

Crop(s)	Wide host range of plant species including onion, potato, brassica, beet, spinach, peas, beans and cut flowers
Insect(s)	Serpentine leafminer (<i>Liriomyza huidobrensis</i>)

Guidelines

1. The Serpentine Leafminer is a highly polyphagous pest of around 50 different plant families including many crops and weeds. Problems with *Liriomyza* typically result from the destruction of their parasitoids by excessive use of non-selective insecticides. Therefore, an Integrated Pest Management (IPM) approach should be adopted with focus on the preservation of beneficial arthropods and monitoring of pest populations, including:
 - a. Monitoring via regular walk round of crops to determine presence of leafminers, including potential pest reservoirs in surrounding crops and weeds.
 - b. Focus on areas exposed to prevailing winds and transport routes or unloading areas.
2. *Liriomyza* leafminers are vulnerable to a wide range of generalist parasitoid and predator natural enemies, even when introduced into non-endemic regions, thus broad-spectrum products such as Organophosphates, Pyrethroids and Neonicotinoids should be avoided where possible, or used at times to minimize impact on natural enemy population, such as the end of a growing season.
3. Larval stages should be targeted by products showing systemicity or good translaminar or locally systemic activity. This include Cyromazine, Abamectin, Cyantraniliprole, Chlorantraniliprole, Spinetoram, Spirotetramat (use for light infestations - suppression only).
4. Adult flies should be targeted by products with good residual and contact activity, including actives such as Abamectin, Cyantraniliprole, Chlorantraniliprole, Spinetoram.
5. When applying insecticides to this pest, key considerations should be given to:
 - a. Apply insecticides only when needed based on economic damage thresholds (tbd);
 - b. Use insecticides appropriate to the insect growth stage, eg. systemic and translaminar acting products are required for larval stages, and contact and residual activity is key for adults.
 - c. Use a **medium spray quality** to ensure sufficient droplets cover the spray target to ensure the larvae ingest a lethal dose of insecticide.

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Group*	Chemical subgroup	Example chemical (as per permit, and named crops)**	Permit
1B	Acetylcholinesterase inhibitors	Dimethoate (pulses & ornamental shrubs and trees)	PER89184 to 31.3.25
4A	Nicotinic acetylcholine receptor (NaChR) competitive modulators (Neonicotinoids) Chlorantraniliprole + thiamethoxam (Durivo®)	Thiamethoxam + Chlorantraniliprole (Nursery stock – non-food)	PER91161 to 31.6.24
5	Nicotinic acetylcholine receptor (nAChR) allosteric modulators – Site I (Spinosyns) spinetoram (Success® Neo) spinosad (eg. Entrust®)	Spinetoram (brassica vegetables (head and leafy), cucurbits, culinary herbs, fruiting vegetables, leafy vegetables, root and tuber vegetables, stalk and stem vegetables, ginger, nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals, snow peas, sugar snap peas and green beans)	PER93550 to 31.12.26 PER87878 to 31.12.27 PER91155 to 30.6.24
		Spinosad (leafy brassica, cucurbits, culinary herbs, fruiting vegetables, leafy vegetables, root and tuber vegetables, stalk and stem vegetables, ornamentals.)	PER90928 to 30.4.24
6	Glutamate-gated chloride channel (GluCl) allosteric modulators (Avermectins) abamectin (eg. Vertimec®) emamectin benzoate (eg. Proclaim® Opti) chlorantraniliprole + abamectin (Voliam® Targo)	Abamectin (cucurbits and other fruiting vegetables (excluding mushroom and corn), leafy vegetables, legume vegetables, root and tuber vegetables, bulb vegetables, head cabbages, celery and rhubarb),	PER1876 to 30.4.24 PER91812 to 31.3.27
		Chlorantraniliprole + abamectin, Emamectin (nursery stock (non-food), fruiting plants (non-bearing) cut flower and ornamentals)	PER91812 to 31.3.27
		Emamectin (suppression only in Brassica Vegetables)	PER91812 to 31.3.27
15	Inhibitors of chitin biosynthesis affecting CHS1 (Benzoylureas eg. Dimilin®)	Diflubenzuron (nursery stock (non-food and non-bearing), cut flowers, ornamentals)	PER90454 to 31.10.24 PER91812 to 31.3.27
17	Moulting disruptors, Dipteran (eg. Daptex®)	Cyromazine (broccoli, fruiting veg – cucurbits and others (excluding mushroom and corn), head lettuce, legume vegetables, root and tuber vegetables, stalk and stem vegetables, nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)	PER81867 to 30.9.26
22A	Voltage-dependent sodium channel blockers (Oxadiazines)	Indoxacarb (nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)	
23	Inhibitors of COA Carboxylase (eg. Movento®)	Spirotetramat (suppression of snow peas, sugar snap peas, lettuce (head and leafy), parsley, green beans, celery, rhubarb, eggplant, capsicum, chilies, tomatoes.	PER88640 to 28.2.26

