem vegetables	5	
Glyphosate	VS 0078	Stalk and Stem Vegetables	*0.01	-
Heptachlor		Vegetables	E0.05	
Imidacloprid	VS 0627	Rhubarb	T0.2	
Inorganic bromide		Vegetables	20	
Iron EDTA complex		MRLs not required	NR	
Lindane		Vegetables	E2	
Linuron		Vegetables	*0.05	
Mancozeb	VS 0627	Rhubarb	2	
MCPA	VS 0627	Rhubarb	*0.02	

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Mesotrione	V S0627	Rhubarb	-	*0.01
Metalaxyl		Vegetables	T0.1	-
Metaldehyde		Vegetables	1	
Methiocarb		Vegetables	0.1	
Methyl bromide		Vegetables	T*0.05	
Metolachlor	VS 0627	Rhubarb	*0.05	-
Omethoate		Vegetables	2	
Paraquat		Vegetables	*0.05	-
Permethrin	VS 0627	Rhubarb	1	
Phosphorous acid	VS 0627	Rhubarb	T100	
Piperonyl butoxide		Vegetables	8	
Pirimicarb		Vegetables	1	
Potassium salts of fatty acids		MRLs not required	NR	
Prometryn		Vegetables	*0.1	
Propargite		Vegetables	3	
Propazine		Vegetables	*0.1	
Pyrethrins		Vegetables	1	
Quinclorac	VS 0627	Rhubarb	-	0.5
Rotenone		MRLs not required	NR	
Sethoxydim	VS 0627	Rhubarb	0.1	-
Spinetoram	VS 0078	Stalk and stem vegetables	2	
Spinosad	VS 0627	Rhubarb	2	
Spirotetramat	VS 0627	Rhubarb	5	
Sulphur		MRLs not required	NR	
Trichlorfon		Vegetables	0.1	
Trifluralin		Vegetables	0.05	-

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

* Indicates that an MRL is at the Limit of Quantitation (LOQ)
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: Rhubarb Agrichemical Regulatory Risk Assessment

Rhubarb
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 require the generation of new data. A consequence of which can be that many of these chemicals are not meeting contemporary risk assessment standards as the necessary data is unavailable, or where data is available, the risk posed is considered unacceptable.

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

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

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

Rhubarb 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 (Invasive & nuisance ants)	Pyriproxyfen	**7C**	EU: Authorisation renewal process underway	
Aphids				
Aphids	Afidopyropen	**9D**		
	Dimethoate	**1B**	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	Afidopyropen now registered for control of Aphids in rhubarb
	Imidacloprid (PER14212)	**4A**	APVMA: Under review Canada: Under review EU: Removal of all field uses USA: Re-registration with new risk mitigation measures	
Cotton aphid	Spirotetramat	**23**		
Green peach aphid	Permethrin (PER13441)	**3A**	Codex: Re-evaluation scheduled 2021/22. Support uncertain EU: No authorisation	
	Spirotetramat	**23**		
Beetles				
Spotted vegetable weevil	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	
Vegetable weevil	Chlorpyrifos	**1B**		

Problem	Active Constituents	Chemical Group	Comment	Activities
Caterpillars/Lepidoptera				
Cabbage moth	Trichlorfon	**1B**	APVMA: nominated for review Codex: No MRLs EU: deregistered US: No MRLs	
Cabbage white butterfly	Trichlorfon	**1B**	APVMA: nominated for review Codex: No MRLs EU: deregistered US: No MRLs	
Caterpillars	Diazinon	**1B**	EU: Deregistered Codex: To be reviewed by 2020/21. JMPR Periodic re-evaluation 2020	
	Spinetoram	**5**		
Cutworms	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	
	Diazinon	**1B**	EU: Deregistered Codex: To be reviewed by 2020/21. JMPR Periodic re-evaluation 2020	

