



Spinach and Silverbeet

Strategic Agrichemical Review Process
(SARP)

July 2021

Hort Innovation
Project – VG18004

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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 Spinach and Silverbeet industry across Australia. The information in this report will assist the industry with its agrichemical selection and usage into the future.

Date of report:

July 2021

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**Hort
Innovation**
Strategic levy investment

**VEGETABLE
FUND**

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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 Spinach and Silverbeet 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
Silverbeet	
Damping Off	<i>Pythium</i> spp., <i>Phytophthora</i> spp., <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp.
Spinach	
Damping Off	<i>Pythium</i> spp., <i>Phytophthora</i> spp., <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp.
Cercospora Leaf Spot	<i>Cercospora</i> spp.
Sclerotinia Rot	<i>Sclerotinia</i> spp.
Downy Mildew	<i>Peronospora</i> spp.

1.2 Insects, mites and other pests

The high priority insect, mite and other pests are:

Common name	Scientific name
Silverbeet	
Beet Webworm	<i>Spoladea recurvalis</i>
Cotton Bollworm / Corn Earworm	<i>Helicoverpa armigera</i>
Native Budworm	<i>Helicoverpa punctigera</i>
Spinach	
Leafminer (NEW)	<i>Liriomyza chenopodii</i>
Two-Spotted Mite	<i>Tetranychus urticae</i>
Tomato Russet Mite	<i>Aculops lycopersici</i>
European Red Mite	<i>Panonychus ulmi</i>
Rust Mite	Eriophyidae
Crown Mites (NEW)	<i>Tyrophagus similis</i>

1.3 Weeds

The high priority weeds are:

Common name	Scientific name
Capeweed	<i>Arctotheca calendula</i>
Fat Hen	<i>Chenopodium album</i>
Stinging Nettle	<i>Urtica</i> spp.
Wireweed	<i>Polygonum aviculare</i>

2. The Australian Spinach and Silverbeet Industry

The Australian Spinach and Silverbeet industry are both minor horticultural industries. The varieties referred to in this SARP are:

Crop Subgroup	Common Name	Scientific Name
Subgroup 013A, Leafy greens VL 0053	Spinach	<i>Spinacia oleracea</i>
	Silverbeet	<i>Beta vulgaris subsp. vulgaris</i>

Both Spinach and Silverbeet have 'baby-leaf' varieties which are sold as salad mix. These varieties are not included in this SARP.

Spinach and Silverbeet are grouped with kale for production and trade data purposes. Production¹ in Australia for the year ending June 2020 was 7,080 tonnes of spinach, silverbeet, and kale collectively. Of this production:

- 89% was sent for fresh supply
- 7% was sent for processing
- 4% was sent for fresh export

Spinach and Silverbeet are grown in most states, with the major production regions in the Lockyer Valley in Queensland and the Sunraysia region in Victoria.

Australia is a net exporter of fresh spinach. For the year ending June 2020, Australia imported < 0.5 tonnes of spinach while 256 tonnes were exported. Of this export, 32% was destined for Singapore followed by Malaysia (19%), Hong Kong (18%), Thailand (11%) and Indonesia (6%). There is currently no external trade of Silverbeet.

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

Fresh English Spinach/Silverbeet/Kale Seasonality by State

State	19/20 t	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
New South Wales (13%)	898	High	High	Medium	Medium	Low	Low	Low	Low	Low	Low	Low	Low
Victoria (45%)	3,191	High	High	High	Medium	Medium	Low	Low	Low	Low	Low	Low	Low
Queensland (32%)	2,228	High	High	High	High	Medium	Medium	Low	Low	Low	Low	Low	Low
Western Australia (5%)	374	High	High	High	High	Medium	Medium	Low	Low	Low	Low	Low	Low
South Australia (1%)	96	High	High	High	High	Medium	Medium	Low	Low	Low	Low	Low	Low
Tasmania (4%)	294	High	High	High	High	Medium	Medium	Low	Low	Low	Low	Low	Low
Imported	0	High	High	High	High	Medium	Medium	Low	Low	Low	Low	Low	Low
Availability legend		High	High	Medium	Medium	Low	Low	Low	Low	Low	Low	Low	None

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

3. Introduction

3.1 Background

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

Growers may face severe losses from diseases, pests and weeds due to a lack of registered or approved (via a permit) chemical control tools.

Environmental concerns, consumer demands, and public opinion are also significant influences in the marketplace related to pest management practices. Industry IPM practitioners must strive to implement best management practices and tools to incorporate a pest management regime where strategies work in harmony with each other to achieve the desired effects while posing the least risks.

In combination with cultural practices, pesticides are important tools in Spinach and Silverbeet 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 Spinach and Silverbeet 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 Spinach and Silverbeet 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 Spinach and Silverbeet 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 Spinach and Silverbeet but attempts to prioritise the major problems.

Exotic plant pests, not present in Australia, are not addressed in this document. A biosecurity plan has been developed for the Vegetable Industry in consultation with industry, government and scientists. The Biosecurity Plan for the Vegetable Industry which covers Spinach and Silverbeet 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. <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 Spinach and Silverbeet as a minor crop. The crop fits within the APVMA crop group Crop Group 013: Leafy 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 guidance².

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 Spinach and Silverbeet industry is for manufacturers to register new pesticides uses in the crop.

² <https://apvma.gov.au/node/10931>

3.3 Methods

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

Hort Innovation Project Reference	Process of Review - Activity
VG16060 - Vegetable Agrichemical Pest Management Needs and Priorities (AUSVEG) - Commenced: 2 May 2017	<p>Engagement and consultation with growers and other relevant stakeholders. Including; Online crop specific surveys, workshops and one on one consultation Nationally.</p> <p>Collation of information collected by commodity on applicable pests, diseases and weeds in order of priority.</p>
MT17019 – Regulatory Support & Co-ordination (AKC)	<p>Spinach & Silverbeet Agrichemical Regulatory Risk Assessment Document</p> <p>To assist strategic planning, with respect to future pest management options, this document was developed as part of the Hort Innovation funded project MT17019 to highlight the regulatory threats to agrichemicals currently approved for the management of the pests and diseases in Spinach & Silverbeet as well as current initiatives aimed at addressing identified pest management deficiencies.</p>
VG18004 – Vegetable Strategic Agrichemical Review Process (SARP) Report Updates	<p>SARP updated via a desktop audit:</p> <ul style="list-style-type: none"> • Review list of priorities ranked as high, moderate and low for each plant pest groups (disease, insects and weeds) – provided by VG16060 • Identify industries pest priority gaps in order of importance • Update current pesticides available via label registrations or minor use permits • Update available pesticide use patterns, IPM ranking/compatibility, mode of action and chemical group. • Identify pesticides at risk (under review and/or limited uses) via MT17019 Regulatory Support & Co-ordination – AKC consulting. • Identify any appropriate solutions through the outcomes of the AgChem Forum’s or similar market intelligence and their overall suitability (IPM compatibility, Chemical group to manage resistance, risk profile, existing domestic MRL’s or global MRL’s including any potential trade barriers, efficacy, OH&S, environmental safety and sustainability). • Include known pesticide solutions that are currently under development with registrants for new uses in the nominated crops or in current Hort Innovation projects. • Update MRL tables to include Australian MRL’s, Codex and any applicable export market MRL’s

3.4 Results and discussions

3.4.1 Detail

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

3.4.2 Appendices

Refer to additional information in the appendices:

Appendix 1. Products available for disease control in spinach and silverbeet

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

Appendix 3. Products available for weed control in spinach and silverbeet

Appendix 4. Current permits for use in spinach and silverbeet

Appendix 5. Spinach and silverbeet Maximum Residue Limits (MRLs)

Appendix 6. Spinach and silverbeet Agrichemical Regulatory Risk Assessment

4. Diseases, Pests and Weeds of Spinach and Silverbeet

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 website³.

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

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

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

³ <https://www.croplife.org.au/resources/programs/resistance-management/>

4.1 Diseases of spinach and silverbeet

4.1.1 Disease priorities of silverbeet

Common name	Scientific name
High	
Damping Off	<i>Pythium</i> spp., <i>Phytophthora</i> spp., <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp.
Moderate	
Sclerotinia Rot	<i>Sclerotinia</i> spp.
Cercospora Leaf Spot	<i>Cercospora</i> spp.
Downy Mildew	<i>Peronospora</i> spp.
Alternaria Leaf Spot	<i>Alternaria</i> spp.
Powdery Mildew	<i>Erysiphe betae</i>
Rust	<i>Uromyces betae</i>
Low	
Anthracnose	<i>Colletotrichum</i> spp.
Grey Mould	<i>Botrytis cinerea</i>
Bacterial Leaf Spot (NEW)	<i>Xanthomonas</i> spp.
Phoma Leaf Spot (NEW)	<i>Phoma beta</i>

4.1.2 Disease priorities of spinach

Common name	Scientific name
High	
Damping Off	<i>Pythium</i> spp., <i>Phytophthora</i> spp., <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp.
Cercospora Leaf Spot	<i>Cercospora</i> spp.
Sclerotinia Rot	<i>Sclerotinia</i> spp.
Downy Mildew	<i>Peronospora</i> spp.
Moderate	
Alternaria Leaf Spot	<i>Alternaria</i> spp.
Cladosporium Leaf Spot (NEW)	<i>Cladosporium variabile</i>
Stemphylium Leaf Spot (NEW)	<i>Stemphylium botryosum f.sp. Spinacia</i>
Low	
Powdery Mildew	<i>Erysiphe betae</i>
Rust	<i>Uromyces betae</i>
Anthraco nose	<i>Colletotrichum</i> spp.
Grey Mould	<i>Botrytis cinerea</i>
Bacterial Leaf Spot (NEW)	<i>Xanthomonas</i> spp.

The most important disease issues based on the feedback received were Damping Off in silverbeet, and Damping Off, Cercospora Leaf Spot, Sclerotinia Rot and Downy Mildew in spinach. Available and potential products for control of these diseases are detailed in Section 4.1.3.

Resistance Management

There are no specific Resistance Management Strategies for spinach and silverbeet listed on the Croplife website⁴ however there are strategies for some of the important diseases such Downy Mildew and Sclerotinia in other crops that provide a useful reference for these crops.

⁴ www.croplife.org.au/resources/programs/resistance-management/

4.1.3 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
Damping Off (<i>Pythium</i> spp., <i>Phytophthora</i> spp., <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp.)							
Priority: High							
Spinach: Damping Off was ranked as a high priority in VIC, QLD, NSW, WA & TAS and as a moderate priority in SA.							
Silverbeet: Damping Off was ranked as a high priority in NSW (13%), as a moderate priority in QLD, WA & SA and as a low priority in VIC & TAS .							
Symptoms of damping-off and root rot consist of poor seed germination, pre-emergence and death of seedlings, post-emergence death of newly emerged seedlings, stunted plants, yellowed lower leaves, general poor growth, wilting, and eventual collapse and death of older plants. Roots of infected plants can appear water-soaked or brown to black in colour. In severe cases, nearly all roots may be girdled or rotted off.							
While all stages of silverbeet and spinach can be infected by root rot organisms, newly emerging plants and young seedlings are very susceptible. Control options are limited and include the use of crop rotation to break the disease cycle.							
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables as a pre-plant treatment for control of soil borne diseases. Leave soil undisturbed for 14 d after treatment. For use by professional and registered fumigators only.	-
Cyazofamid (Ranman) UPL	21	Protectant & Curative	3 NG	A	ALL	Registered in spinach & silverbeet (field) for control of Damping Off (<i>Pythium</i>). [Max. 6 applications per crop; re-treatment interval 7-10 d]	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Registered in broadacre seed beds for control of soil fungi (including <i>Fusarium</i> spp.), nematodes (cyst and non-cyst forming), soil insects and germinating seeds of weeds.	-
Fludioxonil + Metalaxyl-M (Maxim XL) Syngenta	12+4	Protectant	NR G:28	A	ALL	Registered in spinach & silverbeet as a seed treatment for control of Damping Off caused by <i>Rhizoctonia solani</i> and <i>Phytophthora</i> spp. [Max. 1 application to seed prior to planting]	R3
<i>Streptomyces lydicus</i> WYEC108 (Actinovate) Novozymes Bioag	BM 02	Biological	NR	A	ALL	Registered in vegetables as a seed treatment for <i>Fusarium</i> , <i>Rhizoctonia</i> & <i>Pythium</i> Management.	-
<i>Bacillus amyloliquefaciens</i> Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	BM 02	Biological	NR	P-A	ALL	Registered in vegetables for application to soil to improve bioavailability of soil resources to horticultural crops.	-
<i>Bacillus amyloliquefaciens</i> strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of <i>Botrytis</i> in grapes. US registration for control of Pythium Damping Off in artichoke, asparagus, brassica leafy vegetables, bulb vegetables, citrus, cucurbits, corn, fruiting vegetables, legume vegetables, oilseeds, soybean, strawberry and root and tuber vegetables (except sugar beet).	-
Fludioxonil + Sedaxane (Vibrance Premium) Syngenta	12+7	Protective Seed Treatment		P		Registered for control of Black Scurf (<i>Rhizoctonia</i>), Silver Surf, Black Rot, Gangrene and Fusarium Dry Rot and suppression of Scab in potatoes. Hort innovation is pursuing studies to control Rhizoctonia in beetroot.	R3
Metalaxyl-M (Ridomil Gold) Syngenta	4	Protectant		P		Registered as a pre-plant treatment for control of Damping Off (<i>Pythium</i> & <i>Phytophthora</i> spp.) in cucurbits, capsicums, cabbage, cauliflower, broccoli, brussel sprouts, carrots and tomatoes and permitted for control of Damping Off (<i>Pythium</i> & <i>Phytophthora</i> spp.) in lettuce (field).	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
NUL3163 Nufarm	TBC			P		New active in development from Nufarm with activity on <i>Fusarium</i> , <i>Pythium</i> & <i>Rhizoctonia</i> .	-
Thiophanate-Methyl + Etridiazole (Banrot)	1+14	Protectant		P		Registered in container grown ornamentals and in ground bedding plants as a post plant soil drench for control of <i>Pythium</i> , <i>Phytophthora</i> , <i>Rhizoctonia</i> and <i>Thielaviopsis</i> .	-
Cercospora Leaf Spot (<i>Cercospora</i> spp.)							
Priority: High (spinach), Moderate (silverbeet)							
Spinach: <i>Cercospora</i> Leaf Spot was ranked as a high priority in VIC & TAS and as a moderate priority in QLD, NSW, WA & SA.							
Silverbeet: <i>Cercospora</i> Leaf Spot was ranked as a moderate priority in VIC, QLD, NSW, WA, SA & TAS.							
This disease is seed borne and can survive in crop trash. Disease free planting material is important for preventing the spread of this disease. The slightest disease on leaves can lead to whole crop being unmarketable.							
Mancozeb	M3	Protectant	14	A	ALL	Registered in spinach & silverbeet for control of Cercospora Leaf Spot and Downy Mildew. Apply at first sign of disease. [Max, no. of applications not specified; re-treatment interval 7-10 d]	R2
Propiconazole PER14479	3	Protectant	7	A	ALL (excl. VIC)	Permitted for use in spinach for control of Cercospora Leaf Spot and in silverbeet for suppression of Leaf Spot, Powdery Mildew & Rust. [Spinach - Max. 5 applications per crop; re-treatment interval 14 d] [Silverbeet - Max. 2 applications per crop; re-treatment interval 10 d].	R3
Copper	M1	Protectant	1	P-A	ALL	Registered in Spinach and Silverbeet for control of Downy Mildew. Registered for control of <i>Cercospora</i> in bananas, figs and celery.	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative	3 NG	P-A	ALL	Registered in spinach & silverbeet (field & protected) for control of <i>Botrytis</i> and <i>Sclerotinia</i> . Hort Innovation Project ST17000 contracted 2018 to undertake the required data package to support a label registration in celery for Early Blight / Cercospora Leaf Spot . US registration for control of <i>Cercospora</i> in brassicas, carrots, cucurbits, stalk vegetables and root and tuber vegetables.	R3
<i>Bacillus amyloliquefaciens</i> strain QST713 (Serenade Opti) Bayer	BM 02	Biological		P		Registered for control of various leaf diseases in avocado, fruiting vegetables, grapes, mango and strawberry. US registration for control of Pink Rot and Sclerotinia Head and Leaf Drop in celery.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<i>Bacillus amyloliquefaciens</i> strain MBI 600 (Serifel) BASF	BM 02	Biological		P		Registered for control of <i>Botrytis</i> in grapes and strawberries. US registration for control of Bacterial Leaf Spot, <i>Botrytis</i> , Cercospora , Downy Mildew, Head and Leaf Drop, Pink Rot, Powdery Mildew, White Mould, White Rust, Bottom Rot and Verticillium Wilt in celery.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New Mode of Action fungicide being developed for AU with activity on Powdery Mildew, <i>Botrytis</i> spp., <i>Septoria</i> spp., Anthracnose, <i>Alternaria</i> spp., Scab, <i>Monilinia</i> spp. and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot. US registration for control of Cercospora in almond, Brassica leafy vegetables, legume vegetables, melons and various fruit crops.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot. US registration for control of Cercospora in peanuts and sugarbeet.	-
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of Cercospora Leaf Spot in celery.	-
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered for control of Black Spot in apples and Powdery Mildew in grapes. US registration for control of Cercospora in corn, legume vegetables, peanuts, sorghum, millet, soybean and sugar beet.	-
Tebuconazole + Azoxystrobin (Veritas) Adama	3+11	Protectant		P		Registered for control of Cercospora Leaf Spot in Faba beans and Broad beans.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Downy Mildew (<i>Peronospora</i> spp.)							
Priority: High (spinach), Moderate (silverbeet)							
Spinach: Downy Mildew was ranked as a high priority in VIC & WA, as a moderate priority in QLD, SA & TAS and as a low priority in NSW. Silverbeet: Downy Mildew was ranked as a moderate priority in VIC, QLD, WA & SA and as a low priority in NSW & TAS. Characterised by a white downy fungal growth that develops on the underside of the leaf. It is a common disease that is favoured by warm, moist weather. Management options include general farm hygiene, crop rotation, planting space (to allow air movement) and the use of protectant and curative fungicide spray applications when conditions favour disease outbreaks.							
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protectant & Curative	3 NG	A	ALL	Registered in leafy vegetables (not hydroponics) for control of Downy Mildew and suppression of <i>Alternaria</i> and <i>Sclerotinia</i> . [Max. 3 applications per crop; re-treatment interval 7-14 d]	-
Chlorothalonil (Bravo) PER82895	M5	Protectant	7 NG	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Downy Mildew , <i>Alternaria</i> Leaf Spot and Grey Mould. [Max 4 applications per crop; re-treatment interval 7-10 d]	R3
Copper	M1	Protectant	1	A	ALL	Registered in spinach and silverbeet for control of Downy Mildew . [Max. no. of applications not specified; re-treatment interval 10-14 d]	-
Dimethomorph + Mancozeb (Acrobat + Mancozeb) PER14958	40+M3	Protectant	14	A	ALL	Permitted for use in spinach & silverbeet (field & protected) for control of Downy Mildew . [Max 4 applications per crop; 2 sequential; re-treatment interval 7-10 d]	R2
Mancozeb	M3	Protectant	14	A	ALL	Registered in spinach and silverbeet for control of Downy Mildew and <i>Cercospora</i> Leaf Spot. [Max. no. of applications not specified; re-treatment interval: 7-10 d]	R2
Mandipropamid (Revus) Syngenta	40	Protectant	1 NG	A	ALL	Registered in spinach and silver beet for control of Downy Mildew . [Max 4 applications per crop; max 2 consecutive; re-treatment interval 7-10 d]	
Metalaxyl-M + Mancozeb (Ridomil Gold MZ) Syngenta PER13673	4+M3	Protectant & Curative	14	A	ALL (excl. VIC)	Permitted for use in spinach and silverbeet for control of Downy Mildew . [Max 2 applications per crop; max 2 consecutive; re-treatment interval 7-10 d]	R2

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Oxathiapiprolin (Zorvec Enicade) Corteva	49	Protectant	3	A	ALL	Registered in spinach and mustard spinach for control of Downy Mildew . [Max. 2 applications per crop; 2 consecutive; re-treatment interval 7-10 d]	-
Phosphorous Acid PER11951	33	Protectant & Curative	NR	A	ALL (excl. VIC)	Permitted for use in spinach and silverbeet for control of Downy Mildew . [Max. no. of applications and treatment intervals not specified]	-
Propamocarb Hydrochloride + Fluopicolide (Infinito) Bayer	28+43	Protectant	7	A	ALL	Registered in leafy vegetables (field & protected) for control of Downy Mildew . [Max. 3 applications per crop; re-treatment interval 7-10 d]	-
Cyazofamid (Ranman) UPL	21	Protectant & Curative	3 NG	P-A	ALL	Registered in spinach & silverbeet (field) for control of Damping Off. US registration for control of Downy Mildew in herbs, brassica leafy vegetables, cucurbits, grapes, hops, leafy greens, succulent-podded and succulent-shelled beans and bulb vegetables.	-
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.	-
Dimethomorph + Amitoctradin (Zampro) AgNova	40+45	Protectant		P		Registered for control of Downy Mildew in grape vines.	-
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 bulb vegetables, cucurbits and leafy vegetables.	-
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of Downy Mildew in brassica vegetables, bulb vegetables and grapes.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Sclerotinia Rot (<i>Sclerotinia</i> spp.)							
Priority: High (spinach), Moderate (silverbeet)							
Spinach: Sclerotinia Rot was ranked as a high priority in VIC, as a moderate priority in QLD, WA, SA & TAS and as a low priority in NSW. Silverbeet: Sclerotinia Rot was ranked as a moderate priority in QLD, WA & SA and as a low priority in VIC, NSW & TAS. Sclerotinia tends to be a problem at canopy closure, particularly if plants have sustained mechanical injuries. Management options include general farm hygiene, crop rotation, planting space (to allow air movement) and the use of protectant and curative fungicide spray applications when conditions favour disease outbreaks. Correct timing and good penetration of foliage are essential for effective control.							
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protectant & Curative	3 NG	A	ALL	Registered in leafy vegetables (not hydroponics) for control of Downy Mildew and suppression of <i>Alternaria</i> and Sclerotinia . [Max. 3 applications per crop; re-treatment interval 7-14 d]	-
Boscalid (Filan) BASF	7	Protectant	7	A	ALL	Registered in leafy vegetables (field & protected) for control of Sclerotinia Rot . Apply prior to disease development. [Max. 4 applications per year; re-treatment interval 7-14 d]	-
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protectant	7	A	ALL	Registered in leafy vegetables (field & protected) for control of Sclerotinia Rot . Apply prior to disease development. [Max 2 sequential treatments; re-treatment interval 7-14 d]	-
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Registered as a pre-plant fumigant in seed beds for control of soil fungi including <i>Pythium</i> , <i>Phytophthora</i> , Sclerotinia , <i>Sclerotium</i> , <i>Rhizoctonia</i> , <i>Verticillium</i> , <i>Plasmodiophora</i> , <i>Armillaria</i> and <i>Fusarium</i> spp. Apply granules to the soil surface and incorporate and seal the soil surface immediately. Do not plant into soil until a positive germination test has been conducted.	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative	3 NG	A	ALL	Registered in spinach & silverbeet (field & protected) for control of Grey Mould (<i>Botrytis cinerea</i>) and White Mould (<i>Sclerotinia sclerotiorum</i> , <i>Sclerotinia minor</i>). [Max 2 applications per crop per year; re-treatment interval 7-14 d]	R3
Iprodione (Rovral) PER84955	2	Protectant	7 NG	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Sclerotinia and Grey Mould. [Max. 4 applications per crop; re-treatment interval 7-10 d]	R2