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28	Ryanodine receptor modulators (Diamides) chlorantraniliprole (eg. Coragen®) cyantraniliprole (Benevia®) cyclaniliprole (Teppan®) chlorantraniliprole + thiamethoxam (Durivo®) chlorantraniliprole + abamectin (Voliam® Targo)	Chlorantraniliprole (spinach and silverbeet)	PER87631 to 31.3.29
		Chlorantraniliprole (nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)	PER91812 to 31.3.27
		Chlorantraniliprole + Thiamethoxam (brassica leafy vegetable and leafy vegetables – seedlings)	PER91161 to 31.6.24
		Chlorantraniliprole + Abamectin (nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)	PER91812 to 31.3.27
		Cyantraniliprole (bulb vegetables, fruiting vegetables, potatoes, celery, nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)	PER93850 to 31.12.26 PER93849 to 31.12.26 PER91811 to 31.3.27
		Cyclaniliprole (nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)	PER91811 to 31.3.27
UN	Unknown (eg. Azamax®)	Azadirachtin (nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)	PER91812 to 31.3.27

- d. Use a well calibrated, functioning boom spray with appropriate water rate for the target crop to ensure optimum spray coverage.
 - e. Use the recommended insecticide rates as stipulated on the relevant APVMA Emergency Use Permit.
 - f. Inspect the performance of the insecticide 3-4 days after application. Always document the effectiveness of each insecticide application and never re-spray a failure with an insecticide with the same mode of action. Inform the permit holder, APVMA and agronomist of any spray failures.
 - g. Resistance risk is increased where known incidences have been recorded internationally in *Liriomyza* species. This includes the following MoA groups: Carbamates (Group 1A); Cyclodienes/Organochlorines (Group 2A), Organophosphates (Group 1B); Pyrethroids (Group 3); Spinosyns (Group 5), Abamectin (Group 6) and Cyromazine (Group 17).
 - h. When rotating between modes of action, take into account the resistance management strategies for other pests which may be present.
6. When using selected insecticides targeting the serpentine leafminer, the following resistance management strategy guidelines should be implemented:
- a. If the label allows and it is required for sustained pest management, use two sequential applications of any one Mode of Action (MOA) insecticide to span a **single generation of**

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Serpentine leafminer (~13-26 days at 20-30°C) and then **rotate to a different MOA insecticide**;

- b. Do not treat successive generations with products of the same MOA;
- c. The total exposure period of any one MOA insecticide applied throughout the crop cycle (from seedling to harvest) **should not exceed 50% of the crop cycle**;
- d. Abide by the individual label recommendation for maximum **number of allowable applications per crop per season**;
- e. Abide by individual label recommendation for the **minimum reapplication interval** and always use the **full recommended label rates**; and
- f. Where possible, an Area Wide Management strategy should be adopted where the same MOA insecticides are used **by all growers** in the **same time period**.
- g. As the industry learns more about how to manage this pest, this Strategy may be updated and regional-specific strategies may be developed. Check the CropLife Resistance Management [website](#) to ensure you are following the most up to date serpentine leafminer strategy.

