

# Preliminary advice on minimising insecticide resistance in lettuce aphids

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## Introduction

Insecticides have an important role to play in controlling pests such as the lettuce aphid (*Nasonovia ribis-nigri*), which arrived in Canterbury in early 2002. However, growers must be aware of the possibilities of insecticide resistance developing when insecticides are used to control this new threat to lettuce production.

Usually, insecticide resistance strategies are based on research into the behaviour of a pest in a particular environment over several seasons. The newness of the lettuce aphid in New Zealand means that there has not yet been time to do this research. For example, initially we need to attempt to determine peak flight times for lettuce aphid. We then need to establish the effectiveness and optimum timing of various control measures.

Therefore, this article can only provide some preliminary advice on the insecticides to use, and the strategies that should be followed to help reduce the development of insecticide resistance in lettuce aphids. It does not cover the organic techniques and chemicals that may offer some degree of control of this new pest.

The lettuce aphid is known to have full or partial resistance to a number of insecticides in Europe (e.g. Pirimor, some synthetic pyrethroids, and some organo-phosphates). These have not been tested against the lettuce aphid in New Zealand, but we know there are other species of aphids, some of which live on lettuce, that are resistant or partially resistant to these insecticides. Resistance can vary with locality, so local knowledge of resistant strains will be necessary as the aphid spreads.

If the lettuce aphid in New Zealand has similar resistance or partial resistance to any insecticides, their use will only increase the level of resistance and decrease the number of insecticides effective against this potentially important new pest.

## Growing lettuces

**Aphid identification:** It is important to accurately identify the lettuce aphid. Different aphids may require different control strategies as they may live on different parts of the plant and be susceptible to different insecticides. Most aphids on lettuce are found on the outer leaves, while the lettuce aphid prefers the new leaves in the centre of the plant as well as the outer leaves.

The nymphs and wingless adults of the lettuce aphid are up to 2.7 mm long. They are yellow to green in colour with brown markings on the back of the adult. Winged adults are medium sized, 1.5-2.5 mm long, and pale yellow to green with dark brown/black markings on the back and legs. A pink form is known overseas but has not been seen in New Zealand so far.



*Winged lettuce aphid*

*Adult lettuce aphid*

There are six other aphids found on lettuce. Two of the most common aphids found are the green peach aphid (usually whitish green/yellow, small to medium in size (1.2-2.1 mm)) and the potato aphid (usually some shade of green, medium to large (1.7-3.6 mm)).

**Resistant lettuce varieties:** Some aphid-resistant lettuce varieties are available overseas and these are now being imported into New Zealand. However, monitoring for aphids is still vital as new biotypes of the aphid can develop, making the resistant lines of lettuce ineffective. Overseas reports recommend a clean-up insecticide 10 days before harvest to minimise these biotypes becoming established. It is important to identify the aphids found on the resistant lettuce lines as not all aphid species on lettuce are affected by the resistance factors in the plants.

**Sowing dates:** At certain times of the year aphids are more active so more crop monitoring and spraying are needed at those times (e.g. late summer and autumn). By growing lettuces when aphid flights are reduced or nonexistent, you decrease the chances of aphid infestation and also the amount of spraying needed. Planting crops of different ages close to each other means aphids can easily move from older plants across to younger plants. This also increases the chances of insecticide resistance developing as the same insecticides are likely to be sprayed on adjacent plantings. Separating lettuce plantings with other crops will reduce this occurring.

**Monitoring the crop:** Crop monitoring should start as soon as the crop is planted because the lettuce aphid can distort young plants and populations can rapidly build up and become uncontrollable. Monitor crops regularly; during the aphid flight peaks, aphids can be expected to be landing on the crop daily. Overseas publications recommend monitoring at least twice a week. Lettuces should be sampled from the edge of each block as well as in the middle, giving a good cross section of the block. Check entire plants, both under the leaves and on new leaves in the centre of each plant. This also applies to mature, non-hearting fancy lettuce varieties. At least 50 young plants, randomly selected in the block, should be checked each time. Good aphid control is only possible before the heart starts to form. Overseas data suggest that a spray programme should be put in place immediately aphids are found. When plants are hearted, destructive sampling is required as most of the aphids will be inside the hearts and not visible from the outside. At this stage, aphid control is very difficult as very few insecticides penetrate into the lettuce heart. Those that do usually have long withholding periods, which affects harvest dates.