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Metham Sodium	-	Fumigant	NR	A	ALL	Registered in food crops as a pre-plant fumigant for control of fungus diseases including <i>Rhizoctonia</i> , <i>Pythium</i> , <i>Fusarium</i> , <i>Phytophthora</i> , <i>Verticillium</i> , Sclerotinia and Club Root of crucifers. Applied as a soil injection, soil surface spray in front of a rotary tiller or through approved trickle irrigation systems.	-
Penthiopyrad (Fontelis) Corteva	7	Protectant	3	A	ALL	Registered in silverbeet and spinach for control of Sclerotinia Rot , Grey Mould & Powdery Mildew. [Max 2 sequential treatments; re-treatment interval 7-10 d]	-
Tebuconazole (Folicur)	3	Protectant & Curative	35	A	ALL (excl. VIC)	Registered in spinach & silverbeet for control of Sclerotinia Rot . [Max 2 sequential treatments; re-treatment interval 7-10 d]	R3
<i>Bacillus amyloliquefaciens</i> Strain QST 713 (Serenade Prime Soil Ameliorant and Biofungicide) Bayer	BM 02	Biological	NR	P-A	ALL	Registered in vegetables for application to soil to improve bioavailability of soil resources to horticultural crops.	-
<i>Aureobasidium pullulans</i> (Botector) Nufarm	BM 02	Biological		P		Registered for suppression of Sclerotinia in fruiting vegetables.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot.	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Mandestrobin (Intuity) Sumitomo	11	Protectant & Curative		P		Registered for control of Sclerotinia Rot in head and leafy lettuce.	-
NUL3446	TBC			P		Fungicide in development from Nufarm with activity on Sclerotinia spp.	-
Alternaria Leaf Spot (<i>Alternaria</i> spp.)							
Priority: Moderate							
Spinach: <i>Alternaria</i> Leaf Spot was ranked as a moderate priority in VIC, QLD, NSW, WA, SA & TAS.							
Silverbeet: <i>Alternaria</i> Leaf Spot was ranked as a moderate priority in NSW, SA & TAS and as a low priority in VIC, QLD & WA.							
<i>Alternaria</i> species produce various sorts of toxic metabolites during their active growth and causes severe diseases in many plants by limiting their productivity. Crop rotation, removal and burning of plant debris, if infected, and eradication of weed hosts help reduce the inoculum for subsequent plantings of susceptible crops.							
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Protectant & Curative	3 NG	A	ALL	Registered in leafy vegetables (not hydroponics) for control of Downy Mildew and suppression of Alternaria and <i>Sclerotinia</i> . [Max. 3 applications per crop; re-treatment interval 7-14 d]	-
Chlorothalonil (Bravo) PER82895	M5	Protectant	7 NG	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Downy Mildew, Alternaria Leaf Spot and Grey Mould. [Max 4 applications per crop; re-treatment interval 7-10 d]	R3
Boscalid (Filan) BASF	7	Protectant	7	P-A	ALL	Registered in leafy vegetables (field & protected) for control of Sclerotinia Rot. Registered for control of Alternaria in potatoes, capsicum, eggplant, peppers and tomatoes.	-
Penthiopyrad (Fontelis) Corteva	7	Protectant	3	P-A	ALL	Registered in silverbeet and spinach for control of Sclerotinia Rot, Grey Mould & Powdery Mildew. Registered for control of Alternaria in pome fruit, onions, shallots, spring onions, fruiting vegetables and root and tuber vegetables.	-
<i>Bacillus amyloliquefaciens</i> strain QST713 (Serenade Opti) Bayer	BM 02	Biological	NR	P	ALL	Registered in tomato, capsicum, chilli and several fruits for suppression of Bacterial Spot. Permitted for use in eggplant for control of Alternaria , Botrytis, Powdery Mildew and suppression of Bacterial Spot.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Azoxystrobin + Difenconazole (Amistar Top) Syngenta	11+3	Protectant & Curative		P		Registered in carrots for control of Alternaria , Cercospora and Powdery Mildew; Alternaria and Phytophthora in potatoes; Alternaria , Phytophthora, Sclerotinia and Powdery mildew in tomatoes.	R3
Fluazinam (Shirlan) Syngenta	29	Protectant		P		Registered for control of Club Root in Brassica vegetables. US registration for control of Sclerotinia and Alternaria in carrots.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot. US registration for use in almond, Brassica leafy vegetables, legume vegetables, melons and various fruit crops for control of a variety of diseases including Alternaria Leaf Spot .	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot.	-
Florylpicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New Mode of Action fungicide being developed for AU with activity on Powdery Mildew, <i>Botrytis</i> spp., <i>Septoria</i> spp., Anthracnose, Alternaria spp., Scab, <i>Monilinia</i> spp. and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
NUL3446 Nufarm	TBC			P		New active in development from Nufarm with activity on Alternaria spp.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Powdery Mildew (<i>Erysiphe betae</i>)							
Priority: Moderate (silverbeet), Low (spinach)							
Spinach: Powdery Mildew was ranked as a moderate priority in QLD, WA & SA and as a low priority in VIC, NSW & TAS. Silverbeet: Powdery Mildew was ranked as a moderate priority in VIC, QLD, WA & SA and as a low priority in NSW & TAS. Powdery Mildew causes a characteristic white, powdery growth on infected plants. Photosynthetic efficiency is reduced in affected leaves and fruit can be scarred and damaged, causing produce to be downgraded. Severe outbreaks can cause defoliation, exposing fruit to sunburn and predisposing them to secondary rots.							
Difenoconazole (Score) Syngenta PER87973	3	Protectant & Curative	7 NG	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet (field & protected) for control of Powdery Mildew . [Max 2 applications; re-treatment interval 10 d]	R3
Penthiopyrad (Fontelis) Corteva	7	Protectant	3	A	ALL	Registered in silverbeet and spinach for control of Sclerotinia Rot, Grey Mould & Powdery Mildew . [Max 2 sequential treatments; re-treatment interval 7-10 d]	-
Potassium Bicarbonate (EcoCarb) PER13695	M2	Protectant	NR	A	ALL (excl. VIC)	Permitted for use in silverbeet for control of Powdery Mildew . [Max. no. of applications not specified; re-treatment interval 10-14 d]	-
Propiconazole PER14479	3	Protectant	7	A	ALL (excl. VIC)	Permitted for use in spinach for control of Cercospora Leaf Spot and in silverbeet for suppression of Leaf Spot, Powdery Mildew & Rust. [Spinach - Max. 5 applications per crop; re-treatment interval 14 d] [Silverbeet - Max. 2 applications per crop; re-treatment interval 10 d].	R3
Quinoxifen (Legend) Gowan PER11991	13	Protectant	7	A	ALL (excl. VIC)	Permitted for use in silverbeet for control of Powdery Mildew . [Max 3 applications per crop; re-treatment interval 10 d]	-
Sulphur	M2	Protectant	NR	A	ALL	Registered in vegetables for control of Powdery Mildew and Rust. [Max no. of applications not specified; re-treatment interval 14-21 d]	-
Trifloxystrobin (Flint) Bayer PER14494	11	Protectant & Curative	3	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet (field & protected) for control of Powdery Mildew . [Max 3 applications per crop; re-treatment interval 10 d]	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative	3 NG	P-A	ALL	Registered in spinach & silverbeet (field & protected) for control of <i>Botrytis</i> and <i>Sclerotinia</i> . US registration for control of Powdery Mildew in brassica vegetables cucurbits, fruiting vegetables, grapes, specific leaf petioles, leafy greens, root and tuber vegetables, mustard greens, potato, root vegetables. strawberry and tuberous and corm vegetables.	R3
<i>Streptomyces lydicus</i> WYEC108 (Actinovate) Novozymes Bioag	BM 02	Biological	NR	P-A	ALL	Registered in vegetables as a seed treatment for <i>Fusarium</i> , <i>Rhizoctonia</i> & <i>Pythium</i> Management. Registered for control of Powdery Mildew in strawberries, carrots, cucurbits, fruiting vegetables and verbena.	-
Acibenzolar-S-Methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		Registered in tomatoes for the suppression of Bacterial Speck, Bacterial Spot, Bacterial Canker and Powdery Mildew. US registration for control of Powdery Mildew in cucurbits.	-
ADM1700F Adama	TBC			P		Fungicide in development from Adama with Powdery Mildew activity	-
<i>Bacillus amyloliquefaciens</i> strain QST713 (Serenade Opti) Bayer	BM 02	Biological	NR	P		Permitted for control of Powdery Mildew in eggplant. US registration for control of Powdery Mildew in cucurbits, grapes, pome fruit, stone fruit and strawberries.	-
BLAD (ProBlad Plus)	BM 01	Biological	NR	P		Registered for control of Brown Rot and Blossom Blight in stone fruit. US registration for control of Powdery Mildew in cucurbits, fruiting vegetables, grapes, hops, pome fruit and strawberries.	-
Boscalid + Kresoxim-Methyl (Colliss) BASF	7+11	Protectant & Curative		P		Registered for control of Powdery Mildew in cucurbits.	-
Bupirimate (Nimrod) Adama	8	Protectant & Curative		P		Registered for control of Powdery Mildew in apples, cucurbits, cut flower, eggplant, melons, nursery stock, ornamentals, peppers and strawberries.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Cyflufenamid (Flute) AgNova	U6	Protectant & Curative		P		Registered for control of Powdery Mildew in cucurbits, grapevines and strawberries.	-
Florylpicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew , Botrytis, Anthracnose, Alternaria, Scab, Monilinia, Rust and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
Fuopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot. US registration for control of Powdery Mildew in almonds, brassica leafy greens, cucurbits, grapes, hops, dry and succulent beans, stone fruit and sunflowers.	R3
Fuopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of Powdery Mildew in apples. Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot.	-
Hydrogen Peroxide + Peroxyacetic Acid (Peratec Plus)	M	Protectant		P		Registered for control of Powdery Mildew in grapes, fruiting vegetables, cucurbits and potatoes.	-
Isofetamid (Kenja) ISK / AgNova	7	Protectant & Curative		P		Registered in berries for control of Botrytis Grey Mould. US registration for control of Powdery Mildew in grapes, low-growing berries and pome fruit.	-
Mefentrifluconazole (Belanty) BASF	3	Protectant & Curative		P		Registered for control of Powdery Mildew in grapes.	-
Metrafenone (Vivando) BASF	U8	Protectant		P		Registered for control of Powdery Mildew in cucurbits and grapes.	-
NUL3195 Nufarm	TBC			P		Fungicide in development from Nufarm with activity on Powdery Mildew and <i>Botrytis</i> .	-
Proquinazid (Talendo) Corteva	13	Protectant		P		Registered for control of Powdery Mildew in fruiting vegetables, cucurbits, grapes and pome fruit.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Pyriofenone (Kusabi) AgNova	50	Protectant & Curative		P		Registered for control of Powdery Mildew in cucurbits and grapes.	-
Tea Tree Oil (Timorex)	46	Protectant				Registered for control of Powdery Mildew in fruiting vegetables, cucurbits and grapes.	-
Rust (<i>Uromyces betae</i>)							
Priority: Moderate (silverbeet), Low (spinach)							
Spinach: Rust was ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS.							
Silverbeet: Rust was ranked as a moderate priority in QLD, WA, SA & TAS and as a low priority in VIC & NSW.							
Rusts are plant diseases caused by pathogenic fungi which are essentially parasitic in their behaviour. Although not fatal, they can severely limit growth.							
Sulphur	M2	Protectant	NR	A	ALL	Registered in vegetables for control of Powdery Mildew and Rust . [Max no. of applications not specified; re-treatment interval 14-21 d]	-
Fuopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of Powdery Mildew, Black Spot and <i>Alternaria</i> in apples. US registration for control of Rust in leafy petioles (including celery fennel (bulb) & rhubarb) almond, carrot, cherry, & root vegetables except sugar beet. Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot.	-
Cladosporium Leaf Spot (<i>Cladosporium variabile</i>)							
Priority: Moderate (spinach only)							
Spinach: Cladosporium Leaf Spot was ranked as a moderate priority in VIC & QLD.							
Silverbeet: Cladosporium Leaf Spot was not ranked as a significant disease.							
<i>Cladosporium</i> is a genus of fungi which includes some of the most common moulds. It is found on living and dead plant material. Good on-farm sanitation is recommended.							
Copper Oxychloride	M1	Protectant	1	P-A	ALL	Registered in spinach and silverbeet for control of Downy Mildew. Registered for control of Cladosporium spp. in olives.	-
Azoxystrobin (Amistar)	11	Protectant & Curative		P		Registered for control of Cladosporium in passionfruit.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant & Curative		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot. US registration for control of Cladosporium in almond, bulb vegetables, stone fruit and tree nuts.	R3
Pyraclostrobin + Fluxapyroxad (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of Scab (Cladosporium) in almonds.	-
Stemphylium Leaf Spot (<i>Stemphylium botryosum f.sp. spinacia</i>)							
Priority: Moderate (spinach only)							
Spinach: Stemphylium Leaf Spot was ranked as a moderate priority in VIC & TAS. Silverbeet: Stemphylium Leaf Spot was not ranked as a significant disease. This is a seed borne fungal pathogen and when infected, visual signs of fungal growth are generally absent from the spots. Circular spots resemble those from fertiliser or pesticide damage. Use of clean seeds and on-farm sanitation are recommended.							
Chlorothalonil (Bravo) PER82895	M5	Protectant	7 NG	P-A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Downy Mildew, Alternaria Leaf Spot and Grey Mould. Registered for control of Stemphylium Leaf Spot in tomatoes.	R3
Azoxystrobin (Amistar)	11	Protectant & Curative		P		Registered for control of Stemphylium spp. in snow peas, sugar snap peas and garden peas.	-
Anthracnose (<i>Colletotrichum spp.</i>)							
Priority: Low							
Spinach & Silverbeet: Anthracnose was ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. This fungus can be seed-borne and carry over on crop residue in the soil. It is spread in water droplets and is worse in warm, humid weather.							
Zineb PER14839	M3	Protectant	14	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Anthracnose . [Max. no. of applications not specified; re-treatment interval 7 d]	R2
Chlorothalonil (Bravo) PER82895	M5	Protectant	7 NG	P-A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Downy Mildew, Alternaria Leaf Spot and Grey Mould. Registered for control of Anthracnose in capsicums, peppers, cucurbits and grapes and permitted for control of Anthracnose in lettuce.	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Copper	M1	Protectant	1	P-A	ALL	Registered in spinach and silverbeet for control of Downy Mildew. Registered for control of Anthracnose in avocados, durians, guavas, macadamias, mangosteens, olives, rambutans, cucurbits and lettuce.	-
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protectant	7	P-A	ALL	Registered in leafy vegetables (field & protected) for control of Sclerotinia Rot. Registered for control of Anthracnose in lettuce and nursery stock.	-
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative	3 NG	P-A	ALL	Registered in spinach & silverbeet (field & protected) for control of <i>Botrytis</i> and <i>Sclerotinia</i> . US registration for control of Anthracnose in berries and tuberous and corm vegetables, suppression of Anthracnose in lemons and limes.	R3
<i>Aureobasidium pullulans</i> (Botector) Nufarm	BM 02	Biological	NR	P		Registered for control of Anthracnose in berries.	-
<i>Bacillus amyloliquefaciens</i> strain QST713 (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for control of Anthracnose in avocado and mango.	-
<i>Bacillus amyloliquefaciens</i> strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of Botrytis in grapevines and strawberries. US registration for control of Anthracnose in artichoke, asparagus, berries, citrus, cucurbits, fruiting vegetables, pome fruit, stone fruit, tobacco, root and tuber vegetables (except sugar beet) and tree nuts.	-
Benzovindiflupyr + Propiconazole (Elatus) Syngenta	7+3	Protectant & Curative		P		Registered for control of various disease in wheat and barley. US registration for control of Anthracnose in sweet corn.	R3
Dimethomorph (Acrobat) BASF	40	Protectant & Curative		P		Registered for control of Anthracnose in cucurbits and closed head varieties of lettuce.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Florylpicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis, Anthracnose , Alternaria, Scab, Monilinia, Rust and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
Fuopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot. US registration for control of Anthracnose in almonds, cucurbits and tree nuts.	R3
Fuopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Registered for control of Anthracnose in tropical and sub-tropical fruit. Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot.	-
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of Alternaria Leaf Spot, Black Spot, Brown Rot Nut Scab, Shot Hole and Rust in almond, Brown Rot in cherries and Husk Spot in macadamia. US registration for control of Anthracnose in cucurbits, leafy vegetables, stone fruit, strawberries and tree nuts.	-
Isofetamid (Kenja) ISK / AgNova	7	Protectant & Curative		P		Registered in berries for control of Botrytis Grey Mould. US registration for control of Anthracnose in almonds, grapes and low-growing berries.	-
Prochloraz (Octave) FMC	3	Protectant & Curative		P		Registered for control of Anthracnose in leafy/open head lettuce.	-
Grey Mould (<i>Botrytis cinerea</i>)							
Priority: Low							
Spinach & Silverbeet: Grey Mould was ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. It can affect plants at most stages of production. Affected fruit become water-soaked and soft and are rapidly covered with a thick grey mould. Other plant parts such as stems can also be affected. <i>Botrytis</i> also causes secondary rots on fruit and vegetables in storage or transit and in the marketplace.							
Chlorothalonil (Bravo) PER82895	M5	Protectant	7 NG	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Downy Mildew, Alternaria Leaf Spot and Grey Mould . [Max 4 applications per crop; re-treatment interval 7-10 d]	R3

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Protectant & Curative	3 NG	A	ALL	Registered in spinach & silverbeet (field & protected) for control of Grey Mould (<i>Botrytis cinerea</i>) and White Mould (<i>Sclerotinia sclerotiorum</i> , <i>Sclerotinia minor</i>). [Max 2 applications per crop per year; re-treatment interval 7-14 d]	R3
Iprodione (Rovral) PER84955	2	Protectant	7 NG	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Sclerotinia and Grey Mould . [Max. 4 applications per crop; re-treatment interval 7-10 d]	R2
Penthiopyrad (Fontelis) Corteva	7	Protectant	3	A	ALL	Registered in silverbeet and spinach for control of Sclerotinia Rot, Grey Mould & Powdery Mildew. [Max 2 sequential treatments; re-treatment interval 7-10 d]	-
Boscalid (Filan) BASF	7	Protectant	7	P-A	ALL	Registered in leafy vegetables (field & protected) for control of Sclerotinia Rot. Registered for control of Botrytis in grapevines and onions.	-
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protectant	7	P-A	ALL	Registered in leafy vegetables (field & protected) for control of Sclerotinia Rot. Registered for control of Botrytis in capsicum, cucumber, cut flower, grapes, green beans, green or garden peas, lettuce, nursery stock, onion, ornamentals, snow peas, sugar snap peas and strawberries and suppression of Botrytis in alliums.	-
<i>Aureobasidium pullulans</i> (Botector) Nufarm	BM 02	Biological		P		Registered for control of Botrytis in berries, fruiting vegetables and grapes.	-
<i>Bacillus amyloliquefaciens</i> strain QST713 (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for control of Botrytis in grapevines and strawberries. US registration for control of Botrytis in artichoke, asparagus, berries, bulb vegetables, fruiting vegetables, grapes, cucurbits, grapes, herbs/spices, legume vegetables, root/tuber and corm vegetables, stone fruit and kiwi.	-
<i>Bacillus amyloliquefaciens</i> strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of Botrytis in grapevines and strawberries. US registration for control of Botrytis in artichoke, asparagus, berries, brassica leafy vegetables, bulb vegetables, fruiting vegetables, grapes, leafy vegetables, legume vegetables, pome fruit, stone fruit and tobacco.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
BLAD (ProBlad Plus)	BM 01	Biological	NR	P		Registered for control of Brown Rot and Blossom Blight in stone fruit. US registration for control of Botrytis in fruiting vegetables, grapes, strawberries and ornamentals.	-
Fenhexamid Imtrade	17	Protectant		P		Registered for control of Botrytis Grey Mould in cucumber, grapevines, green peas, lettuce, nursery stock, peppers, <i>Rubus</i> spp. and strawberries.	-
Fenpyrazamine (Prolectus) Sumitomo	17	Protectant & Curative		P		Registered for Botrytis control in grapes. US registration for control of Botrytis in berries, ginseng, lettuce, pistachio, small fruit vine climbing (except fuzzy kiwifruit) and ornamentals.	-
Florypicoxamid (Adavelt) Corteva	21	Protectant & Curative		P		New active in development from Corteva with activity on Septoria, Powdery Mildew, Botrytis , Anthracnose, Alternaria, Scab, Monilinia, Rust and <i>Mycosphaerella</i> spp. Scheduled for JMPR evaluation in 2023.	-
Fluopyram + Tebuconazole (Luna Experience) Bayer	7+3	Protectant		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot. Registered for control of Grey Mould in grapevines. US registration for control of Botrytis in almond, artichoke, berries, brassica vegetables, Brassica leafy greens, stone fruit, dill seed, pome fruit, small fruit vine climbing (except fuzzy kiwifruit), herbs, hops, leafy greens, cucurbits, pistachio, fruiting vegetables and root vegetables (except sugar beet).	R3
Fluopyram + Trifloxystrobin (Luna Sensation) Bayer	7+11	Protectant & Curative		P		Hort Innovation project ST17000 is generating data to support a label registration in leafy vegetables for control of Sclerotinia Rot. Registered for control of Botrytis in almonds and stone fruit. US registration for control of Botrytis in almond, artichoke, berries, brassica vegetables, brassica leafy greens, cherries, dill seed, pome fruit, small vine climbing fruit (except fuzzy kiwifruit), ginseng, herbs, hops. leafy greens, melons, pistachio, tomato, pepper and root vegetables.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
Fluxapyroxad + Pyraclostrobin (Merivon) BASF	7+11	Protectant & Curative		P		Registered for control of Alternaria Leaf Spot, Black Spot, Brown Rot Nut Scab, Shot Hole and Rust in almond, Brown Rot in cherries and Husk Spot in macadamia. US registration for control 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 / AgNova	7	Protectant		P		Registered for control of Botrytis in berries.	-
NUL3195 Nufarm	TBC			P		Fungicide in development from Nufarm with activity on Powdery Mildew and Botrytis .	-
Pyrimethanil (Scala) Bayer	9	Protectant		P		Registered for control of Botrytis Grey Mould in grapevines, ornamentals and strawberries and permitted for use in lettuce (protected) for control of Botrytis Grey Mould .	-

Bacterial Leaf Spot (*Xanthomonas spp.*)

Priority: Low

Spinach & Silverbeet: Bacterial Leaf Spot was ranked as a low priority in VIC & QLD.