List of active constituents approved for use under permits by the Australian Pesticides and Veterinary Medicines Authority (APVMA) as of March 2023

Group*	Chemical sub-group	Example chemical (as per permit, and named crops) **
1B	Acetylcholinesterase inhibitors	Dimethoate (pulses & ornamental shrubs and trees)
4A	Nicotinic acetylcholine receptor (nAChR) competitive modulators (Neonicotinoids)	Thiamethoxam + Chlorantraniliprole (Nursery stock – non-food)
5	Nicotinic acetylcholine receptor (nAChR) allosteric modulators – Site I (Spinosyns)	Spinetoram (brassica vegetables (head and leafy), cucurbits, culinary herbs, fruiting vegetables, leafy vegetables, root and tuber vegetables, stalk and stem vegetables, nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals, snow peas, sugar snap peas and green beans) Spinosad (leafy brassica, cucurbits, culinary herbs, fruiting vegetables, leafy vegetables, root and tuber vegetables, stalk and stem vegetables, ornamentals.)
6	Glutamate-gated chloride channel (GluCl) allosteric modulators	Abamectin (cucurbits and other fruiting vegetables (excluding mushroom and corn), leafy vegetables, legume vegetables, root and tuber vegetables, bulb vegetables, head cabbages, celery and rhubarb), Chlorantraniliprole + abamectin, Emamectin (nursery stock (non-food), fruiting plants (non-bearing) cut flower and ornamentals)

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Group*	Chemical sub-group	Example chemical (as per permit, and named crops) **
		Emamectin (suppression only in Brassica Vegetables)
15	Inhibitors of chitin biosynthesis affecting CHS1 (Benzoylureas)	Diflubenzuron (nursery stock (non- food and non-bearing), cut flowers, ornamentals)
17	Moulting disruptors, Dipteran.	Cyromazine (broccoli, fruiting veg - cucurbits and others (excluding mushroom and corn), head lettuce, legume vegetables, root and tuber vegetables, stalk and stem vegetables, nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)
22A	Voltage-dependent sodium channel blockers (Oxadiazines)	Indoxacarb (nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)
23	Inhibitors of COA Carboxylase	Spirotetramat (suppression of snow peas, sugar snap peas, lettuce (head and leafy), parsley, green beans, celery, rhubarb, eggplant, capsicum, chilies, tomatoes.
28	Ryanodine receptor modulators (Diamides)	Chlorantraniliprole (Spinach and Silverbeet, nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals) Chlorantraniliprole + Thiamethoxam (brassica leafy vegetable and leafy vegetables – seedlings) Chlorantraniliprole + Abamectin (nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals) Cyantraniliprole (bulb vegetables, fruiting vegetables, potatoes, celery, nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals) Cyclaniliprole (nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)
UN	Unknown	Azadirachtin (nursery stock (non-food), fruiting plants (non-bearing), cut flower, ornamentals)

*Refer: CropLife Australia Expert Committee on Insecticide Resistance Mode of Action Classification for Insecticides

**Refer to the APVMA's PubCris website (<https://portal.apvma.gov.au/permits>) to ensure permit is still active

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Notes

1. Life cycle prediction tool developed by Cesar: <https://cesaraustralia.shinyapps.io/darabug2/>
2. Hort innovation guidance document: [1303CR2 Management-guide FINAL 150620.pdf \(ausveg.com.au\)](#)
3. DPI factsheet:
https://keys.lucidcentral.org/keys/v3/leafminers/key/Polyphagous%20Agromyzid%20Leafminers/Media/Html/Liriomyza_huidobrensis.htm
4. CABI datasheet, including information on natural enemies:
<https://www.cabi.org/isc/datasheet/30956#67C668C3-A81D-40A2-8D80-1A04AF7490B4>

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