**Insecticide failure:** When an insecticide appears to have failed, it should not be used again and it should not be replaced with a pesticide in the same chemical group. The insecticide needs to be checked for its efficacy against the aphid concerned. It is important to note that some insecticides may take up to 5 days to kill the aphid (e.g. Chess) and many dead aphids can remain on the plants. They start to go brown and shrivel up a few days after spraying. Mummified, parasitised aphids will also remain on the plants after spraying. The best way to check whether an aphid is dead is to lightly touch it and see if there is any movement.

**Label rates:** Insecticides should be applied at the recommended label rates. Higher rates could affect insecticide residues and withholding periods, while lower rates can increase the likelihood that insecticide resistance will develop. Withholding periods are defined as the minimum time required between spraying and harvesting (not between spraying and selling).

**Coverage:** High water rates are important for spraying insecticides onto lettuce crops to get good coverage. The recommended rate is 500-1000 litres per hectare. Anything that improves coverage enhances the effectiveness of the insecticide (e.g. wetter-spreaders).

**Temperature:** The fumigant effects of some chemicals are only active in warmer temperatures (e.g. Pirimor and Nuvos). Cooler temperatures mean slower drying times, so it is important to spray early enough in the day for the insecticide to dry before evening sets in, especially in autumn.

**Spray application:** The sprays need time to dry to be effective, so spraying should not be carried out before rain or when heavy dew is expected. Spray boom calibration is vital to get even insecticide coverage over the entire block. Care should also be taken not to overlap the spray boom passes (see label rates above).

**Hearting:** Spraying lettuces in heart will have very little, if any effect as most insecticides cannot penetrate the lettuce heart where the aphid is found. Spraying infested, hearted lettuces may only increase the likelihood that the aphid will adapt to the insecticide.

**Cultivation:** If lettuce aphids are present in the area to be cultivated, the ground must be completely ploughed under. Rotary hoeing is not effective because aphids can mature to winged adults on parts of leaves left exposed or close to the soil surface. They can then infest other lettuce crops.

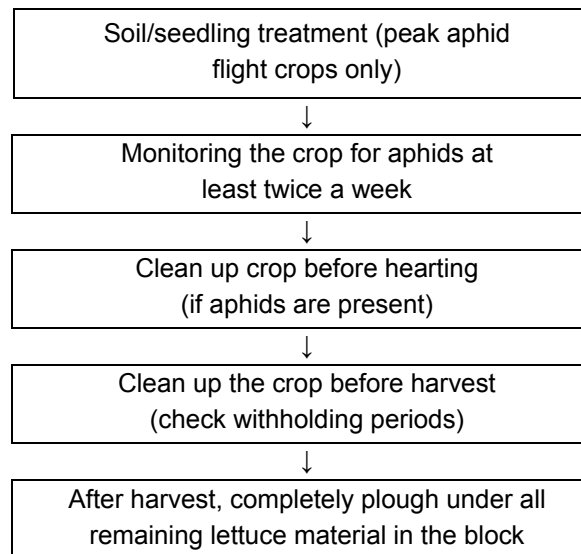
**Hygiene:** Aphids on infested lettuces left in bins or on the ground will mature and fly to neighbouring crops. Equipment and people moving from infested blocks to clean areas can also transfer the aphids.

**Biological control:** In autumn, the lettuce aphid attracts many different aphid predators (spiders, lacewings, syrphids, ladybirds) and parasitoids. In Canterbury, up to 15 predators have been regularly found in lettuce hearts. At harvest, these predators remain in the heart causing the lettuces to be rejected by the market.

**Chemical usage:** To decrease the chances of insecticide resistance developing in lettuce aphids, it is recommended that insecticides from the same chemical group should be used as infrequently as possible on each crop, and not more than twice back-to-back. Foliar insecticides should only be used when aphids are found in the crop. The insecticides registered for use on lettuce in New Zealand with

short withholding periods should be kept for use as pre-harvest clean up sprays. If an insecticide is used as a seedling drench it should not be used again later as a spray on the crop (e.g. Confidor should only be used as a seedling drench). Continuous use of the same seedling drench will also increase the likelihood that insecticide resistance will develop. It is better to save this type of insecticide for use when winged aphids are expected to be at their peak. Most overseas data suggest that aphid flights peak in late summer and autumn, but this has yet to be determined for New Zealand.

*Management sequence used overseas for control of lettuce aphid when using soil applied insecticides.*



**Currants/gooseberries:** Some of the insecticides recommended for use in the spring to control aphids on blackcurrants are the same as those used on lettuces. These are Pirimor, Thiodan and Vydate. This means that some insecticides are likely to be used for aphid control in both currant and gooseberries and lettuce in the same season. This may increase the chances of insecticide resistance developing.