It may be introduced in seed or in surviving undecomposed crop residue or other host plants. Bacteria spread in water splash during wet, windy weather or by overhead irrigation. It can also disperse by insects, people or equipment moving through the crop.

Copper	M1	Protectant	1	P-A	ALL	Registered in spinach and silver beet for control of Downy Mildew. Registered for control of Bacterial Leaf Spot in mangoes, stone fruit, beans, capsicum, brassicas, lettuce and tomatoes.	-
Acibenzolar-S-methyl (Actigard Plant Activator) Syngenta	P01	Protectant		P		Registered for the suppression of Bacterial Speck, Bacterial Spot (<i>Xanthomonas spp.</i>), Bacterial Canker and Powdery Mildew in tomatoes. US registration for suppression of <i>Xanthomonas spp.</i> in Brassica leafy vegetables, cucurbits, low growing berry, bulb onion, pepper and tomato.	-

Disease / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Regulatory risk
<i>Bacillus amyloliquefaciens</i> strain QST713 (Serenade Opti) Bayer	BM 02	Biological	NR	P		Registered for suppression of Bacterial Spot (<i>Xanthomonas spp.</i>) in tomatoes, capsicums and chillies and permitted for suppression of Bacterial Blight (<i>Xanthomonas spp.</i>) in lettuce.	-
<i>Bacillus amyloliquefaciens</i> strain MBI 600 (Serifel) BASF	BM 02	Biological	NR	P		Registered for control of Botrytis in grapevines and strawberries. US registration for control of <i>Xanthomonas spp.</i> in brassica leafy vegetables, citrus, fruiting vegetables, leafy vegetables, stone fruit, strawberries, root and tuber vegetables and tree nuts.	-
Phoma Leaf Spot (<i>Phoma beta</i>) Priority: Low Spinach: Phoma Leaf Spot was not ranked as a significant disease. Silverbeet: Phoma Leaf Spot was ranked as a low priority in VIC & QLD. It is a fungal infection caused by various <i>Phoma</i> species. Management options include general farm hygiene, crop rotation, planting space (to allow air movement). Avoid over watering and overhead sprinklers.							
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Protectant	7	P-A	ALL	Registered in leafy vegetables (field & protected) for control of Sclerotinia Rot. Registered for control of <i>Phoma spp.</i> in pyrethrum.	-
Fludioxonil + Sedaxane (Vibrance Premium) Syngenta	12 +7	Protective Seed Treatment		P		Registered as a seed treatment for control of <i>Phoma spp.</i> infections in potatoes.	R3

4.2 Insects, mites and other pests of spinach and silverbeet

4.2.1 Insect, mite and other pest priorities of Silverbeet

Common name	Scientific name
High	
Beet Webworm	<i>Spoladea recurvalis</i>
Cotton Bollworm / Corn Earworm	<i>Helicoverpa armigera</i>
Native Budworm	<i>Helicoverpa punctigera</i>
Moderate	
Leafminer (NEW)	<i>Liriomyza chenopodii</i>
Green Peach Aphid	<i>Myzus persicae</i>
Rutherglen Bug	<i>Nysius vinitor</i>
Slugs and Snails	<i>Gastropoda</i>
Low	
Two-Spotted Mite	<i>Tetranychus urticae</i>
Tomato Russet Mite	<i>Aculops lycopersici</i>
European Red Mite	<i>Panonychus ulmi</i>
Rust Mite	Eriophyidae
Western Flower Thrips	<i>Frankliniella occidentalis</i>
Redlegged Earth Mite	<i>Halotydeus destructor</i>
Plague Thrips	<i>Thrips imaginis</i>
Green Vegetable Bug	<i>Nezara viridula</i>
Jassids / Leafhoppers	Cicadellidae
Looper Caterpillars	<i>Chrysodeixis</i> spp.
Webworm	Lepidoptera
Vegetable Weevil	<i>Listroderes difficilis</i>
African Black Beetle	<i>Heteronychus arator</i>
Broad Mites (NEW)	<i>Polyphagotarsonemus latus</i>
False Wireworm and True Wireworm	<i>Gonocephalum</i> spp. <i>Arachnodima</i> spp., <i>Agrypnus</i> spp.
Nematodes (NEW)	<i>Meloidogyne</i> sp.
Cutworms (NEW)	<i>Agrotis</i> spp.

4.2.2 Insect, mite and other pest priorities of Silverbeet

Common name	Scientific name
High	
Leafminer (NEW)	<i>Liriomyza chenopodii</i>
Two-Spotted Mite	<i>Tetranychus urticae</i>
Tomato Russet Mite	<i>Aculops lycopersici</i>
European Red Mite	<i>Panonychus ulmi</i>
Rust Mite	Eriophyidae
Crown Mites (NEW)	<i>Tyrophagus similis</i>
Moderate	
Green Peach Aphid	<i>Myzus persicae</i>
Cotton Bollworm / Corn Earworm	<i>Helicoverpa armigera</i>
Native Budworm	<i>Helicoverpa punctigera</i>
Plague Soldier Beetle (NEW)	<i>Chauliognathus pulchellus</i> <i>Chauliognathus lugubris</i>
Western Flower Thrips	<i>Frankliniella occidentalis</i>
Redlegged Earth Mite	<i>Halotydeus destructor</i>
Rutherglen Bug	<i>Nysius vinitor</i>
Slugs and Snails	<i>Gastropoda</i>
Low	
Beet Webworm	<i>Spoladea recurvalis</i>
Plague Thrips	<i>Thrips imaginis</i>
Green Vegetable Bug	<i>Nezara viridula</i>
Jassids / Leafhoppers	Cicadellidae
Looper Caterpillars	<i>Chrysodeixis</i> spp.
Webworm	Lepidoptera
Vegetable Weevil	<i>Listroderes difficilis</i>
African Black Beetle	<i>Heteronychus arator</i>
Broad Mites (NEW)	<i>Polyphagotarsonemus latus</i>
False Wireworm and True Wireworm	<i>Gonocephalum</i> spp. <i>Arachnodima</i> spp., <i>Agrypnus</i> spp.

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

New Pest to Australia (unknown priority)	
Fall Armyworm	<i>Spodoptera frugiperda</i>
Vegetable Leafminer	<i>Liriomyza sativae</i>
Pea Leaf Miner/Serpentine Leaf Miner	<i>Liriomyza huidobrensis</i>
American Serpentine Leaf Miner	<i>Liriomyza trifolii</i>

The highest priority insect pests identified by the survey are Beet Webworm and Helicoverpa in silverbeet, and Leafminer and Mites in spinach. Available and potential products for these pests are listed in Section 4.2.3.

Resistance Management

There are several insecticide management strategies that apply to spinach and silverbeet on the CropLife website⁵, including Heliiothis, Fall Armyworm, Silverleaf Whitefly, Mites, Thrips & Aphids.

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

4.2.3 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
Leafminer (<i>Liriomyza chenopodii</i>)								
Priority: High (spinach), Moderate (silverbeet)								
Spinach: Leafminer was ranked as a high priority in VIC, QLD, WA SA & TAS and as a moderate priority in NSW. Silverbeet: Leafminer was ranked as a moderate priority in VIC, QLD & TAS. Liriomyza Leafminers are serious horticultural pests, causing severe yield losses and quality downgrades. 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.								
Abamectin PER81876	6	Contact & Ingestion	14 NG	A	ALL (excl. VIC)	Permitted for use in leafy vegetables except lettuce for suppression of Leafminers (<i>Liriomyza</i> spp.) [Max. 2 applications per crop; re-treatment interval 7-14 d]	M Bee:H	-
Chlorantraniliprole (Coragen) FMC PER87631	28	Ingestion	3 G:7	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Cabbage Leafminer (<i>Liriomyza</i> spp.) [Max. 3 applications per crop; re-treatment interval: 7 d]	L Bee:VL	-
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta PER89280	28+4A	Contact & Ingestion	42	A	ALL (excl. VIC)	Permitted for use in leafy vegetables including spinach and silverbeet as a seedling drench prior to transplant for control of Vegetable Leafminer, Serpentine Leafminer and American Serpentine Leafminer. [Max. 1 application per crop]	L-H Bee:H	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cyromazine (Diptex 150 WP)	17	Insect growth regulator	H:7 NG	A	ALL	Permitted for use in fruiting vegetables including cucurbits for control of Liriomyza species, including Vegetable Leafminer (<i>Liriomyza sativa</i>) and Serpentine Leafminer (<i>Liriomyza huidobrensis</i>). Not supported for food use. Crops must be destroyed if treated and must not be made available for human consumption. [Max. 6 applications per crop; min. re-treatment interval 7 d]	-	-
Spinetoram (Success Neo) Corteva PER91155	5	Ingestion	3 NG	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Liriomyza species, including Vegetable Leafminer (<i>Liriomyza sativa</i>), Pea Leafminer / Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) & American Serpentine Leafminer (<i>Liriomyza trifolii</i>). [Max. 4 applications per crop; re-treatment interval 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva PER90928	5	Ingestion	3 G:14	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of Liriomyza species, including Vegetable Leafminer (<i>Liriomyza sativa</i>), Pea Leafminer / Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) & American Serpentine Leafminer (<i>Liriomyza trifolii</i>). [Max. 4 applications per crop; re-treatment interval 4 d]	L Bee:L	-
Spirotetramat (Movento) Bayer	23	Ingestion	3	P-A	ALL	Registered in leafy vegetables including spinach & silverbeet (field & protected) for control of Green Peach Aphid. Permitted for control of Liriomyza Leafminers in snow peas, sugar snap peas, lettuce, parsley, eggplant, capsicums, chillies, tomatoes (field and protected cropping systems), green beans, celery and rhubarb (field cropping systems). Field cropping systems only.	M Bee:VL	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2022/23 for various pests including Thrips, Bugs, Mites and Caterpillars. Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer .	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
<p>Two-Spotted Mite (<i>Tetranychus urticae</i>) Tomato Russet Mite (<i>Aculops lycopersici</i>) European Red Mite (<i>Panonychus ulmi</i>) Rust Mite (<i>Eriophyidae</i>) Priority: High (spinach), Low (silverbeet)</p> <p>Spinach: Mites were ranked as a high priority in VIC, QLD & TAS, and as a moderate priority in NSW, WA & SA. Silverbeet: Mites were ranked as a moderate priority in QLD and as a low priority in VIC, NSW, WA, SA & TAS. Mites feed on aerial parts of the plant with the damage caused providing entry points for soil-borne disease. Two-Spotted Mite causes minor and infrequent damage to the aerial parts of the plant. Predatory Mites (<i>Phytoseiulus persimilis</i>) which attack Two-Spotted Mites are available commercially.</p>								
<i>Beauveria bassiana</i> (Velifer) BASF	UNF	Biological	NR	A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites . [Max. 3 application per crop; re-treatment interval 3-14 d]	L Bee:L	-
Petroleum Oil PER12221	-	Contact	1	A	ALL (excl. VIC)	Permitted for use in leafy vegetables (field and protected) for control of Silverleaf Whitefly, Greenhouse Whitefly, Aphids, Green Mirid, Green Vegetable Bug, Grey Cluster Bug, Leafhoppers, Mites , Rutherglen Bug and Thrips. [Max. no. of applications and re-treatment interval not specified]	VL Bee:L	-
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables (field and protected) for control of Aphids, Thrips, Mealybug, Two Spotted Mites , Spider Mite and Whitefly. Apply when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Propargite (Omite)	12C	Contact	7	A	ALL	Registered in vegetables (field and protected) for control of Mites . [Max no. of applications not specified; re-treatment interval 10-14 d]	M Bee:L	R3
Sulphur	UN	Contact	NR	A	ALL	Registered in vegetables (field and protected) for control of Mites . [Max no. of applications not specified; re-treatment interval 14 d]	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Abamectin	6	Contact & Ingestion	3	P-A	ALL	Registered in spinach and silverbeet for control of Western Flower Thrips. Registered for control of various mites in pome fruit, tropical fruit, berries, citrus, cucurbits, spring onions, snow peas, sugar snap peas, sweet corn, fruiting vegetables, hops, lettuce, mushrooms, ornamentals, rhubarb and strawberries.	M Bee:H	-
Spiromesifen (Oberon) Bayer	23	Ingestion		P		Australian Registration pending for control of Mites in various vegetables crops. Hort Innovation project ST18001 is generating data to support a label registration in spinach and silverbeet for control of various mites.	M Bee:VL	-
Bifenazate (Acramite) UPL	20D	Contact & Ingestion		P		Registered for control of various mites in almonds, pome fruit, stone fruit, cucurbits, eggplant, pawpaw, pepper, strawberries and tomatoes.	L Bee:H	-
Cyflumetofen (Danisaraba) BASF	25A	Contact		P		BASF is seeking registration in Australia for the control of Spider Mites in various crops.	L Bee:L	-
Etoxazole (Paramite) Sumitomo	10B	Contact		P		Registered for control of Two-Spotted Mites in pome fruit, stone fruit, almonds and grapes.	L Bee:VL	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2022/23 for various pests including Thrips, Bugs, Mites and Caterpillars. Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
<p>Crown Mites (<i>Tyrophagus similis</i>) Priority: High (spinach only) Spinach: Crown Mite was ranked as a high priority in VIC & TAS, as a moderate priority in QLD & SA and as a low priority in NSW & WA. Silverbeet: Crown Mite was not ranked as an issue for the industry. Crown Mite damage is generally associated with soils that are high in organic matter and cool, wet conditions. Crop rotation, good farm hygiene and having a six-week fallow gap prior to planting are good management options. Overseas research has shown that use of miticides is not effective due to the location of mites deep within the crown. In addition, if sprays are applied once damage has been noticed, it is too late to prevent crop loss.</p>								
Petroleum Oil PER12221	-	Contact	1	A	ALL (excl. VIC)	Permitted for use in leafy vegetables (field and protected) for control of Silverleaf Whitefly, Greenhouse Whitefly, Aphids, Green Mirid, Green Vegetable Bug, Grey Cluster Bug, Leafhoppers, Mites , Rutherglen Bug and Thrips. [Max. no. of applications and re-treatment interval not specified]	VL Bee:L	-
Propargite (Omite)	12C	Contact	7	A	ALL	Registered in vegetables (field and protected) for control of Mites . [Max no. of applications not specified; re-treatment interval 10-14 d]	M Bee:L	R3
Sulphur	UN	Contact	NR	A	ALL	Registered in vegetables (field and protected) for control of Mites . [Max no. of applications not specified; re-treatment interval 14 d]	L Bee:L	-
Spiromesifen (Oberon) Bayer	23	Ingestion		P		Australian Registration pending for control of Mites in various vegetables crops. Hort Innovation project ST18001 is generating data to support a label registration in spinach and silverbeet for control of various mites.	M Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Green Peach Aphid (<i>Myzus persicae</i>) Priority: Moderate								
Spinach: Green Peach Aphid was ranked as a high priority in WA and as a moderate priority in VIC, QLD, NSW, SA & TAS. Silverbeet: Green Peach Aphid was ranked as a moderate priority in VIC, QLD, NSW, WA & SA and as a low priority in TAS. Nymphs and adults 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 leafy vegetables (field) for control of Green Peach Aphid , Cabbage Aphid, Currant Lettuce Aphid, Cotton Aphid & suppression of Silverleaf Whitefly. [Max. 4 applications per crop; re-treatment interval 14 d]	L Bee:L	-
<i>Beauveria bassiana</i> (Velifer) BASF	UNF	Biological	NR	A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites. [Max. 3 application per crop; re-treatment interval 3-14 d]	L Bee:L	-
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta	28+4A	Contact & Ingestion	42	A	ALL	Registered in leafy vegetables as a seedling treatment for control of Helicoverpa, Cluster Caterpillar, Looper, Lettuce Aphid, Green Peach Aphid , Brown Sowthistle Aphid, Silverleaf Whitefly, Western Flower Thrips, Vegetable Leafhopper, and Lucerne Leafroller. [Max 1 application per crop; seedlings should be transplanted within 48 h of application]	L-H Bee:H	R2
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids , Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Imidacloprid (Confidor) PER10918	4A	Contact & Ingestion	7	A	ALL	Permitted for use in in spinach & silverbeet (field) for control of Aphids & Greenhouse Whitefly. [Max. 1 application per crop]	M Bee:M	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Petroleum Oil PER12221	-	Contact	1	A	ALL (excl. VIC)	Permitted for use in leafy vegetables (field and protected) for control of Silverleaf Whitefly, Greenhouse Whitefly, Aphids , Green Mirid, Green Vegetable Bug, Grey Cluster Bug, Leafhoppers, Mites, Rutherglen Bug and Thrips. [Max. no. of applications and re-treatment interval not specified]	VL Bee:L	-
Pirimicarb (Aphidex)	1A	Contact & Ingestion	2	A	ALL	Registered in spinach for control of Aphids . Spray when aphids are detected. [Max. no. of applications & re-treatment interval not specified]	VL Bee:VL	R3
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables (field and protected) for control of Aphids , Thrips, Mealybug, Two Spotted Mites, Spider Mite and Whitefly. Apply when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Pymetrozine (Chess) Syngenta	9B	Contact	3	A	ALL	Registered in spinach and silverbeet (field and protected) for control of Brown Sowthistle Aphid, Green Peach Aphid , Currant Lettuce Aphid, Brown Sowthistle Aphids and suppression of Silverleaf Whitefly. [Max. 2 applications per crop; re-treatment interval: 7 d]	L Bee:VL	R3
Spirotetramat (Movento) Bayer	23	Ingestion	1	A	ALL	Registered in leafy vegetables (protected and field) for control of Brown Sowthistle Aphid, Currant Lettuce Aphid, Green Peach Aphid and Western Flower Thrips. [Max 3 applications per crop; re-treatment interval 7 d]	M Bee:VL	-
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	3	A	ALL	Registered in leafy vegetables (field and protected) for control of Green Peach Aphid , Brown Sowthistle Aphid, Greenhouse Whitefly and suppression of Rutherglen Bug. [Max no. of applications not specified; re-treatment interval 7-10 d;]	M Bee:VH	-
Dimpropridaz (Axalion) BASF	TBC			P		BASF has applied for registration in leafy vegetables, brassica vegetables and fruiting vegetables, including cucurbits to control Whitefly, Aphids and Thrips. Pending regulatory approvals, first market introduction in Australia is expected by late 2022 or early 2023.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of Green Peach Aphid in brassica leafy vegetables, cucurbits, fruiting vegetables, leafy vegetables, tuberous and corm vegetables and turnip greens.	L Bee:VL	-
<p>Beet Webworm (<i>Spoladea recurvalis</i>) Priority: High (silverbeet), Low (spinach)</p> <p>Spinach: Webworm was ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Silverbeet: Webworm was ranked as a high priority in QLD & NSW and as a low priority in VIC, WA, SA & TAS. Webworm larvae are leaf-chewing pests of seedlings. It is important to monitor crops for eggs and larvae by regular field scouting. Target sprays against mature eggs and larvae before pests become entrenched.</p>								
Diazinon	1B	Contact	14 G:14	A	ALL (excl. TAS)	Registered in silverbeet for control of Webworm . [Max no. of applications and re-treatment interval not specified]	H Bee:VH	R3
Methomyl (Lannate) PER82428	1A	Contact	14	A	ALL	Permitted for use in silverbeet for control of <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm , Rutherglen Bug & Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval: 7 d]	H Bee:H	R2
Chlorantraniliprole (Coragen) FMC	28	Ingestion	7	P-A	ALL	Registered in spinach and silverbeet for control of Cotton Bollworm and Native Budworm.	L Bee:VL	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3	P-A	ALL	Registered in spinach and silverbeet (field) for control of <i>Helicoverpa</i> , Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillar and Loopers.	M Bee:H	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion	3 NG	P-A	ALL	Registered in spinach and silverbeet (field only) for control of <i>Helicoverpa</i> and Lucerne Leafroller.	L Bee:H	-
Spinetoram (Success Neo) Corteva	5	Ingestion	3	P-A	ALL	Registered in leafy vegetables including spinach and silverbeet for control of Loopers, Western Flower Thrips and <i>Helicoverpa</i> spp.	M Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinosad (Entrust Organic) Corteva	5	Ingestion	3	P-A	ALL	Registered in leafy vegetables including silverbeet & spinach for control of Loopers, Helicoverpa & Western Flower Thrips.	L Bee:L	-
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 2020/21 for Thrips, Bugs, Mites and Caterpillars. Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer.	-	-
<p>Cotton Bollworm / Corn Earworm (<i>Helicoverpa armigera</i>) Native Budworm (<i>Helicoverpa punctigera</i>) Priority: High (silverbeet), Moderate (spinach)</p> <p>Spinach: <i>Helicoverpa</i> was ranked as a moderate priority in VIC, QLD, NSW, WA, SA & TAS. Silverbeet: <i>Helicoverpa</i> was ranked as a high priority in QLD and as a moderate priority in VIC, NSW, WA, SA & TAS. <i>Helicoverpa armigera</i> is generally regarded as the more serious pest because of its greater capacity to develop resistance to insecticides, broader host range, and persistence in cropping areas from year to year. Larvae feed on leaves but are most damaging when feeding on growing terminals.</p>								
<i>Bacillus thuringiensis subsp. kurstaki</i> (Dipel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Armyworm, Cabbage Moth, Cabbage White Butterfly, Green Looper, Light Brown Apple Moth, Pear Looper, Soybean Looper, Vine Moth, Tobacco Looper and <i>Helicoverpa spp.</i> Most effective on larvae < 8 mm. [Apply a minimum of 2 sprays, 3 d apart; re-treatment interval 3-5 d]	VL Bee:L	-
Chlorantraniliprole (Coragen) FMC	28	Ingestion	7	A	ALL	Registered in spinach and silverbeet for control of Cotton Bollworm and Native Budworm . Spray during egg laying/hatching. [Max of 3 sprays per crop; max 2 consecutive; Re-treatment interval 7 d]	L Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta	28+4A	Contact & Ingestion	42	A	ALL	Registered in leafy vegetables as a seedling treatment for control of Helicoverpa , Cluster Caterpillar, Looper, Lettuce Aphid, Green Peach Aphid, Brown Sowthistle Aphid, Silverleaf Whitefly, Western Flower Thrips, Vegetable Leafhopper and Lucerne Leafroller. [Max 1 application per crop; seedlings should be transplanted within 48 h of application]	L-H Bee:H	R2
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3	A	ALL	Registered in spinach and silverbeet (field) for control of Helicoverpa , Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillar and Loopers. Spray at first signs of infestation. [Max 4 applications per crop; re-treatment interval: 7 d]	M Bee:H	-
Emamectin (Proclaim Opti) Syngenta PER14907	6	Ingestion	1 NG	A	ALL (excl. VIC)	Permitted for use in leafy vegetables including spinach and silverbeet (protected cropping) for control of Diamondback Moth, Helicoverpa , Cabbage White Butterfly & Vegetable Looper. Use subject to CropLife Resistance Management Strategies. [Max 4 applications per crop; re-treatment interval: 7 d]	M Bee:H	-
Flubendiamide (Belt) Bayer	28	Ingestion	1 NG	A	ALL	Registered in leafy vegetables (field & protected) for control of Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillar, Helicoverpa spp. and Soybean Looper. [Max 3 applications per crop; re-treatment interval 7-14 d]	L-M Bee:L	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars , Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Helicoverpa NPV (Vivus Max) AgBiTech	31	Biological	NR	A	ALL	Registered in spinach and silverbeet for control of Helicoverpa . [Max no. of applications not specified; re-treatment interval 2-3 d]	VL Bee:L	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion	3 NG	A	ALL	Registered in spinach and silverbeet (field only) for control of Helicoverpa and Lucerne Leafroller. [Max 3 applications per crop; re-treatment interval: 7 d]	L Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Indoxacarb + Novaluron (Plemax) Adama	22A+15	Contact & Ingestion	3 NG	A	ALL	Registered in leafy vegetables (field) for control of Cabbage White Butterfly, Cotton Bollworm, Native Budworm , Cabbage Cluster Caterpillar, Centre Grub, Cluster Caterpillar and Diamondback Moth. [Max. 3 applications per crop; re-treatment interval: 7 d]	M Bee:H	R3
Methomyl (Lannate) PER82428	1A	Contact	14	A	ALL	Permitted for use in silverbeet for control of Helicoverpa spp. , Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug & Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval: 7 d]	H Bee:H	R2
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in leafy vegetables including spinach and silverbeet for control of Loopers, Western Flower Thrips and Helicoverpa spp. [Max no. of applications not specified; re-treatment interval: 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in leafy vegetables including silverbeet & spinach for control of Loopers, Helicoverpa & Western Flower Thrips. [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-
Broflanilide (Vedira) BASF	30	Contact & Ingestion		P		Pending registration as an ant bait. It also has potential uses as a seed treatment for the control of Wireworms, and a foliar treatment for the control of chewing pests in various crops.	-	-
<i>Clitoria ternatea</i> Extract (Sero-X) Growth Agriculture	-	Biological	NR	P		Registered in cotton for control of Helicoverpa spp. , Green Mirids and Silverleaf Whitefly and in brassica leafy vegetables for control of Diamondback Moth. Label extension has been submitted seeking to add new uses for control of Silverleaf Whitefly and Thrips in brassicas and cucurbits.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera , Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for control of Thrips, Bugs, Mites and Caterpillars . Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Plague Soldier Beetle (<i>Chauliognathus pulchellus</i> or <i>Chauliognathus lugubris</i>) Priority: Moderate (spinach only) Spinach: Soldier Beetle was ranked as a high priority in VIC and as a low priority in QLD & SA. Silverbeet: Soldier Beetle received no ranking as a significant pest. Plague Soldier Beetle, found in temperate southeastern Australia, occasionally builds up to massive numbers. The Plague Soldier Beetle is omnivorous, feeding on other insects and plants. The larvae live on the ground and prey on other insects and adults survive on pollen and nectar.								
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of soil borne pests , diseases & weeds. Soil moisture is essential for release of gas and plastic cover brings optimum results.	-	-
Western Flower Thrips (<i>Frankliniella occidentalis</i>) Priority: Moderate (spinach), Low (silverbeet) Spinach: Western Flower Thrips was ranked as a high priority in WA and as a moderate priority in VIC, QLD, NSW, SA & TAS. Silverbeet: Western flower Thrips were ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Western Flower Thrips develop resistance more easily than other thrips species. They are a vector for many viruses including Tomato Spotted Wilt Virus. MT16009 IPM Project Recommends: The use of predatory thrips, mites & bug releases, control flowering weeds, mulch and use of certified seed.								
Abamectin	6	Contact & Ingestion	3	A	ALL	Registered in spinach and silverbeet for control of Western Flower Thrips . [max 2 application per crop; re-treatment interval: 28 d]	M Bee:H	-
<i>Beauveria bassiana</i> (Velifer) BASF	UNF	Biological	NR	A	ALL	Registered in protected vegetables and ornamentals for suppression of various pests including Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites . [Max. 3 application per crop; re-treatment interval 3-14 d]	L Bee:L	-
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta	28+4A	Contact & Ingestion	42	A	ALL	Registered in leafy vegetables as a seedling treatment for control of Helicoverpa, Cluster Caterpillar, Looper, Lettuce Aphid, Green Peach Aphid, Brown Sowthistle Aphid, Silverleaf Whitefly, Western Flower Thrips , Vegetable Leafhopper and Lucerne Leafroller. [Max 1 application per crop; seedlings should be transplanted within 48 h of application]	L-H Bee:H	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Methomyl (Lannate) PER82428	1A	Contact	14	A	ALL	Permitted for use in silverbeet for control of <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug & Thrips including Western Flower Thrips . [Max 3 applications per crop; re-treatment interval: 7 d]	H Bee:H	R2
Petroleum Oil PER12221	-	Contact	1	A	ALL (excl. VIC)	Permitted for use in leafy vegetables (field and protected) for control of Silverleaf Whitefly, Greenhouse Whitefly, Aphids, Green Mirid, Green Vegetable Bug, Grey Cluster Bug, Leafhoppers, Mites, Rutherglen Bug and Thrips . [Max. no. of applications and re-treatment interval not specified]	VL Bee:L	-
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables (field and protected) for control of Aphids, Thrips , Mealybug, Two Spotted Mites, Spider Mite and Whitefly. Apply when temperatures are cooler. [Max no. of applications not specified; re-treatment interval 5-7 d]	L Bee:L	-
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in leafy vegetables including spinach and silverbeet for control of Loopers, Western Flower Thrips and <i>Helicoverpa</i> spp. [Max no. of applications not specified; re-treatment interval: 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in leafy vegetables including silverbeet & spinach for control of Loopers, <i>Helicoverpa</i> & Western Flower Thrips . [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-
Spirotetramat (Movento) Bayer	23	Contact & systemic	3	P-A	ALL	Registered in leafy vegetables including spinach & silverbeet (field & protected) for control of Green Peach Aphid. Registered for control of Western Flower Thrips in green beans, celery, rhubarb, eggplant, peppers, tomatoes, herbs, lettuce and bulb vegetables.	M Bee:VL	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Dimpropyridaz (Axalion) BASF	TBC			P		BASF has applied for registration in leafy vegetables, brassica vegetables and fruiting vegetables, including cucurbits to control Whitefly, Aphids and Thrips . Pending regulatory approvals, first market introduction in Australia is expected by late 2022 or early 2023.	-	-
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for suppression of Thrips in berries, citrus, fruiting vegetables, tropical and subtropical fruit.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and Thrips .	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips , Bugs, Mites and Caterpillars. Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips , Plague Thrips and Leafminer.	-	-
Red Legged Earth Mite (<i>Halotydeus destructor</i>)								
Priority: Moderate (spinach), Low (silverbeet)								
Spinach: Red Legged Earth Mite was ranked as moderate priority in QLD, NSW, WA, SA & TAS and as a low priority in VIC. Silverbeet: Red Legged Earth Mite was ranked as a moderate priority in QLD and as a low priority in VIC, NSW, WA, SA & TAS. Red Legged Earth Mite can cause minor leaf feeding damage to newly emerged crops. MT16009 IPM Project Recommends: Control broadleaf weed hosts (e.g. capeweed) in the season prior to planting.								
Alpha-Cypermethrin PER81702	3A	Contact	NR	A	ALL (excl. VIC)	Permitted for use in spinach and silverbeet for control of Red Legged Earth Mite . [Max 2 pre-emergence soil applications per crop or max. 1 post-emergence seedling application]	VH Bee:H	-
Chlorpyrifos (Lorsban)	1B	Contact	NR	A	NSW	Registered in silverbeet for control of Red Legged Earth Mite & Blue Oat Mite. [Max. no. applications and re-treatment interval not specified]	H Bee:H	R1