Problem	Active Constituents	Chemical Group	Comment	Activities
Green looper	Permethrin (PER13441)	**3A**	Codex: Re-evaluation scheduled 2021/22. Support uncertain EU: No authorisation	
Fall armyworm	Abamectin	**6**		
	Chlorantraniliprole (PER89259)	**28**		
	Spinetoram (PER89241)	**5**		
	Spinosad (PER89870)	**5**		
Helicoverpa species Native Budworm (*H. punctigera*) Corn earworm/Cotton bollworm (*H. armigera*)	Chlorantraniliprole	**28**		ST17000 data generation for Tetraniliprole label extension in stalk and stem vegetables
	Flubendiamide	**28**		
	Helicoverpa NPV	**-**		
	Permethrin (PER13441)	**3A**	Codex: Re-evaluation scheduled 2021/22. Support uncertain EU: No authorisation	
	Spinetoram	**5**		
	Spinosad	**5**		
Lightbrown apple moth	Permethrin (PER13441)	**3A**	Codex: Re-evaluation scheduled 2021/22. Support uncertain EU: No authorisation	
Sugarcane bud (Detritus) moth	Ethyl formate (Post-harvest)	**8A**		
Grasshoppers/Locusts				
Australian plague 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	
Black field cricket	Chlorpyrifos	**1B**		
Field crickets	Chlorpyrifos	**1B**		
Migratory locust	Chlorpyrifos (PER11843)	**1B**		
Mole crickets	Chlorpyrifos	**1B**		
Spur-throated locust	Chlorpyrifos (PER11843)	**1B**		
Wingless grasshopper	Chlorpyrifos	**1B**		

Problem	Active Constituents	Chemical Group	Comment	Activities
Jassids/Plant bugs				
Bugs	Dimethoate	**1B**	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
Green vegetable bug	Dimethoate	**1B**		
	Trichlorfon	**1B**	APVMA: nominated for review Codex: No MRLs EU: deregistered US: No MRLs	
Jassids	Dimethoate	**1B**	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
Leafhoppers	Dimethoate	**1B**		
Rutherglen bug	Trichlorfon	**1B**	APVMA: nominated for review Codex: No MRLs EU: deregistered US: No MRLs	
Mites				
Broad mite	Abamectin	**6**		ST19020 data generation for label registration for use of Spiromesifen for control of Broad Mites in rhubarb and artichoke.
Mites	Dimethoate	**1B**	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
Thrips				
Plague thrips	Spirotetramat	**23**		
Thrips	Dimethoate	**1B**	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
Tomato thrips	Spirotetramat	**23**		
Western flower thrips	Spirotetramat	**23**		
Other				
Leafminer	Dimethoate	**1B**	Codex: MRL deletion recommended. EU proposing to set all MRLs to < 0.01 mg/kg	
	Abamectin (PER81876)			
	Cyromazine (PER81867)	**17**		
	Spirotetramat (PER88640)	**23**		

Problem	Active Constituents	Chemical Group	Comment	Activities
DISEASES				
Ascochyta leaf spot	Chlorothalonil	**M5**	APVMA: Nominated for review Canada: Review recently completed, continued use considered acceptable EU: Authorisation not renewed[i].	
Bactericide	Hydrogen peroxide + peroxyacetic acid	**M**		
Damping off	Thiram	**M3**	APVMA: Nominated for review Canada: Proposed cancelling of all foliar uses Codex: To be reviewed 2022/23 EU: No authorisation in place	
Downy mildew	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	
	Metalaxyl/Metalaxyl-M	**4**	Metalaxyl EU: Candidate for substitution Metalaxyl-M EU: Restricted use approval	
	Phosphorous acid (PER86805)	**33**		
Leaf spots	Copper	**M1**	EU: Candidate for substitution	
Phytophthora crown rot	Copper	**M1**	EU: Candidate for substitution	
Rust	Copper	**M1**	EU: Candidate for substitution	
	Mancozeb	**M3**	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Sulphur	**M2**		

Problem	Active Constituents	Chemical Group	Comment	Activities
WEEDS				
Broadleaf weeds and grasses	Clethodim (PER82459)	**A**	Codex: MRLs proposed for deletion	
	Diquat	**L**	APVMA: Currently under review EU: No authorisation in place	
	MCPA (PER13152)	**I**		
	Paraquat	**L**	APVMA: Currently under review EU: No authorisation in place Rotterdam Convention: nomination	
	S-metolachlor	**K**		

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[i] Chlorothalonil - Withdrawal of authorisations 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