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Rutherglen Bug (<i>Nysius vinitor</i>)								
Priority: Moderate								
Spinach: Rutherglen Bug was ranked as a moderate priority in VIC, QLD NSW, WA & TAS and as a low priority in SA. Silverbeet: Rutherglen Bug was ranked as a moderate priority in VIC, QLD, NSW and as a low priority in WA, TAS & SA. They breed up on weeds adjacent to cropping areas. It is important to monitor crops for eggs and nymphs by regular field scouting. Repeated influxes of migrating adults can make repeat insecticide applications necessary. Large numbers can cause significant feeding damage to foliage by sucking the sap and depleting the crop of nutrients.								
Methomyl (Lannate) PER82428	1A	Contact	14	A	ALL	Permitted for use in silverbeet for control of <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug & Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval: 7 d]	H Bee:H	R2
Petroleum Oil PER12221	-	Contact	1	A	ALL (excl. VIC)	Permitted for use in leafy vegetables (field and protected) for control of Silverleaf Whitefly, Greenhouse Whitefly, Aphids, Green Mirid, Green Vegetable Bug, Grey Cluster Bug, Leafhoppers, Mites, Rutherglen Bug and Thrips. [Max. no. of applications and re-treatment interval not specified]	VL Bee:L	-
Pyrethrins (Pyganic)	3A	Contact	1	A	ALL	Registered in leafy vegetables as a pre-harvest clean up spray for insects such as Fruitfly, Rutherglen Bug and Spiders.	VH Bee:H	-
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	3	A	ALL	Registered in leafy vegetables (field and protected) for control of Green Peach Aphid, Brown Sowthistle Aphid, Greenhouse Whitefly and suppression of Rutherglen Bug . [Max no. of applications not specified; re-treatment interval 7-10 d;]	M Bee:VH	-
Trichlorfon (Lepidex)	1B	Contact	2	A	ALL	Registered in vegetables for control of Cabbage White Butterfly, Cabbage Moth, Green Vegetable Bug and Rutherglen Bug . Use when pests are first seen. [Max no. of applications not specified; re-treatment interval 7-10 d]	H Bee:H	R2
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of Leafhoppers, Aphids and Whiteflies in leafy vegetables.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs , Beetles/Weevils, Fruit Fly and Thrips.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2020/21 for Thrips, Bugs and Caterpillars. Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer.	-	-
Slugs and Snails (Gastropoda)								
Priority: Moderate								
Spinach: Slugs and Snails were ranked as a moderate priority in VIC, NSW, SA & TAS, and as a low priority in QLD & WA. Silverbeet: Slugs and Snails were ranked as a moderate priority in VIC, QLD NSW, WA & SA, and as a low priority in TAS. They are active after dusk when chemical treatments can be most effective.								
Iron EDTA Complex	-	Contact & Ingestion	NR	A	ALL	Registered in all plants for the control of Snails and Slugs . Spread pellets evenly on ground. [Max no. of applications and re-treatment not specified]	-	-
Metaldehyde	-	Contact & Ingestion	7	A	ALL	Registered in vegetables for the control of Snails and Slugs . Spread pellets evenly on ground. [Max no. of applications and re-treatment not specified]	-	-
Methiocarb (Mesuro)	1A	Contact & Ingestion		P		Registered for control of Snails and Slugs in brassica vegetables, citrus, artichoke, grapes, head lettuce, ornamentals, pome fruit, potato, stone fruit and strawberries.	-	R2
Plague Thrips (<i>Thrips imaginis</i>)								
Priority: Low								
Spinach: Plague Thrips were ranked as a moderate priority in WA and as a low priority in VIC, QLD NSW, SA & TAS. Silverbeet: Plague Thrips were ranked as a low priority in VIC, QLD NSW, WA, SA & TAS. It can be difficult to distinguish between thrips species in the field. 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.								
Alpha- Cypermethrin PER81702	3A	Contact	NR	A	ALL (excl. VIC)	Permitted for use in spinach and silverbeet for control of Vegetable Weevil and Plague Thrips . [Max 2 applications per crop; minimum 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
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Methomyl (Lannate) PER82428	1A	Contact	14	A	ALL	Permitted for use in silverbeet for control of <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug & Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval: 7 d]	H Bee:H	R2
Petroleum Oil PER12221	-	Contact	1	A	ALL (excl. VIC)	Permitted for use in leafy vegetables (field and protected) for control of Silverleaf Whitefly, Greenhouse Whitefly, Aphids, Green Mirid, Green Vegetable Bug, Grey Cluster Bug, Leafhoppers, Mites, Rutherglen Bug and Thrips . [Max. no. of applications and re-treatment interval not specified]	VL Bee:L	-
Potassium Salts of Fatty Acids (Natrasoap)	-	Contact	NR	A	ALL	Registered in vegetables (field and protected) 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	-
<i>Beauveria bassiana</i> (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	-
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta	4A+28	Contact & Ingestion	28	P-A	ALL	Registered in spinach and silverbeet for control of Helicoverpa, Cluster Caterpillar, Looper, Lettuce Aphid, Green Peach Aphid, Brown Sowthistle Aphid, Silverleaf White Fly, Western Flower Thrips, Vegetable Leaf Hopper and Lucerne Leaf Roller.	L-H Bee:H	R2
Spinosad (Entrust Organic) Corteva	5	Ingestion	3	P-A	ALL	Registered in leafy vegetables including silverbeet & spinach for control of Loopers, Helicoverpa & Western Flower Thrips.	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spirotetramat (Movento) Bayer	23	Ingestion	3	P-A	ALL	Registered in leafy vegetables including spinach & silverbeet (field & protected) for control of Green Peach Aphid. Registered for control of Plague Thrips in celery, rhubarb, herbs, bulb vegetables (excluding bulb onions) and grapes.	M Bee:VL	
Dimpropridaz (Axalion) BASF	TBC			P		BASF has applied for registration in leafy vegetables, brassica vegetables and fruiting vegetables, including cucurbits to control Whitefly, Aphids and Thrips . Pending regulatory approvals, first market introduction in Australia is expected by late 2022 or early 2023.	-	-
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for suppression of Thrips in berries, citrus, fruiting vegetables, tropical and subtropical fruit.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and Thrips .	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips , Bugs, Mites and Caterpillars. Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Green Vegetable Bug (<i>Nezara viridula</i>)								
Priority: Low								
Spinach: Green Vegetable Bug was ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Silverbeet: Green Vegetable Bug was ranked as a moderate priority in QLD and as a low priority in VIC, NSW, WA, SA & TAS. These bugs use their long, thin mouthpart to suck nutrients from the aerial parts of the plant. It emits a foul smell when disturbed to deter predators. The nymphs are predated by ants, spiders & predatory bugs. It is important to monitor crops for eggs and nymphs of pest species by regular field scouting. Target sprays against mature eggs and nymphs before pests become entrenched.								
Petroleum Oil PER12221	-	Contact	1	A	ALL (excl. VIC)	Permitted for use in leafy vegetables (field and protected) for control of Silverleaf Whitefly, Greenhouse Whitefly, Aphids, Green Mirid, Green Vegetable Bug , Grey Cluster Bug, Leafhoppers, Mites, Rutherglen Bug and Thrips. [Max. no. of applications and re-treatment interval not specified]	VL Bee:L	-
Trichlorfon (Lepidex)	1B	Contact	2	A	ALL	Registered in vegetables for control of Cabbage White Butterfly, Cabbage Moth, Green Vegetable Bug and Rutherglen Bug. Use when pests are first seen. [Max no. of applications not specified; re-treatment interval 7-10 d]	H Bee:H	R2
Sulfoxaflor (Transform) Corteva	4C	Contact & Ingestion	3	P-A	ALL	Registered in leafy vegetables (field and protected) for control of Green Peach Aphid, Brown Sowthistle Aphid, Greenhouse Whitefly and suppression of Rutherglen Bug.	M Bee:VH	-
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of Leafhoppers, Aphids and Whiteflies in leafy vegetables.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs , Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2020/21 for Thrips, Bugs and Caterpillars. Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Jassids / Leafhoppers (Cicadellidae)								
Priority: Low								
Spinach & Silverbeet: Jassids were ranked as a moderate priority in QLD and as a low priority in VIC, NSW, WA, SA & TAS. Adult and nymph leafhoppers suck sap and inject toxins into the plant. Some species transmit diseases such as viruses and phytoplasmas. Perimeter sprays may be effective for minimising vector transmission.								
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta	28+4A	Contact & Ingestion	42	A	ALL	Registered in leafy vegetables as a seedling treatment for control of <i>Helicoverpa</i> , Cluster Caterpillar, Looper, Lettuce Aphid, Green Peach Aphid, Brown Sowthistle Aphid, Silverleaf Whitefly, Western Flower Thrips, Vegetable Leafhopper and Lucerne Leafroller. [Max 1 application per crop; seedlings should be transplanted within 48 h of application]	L-H Bee:H	R2
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers . Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Petroleum Oil PER12221	-	Contact	1	A	ALL (excl. VIC)	Permitted for use in leafy vegetables (field and protected) for control of Silverleaf Whitefly, Greenhouse Whitefly, Aphids, Green Mirid, Green Vegetable Bug, Grey Cluster Bug, Leafhoppers , Mites, Rutherglen Bug and Thrips. [Max. no. of applications and re-treatment interval not specified]	VL Bee:L	-
Sulfoxaflor (Transform) Corteva	4C	Systemic	3	P-A	ALL	Registered in leafy vegetables including spinach & silverbeet (field) for control of Green Peach Aphid, Brown Sowthistle Aphid, Rutherglen Bug & Greenhouse Whitefly. US registration for control of Leafhoppers in berries, pome fruit and root and tuber vegetables.	M Bee:VH	-
Buprofezin (Applaud) Corteva	16	Contact & Ingestion		P		Registered for control of Jassids in citrus and permitted for control of Jassids in leafy lettuce.	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Flupyradifurone (Sivanto 200 SL) Bayer	4D	Contact & Ingestion		P		Registered in macadamia for control of Macadamia Lace Bug, Banana Spotting Bug, Fruit Spotting Bug and suppression of Scirtothrips. US registration for control of Leafhoppers in brassica leafy vegetables, cucurbits, fruiting vegetables, leafy vegetables, legume vegetables, peanuts, root vegetables (except sugar beet), small fruit vine climbing (except fuzzy kiwifruit), taro, tuberous and corm vegetables and turnip greens.	L Bee:VL	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2020/21 for Thrips, Bugs and Caterpillars. Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer.	-	-
Looper Caterpillars (<i>Chrysodeixis</i> spp.)								
Priority: Low								
Spinach: Looper Caterpillars were ranked as a moderate priority in WA and as a low priority in VIC, QLD NSW, SA & TAS. Silverbeet: Looper Caterpillars were ranked as a moderate priority in QLD and as a low priority in VIC, NSW, SA, WA & TAS. The last two larval instars are the most voracious feeders and will usually eat the entire leaf but may avoid the midrib or other large veins. It is important to monitor crops for eggs and larvae by regular field scouting. Target sprays against mature eggs and larvae before pests become entrenched.								
<i>Bacillus thuringiensis subsp. kurstaki</i> (Dipel)	11A	Biological	NR	A	ALL	Registered in vegetables for control of Armyworm, Cabbage Moth, Cabbage White Butterfly, Green Looper , Light Brown Apple Moth, Pear Looper , Soybean Looper , Vine Moth, Tobacco Looper and <i>Helicoverpa</i> spp. Most effective on larvae < 8 mm. [Apply a minimum of 2 sprays, 3 d apart; re-treatment interval 3-5 d]	VL Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta	28+4A	Contact & Ingestion	42	A	ALL	Registered in leafy vegetables as a seedling treatment for control of <i>Helicoverpa</i> , Cluster Caterpillar, Looper , Lettuce Aphid, Green Peach Aphid, Brown Sowthistle Aphid, Silverleaf Whitefly, Western Flower Thrips, Vegetable Leafhopper and Lucerne Leafroller. [Max 1 application per crop; seedlings should be transplanted within 48 h of application]	L-H Bee:H	R2
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3	A	ALL	Registered in spinach and silverbeet (field) for control of <i>Helicoverpa</i> , Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillar and Loopers . Spray at first signs of infestation. [Max 4 applications per crop; re-treatment interval: 7 d]	M Bee:H	-
Emamectin (Proclaim Opti) Syngenta PER14907	6	Ingestion	1 NG	A	ALL (excl. VIC)	Permitted for use in leafy vegetables including spinach and silverbeet (protected cropping) for control of Diamondback Moth, <i>Helicoverpa</i> , Cabbage White Butterfly & Vegetable Looper . Use subject to CropLife Resistance Management Strategies. [Max 4 applications per crop; re-treatment interval: 7 d]	M Bee:H	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars , Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Methomyl (Lannate) PER82428	1A	Contact	14	A	ALL	Permitted for use in silverbeet for control of <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers , Webworm, Rutherglen Bug & Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval: 7 d]	H Bee:H	R2
Spinetoram (Success Neo) Corteva	5	Ingestion	3	A	ALL	Registered in leafy vegetables including spinach and silverbeet for control of Loopers , Western Flower Thrips and <i>Helicoverpa</i> spp. [Max no. of applications not specified; re-treatment interval: 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva	5	Ingestion	3 G:14	A	ALL	Registered in leafy vegetables including silverbeet & spinach for control of Loopers , <i>Helicoverpa</i> & Western Flower Thrips. [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Chlorantraniliprole (Coragen) FMC	28	Ingestion	3	P-A	ALL	Registered in leafy vegetables for control of <i>Helicoverpa</i> . Registered for control of Soybean Looper in brassica vegetables and brassica leafy vegetables.	L Bee:VL	-
Flubendiamide (Belt) Bayer	28	Ingestion	1	P-A	ALL	Registered in leafy vegetables (field & protected) for control of <i>Helicoverpa</i> spp. Registered for control of Soybean Looper in brassica vegetables and brassica leafy vegetables.	L-M Bee:L	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion	3 NG	P-A	ALL	Registered in leafy vegetables (field) for control of Cotton Bollworm and Native Budworm. Registered for control of Soybean Looper in fruiting vegetables.	L Bee:H	R3
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera , Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips, Bugs, Mites and Caterpillars . Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer.	-	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered in almonds, macadamias, pomefruit, and stonefruit for various insect pests such as Fruit Fly suppression, Carpophilus Beetles, Weevils & Lepidoptera. Hort Innovation has several projects underway towards assisting registration in vegetables including Root & Tuber and Stalk & Stem. Canadian registration for control of Cabbageworm, Diamondback Moth, Cutworms, Armyworms, Flea Beetles and suppression of Aphids and Cabbage Looper in leafy vegetables.	M Bee:VH	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Webworm (Lepidoptera)								
Priority: Low								
Spinach: Webworm were ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS.								
Silverbeet: Webworm were ranked as a moderate priority in QLD & WA and as a low priority in VIC, NSW, SA & TAS.								
Webworm larvae are leaf-chewing pests of seedlings. It is important to monitor crops for eggs and larvae by regular field scouting. Target sprays against mature eggs and larvae before pests become entrenched.								
Diazinon	1B	Contact	14 G:14	A	ALL (excl. TAS)	Registered in silverbeet for control of Webworm . [Max no. of applications and re-treatment interval not specified]	H Bee:VH	R3
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Contact	1	A	ALL	Registered in vegetables for control of Ants, Aphids, Caterpillars , Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers. Apply as a cover spray and re-apply as necessary every 2-3 weeks.	VH Bee:H	-
Methomyl (Lannate) PER82428	1A	Contact	14	A	ALL	Permitted for use in silverbeet for control of <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm , Rutherglen Bug & Thrips including Western Flower Thrips. [Max 3 applications per crop; re-treatment interval: 7 d]	H Bee:H	R2
Chlorantraniliprole (Coragen) FMC	28	Ingestion	3	P-A	ALL	Registered in leafy vegetables for control of <i>Helicoverpa</i> .	L Bee:VL	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3	P-A	ALL	Registered in Spinach and Silverbeet (field) for control of <i>Helicoverpa</i> , Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillars and Loopers.	M Bee:H	-
Flubendiamide (Belt) Bayer	28	Ingestion	1	P-A	ALL	Registered in leafy vegetables (field & protected) for control of <i>Helicoverpa</i> spp.	L-M Bee:L	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion	3 NG	P-A	ALL	Registered in leafy vegetables (field) for control of Cotton Bollworm and Native Budworm.	L Bee:H	R3
Spinetoram (Success Neo) Corteva	5	Ingestion	3	P-A	ALL	Registered in leafy vegetables including spinach and silverbeet for control of Loopers, Western Flower Thrips and <i>Helicoverpa</i> spp.	M Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinosad (Entrust Organic) Corteva	5	Contact & ingestion	3 G:14	P-A	ALL	Registered in leafy vegetables for control of Loopers, Helicoverpa & Western Flower Thrips.	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.	-	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips, Bugs and Caterpillars . Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer.	-	-
Vegetable Weevil (<i>Listroderes difficilis</i>)								
Priority: Low								
Spinach: Vegetable Weevil was ranked as a moderate priority in TAS and as a low priority in VIC, QLD, NSW, WA & SA. Silverbeet: Vegetable Weevil was ranked as a moderate priority in QLD and as a low priority in VIC, NSW, WA SA & 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.								
Alpha- Cypermethrin PER81702	3A	Contact	NR	A	ALL (excl. VIC)	Permitted for use in spinach and silverbeet for control of Vegetable Weevil and Plague Thrips. [Max 2 applications per crop; minimum re-treatment interval 7 d]	VH Bee:H	-
Indoxacarb (Avatar eVo) FMC	22A	Ingestion	3 NG	P-A	ALL	Registered in leafy vegetables for control of <i>Helicoverpa</i> spp. Registered for control of Weevils in pome & stone fruits.	L Bee:H	R3
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles/ Weevils , Fruit Fly and Thrips.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered in Australia in multiple crops for various insect pests such as Beetles, Weevils & Lepidoptera. Hort Innovation Project ST17000 contracted 2018 to undertake the required data package to support a label registration in stalk & stem vegetables, including celery for Light Brown Apple Moth, <i>Helicoverpa</i> spp., Green Looper and other pests.	M Bee:VH	-
African Black Beetle (<i>Heteronychus arator</i>)								
Priority: Low								
Spinach and Silverbeet: African Black Beetle was ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Larvae are soil dwelling and adults chew plants at or just beneath ground level. The larvae are less damaging than adults. There is a commercially available nematode (<i>Heterorhabditis zealandica</i>) for the biological control of African Black Beetle in turf and other high value crops. A new and promising biopesticide based on the naturally occurring bacteria <i>Yersinia entomophaga</i> , is being evaluated in New Zealand.								
Chlorpyrifos (Lorsban) PER14583	1B	Contact	NR	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of African Black Beetle , False Wireworms & Wireworms. [Max no. of applications per crop and re-treatment interval not specified]	H Bee:H	R1
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Registered as a pre-planting soil fumigation for control of soil borne pests , diseases & weeds. Soil moisture is essential for release of gas and plastic cover brings optimum results.	-	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera, Bugs, Beetles /Weevils, Fruit Fly and Thrips.	-	-
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered in almonds, macadamias, pomefruit, and stonefruit for various insect pests such as Fruit Fly suppression, Carpophillus Beetles, Weevils & Lepidoptera. Hort Innovation has several projects underway towards assisting registration in vegetables including Root & Tuber and Stalk & Stem. Canadian registration for control of Cabbageworm, Diamondback Moth, Cutworms, Armyworms, Flea Beetles and suppression of Aphids and Cabbage Looper in leafy vegetables.	M Bee:VH	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Broad Mites (<i>Polyphagotarsonemus latus</i>)								
Priority: Low								
Spinach: Broad Mites were ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Silverbeet: Broad Mites were ranked as a low priority only in NSW. 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.								
Petroleum Oil PER12221	-	Contact	1	A	ALL (excl. VIC)	Permitted for use in leafy vegetables (field and protected) for control of Silverleaf Whitefly, Greenhouse Whitefly, Aphids, Green Mirid, Green Vegetable Bug, Grey Cluster Bug, Leafhoppers, Mites , Rutherglen Bug and Thrips. [Max. no. of applications and re-treatment interval not specified]	VL Bee:L	-
Propargite (Omite)	12C	Contact	7	A	ALL	Registered in vegetables (field and protected) for control of Mites . [Max no. of applications not specified; re-treatment interval 10-14 d]	M Bee:L	R3
Sulphur	UN	Contact	NR	A	ALL	Registered in vegetables (field and protected) for control of Mites . [Max no. of applications not specified; re-treatment interval 14 d]	L Bee:L	-
Abamectin	6	Contact & Ingestion	3	P-A	ALL	Registered in spinach and silverbeet for control of Western Flower Thrips. Registered for control of various mites in pome fruit, tropical fruit, berries, citrus, cucurbits, spring onions, snow peas, sugar snap peas, sweet corn, fruiting vegetables, hops, lettuce, mushrooms, ornamentals, rhubarb and strawberries.	M Bee:H	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Wireworms & False Wireworms (<i>Gonocephalum</i> spp. <i>Arachnodima</i> spp., <i>Agrypnus</i> spp.)								
Priority: Low								
Spinach & Silverbeet: Wireworms and False wireworms were ranked as a low priority in VIC, QLD, NSW, WA, SA & TAS. Larvae are soil-dwelling and will attack newly germinated seedlings by chewing the leaves. Severe infestations can cause death of plants.								
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables as a pre-plant treatment for control of Wireworms . Leave soil undisturbed at least 7 d after treatment. Aeration before planting should be minimised for 21 days. For use by professional and registered fumigators only.	-	-
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Registered as a pre-planting soil fumigation for control of soil borne pests , diseases & weeds. Soil moisture is essential for release of gas and plastic cover brings optimum results.	-	-
Chlorpyrifos (Lorsban) PER14583	1B	Contact	NR	A	ALL (excl. VIC)	Permitted for use in spinach & silverbeet for control of African Black Beetle, False Wireworms & Wireworms . [Max no. of applications per crop and re-treatment interval not specified]	H Bee:H	R1
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.	-	-
Nematodes (<i>Meloidogyne</i> spp.)								
Priority: Low (silverbeet only)								
Spinach: Nematodes were not ranked as significant pests. Silverbeet: Nematodes were ranked as a low priority in VIC, QLD & WA. Nematodes are minute, worm-like animals that are quite common in soil. The juveniles hatch from eggs, move through the soil and invade roots near the root tip. Affected plants have an unthrifty appearance and often show symptoms of stunting, wilting or chlorosis. Control measures include pre-plant soil fumigation, nematicides, crop rotation and use of nematode free transplants.								
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Soil Fumigant	NR	A	ALL	Registered in vegetables for control of Wireworms, Plant Parasitic Nematodes and Symphylans. Leave soil undisturbed at least 7 d after treatment. Aeration before planting should be minimised for 21 days. For use by professional and registered fumigators only.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Registered in broadacre seed beds for control of soil fungi (including <i>Fusarium</i> spp.), nematodes (cyst and non-cyst forming), soil insects and germinating seeds of weeds.	-	-
Metham Sodium	-	Fumigant	NR	A	ALL	Registered as a soil fumigant for plant parasitic Nematodes , weed seeds and various fungal diseases as a pre-plant treatment only.	-	-
Abamectin (Tervigo) Syngenta	6	Contact		P		Registered for control of Root-Knot Nematode in peppers, chillis, cucurbits, eggplant and tomatoes.	M Bee:H	-
Fluazaindolizine (Reklemel, Salibro) Corteva	TBC			P		Development underway in AU, to be launched globally in 2021. New MOA nematicide from Corteva.	-	-
Fluensulfone (Nimitz) Adama	-	Contact		P		Registered for control of Root-Knot Nematode in peppers, carrot, chilli, cucurbits, eggplant, okra, potato, sugarcane, sweet potato and tomato.	L Bee:L	-
Fluopyram (Velum) Bayer	7			P		Registration pending for control of nematodes in various crops. US registration for control of nematodes in a range of vegetables.	L Bee:L	-
NUL3145 Nufarm	TBC			P		New product in development from Nufarm with activity on Scale, nematodes , Mealybug and Whitefly.		-
SYNSTN1 Syngenta	TBC			P		Nematicide in development from Syngenta.	-	-
Cutworms (<i>Agrotis</i> spp.)								
Priority: Low (silverbeet only)								
Spinach: Cutworms received no ranking as a significant pest.								
Silverbeet: Cutworms were ranked as a low priority in VIC & TAS.								
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.								
Dazomet (Basamid)	8F	Soil Fumigant	NR	A	ALL	Registered as a pre-planting soil fumigation for control of soil borne pests , diseases & weeds. Soil moisture is essential for release of gas and plastic cover brings optimum results.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Fall Armyworm (<i>Spodoptera frugiperda</i>)								
Priority: Unknown								
Fall Armyworm was not ranked as a pest in Spinach and Silverbeet. It is an exotic pest that is considered a potential threat that could affect most vegetable crops if allowed to spread. It is important to monitor crops for eggs and larvae of pest species by regular field scouting. Target sprays against mature eggs and newly hatched larvae before pests become entrenched.								
Chlorantraniliprole (Coragen) FMC PER89259	28	Ingestion	1	A	ALL (excl. VIC)	Permitted for use in leafy vegetables for control of Fall Armyworm . [Max. 3 applications per crop; 2 consecutive; re-treatment interval 7 d]	L Bee:VL	-
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta PER89280	28+4A	Contact & Ingestion	42	A	ALL (excl. VIC)	Permitted for use in leafy vegetables for control of Fall Armyworm . Do not transplant seedlings treated by seedling drench into hydroponic production systems. [Max. 1 application per crop]	L-H Bee:H	R2
Emamectin (Proclaim Opti) Syngenta PER89263	6	Ingestion	3 NG	A	ALL (excl. VIC)	Permitted for use in leafy vegetables (field grown and protected cropping) for control of Fall Armyworm . [Max 4 applications per crop; re-treatment interval: 7 d]	M Bee:H	-
Emamectin (Proclaim Opti) Syngenta PER89285	6	Ingestion	3 NG	A	ALL (excl. VIC)	Permitted for use in silverbeet and spinach (protected cropping) for control of Fall Armyworm . [Max 4 applications per crop; 2 consecutive; re-treatment interval: 7 d]	M Bee:H	-
Indoxacarb (Avatar eVo) FMC PER89278	22A	Ingestion	7	A	ALL (excl. VIC)	Permitted for use in leafy vegetables for control of Fall Armyworm . [Max 4 applications per crop; re-treatment interval: 7 d]	L Bee:H	R3
Methomyl (Lannate) PER89293	1A	Contact	14	A	ALL	Permitted for use in spinach & silverbeet (field grown only) for control of Fall Armyworm . [Max. 3 application per crop; re-treatment interval not specified]	H Bee:H	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Spinetoram (Success Neo) Corteva PER89241	5	Ingestion	3	A	ALL (excl. VIC)	Permitted for use in leafy vegetables for control of Fall Armyworm . [Max. 4 applications per crop; re-treatment interval 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva PER89870	5	Ingestion	3 G:14	A	ALL (excl. VIC)	Permitted for use in Leafy vegetables for control of Fall Armyworm . [Max. 4 applications per season; re-treatment interval 7-14 d]	L Bee:L	-
<i>Spodoptera frugiperda</i> Multiple Nucleopolyhedrovirus (Fawligen) AgBiTech PER90820	31	Biological	NR	A	ALL	Permitted for use in leafy vegetables for control of Fall Armyworm . [Max. 10 applications per crop; re-treatment interval 3d]	VL Bee:L	-
Amorphous Silica (Abrade) Grow Choice	-	Contact		P		Registered for control of <i>Spodoptera</i> spp. in fruiting vegetables and permitted for control of Fall Armyworm in sweet corn.	L Bee:L	-
Broflanilide (Vedira) BASF	30	Contact & Ingestion		P		Registration submitted concurrently in Australia, Canada, USA, and Mexico as a soil application and seed treatment against chewing insects such as ants, cockroaches and <i>Spodoptera</i> spp. BASF are seeking registrations in amenity turf initially, then potential horticultural crops thereafter.	H Bee:VH	-
Magnet Insect Attractant Technology	-	Attractant		P		Permitted for control of Fall Armyworm in cotton, cereal grains, sweet corn, pastures & oilseeds.	-	-
NUL3445 Nufarm	TBC			P		New product in development from Nufarm with activity on Lepidoptera , Bugs, Beetles/Weevils, Fruit Fly and Thrips.	-	-
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2023 for Thrips, Bugs, Mites and Caterpillars . Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer.	-	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Tetraniliprole (Vayego) Bayer	28	Ingestion		P		Registered in Australia in multiple crops for various insect pests such as Beetles, Weevils & Lepidoptera . Hort Innovation has several projects underway towards assisting registration in minor crops. Indonesia registration for control of <i>Liriomyza</i> Leafminers and Fall Armyworm in vegetable crops.	M Bee:VH	-
Leafminers (<i>Liriomyza</i> spp.) Priority: Unknown Leafminer was not ranked as a pest in spinach and silverbeet. Dipteran Leafminers (<i>Liriomyza</i> spp.) are exotic pests that have recently been detected and become problematic in Australia. For example, the Serpentine Leafminer was first detected in the Sydney area in October 2020 and has since been found in crops in SE Qld. As a group they are destructive pests and can cause significant economic loss through reduced yields and quality when uncontrolled.								
Abamectin PER81876	6	Contact & Ingestion	14 NG	A	ALL (excl. VIC)	Permitted in leafy vegetables for suppression of Leafminers (<i>Liriomyza</i> spp.) including Vegetable Leafminer (<i>Liriomyza sativae</i>) & Serpentine Leafminer (<i>Liriomyza huidobrensis</i>). [Max 2 applications per crop; re-treatment interval 7-14 d]	M Bee:H	-
Chlorantraniliprole (Coragen) FMC PER87631	28	Ingestion	3 G:7	A	ALL (excl. VIC)	Permitted in spinach and silverbeet for suppression of Leafminers (<i>Liriomyza</i> spp.) including Cabbage Leafminer (<i>Liriomyza brassicae</i>), Vegetable Leafminer (<i>Liriomyza sativae</i>) & Serpentine Leafminer (<i>Liriomyza huidobrensis</i>). [Max 3 applications per crop; re-treatment interval min. 7 d]	L Bee:VL	-
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta PER91161	28+4A	Contact & Ingestion	42	A	ALL (excl. VIC)	Permitted in spinach and silverbeet for control of Vegetable Leafminer (<i>Liriomyza sativae</i>), Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) and American Serpentine Leafminer (<i>Liriomyza trifolii</i>). [Max 1 application per crop]	L-H Bee:H	R2

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
Cyromazine (Diptex 150 WP)	17	Insect growth regulator	H:7 NG	A	ALL	Permitted for use in fruiting vegetables including cucurbits for control of Liriomyza species, including Vegetable Leafminer (<i>Liriomyza sativa</i>) and Serpentine Leafminer (<i>Liriomyza huidobrensis</i>). Not supported for food use. Crops must be destroyed if treated and must not be made available for human consumption. [Max. 6 applications per crop; min. re-treatment interval 7 d]	-	-
Spinetoram (Success Neo) Corteva PER91155	5	Ingestion	3 NG	A	ALL (excl. VIC)	Permitted in spinach and silverbeet for control of Vegetable Leafminer (<i>Liriomyza sativae</i>), Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) and American Serpentine Leafminer (<i>Liriomyza trifolii</i>). [Max 4 applications per crop; re-treatment interval 7-14 d]	M Bee:H	-
Spinosad (Entrust Organic) Corteva PER90928	5	Ingestion	3 G:14	A	ALL	Permitted in spinach and silverbeet (field & protected) for control of Vegetable Leafminer (<i>Liriomyza sativae</i>), Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) and American Serpentine Leafminer (<i>Liriomyza trifolii</i>). [Max 4 applications per crop; re-treatment interval min. 5 d]	L Bee:L	-
Emamectin (Proclaim Opti) Syngenta	6	Ingestion	3	P-A	ALL	Registered in Spinach and Silverbeet (field) for control of Helicoverpa, Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillars and Loopers. Permitted for control of Liriomyza species, including Vegetable Leafminer (<i>Liriomyza sativae</i>) in brassica vegetables.	M Bee:H	-
Cyantraniliprole (Benevia) FMC	28	Ingestion		P		Permitted for use in bulb vegetables, fruiting vegetables (all) and potatoes for control of Liriomyza species, including Vegetable Leafminer (<i>Liriomyza sativae</i>), Pea Leafminer/Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) and American Serpentine Leafminer (<i>Liriomyza trifolii</i>).	L Bee:L	-

Pest / Active Ingredient (Trade Name)	Chemical group	Activity	WHP, days	Availability	States	Comments	Impact on beneficials	Regulatory risk
SYNFOI21 Syngenta	TBC			P		SYNFOI21 is not registered but the first global application is proposed for 2022/23 for various pests including Thrips, Bugs, Mites and Caterpillars. Hort Innovation project ST19020 is generating data to support a label registration in spinach and silverbeet for control of Western Flower Thrips, Plague Thrips and Leafminer .	-	-

4.3 Weeds in spinach and silverbeet

4.3.1 Weed priorities

Common name	Scientific name
High	
Capeweed	<i>Arctotheca calendula</i>
Fat Hen	<i>Chenopodium album</i>
Stinging Nettle	<i>Urtica</i> spp.
Wireweed	<i>Polygonum aviculare</i>
Moderate	
Chickweed	<i>Stellaria media</i>
Pigweed	<i>Portulaca</i> spp.
Annual Grasses	<i>Poaecae</i>
Marshmallow	<i>Malva parviflora</i>
Amaranthus	<i>Amaranthus</i> spp.
Milk Thistle	<i>Sonchus</i> spp.
Slender Celery	<i>Cyclosporum leptophyllum</i>
Fumitory	<i>Fumaria</i> spp.

The high priority weed issues based on the feedback received were Capeweed, Fat Hen, Stinging Nettle and Wireweed. Herbicide options are listed in Appendix 3 which can be used in conjunction with various management practices such as soil fumigation, pre-crop spraying, spot spraying and mechanical controls.

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

Resistance management

Specific resistance management strategies for high resistance risk (A and B) and moderate resistance risk (C, D, F, G, I, J, K, L, M, N, Q and Z) herbicide modes of action are available on the CropLife Australia webpage⁶.

⁶ <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	
Grazing	G	No Grazing Permitted	

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Capeweed (<i>Arctotheca calendula</i>)							
Priority: High							
Spinach: Capeweed was ranked as a high priority in VIC & SA.							
Silverbeet: Capeweed was not ranked as a significant weed.							
A problem weed because it seeds and grows prolifically and is difficult to control with knockdown herbicides. It is an annual weed that germinates in the cooler months and is widespread in temperate regions.							
Chloridazon (Pyramin) BASF	C**	Silverbeet & baby spinach / pre-emergent	Registered in silverbeet and baby leaf spinach for control of grass and broadleaf weeds, including Capeweed .	NR	A	ALL	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Capeweed .	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 Capeweed .	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 grass and broadleaf weeds, including Capeweed , as a pre-emergence application in various vegetable crops.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including Capeweed in berries, tomatoes, beans and fallow.		P		R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Capeweed 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 Capeweed in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Fat Hen (<i>Chenopodium album</i>)							
Priority: High							
Spinach: Fat Hen was ranked as a high priority in QLD.							
Silverbeet: 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.							
Chloridazon (Pyramin) BASF	C**	Silverbeet & baby spinach / pre-emergent	Registered in silverbeet and baby leaf spinach for control of grass and broadleaf weeds, including Fat Hen .	NR	A	ALL	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
S-Metolachlor (Dual Gold) Syngenta	K**	Spinach & silverbeet / Pre-emergent	Registered in spinach & silverbeet for control of grass and broadleaf weeds, including Fat Hen . [Max. 1 application per year]	NR G:56	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

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Phenmedipham (Betanal) Bayer	C**	Silverbeet / post-emergent	Registered in silverbeet for control of grass and broadleaf weeds, including Fat Hen . Apply when weeds are at 2-leaf stage. [Max no of applications and re-treatment interval not specified]	28	A	ALL	R3
Phenmedipham (Betanal) Bayer PER81241	C**	Spinach & baby spinach / post-emergent	Permitted for use in spinach & baby spinach for control of grass and broadleaf weeds, including Fat Hen .	28 NG	A	ALL (excl. VIC)	R3
Propachlor (Ramrod) PER12008	K**	Spinach & silverbeet / pre-emergent	Permitted for use in transplanted spinach & silverbeet for control of annual grass and broadleaf weeds, including Fat Hen . Apply as a surface spray immediately after transplanting.	NR	A	All (excl. VIC)	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		-
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Fat Hen , as a pre-emergence application in various vegetable crops.		P		-
Clomazone	Q**		Registered for control of broadleaf weeds including Fat Hen in beans, poppies, potato and tobacco transplants.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including Fat Hen in sweet corn, beans, peas, pumpkins and kabocha.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including Fat Hen in berries, tomatoes, beans and fallow.		P		R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Fat Hen in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Fat Hen in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Stinging Nettle (<i>Urtica</i> spp.)							
Priority: High							
Spinach: Stinging Nettle was ranked as a high priority in VIC & TAS.							
Silverbeet: Stinging Nettle was ranked as a moderate priority in VIC.							
This is a soft herb whose leaves are sparsely covered with rigid, stinging hairs. Management practices include soil fumigation, pre-crop spraying, spot spraying or using mechanical devices.							
Chloridazon (Pyramin) BASF	C**	Silverbeet & baby spinach / pre-emergent	Registered in silverbeet and baby leaf spinach for control of grass and broadleaf weeds, including Nettles .	NR	A	ALL	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
S-Metolachlor (Dual Gold) Syngenta	K**	Spinach & silverbeet / Pre-emergent	Registered in spinach & silverbeet for control of grass and broadleaf weeds, including Stinging Nettle . [Max. 1 application per year]	NR G:56	A	ALL	-
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Stinging Nettle .	1 G:1	A	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Silverbeet / post-emergent	Registered in silverbeet for control of grass and broadleaf weeds, including Nettles . Apply when weeds are at 2-leaf stage. [Max no of applications and re-treatment interval not specified]	28	A	ALL	R3
Phenmedipham (Betanal) Bayer PER81241	C**	Spinach & baby spinach / post-emergent	Permitted for use in spinach & baby spinach for control of grass and broadleaf weeds, including Nettles .	28 NG	A	ALL (excl. VIC)	R3

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Propachlor (Ramrod) PER12008	K**	Spinach & silverbeet / pre-emergent	Permitted for use in transplanted spinach & silverbeet for control of annual grass and broadleaf weeds, including Stinging Nettle . Apply as a surface spray immediately after transplanting.	NR	A	All (excl. VIC)	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Stinging Nettle , as a pre-emergence application in various vegetable crops.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Stinging Nettle in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Wireweed (Polygonum aviculare)							
Priority: High							
Spinach: Wireweed was ranked as a high priority in VIC and as a moderate priority in QLD.							
Silverbeet: Wireweed was not ranked as a significant weed.							
Grows rapidly in the warmer months and is difficult to control with herbicides. Application timing is critical to ensure small weeds are targeted.							
Ethofumesate (Tramat) PER14703	K**	Spinach & silverbeet / pre-emergent	Permitted for use in spinach & silverbeet for control of broadleaf and grass weeds, including Wireweed . [Max. 1 application per crop].	NR	A	ALL (excl. VIC)	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Wireweed .	NR	A	ALL	R3
S-Metolachlor (Dual Gold) Syngenta	K**	Spinach & silverbeet / Pre-emergent	Registered in spinach & silverbeet for control of grass and broadleaf weeds, including suppression of Wireweed . [Max. 1 application per year]	NR G:56	A	ALL	-
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Wireweed .	1 G:1	A	ALL	R3

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Phenmedipham (Betanal) Bayer	C**	Silverbeet / post-emergent	Registered in silverbeet for control of grass and broadleaf weeds, including Wireweed . Apply when weeds are at 2-leaf stage. [Max no of applications and re-treatment interval not specified]	28	A	ALL	R3
Phenmedipham (Betanal) Bayer PER81241	C**	Spinach & baby spinach / post-emergent	Permitted for use in spinach & baby spinach for control of grass and broadleaf weeds, including Wireweed .	28 NG	A	ALL (excl. VIC)	R3
Propachlor (Ramrod) PER12008	K**	Spinach & silverbeet / pre-emergent	Permitted for use in transplanted spinach & silverbeet for control of annual grass and broadleaf weeds, including Wireweed . Apply as a surface spray immediately after transplanting.	NR	A	All (excl. VIC)	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Wireweed , as a pre-emergence application in various vegetable crops.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Wireweed in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Wireweed in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Chickweed (<i>Stellaria media</i>)							
Priority: Moderate							
Spinach: Chickweed was ranked as a high priority in WA and as a moderate priority in QLD.							
Silverbeet: Chick weed was not ranked as a significant weed.							
A low growing, winter annual weed that can continue growing all through summer.							
Chloridazon (Pyramin) BASF	C**	Silverbeet & baby spinach / pre-emergent	Registered in silverbeet and baby leaf spinach for control of grass and broadleaf weeds, including Chickweed .	NR	A	ALL	-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Ethofumesate (Tramat) PER14703	K**	Spinach & silverbeet / pre-emergent	Permitted for use in spinach & silverbeet for control of broadleaf and grass weeds, including Chickweed . [Max. 1 application per crop].	NR	A	ALL (excl. VIC)	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Chickweed .	NR	A	ALL	R3
S-Metolachlor (Dual Gold) Syngenta	K**	Spinach & silverbeet / Pre-emergent	Registered in spinach & silverbeet for control of grass and broadleaf weeds, including suppression of Chickweed . [Max. 1 application per year]	NR G:56	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
Phenmedipham (Betanal) Bayer	C**	Silverbeet / post-emergent	Registered in silverbeet for control of grass and broadleaf weeds, including Chickweed . Apply when weeds are at 2-leaf stage. [Max no of applications and re-treatment interval not specified]	28	A	ALL	R3
Phenmedipham (Betanal) Bayer PER81241	C**	Spinach & baby spinach / post-emergent	Permitted for use in spinach & baby spinach for control of grass and broadleaf weeds, including Chickweed .	28 NG	A	ALL (excl. VIC)	R3
Propachlor (Ramrod) PER12008	K**	Spinach & silverbeet / pre-emergent	Permitted for use in transplanted spinach & silverbeet for control of annual grass and broadleaf weeds, including Chickweed . Apply as a surface spray immediately after transplanting.	NR	A	All (excl. VIC)	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Chickweed , as a pre-emergence application in various vegetable crops.		P		-
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Chickweed in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Chickweed in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Pigweed (<i>Portulaca</i> spp.) Priority: Moderate Spinach: Pigweed was ranked as a high priority in WA and as a moderate priority in QLD. Silverbeet: Pigweed was not ranked as a significant weed. Summer growing weed that competes aggressively in-crop and can be difficult to control with herbicides.							
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Pigweed .	NR	A	ALL	R3
S-Metolachlor (Dual Gold) Syngenta	K**	Spinach & silverbeet / Pre-emergent	Registered in spinach & silverbeet for control of grass and broadleaf weeds, including suppression of Pigweed . [Max. 1 application per year]	NR G:56	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
Phenmedipham (Betanal) Bayer	C**	Silverbeet / post-emergent	Registered in silverbeet for control of grass and broadleaf weeds, including Pigweed . Apply when weeds are at 2-leaf stage. [Max no of applications and re-treatment interval not specified]	28	A	ALL	R3
Phenmedipham (Betanal) Bayer PER81241	C**	Spinach & baby spinach / post-emergent	Permitted for use in spinach & baby spinach for control of grass and broadleaf weeds, including Pigweed .	28 NG	A	ALL (excl. VIC)	R3
Propachlor (Ramrod) PER12008	K**	Spinach & silverbeet / pre-emergent	Permitted for use in transplanted spinach & silverbeet for control of annual grass and broadleaf weeds, including Pigweed . Apply as a surface spray immediately after transplanting.	NR	A	All (excl. VIC)	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 grass and broadleaf weeds, including Pigweed , as a pre-emergence application in various vegetable crops.		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		-
Annual Grasses (Poaceae)							
Priority: Moderate							
Spinach: Annual Grasses were ranked as a moderate priority in VIC.							
Silverbeet: Annual Grasses were ranked as a moderate priority in QLD.							
Chloridazon (Pyramin) BASF	C**	Silverbeet & baby spinach / pre-emergent	Registered in silverbeet and baby leaf spinach for control of grass and broadleaf weeds, including various annual grasses.	NR	A	ALL	-
Clethodim (Select) PER82459	A***	Spinach & silverbeet / Grass selective post-emergent	Permitted for use in spinach & silverbeet for control of various annual grasses. [Max. 1 application per crop]	28	A	ALL	-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Ethofumesate (Tramat) PER14703	K**	Spinach & silverbeet / pre-emergent	Permitted for use in spinach & silverbeet for control of various annual grass weeds. [Max. 1 application per crop].	NR	A	ALL (excl. VIC)	-
Fluazifop-P-Butyl (Fusilade) PER81244	A***	Spinach & silverbeet / Grass selective, post emergent	Permitted for use in spinach & silverbeet for control of various annual grass weeds. [Max. 1 application per crop]	49 G:49	A	All (excl. VIC)	-
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) Syngenta	K**	Spinach & silverbeet / Pre-emergent	Registered in spinach & silverbeet for control of grass and broadleaf weeds. [Max. 1 application per year]	NR G:56	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
Phenmedipham (Betanal) Bayer	C**	Silverbeet / post-emergent	Registered in silverbeet for control of grass and broadleaf weeds. Apply when weeds are at 2-leaf stage. [Max no of applications and re-treatment interval not specified]	28	A	ALL	R3
Phenmedipham (Betanal) Bayer PER81241	C**	Spinach & baby spinach / post-emergent	Permitted for use in spinach & baby spinach for control of grass and broadleaf weeds.	28 NG	A	ALL (excl. VIC)	R3
Propachlor (Ramrod) PER12008	K**	Spinach & silverbeet / pre-emergent	Permitted for use in transplanted spinach & silverbeet for control of annual grass and broadleaf weeds. Apply as a surface spray immediately after transplanting.	NR	A	All (excl. VIC)	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds as a pre-emergence application in various vegetable crops.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds in sweet corn, beans, peas, pumpkins and kabocha.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds in berries, tomatoes, beans and fallow.		P		R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
Marshmallow (<i>Malva parviflora</i>)							
Priority: Moderate							
Spinach: Marshmallow was ranked as a moderate priority in QLD.							
Silverbeet: Marshmallow was ranked as a moderate priority in VIC & QLD.							
It is adapted to a wide variety of environments and is a highly competitive weed. Control with knockdown herbicides can be unreliable.							
Chloridazon (Pyramin) BASF	C**	Silverbeet & baby spinach / pre-emergent	Registered in silverbeet and baby leaf spinach for control of grass and broadleaf weeds, including Marshmallow .	NR	A	ALL	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	NR	A	ALL	R3
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Marshmallow .	1 G:1	A	ALL	R3
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Small Flowered Mallow in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Amaranthus (<i>Amaranthus</i> spp.)							
Priority: Moderate							
Spinach: Amaranthus was ranked as a moderate priority in QLD.							
Silverbeet: Amaranthus was not ranked as a significant weed.							
It is a short-lived annual weed that can pose a problem every year as they are prolific seed producers.							

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Ethofumesate (Tramat) PER14703	K**	Spinach & silverbeet / pre-emergent	Permitted for use in spinach & silverbeet for control of broadleaf and grass weeds, including Amaranthus . [Max. 1 application per crop].	NR	A	ALL (excl. VIC)	-
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
S-Metolachlor (Dual Gold) Syngenta	K**	Spinach & silverbeet / Pre-emergent	Registered in spinach & silverbeet for control of grass and broadleaf weeds, including suppression of Amaranthus . [Max. 1 application per year]	NR G:56	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
Phenmedipham (Betanal) Bayer	C**	Silverbeet / post-emergent	Registered in silverbeet for control of grass and broadleaf weeds, including Amaranthus . Apply when weeds are at 2-leaf stage. [Max no of applications and re-treatment interval not specified]	28	A	ALL	R3
Phenmedipham (Betanal) Bayer PER81241	C**	Spinach & baby spinach / post-emergent	Permitted for use in spinach & baby spinach for control of grass and broadleaf weeds, including Amaranthus .	28 NG	A	ALL (excl. VIC)	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Green Amaranth , as a pre-emergence application in various vegetable crops.		P		-
Clomazone	Q**		Registered for control of broadleaf weeds including suppression of Amaranthus in beans, poppies, potato and tobacco transplants.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including Amaranthus in sweet corn, beans, peas, pumpkins and kabocha.		P		-

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including Amaranthus in berries, tomatoes, beans and fallow.		P		R3
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Milk Thistle (<i>Sonchus</i> spp.)							
Priority: Moderate							
Spinach: Milk Thistle was not ranked as a significant weed.							
Silverbeet: Milk Thistle was ranked as a moderate priority in QLD.							
Spring to autumn are the best times to control Thistle. Spraying at early stages of growth is the most effective.							
Chloridazon (Pyramin) BASF	C**	Silverbeet & baby spinach / pre-emergent	Registered in silverbeet and baby leaf spinach for control of grass and broadleaf weeds, including Milk Thistle .	NR	A	ALL	-
Glyphosate (Roundup)	M**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Milk Thistle .	NR	A	ALL	R3
S-Metolachlor (Dual Gold) Syngenta	K**	Spinach & silverbeet / Pre-emergent	Registered in spinach & silverbeet for control of grass and broadleaf weeds, including Milk Thistle . [Max. 1 application per year]	NR G:56	A	ALL	-
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds, including Milk Thistle .	1 G:1	A	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Silverbeet / post-emergent	Registered in silverbeet for control of grass and broadleaf weeds, including Sowthistle . Apply when weeds are at 2-leaf stage. [Max no of applications and re-treatment interval not specified]	28	A	ALL	R3
Phenmedipham (Betanal) Bayer PER81241	C**	Spinach & baby spinach / post-emergent	Permitted for use in spinach & baby spinach for control of grass and broadleaf weeds, including Sowthistle .	28 NG	A	ALL (excl. VIC)	R3

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Propachlor (Ramrod) PER12008	K**	Spinach & silverbeet / pre-emergent	Permitted for use in transplanted spinach & silverbeet for control of annual grass and broadleaf weeds, including Milk Thistle . Apply as a surface spray immediately after transplanting.	NR	A	All (excl. VIC)	R3
Chlorthal-Dimethyl (Dacthal)	D**		Registered for control of grass and broadleaf weeds, including Sowthistle , as a pre-emergence application in various vegetable crops.		P		-
Dimethenamid-P (Outlook) BASF	K**		Registered for control of grass and broadleaf weeds including Sowthistle in sweet corn, beans, peas, pumpkins and kabocho.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including Sowthistle in berries, tomatoes, beans and fallow.		P		R3
Norflurazon (Zoliar) AgNova	F**		Registered for control of grass and broadleaf weeds including Sowthistle in asparagus, citrus, grapes, nuts, stone & pome fruits.		P		-
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Oxyfluorfen (Goal)	G**		Registered for control of grass and broadleaf weeds, including Sowthistle in fallow, Brassica vegetables and fruit and nut trees. Compatible with glyphosate and diquat/paraquat.		P		-
Slender Celery (<i>Ciclospermum leptophyllum</i>)							
Priority: Moderate							
Spinach: Slender Celery was not ranked as a significant weed.							
Silverbeet: Slender Celery was ranked as a moderate priority in QLD.							
Management practices include 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.	NR	A	ALL	R3

Active Ingredient (Trade Name)	Chemical Group	Crop / Situation	Comment / Use / Weed	WHP (days)	Availability	States	Regulatory risk
Paraquat + Diquat (SpraySeed)	L**	Pre-plant knockdown	Registered as a pre-plant knockdown application for control of grass and broadleaf weeds.	1 G:1	A	ALL	R3
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		P		-
Fumitory (<i>Fumaria</i> spp.) Priority: Moderate Spinach: Fumitory was not ranked as a significant weed. Silverbeet: Fumitory was ranked as a moderate priority in QLD. It is a strongly competitive weed with highly persistent seeds making it an ongoing problem every year.							
Ethofumesate (Tramat) PER14703	K**	Spinach & silverbeet / pre-emergent	Permitted for use in spinach & silverbeet for control of broadleaf and grass weeds, including Fumitory . [Max. 1 application per crop].	NR	A	ALL (excl. VIC)	-
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
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
Phenmedipham (Betanal) Bayer	C**	Silverbeet / post-emergent	Registered in silverbeet for control of grass and broadleaf weeds, including Fumitory . Apply when weeds are at 2-leaf stage. [Max no of applications and re-treatment interval not specified]	28	A	ALL	R3
Phenmedipham (Betanal) Bayer PER81241	C**	Spinach & baby spinach / post-emergent	Permitted for use in spinach & baby spinach for control of grass and broadleaf weeds, including Fumitory .	28 NG	A	ALL (excl. VIC)	R3

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 Fumitorty (cotyledon to 2 leaf stage) in poppies.		P		-
Glufosinate-Ammonium (Basta) BASF	N**		Registered for control of grass and broadleaf weeds including Fumitorty in berries, tomatoes, beans and fallow.		P		R3
NUL3438 Nufarm	TBC		New active in development, Nufarm claims activity on broadleaf weeds.		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 spinach and silverbeet

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

Appendix 3. Products available for weed control in spinach and silverbeet

Appendix 4. Current permits for use in spinach and silverbeet

Appendix 5. Spinach and silverbeet Maximum Residue Limits (MRLs)

Appendix 6. Spinach and silverbeet Agrichemical Regulatory Risk Assessment

Appendix 1. Products available for disease control in spinach and silverbeet

Active Ingredient (Trade Name)	Chemical group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Vegetables	Plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases (including <i>Fusarium</i> and <i>Verticillium</i> wilts, <i>Rhizoctonia</i> , <i>Pythium</i>) and suppression of weeds. <i>For use by professional and registered fumigators only.</i>	ALL	NR	-
Azoxystrobin + Oxathiapiprolin (Orondis Flexi) Syngenta	11+49	Leafy Vegetables	Downy Mildew (<i>Hyaloperonospora</i> spp. and <i>Peronospora</i> spp.) Suppression of Alternaria Leaf Spot (<i>Alternaria</i> spp.) and Sclerotinia Rot (<i>Sclerotinia</i> spp.)	ALL	3 NG	-
Chlorothalonil (Bravo) PER82895	M5	Spinach & Silverbeet	Downy Mildew, Alternaria Leaf Blight, Botrytis Grey Mould	ALL (excl. VIC)	7 NG	R3
Copper	M1	Spinach & Silverbeet	Downy Mildew	ALL	1	-
Cyazofamid (Ranman) UPL	21	Spinach & Silverbeet (field)	Damping Off (<i>Pythium</i>)	ALL (excl. VIC)	3 NG	-
Cyprodinil + Fludioxonil (Switch) Syngenta	9+12	Leafy Vegetables	Sclerotinia Rot	ALL	7	R3
Dazomet (Basamid)	8F	Vegetables	Soil fungi, nematodes, soil insects & weeds	ALL	NR	-
Difenoconazole (Score) Syngenta PER87973	3	Spinach & Silverbeet	Powdery Mildew	ALL (excl. VIC)	7 NG	R3
Dimethomorph + Mancozeb (Acrobat + Mancozeb) PER14958	40+M3	Spinach & Silverbeet (field & protected)	Downy Mildew	ALL (excl. VIC)	14 NG	R2

Active Ingredient (Trade Name)	Chemical group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
Fludioxonil + Metalaxyl-M (Maxim XL) Syngenta	12+4	Spinach & Silverbeet as a seed treatment	Damping off caused by <i>Rhizoctonia solani</i> & <i>Phytophthora</i> spp.	ALL	NR G:28	R3
Iprodione (Rovral)	2	Mustard Spinach	Sclerotinia, Grey Mould & Alternaria Leaf Spot	ALL	7	R2
Iprodione (Rovral) PER84955	2	Spinach & Silverbeet	Sclerotinia & Grey Mould	ALL (excl. VIC)	7 NG	R2
Mancozeb	M3	Spinach & Silverbeet	Cercospora Leaf Spot & Downy Mildew	ALL	14	R2
Mandipropamid (Revus) Syngenta	40	Spinach & Silverbeet	Downy Mildew	ALL	1	-
Metalaxyl-M + Mancozeb (Ridomil Gold MZ) Syngenta PER13673	4+M3	Spinach & Silverbeet	Downy Mildew	ALL (excl. VIC)	14	R2
Metham Sodium	-	General pre-plant soil fumigation	Nematodes, fungi & weed seeds	ALL	NR	-
Oxathiapiprolin (Zorvec Enicade) Corteva	49	Spinach & Silverbeet	Downy Mildew	ALL	3	-
Penthiopyrad (Fontelis) Corteva	7	Spinach & Silverbeet	Sclerotinia Rot, Botrytis Grey Mould & Powdery Mildew	ALL	3	-
Phosphorous Acid PER11951	33	Spinach & Silverbeet	Downy Mildew	ALL (excl. VIC)	Nil	-
Potassium Bicarbonate (EcoCarb) PER13695	M2	Silverbeet	Powdery Mildew	ALL (excl. VIC)	NR	-

Active Ingredient (Trade Name)	Chemical group	Situation	Diseases / Comments	States	WHP Days	Regulatory risk
Propamocarb Hydrochloride + Fluopicolide (Infinito) Bayer	28+43	Leafy Vegetables	Downy Mildew (<i>Peronospora farinosa</i> , <i>Peronospora parasitica</i>)	ALL	7	-
Propiconazole PER14479	3	Spinach	Cercospora Leaf Spot	ALL (excl. VIC)	7	R3
		Silverbeet	Suppression of Cercospora Leaf Spot, Powdery Mildew and Rust.			
Pydiflumetofen + Fludioxonil (Miravis Prime) Syngenta	7+12	Spinach & Silverbeet	Grey Mould (<i>Botrytis cinerea</i>) White Mould (<i>Sclerotinia sclerotiorum</i> , <i>Sclerotinia minor</i>)	ALL	3 NG	R3
Quinoxifen (Legend) Gowan PER11991	13	Silverbeet including Swiss chard & spinach beet	Powdery Mildew	ALL (excl. VIC)	7	-
<i>Streptomyces lydicus</i> WYEC108 (Actinovate) Novozymes Bioag	BM 02	Vegetables	As a seed treatment for <i>Fusarium</i> , <i>Rhizoctonia</i> & <i>Pythium</i> Management	ALL	NR	-
Sulphur	M2	Vegetables	Powdery Mildew, Rust, Tomato Russet Mite, Bean Spider Mite & Two-Spotted Mite	ALL	NR	-
Tebuconazole (Folicur)	3	Spinach & Silverbeet	Sclerotinia Rot	ALL (excl. VIC)	3	R3
Trifloxystrobin (Flint) Bayer PER14494	11	Spinach & Silverbeet	Powdery Mildew	ALL (excl. VIC)	3	-
Zineb PER14839	M3	Spinach	Anthraco-nose	ALL (excl. VIC)	14	R2

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

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
1,3-Dichloropropene + Chloropicrin (Telone C-35)	8B	Vegetables	Plant parasitic Nematodes, Symphylans, Wireworms, soil borne diseases and suppression of weeds. <i>For use by professional and registered fumigators only.</i>	ALL	NR	-
Abamectin	6	Spinach & Silverbeet	Western Flower Thrips	ALL	3	-
Abamectin PER81876	6	Leafy vegetables	Leafminers (<i>Liriomyza</i> spp.) including Vegetable Leafminer (<i>Liriomyza sativae</i>) & Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) (suppression only)	ALL (excl. VIC)	14 NG	-
Afidopyropen (Versys) BASF	9D	Leafy Vegetables (field)	Green Peach Aphid, Cabbage Aphid, Currant Lettuce Aphid, Cotton/ Melon Aphid & suppression of Silverleaf Whitefly	ALL	1	-
Alpha-Cypermethrin PER81702	3A	Spinach & Silverbeet	Vegetable Weevil, Plague Thrips	ALL (excl. VIC)	1	-
			Red Legged Earth Mite		NR	
<i>Bacillus thuringiensis subsp. kurstaki</i> (Dipel)	11A	Leafy Vegetables	Armyworm, Cotton Bollworm, Native Budworm, Cabbage Moth, Cabbage White Butterfly, Green Looper, Lightbrown Apple Moth, Pear Looper, Soybean Looper, Vine Moth & Tobacco Looper	ALL	NR	-
<i>Beauveria bassiana</i> (Velifer) BASF	UNF	Protected vegetables & ornamentals	Suppression Of Various Pests Including Western Flower Thrips, Onion Thrips, Greenhouse Whitefly, Silverleaf Whitefly, Sweet Potato Whitefly, Green Peach Aphid & Two-Spotted Spider Mites.	ALL	NR	-
Chlorantraniliprole (Coragen) FMC	28	Leafy vegetables	Cotton Bollworm & Native Budworm	ALL	3	-

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Chlorantraniliprole (Coragen) FMC PER89259	28	Leafy Vegetables	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	1	-
Chlorantraniliprole (Coragen) FMC PER87631	28	Spinach & Silverbeet	Leafminers (<i>Liriomyza</i> spp.) including Cabbage Leafminer (<i>Liriomyza brassicae</i>), Vegetable Leafminer (<i>Liriomyza sativae</i>) & Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) (suppression only)	ALL (excl. VIC)	3 G:7	-
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta	28+4A	Spinach & Silverbeet	<i>Helicoverpa</i> , Cluster Caterpillar, Looper, Lettuce Aphid, Green Peach Aphid, Brown Sowthistle Aphid, Silverleaf White Fly, Western Flower Thrips, Vegetable Leaf Hopper and Lucerne Leaf Roller	ALL	42	R2
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta PER89280	28+4A	Leafy Vegetables including Spinach & Silverbeet	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	42	R2
Chlorantraniliprole + Thiamethoxam (Durivo) Syngenta PER91161	28+4A	Leafy Vegetables including Spinach & Silverbeet	Vegetable Leafminer (<i>Liriomyza sativae</i>) Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) American Serpentine Leafminer (<i>Liriomyza trifolii</i>)	ALL (excl. VIC)	42	R2
Chlorpyrifos (Lorsban)	1B	Silverbeet	Red Legged Earth Mite & Blue Oat Mite	NSW, TAS & WA	NR	R1
Chlorpyrifos (Lorsban) PER14583	1B	Spinach & Silverbeet	African Black Beetles, False Wireworms & Wireworms	ALL (excl. VIC)	NR	R1
Dazomet (Basamid)	8F	Vegetables	Soil fungi, nematodes, soil insects & weeds	ALL	NR	-

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Diazinon	1B	Silverbeet	Webworm	ALL (excl. TAS)	14	R3
Emamectin (Proclaim Opti) Syngenta	6	Spinach & silverbeet (field only)	<i>Helicoverpa</i> , Diamondback Moth, Cabbage White Butterfly, Cluster Caterpillars & Loopers.	ALL	3	-
Emamectin (Proclaim Opti) Syngenta PER14907	6	Leafy Vegetables including Spinach & Silverbeet (protected cropping)	Diamondback Moth, <i>Helicoverpa</i> spp., Cabbage White Butterfly & Vegetable Looper	ALL (excl. VIC)	1 NG	-
Emamectin (Proclaim Opti) Syngenta PER89263	6	Leafy Vegetables	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	3	-
Emamectin (Proclaim Opti) Syngenta PER89285	6	Silverbeet & Spinach (protected cropping)	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	3	-
Emulsifiable Botanical Oils (Eco-Oil)	-	Vegetables	Greenhouse Whitefly	ALL	NR	-
Flubendiamide (Belt) Bayer	28	Leafy Vegetables	<i>Helicoverpa</i> spp	ALL	1	-
Garlic + Chilli + Pyrethrins + Piperonyl Butoxide	3A	Vegetables	Ants, Aphids, Caterpillars, Earwigs, Whitefly, Thrips and Leafhoppers. Suitable for organic growers.	ALL	1	-
Helicoverpa NPV (Vivus Max) AgBiTech	31	Leafy vegetables	Cotton Bollworm, Corn Earworm, Tobacco Budworm & Native Budworm	ALL	NR	-
Imidacloprid (Confidor) PER10918	4A	Spinach & Silverbeet	Greenhouse Whitefly & Aphids	ALL	7	R2

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Indoxacarb (Avatar eVo) FMC	22A	Leafy Vegetables (field grown only, NOT hydroponic)	Cotton Bollworm, Native Budworm and Lucerne Leafroller	ALL	3 NG	R3
Indoxacarb (Avatar eVo) FMC PER89278	22A	Leafy Vegetables	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	7	R3
Indoxacarb + Novaluron (Plemax) Adama	22A+15	Leafy Vegetables (field)	Cabbage White Butterfly, Cotton Bollworm, Native Budworm, Cabbage Cluster Caterpillar, Centre Grub, Cluster Caterpillar, Diamondback Moth	ALL	3 NG	R3
Iron EDTA Complex	-	All plants	Snails and Slugs	ALL	NR	-
Metaldehyde	-	Vegetables	Snails and Slugs	ALL	7	-
Metham Sodium	-	General pre-plant soil fumigation	Nematodes, fungi & weed seeds	ALL	NR	-
Methomyl (Lannate) PER82428	1A	Silverbeet	<i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug & Thrips including Western Flower Thrips	ALL	14	R2
Methomyl (Lannate) PER89293	1A	Spinach & Silverbeet	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL	14	R2
Petroleum Oil PER12221	UN	Leafy Vegetables	Aphids, Green Mirid, Green Vegetable Bug, Grey Cluster Bug, Leafhoppers, Mites, Rutherglen Bug & Thrips	ALL (excl. VIC)	1	-
Pirimicarb (Aphidex)	1A	Leafy Vegetables	Aphids	ALL	2	R3
Potassium Salts of Fatty Acids (Natrasoap)	-	Vegetables	Aphids, Thrips, Mealybug, Two Spotted Mites, Spider Mite & Whitefly	ALL	NR	-
Propargite (Omite)	12C	Vegetables	Mites	ALL	7	R3

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Pymetrozine (Chess) Syngenta	9B	Spinach & Silverbeet	Potato Aphid, Melon Aphid & Green Peach Aphid	ALL	3	R3
Pyrethrins (Pyganic)	3A	Leafy Vegetables	Pre-harvest clean-up spray for insects such as Fruitfly, Rutherglen Bug and Spiders.	ALL	1	-
Spinetoram (Success Neo) Corteva	5A	Leafy Vegetables	Loopers, <i>Helicoverpa</i> spp. & Western Flower Thrips	ALL	3	-
Spinetoram (Success Neo) Corteva PER89241	5	Leafy Vegetables	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL (excl. VIC)	1	
Spinetoram (Success Neo) Corteva PER13322	5	Specified Leafy Vegetables including Ceylon Spinach	Potato Moth	ALL (excl. VIC)	3 NG	-
Spinetoram (Success Neo) Corteva PER91155	5	Spinach and Silverbeet	Vegetable Leafminer (<i>Liriomyza sativae</i>) Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) American Serpentine Leafminer (<i>Liriomyza trifolii</i>)	ALL (excl. VIC)	3 NG	-
Spinosad (Entrust Organic) Corteva	5	Leafy Vegetables including silverbeet & spinach	Loopers, <i>Helicoverpa</i> & Western Flower Thrips	ALL	3	-
Spinosad (Entrust Organic) Corteva PER89870	5	Leafy Vegetables including Silverbeet & Spinach	Fall Armyworm (<i>Spodoptera frugiperda</i>)	ALL	3 G:14	-
Spinosad (Entrust Organic) Corteva PER90928	5	Silverbeet & Spinach	Vegetable Leafminer (<i>Liriomyza sativae</i>) Serpentine Leafminer (<i>Liriomyza huidobrensis</i>) American Serpentine Leafminer (<i>Liriomyza trifolii</i>)	ALL	3 G:14	-

Active Ingredient (Trade Name)	Chemical group	Situation	Pests / Comments	States	WHP	Regulatory risk
Spirotetramat (Movento) Bayer	23	Leafy Vegetables	Green Peach Aphid	ALL	3	-
<i>Spodoptera frugiperda</i> Multiple Nucleopolyhedrovirus (Fawligen) AgBiTech PER90820	31	Leafy Vegetables	Fall Armyworm	ALL	NR	-
Sulfoxaflor (Transform) Corteva	4C	Leafy Vegetables (field use only)	Green Peach Aphid, Brown Sowthistle Aphid, Rutherglen Bug & Greenhouse Whitefly.	ALL	3	-
Sulphur	UN	Vegetables	Powdery Mildew, Rust, Tomato Russet Mite, Bean Spider Mite & Two-Spotted Mite	ALL	NR	-
Trichlorfon (Lepidex)	1B	Vegetables	Cabbage White Butterfly, Cabbage Moth, Green Vegetable Bug & Rutherglen Bug	ALL	2	R2

Appendix 3. Products available for weed control in spinach and silverbeet

Active Ingredient (Trade Name)	Chemical Group	Situation	Comment / Use / Weed	WHP (days)	States	Regulatory risk
Chloridazon (Pyramin) BASF	C**	Silverbeet / pre-emergent residual	Grass and broadleaf weeds	NR	ALL	-
Clethodim (Select) PER82459	A***	Spinach & Silverbeet / post-emergent	Grass weeds as per the product label	28	ALL	R3
Ethofumesate (Tramat) PER14703	K**	Spinach & Silverbeet / pre-emergence use only	Grass and broadleaf weeds as listed on the product label	NR	ALL (excl. VIC)	-
Fluazifop-P-Butyl (Fusilade) PER81244	A***	Spinach & Silverbeet / selective post-emergent	Grass weeds as specified on the product label	49 G:49	ALL (excl. VIC)	-
Glyphosate (Roundup)	M**	General knockdown / Vegetables	Grass and Broadleaf Weeds as a pre-crop spray	NR	ALL	R3
S-Metolachlor (Dual Gold) Syngenta	K**	Spinach & Silverbeet / Pre-plant residual	Various broadleaf & grass weeds as per the product label	NR G:56	ALL	-
Paraquat + Diquat (SpraySeed)	L**	General knockdown	Grass and Broadleaf Weeds	NR	ALL	R3
Phenmedipham (Betanal) Bayer	C**	Silverbeet / Selective post-emergent	Grass and Broadleaf Weeds	28	ALL	R3
Phenmedipham (Betanal) Bayer PER81241	C**	Spinach (field) / Selective post-emergent	Grass and broadleaf weeds as per the product label	28 NG	ALL (excl. VIC)	R3
Propachlor (Ramrod) PER12008	K**	Spinach & Silverbeet / Selective post-emergent	Annual grasses & broadleaf weeds as per product label	NR	ALL (excl. VIC)	R3

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

Appendix 4. Current permits for use in spinach and silverbeet

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER81876 Version 4	Abamectin / Leafy vegetables except lettuce (Spinach & Silverbeet) / Leafminers (<i>Liriomyza</i> spp.) suppression	24-Jun-16	30-Apr-24	Hort Innovation
PER81702 Version 3	Alpha-Cypermethrin / Spinach & Silverbeet / Plague Thrips, Vegetable Weevil & Red Legged Earth Mite	24-Mar-16	28-Feb-24	Hort Innovation
PER87631 Version 2	Chlorantraniliprole (Coragen) / Spinach & Silverbeet t/ Leafminers (<i>Liriomyza</i> spp.)	21-Jun-19	30-Jun-24	Hort Innovation
PER89259	Chlorantraniliprole (Coragen) / Various, including Leafy vegetables / Fall Armyworm	06-Mar-20	31-Mar-23	Hort Innovation
PER89280	Chlorantraniliprole + Thiamethoxam (Durivo) / Various, including Leafy vegetables (Spinach & Silverbeet) / Fall Armyworm	12-Mar-20	31-Mar-23	Hort Innovation
PER91161	Chlorantraniliprole + Thiamethoxam (Durivo) / Various, including Leafy vegetables (Spinach & Silverbeet) / Leafminers (<i>Liriomyza</i> spp.)	09-Jun-21	30-Jun-24	Hort Innovation
PER82895 Version 2	Chlorothalonil (Bravo) / Spinach & Silverbeet / Downy Mildew, Alternaria Leaf Blight, Botrytis Grey Mould	04-Aug-17	31-Aug-25	Hort Innovation
PER14583 Version 5	Chlorpyrifos (Lorsban) / Spinach & Silverbeet / African Black Beetles, False Wireworms & Wireworms	01-Apr-14	31-Oct-24	Hort Innovation
PER82459	Clethodim (Select) / Spinach & Silverbeet / Various grasses	19-Apr-17	30-Sep-21	Hort Innovation
PER81867 Version 2	Cyromazine (Diptex 150 WP) / Various including Leafy vegetables except lettuce (Spinach & Silverbeet) / Leafminers (<i>Liriomyza</i> spp.) *These crops must be destroyed if treated and must not be made available for human consumption	2-Dec-19	30-Nov-23	Hort Innovation
PER87973	Difenoconazole (Score) / Spinach & Silverbeet (field & protected) / Powdery Mildew	27-Aug-20	31-Aug-25	Hort Innovation
PER14958 Version 2	Dimethomorph + Mancozeb / Spinach & Silverbeet (field & protected) / Downy Mildew	21-Dec-14	31-Dec-22	Hort Innovation

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER14907 Version 3	Emamectin (Proclaim) / Leafy vegetables / Diamondback Moth, <i>Helicoverpa</i> spp., Cabbage White Butterfly & Vegetable Looper (Protected Cropping)	09-Dec-14	30-Nov-24	Hort Innovation
PER89263	Emamectin (Proclaim Opti) / Various, including Leafy vegetables (Spinach & Silverbeet) / Fall Armyworm	10-Mar-20	31-Mar-23	Hort Innovation
PER89285	Emamectin (Proclaim Opti) / Various, including Leafy vegetables (Spinach & Silverbeet) Protected / Fall Armyworm (Protected Cropping)	16-Mar-20	31-Mar-23	Hort Innovation
PER14703 Version 3	Ethofumesate (Tramat) / Spinach & Silverbeet (pre-emergent use only) / Weeds as listed on the product label	01-Aug-14	31-Jul-24	Hort Innovation
PER81244 Version 3	Fluazifop-P-Butyl (Fusilade) / Spinach & Silverbeet / Grass weeds	01-Jul-16	30-Jun-22	Hort Innovation
PER10918 Version 3	Imidacloprid (Confidor) / Spinach & Silverbeet / Greenhouse Whitefly & Aphids	30-Jun-15	31-Dec-23	Hort Innovation
PER89278	Indoxacarb (Avatar) / Various, including Leafy vegetables (Spinach & Silverbeet) / Fall Armyworm	13-Mar-20	31-Mar-23	Hort Innovation
PER84955	Iprodione (Rovral) / Spinach & Silverbeet / Sclerotinia, Black Rot & Grey Mould	12-Feb-18	28-Feb-23	Hort Innovation
PER13673 Version 4	Metalaxyl-M + Mancozeb (Ridomil Gold MZ) / Spinach & Silverbeet / Downy Mildew	22-Apr-13	31-Jul-26	Hort Innovation
PER14958 Version 2	Mancozeb (Dithaine Rainshield) & Dimethomorph (Acrobat) / Various, including Spinach & Silverbeet / Downy Mildew	21-Dec-14	31-Dec-22	Hort Innovation
PER82428 Version 4	Methomyl (Lannate) / Silverbeet / <i>Helicoverpa</i> spp., Cucumber Moth, Cluster Caterpillar, Loopers, Webworm, Rutherglen Bug, Thrips including Western Flower Thrips	22-Apr-16	31-Mar-24	Hort Innovation
PER89293	Methomyl (Lannate) / Various, including Leafy vegetables (Spinach & Silverbeet) Spinach & Silverbeet / Fall Armyworm	10-Apr-20	30-Apr-23	Hort Innovation
PER12221 Version 4	Petroleum Oil / Leafy vegetables / Aphids, Green Mirid, Green Vegetable Bug, Grey Cluster Bug, Leafhoppers, Mites, Rutherglen Bug, & Thrips	29-Jun-12	30-Nov-22	Hort Innovation

Permit No.	Description	Issued Date	Expiry Date	Permit Holder
PER81241 Version 3	Phenmedipham (Betanal) / Spinach & Baby Spinach / Weeds as per the product label (field only)	29-May-15	31-May-25	Hort Innovation
PER11951 Version 5	Phosphorous Acid / Spinach & Silverbeet / Downy Mildew	01-Nov-10	31-Mar-25	Hort Innovation
PER13695 Version 3	Potassium Bicarbonate (EcoCarb) / Silverbeet / Powdery Mildew	31-Oct-12	31-Jul-25	Hort Innovation
PER12008 Version 6	Propachlor (Ramrod) / Spinach & Silverbeet / Annual grasses & broadleaf weeds as per product label	18-Jun-12	30-Nov-25	Hort Innovation
PER14479 Version 4	Propiconazole / Spinach & Silverbeet / Leaf Spot & Powdery Mildew	12-May-14	30-Nov-24	Hort Innovation
PER11991 Version 4	Quinoxifen (Legend) / Silverbeet including Swiss Chard & Spinach Beet / Powdery Mildew	29-Jun-11	31-Jan-26	Hort Innovation
PER13322 Version 2	Spinetoram (Success Neo) / Specified Leafy Vegetables (Spinach & Silverbeet) / Potato Moth	12-Jun-12	31-May-22	Hort Innovation
PER89241	Spinetoram (Success Neo) / Various, including Leafy Vegetables (Spinach & Silverbeet) / Fall Armyworm	06-Mar-20	31-Mar-23	Hort Innovation
PER91155	Spinetoram (Success Neo) / Various, including leafy vegetables (Spinach & Silverbeet) / Leafminers (<i>Liriomyza</i> spp.)	09-Jun-21	30-Jun-24	Hort Innovation
PER89870	Spinosad (Entrust Organic) / Various, including Leafy Vegetables (Spinach & Silverbeet) / Fall Armyworm	21-Jul-20	31-Jul-23	Hort Innovation
PER90928	Spinosad (Entrust Organic) / Various, including leafy vegetables (Silverbeet & Spinach) / Leafminers (<i>Liriomyza</i> spp.)	23-Apr-21	30-Apr-24	Hort Innovation
PER90820 Version 3	<i>Spodoptera frugiperda</i> Multiple Nucleopolyhedrovirus (Fawligen) / Various including Leafy Vegetables / Fall Armyworm	30-Mar-21	31-Mar-24	AgBiTech
PER14494 Version 2	Trifloxystrobin (Flint) / Spinach & Silverbeet / Powdery Mildew	01-Oct-14	31-Aug-22	Hort Innovation
PER14839 Version 3	Zineb / Spinach / Anthracnose	01-Aug-14	30-Sep-24	Hort Innovation

Appendix 5. Spinach and Silverbeet Maximum Residue Limits (MRLs)

CODEX commodity grouping of Leafy vegetables:

VL0053	Leafy vegetables
VL0502	Spinach (English)
VL0464	Chard (Silverbeet)
-	Vegetables

Note: Major export markets for Spinach and Silverbeet include Malaysia, Singapore, Hing Kong, Indonesia and Thailand. Available information indicates that in the absence specific limits in legislation that 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
Abamectin	VL 0053	Leafy vegetables {except Lettuce, leaf}	T0.5	-
Acibenzolar-S-methyl	VL 0502	Spinach	-	0.6
Afidopyropen	VL 0053	Leafy vegetables	5	-
Aldrin and dieldrin	VL 0053	Leafy vegetables	-	E0.05
Ametoctradin	VL 0053	Leafy vegetables	50	50
Azoxystrobin	VL 0053	Leafy vegetables	15	-
Bifenthrin	VL 0053	Leafy vegetables {except Chervil; Mizuna; Rucola [rocket]}	*0.01	-
Boscalid	VL 0053	Leafy vegetables	30	40
Chlorantranilprole	VL 0053	Leafy vegetables {except Lettuce, head; Rucola [rocket]}	15	-
	VL 0053	Leafy vegetables	-	20
Chloridazon	VL 0502	Spinach	1	-
	VL 0464	Chard [Silverbeet]	1	-
Chlorpyrifos	-	Vegetables (some exceptions)	T*0.01	-
Chlorthal-dimethyl	-	Vegetables {except Lettuce}	5	-
Chlorothalonil	VL 0053	Leafy vegetables {except Lettuce}	T100	-
	VL 0464	Chard	-	50
Clothianidin	VL 0053	Leafy vegetables	0.7	2
Cyantranilprole	VL 0053	Leafy vegetables {except Lettuce, head}	-	20
Cyazofamid	VL 0502	Spinach	T10	-
	VL 0464	Chard [Silverbeet]	T10	-
	VL 0053	Leafy vegetables {except brassica leafy vegetables}	-	10
Cyhalothrin	VL 0464	Chard [Silverbeet]	T0.5	-
Cypermethrins (including alpha- and zeta-cypermethrin)	VL 0053	Leafy vegetables	-	0.7
Cyprodinil	VL 0053	Leafy vegetables {except brassica leafy vegetables}	10	50
Deltamethrin	VL 0053	Leafy vegetables	-	2
Diazinon	VL 0502	Spinach	-	0.5
	-	Vegetables	0.7	-

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Dichlobenil	VL 0053	Leafy vegetables	-	0.3
Dicofol		Vegetables (some exceptions)	5	-
Difenoconazole	VL 0502	Spinach	T5	-
	VL 0464	Chard [Silverbeet]	T5	-
Dimethomorph	VL 0053	Leafy vegetables	15	-
	VL 0502	Spinach	-	30
Dinotefuran	VL 0053	Leafy vegetables	-	6
Dithiocarbamates	VL 0053	Leafy vegetables	5	-
Diquat	-	Vegetables (some exceptions)	*0.05	-
2,2 DPA	-	Vegetables	*0.1	-
Emamectin	VL 0053	Leafy vegetables {except Lettuce, head; Lettuce, leaf}	T0.5	-
EPTC	-	Vegetables	*0.04	-
Ethofumesate	VL 0502	Spinach	T1	-
	VL 0464	Chard [Silverbeet]	1	-
Fonicamid	VL 0502	Spinach	-	20
Fluazifop-p-butyl	VL 0053	Leafy vegetables {except Lettuce, head}	T2	-
Flubendiamide	VL 0053	Leafy vegetables {except Lettuce, head}	10	-
Fludioxonil	VL 0053	Leafy vegetables	15	-
	VL 0502	Spinach	-	30
Fluensulfone	VL0053	Leafy vegetables	-	1
	VL 0502	Spinach	-	4
Fluopicolide	VL 0053	Leafy vegetables	30	30
Fosetyl Al	VL 0053	Leafy vegetables [except Rucola [rocket]; Spinach]	T0.2	-
	VL 0502	Spinach	T0.7	20
Glyphosate	VL 0053	Leafy vegetables	*0.1	-
Haloxyfop	VL 0053	Leafy vegetables	T0.5	-
Heptachlor	-	Vegetables (some exceptions)	E0.05	-
Iprodione	VL 0502	Spinach	T5	-
	VL 0464	Chard [Silverbeet]	T15	-
Imidacloprid	VL 0053	Leafy vegetables {except Lettuce, head}	20	-
Indoxacarb	VL 0053	Leafy vegetables {except Lettuce, head}	5	-
Inorganic bromide	-	Vegetables {except Peppers, sweet [capsicum]}	20	-
Lindane	-	Vegetables	E2	-
Linuron	-	Vegetables {except Celeriac; Celery; Leek; Parsnip}	*0.05	-
Malathion	VL 0502	Spinach	-	3
Mandipropamid	VL 0053	Leafy vegetables	30	25
Metaldehyde	-	Vegetables	1	-
Metalaxyl	VL 0053	Leafy vegetables	0.3	-
	VL 0502	Spinach	-	2
Methiocarb	-	Vegetables	0.1	-
Methomyl	VL 0502	Spinach	T0.7	-
	VL 0464	Chard [Silverbeet]	2	-

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Metolachlor	VL 0502	Spinach	T*0.01	-
	VL 0464	Chard [Silverbeet]	T*0.01	-
Myclobutanil	VL 0053	Leafy vegetables	-	0.05
Novaluron	VL 0464	Chard	-	15
	VL 0053	Leafy vegetables	5	-
Omethoate	-	Vegetables	2	-
Oxadixyl	VL 0053	Leafy vegetables	T5	-
Oxathiapiprolin	VL 0053	Leafy vegetables {except Lettuce, head}	15	-
	VL 0502	Spinach	-	15
Paraquat	VL 0053	Leafy vegetables	-	0.07
	-	Vegetables {except Potato, Pulses}	*0.05	-
Pendimethalin	VL 0053	Leafy vegetables	*0.05	-
Penthiopyrad	VL0053	Leafy vegetables {except Brassica leafy vegetables; Lettuce, head}	50	-
	VL0053	Leafy vegetables {except Brassica leafy vegetables}	-	30
Permethrin	VL 0502	Spinach	-	2
Phenmedipham	VL 0053	Leafy vegetables [except Chard [silver beet]]	T1	-
	VL 0464	Chard [Silverbeet]	2	-
Phorate	VL 0053	Leafy vegetables	T*0.01	-
Phosphorous acid	VL 0053	Leafy vegetables	T150	-
Piperonyl butoxide	VL 0502	Spinach	-	50
	-	Vegetables	8	-
Pirimicarb	VL 0053	Leafy vegetables	7	-
Prometryn	-	Vegetables	*0.1	-
Propachlor	VL 0053	Leafy vegetables {except Lettuce, head; Lettuce, leaf}	T1	-
Propamocarb	VL 0053	Leafy vegetables	70	-
	VL 0502	Spinach	-	40
Propargite	-	Vegetables	3	-
Propazine	-	Vegetables	*0.1	-
Propiconazole	VL 0502	Spinach	T0.7	-
	VL 0464	Chard [Silverbeet]	T0.5	-
Pydiflumetofen	VL 0053	Leafy vegetables {except Brassica leafy vegetables}	T30	-
Pymetrozine	VL 0053	Leafy vegetables	5	-
Pyrethrins	-	Vegetables	1	-
Pyrimethanil	VL 0053	Leafy vegetables {except Lettuce, head; Lettuce, leaf}	T5	-
Quinoxifen	VL 0464	Chard [Silverbeet]	T3	-
Sethoxydim	VL 0053	Leafy vegetables {except Lettuce, head; Lettuce, leaf}	T0.5	-
Spinetoram	VL 0053	Leafy vegetables	0.7	-
	VL 0502	Spinach	-	8
Spinosad	VL 0053	Leafy vegetables	5	10
Spiromesifen	VL0053	Leafy vegetables	-	15

Chemical	Codex	Description	APVMA MRL mg/kg	Codex MRL mg/kg
Spirotetramat	VL 0053	Leafy vegetables {except Brassica leafy vegetables; Lettuce, head; Lettuce, leaf}	5	7
Sulfoxaflor	VL0053	Leafy vegetables {except Lettuce, head}	5	-
	VL0053	Leafy vegetables	-	6
Tebuconazole	VL 0502	Spinach	T2	-
	VL 0464	Chard [Silverbeet]	T2	-
Tebufenozide	VL 0053	Leafy vegetables	-	10
Thiamethoxam	VL 0053	Leafy vegetables	2	3
Trichlorfon	-	Vegetables (some exceptions)	0.1	-
Trifloxystrobin	VL 0502	Spinach	T10	20
	VL 0464	Chard [Silverbeet]	T10	-
Trifluralin	-	Vegetables {except Carrot; Parsnip; Fennel bulb; Galangal, greater}	0.05	-

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

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

T =Temporary MRL

E = The MRL is based on extraneous residues

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

Appendix 6. Spinach and Silverbeet Agrichemical Regulatory Risk Assessment

Spinach/Silverbeet Agrichemical Regulatory Risk Assessment

October 2021

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

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

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

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

Spinach/Silverbeet 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				
Ants	Pyrethrins	3A		
Aphids				
Aphids	Imidacloprid (PER10918)	4A	APVMA: Under review Canada: Under review EU: Removal of all field uses USA: Re-registration with new risk mitigation measures	
	Paraffinic oil/petroleum oil			
	Pirimicarb	1A	Codex: JMPR Periodic re-evaluation 2022/23 EU: Candidate for substitution	
Brown sowthistle aphid	Chlorantraniliprole +thiamethoxam	28 + 4A	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses Europe: Outdoor uses deregistered ¹ USA: Re-registration with new risk mitigation measures	
	Sulfoxaflor	4C	USA: Pollinator concerns	
Cabbage aphid	Afidopyropen	9D		
Cotton aphid	Afidopyropen	9D		
	Pymetrozine	9B	EU- Being phased out Codex: No registrant support	

Problem	Active Constituents	Chemical Group	Comment	Activities
Currant lettuce aphid	Afidopyropen	9D		
	Chlorantraniliprole +thiamethoxam	28 + 4A	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses Europe: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
Green peach aphid	Afidopyropen	9D		
	Chlorantraniliprole +thiamethoxam	28 + 4A	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses Europe: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
Green peach aphid: continued	Pymetrozine	9B	EU- Being phased out Codex: No registrant support	
	Spirotetramat	23		
	Sulfoxaflor	4C	USA: Pollinator concerns	
Potato aphid	Pymetrozine	9B	EU- Being phased out Codex: No registrant support	

Problem	Active Constituents	Chemical Group	Comment	Activities
Beetles / Weevils				
African black beetle	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	Alpha-cypermethrin	3A	EU: Proposed restricted authorisation & Candidate for substitution	
False wireworm	Chlorpyrifos (PER14583)	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	
Wireworm				
Caterpillars/Lepidoptera				
Cabbage white butterfly	Emamectin benzoate	6		
	Spinetoram	5		
Caterpillars	Pyrethrins	3A		
	Spinetoram	5		
Cluster caterpillar	Chlorantraniliprole	28		
	Emamectin benzoate	6		
Cucumber moth	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
Diamondback (Cabbage) moth	Emamectin benzoate	6		
	Pyrethrins	3A		

Problem	Active Constituents	Chemical Group	Comment	Activities
Fall armyworm	Chlorantraniliprole (PER89259)	28		
	Chlorantraniliprole + thiamethoxam (PER89280)	28 + 4A	Thiamethoxam APVMA: Under review Canada: Proposal to deregister outdoor uses Europe: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Emamectin benzoate (PER89263)	6		
	Methomyl (PER89293)	1A	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
	Spinetoram (PER89241)	5		
	Spinosad (PER89870)	5		
Helicoverpa species	<i>Bacillus thuringiensis</i>	11A		
Native Budworm (<i>H. punctigera</i>)	Chlorantraniliprole	28		
Corn earworm/Cotton bollworm (<i>H. armigera</i>)	Emamectin benzoate	6		
	Flubendiamide	28		
	Helicoverpa NPV	31		
	Indoxacarb	22A	EU: Non-renewal	
	Methomyl (PER82428: Silverbeet)	1A	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
	Spinetoram	5		
	Spinosad	5		

Problem	Active Constituents	Chemical Group	Comment	Activities
Looper caterpillars	Chlorantraniliprole	28		
	Emamectin benzoate	6		
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
	Spinetoram	5		
	Spinosad	5		
Lucerne leafroller	Chlorantraniliprole	28		
Webworms	Diazinon	1B	EU: Deregistered Codex: To be reviewed by 2020/21.	
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
Grasshoppers/Locusts				
Field crickets	Chlorpyrifos	1B	APVMA: Under review. Potential issues w.r.t. environmental loading and worker exposure. EU: Proposed cancellation of use Canada: proposed cancellation of most uses. USA: EPA decision to allow continued use	
Mole crickets				

Problem	Active Constituents	Chemical Group	Comment	Activities
Jassids/Plant bugs				
Green vegetable bug	Petroleum oil			
Grey cluster bug	Petroleum oil			
Leafhoppers	Paraffinic oil/petroleum oil			
	Pyrethrins	3A		
Green mirids	Petroleum oil			
Rutherglen bug	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (expired 31/8/19)	
	Petroleum oil			
	Pyrethrins	3A		
Vegetable leafhopper	Chlorantraniliprole +thiamethoxam	28 + 4A	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses Europe: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	

Problem	Active Constituents	Chemical Group	Comment	Activities
Mites				
Blue oat mite	Chlorpyrifos (Silverbeet)	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	
Mites	Paraffinic oil/Petroleum oil			
Redlegged earth mite	Alpha-cypermethrin	3A	EU: Proposed restricted authorisation & Candidate for substitution	
	Chlorpyrifos (Silverbeet)	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	
Two-spotted (Red spider) mite	Pyrethrins	3A		Data generation project ST18001 for spiromesifen for registration

Problem	Active Constituents	Chemical Group	Comment	Activities
Thrips				
Plague thrips	Alpha-cypermethrin	3A	EU: Proposed restricted authorisation & Candidate for substitution	
Thrips	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (Authorisation expired 31/8/19)	
	Paraffinic oil/petroleum oil			
	Pyrethrins	3A		
Western flower thrips	Abamectin	6		
	Chlorantraniliprole +thiamethoxam	28 + 4A	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses Europe: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
	Methomyl (PER82428)	1A	APVMA: nominated for review Canada: Majority of uses cancelled EU: No authorisations (Authorisation expired 31/8/19)	
	Spinetoram	5		
	Spinosad	5		

Problem	Active Constituents	Chemical Group	Comment	Activities
White fly				
Greenhouse whitefly	Imidacloprid (PER10918)	4A	APVMA: Under review Canada: Under review EU: Removal of all field uses USA: Re-registration with new risk mitigation measures	
	Sulfoxaflor	4C	USA: Pollinator concerns	
Silverleaf (Poinsettia) whitefly	Afidopyropen	9D		
	Chlorantraniliprole +thiamethoxam	28 + 4A	Thiamethoxam: APVMA: Under review Canada: Proposal to deregister outdoor uses Europe: Outdoor uses deregistered USA: Re-registration with new risk mitigation measures	
Whitefly	Pyrethrins	3A		
Other				
Cabbage leafminer	Chlorantraniliprole (PER87631)	28		
Flies	Pyrethrins	3A		
Earwig	Pyrethrins	3A		
Vegetable leafminer	Abamectin (PER81876)	6		

Problem	Active Constituents	Chemical Group	Comment	Activities
DISEASES				
Alternaria leaf spots	Azoxystrobin + oxathiapiprolin	11 + 49		
	Chlorothalonil (PER82895)	M5	APVMA: Previously nominated for review Canada: Review recently completed; continued use considered acceptable Europe: Authorisation not renewed ⁱⁱ .	
Anthraco-nose	Zineb (PER14839)	M3	APVMA: Nominated for review Canada: Proposed cancelling of foliar uses Codex: To be reviewed 2022/23 Europe: Deregistered	
Botrytis grey mould	Iprodione (PER84955)	2	Europe: Deregistered Canada: Majority of food crop uses deleted Codex: Review scheduled for 2022/23	
	Chlorothalonil (PER82895)	M5	APVMA: Previously nominated for review Canada: Review recently completed; continued use considered acceptable Europe: Authorisation not renewed.	
	Penthiopyrad	7		
Cercospora leaf spot	Mancozeb	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Propiconazole (PER14479)	3	APVMA: Nominated for review Europe: Deregistered: being phased-out	
Damping off: Pythium	Cyazofamid	21		
Damping off: Rhizoctonia/Phytophthora	Fludioxonil +metalaxyl-M	12 + 4	Fludioxonil: EU: Currently under reviewed Candidate for substitution EU: Metalaxyl-M restricted use approval	

Problem	Active Constituents	Chemical Group	Comment	Activities
Downy mildew	Azoxystrobin + oxathiapiprolin	11 + 49		
	Chlorothalonil (PER82895)	M5	APVMA: Previously nominated for review Canada: Review recently completed; continued use considered acceptable Europe: Authorisation not renewed.	
	Copper	M1	EU: Candidate for substitution	
	Dimethomorph +mancozeb (PER14958)	40 + M3	Mancozeb APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Fluopicolide +propamocarb HCl	28 + 43		
	Mancozeb	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Metalaxyl-M (PER13673)	4	EU: Metalaxyl-M restricted use approval	
	Mandipropamid	40		
	Oxathiapiprolin	49		
	Phosphorous acid (PER11951)	33		
Sulfur	M2			
Fungal diseases: Sclerotinia	Iprodione	2	Europe: Deregistered Canada: Majority of food crop uses deleted Codex: Review scheduled for 2022/23	
Leaf diseases/spot	Copper	M1	EU: Candidate for substitution	
	Mancozeb	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Sulfur	M2		

Problem	Active Constituents	Chemical Group	Comment	Activities
Leaf diseases/spot	Zineb (PER14839)	M3	APVMA: Nominated for review Canada: Proposed cancelling of foliar uses Codex: To be reviewed 2022/23 Europe: Deregistered	
Powdery mildew	Copper	M1	EU: Candidate for substitution	
	Difenoconazole (PER87973)	3	APVMA: Nominated for review Canada: Currently being reviewed	
	Mancozeb	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Penthiopyrad	7		
	Potassium bicarb (PER13695: Silverbeet)	M2		
	Propiconazole (PER14479)	3	APVMA: Nominated for review Europe: Deregistered: being phased-out	
	Quinoxyfen (PER11991)	13	EU: Being phased-out: Expired March2020	
	Sulphur	M2		
	Trifloxystrobin (PER14494)	11		
Rust	Copper	M2	EU: Candidate for substitution	
	Mancozeb	M3	APVMA: Nominated for review Canada: Many uses cancelled Codex: To be reviewed 2022/23 EU: Authorisation not renewed	
	Propiconazole (PER14479)	3	APVMA: Nominated for review Europe: Deregistered: being phased-out	
	Sulphur	M2		

Problem	Active Constituents	Chemical Group	Comment	Activities
Sclerotinia rot	Azoxystrobin +oxathiapiprolin	11 + 49		Data generation project ST17000 for Luna Experience for registration
	Boscalid	7		
	Cyprodinil +fludioxonil	12 + 9	Cyprodinil: Canada: Currently under reviewed EU: Candidate for substitution Fludioxonil: EU: Currently under reviewed Candidate for substitution	
	Penthiopyrad	7		
	Tebuconazole	3	APVMA: Nominated for review	
Target spot (Early blight)	Copper	M1	EU: Candidate for substitution	
WEEDS				
Broadleaf weeds and grasses	Chloridazon	C	EU: No authorisation in place	
	Clethodim (PER82459)	A	Codex: MRLs proposed for deletion	
	Ethofumesate (PER14703)	J		
	Fluazifop-P (PER81244)	A		
	Haloxypop-P (Spinach)	A	EU: Candidate for substitution	
	Metolachlor +S-metolachlor	K		
	Phenmedipham (PER81241)	C	EU: Review outcome not positive	
	Propachlor (PER12008)	K	EU: No authorisation in place	

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

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