**Glasshouse lettuces:** Growing lettuces in glasshouses poses other problems. Lettuces are grown in glasshouses throughout the year and the plants develop more quickly than in the field, and this provides an environment that suits aphids. Insecticide resistance is more common in glasshouses, often due to the more frequent use of insecticides. Considerable care is needed to ensure that not all insecticides used are in the same chemical group. Insecticides should be used at the label rate; off-label applications are not recommended (e.g. in hydroponic systems). The incorrect use of insecticides increases the chances of insecticide resistance developing.

**Movement of plants and marketing:** To minimise the spread of the lettuce aphid in New Zealand, it is important that lettuces are not sent to areas where the aphid has not yet been found, including the North Island, Nelson and Blenheim.

## **Insecticide guidelines**

The accompanying table lists some chemicals and the different chemical groups that are available for aphid control in New Zealand. Note that only four are currently registered for lettuce and they only belong to two chemical groups. Many are registered for vegetables, mainly brassicas, which may have different withholding periods from those for lettuce.

There is a real need for more insecticides to be registered, especially in other chemical groups, to decrease the chances of resistance developing. One group used widely overseas for soil drenching, seedling dipping, and seed treatment is the chloronicotinyls. They have proved very effective at controlling the lettuce aphid, but until they have been fully tested in New Zealand the withholding periods required for these chemicals under local conditions are not known.

Choice of insecticide should be based on knowledge of the aphid resistance present. Managing insecticide usage can prolong the useful life span of insecticides. The choice of insecticide used should take into account other pests in the crop that may need controlling at the same time, and the effect of the insecticide on the biological control agents present. Mixtures of insecticides are not recommended, either within or between chemical groups. Mixtures decrease future options and can increase the chances of resistance to multiple groups of chemicals.

## Insecticide guidelines

Chemical group	Trade name or common name	Registration status		
		NZ lettuce	NZ vegetables <sup>2</sup>	Overseas lettuce
Carbamate (Rx)	Pirimor 50	Y (3) <sup>3</sup>		
	Lannate	Y (7)		Y (7)
Chloro-nicotinyl	Confidor		Y (70)	Y (21)
	Gaucho			Y
Phenylpyrazole	Ascend 200SC		Y (7)	
Organo-phosphate (Rx)	Phorate		Y (56)	Y (45)
	Diazinon <sup>1</sup>	Y (14)		
	Dimethoate <sup>1</sup>		Y (14)	Y (7)
	Nuvos		Y (3)	
	Orthene	Y (3)		
	Methamidophos <sup>1</sup>		Y (14)	
Organo-chloride	Endosulfan <sup>1</sup>		Y (14)	
Synthetic pyrethroid (Rx)	Baythroid		Y (3)	
	Decis Forte		Y (3)	
	Fastac 100 EC		Y (3)	Y (3)
	Karate Xeon		Y (3)	Y (3)
	Mavrik		Y (3)	
	Sumi-Alpha		Y (3)	
Pyridine azomethrine	Chess			Y (14)

<sup>1</sup> Common name/active ingredient for which there is more than one trade name product.

<sup>2</sup> Registered mainly for brassica crops, so withholding periods may be different on lettuce crops. It is strongly recommended that a residue test is undertaken before harvest to show the produce is pesticide free.

<sup>3</sup> Withholding period in days.

(Rx) Known resistance or partial resistance to the lettuce aphid overseas.

	Possible programmes			
Seeding options	Nil	Organo phosphate seeding treatment	Chloro-nicotinyl seed treatment	Chloro-nicotinyl seedling drench
Foliar options arranged alphabetically <sup>3</sup>	Carbamate	Carbamate	Carbamate	Carbamate
	Chloro-nicotinyl	Chloro-nicotinyl	-	-
	Organo-chloride	Organo-chloride	Organo-chloride	Organo-chloride
	Organo-phosphate	-	Organo-phosphate	Organo-phosphate
	Phenylpyrazole	Phenylpyrazole	Phenylpyrazole	Phenylpyrazole
	Pyridine azomethrine	Pyridine azomethrine	Pyridine azomethrine	Pyridine azomethrine
	Synthetic pyrethroid <sup>1</sup>	Synthetic pyrethroid	Synthetic pyrethroid	Synthetic pyrethroid
Maximum of two back-to-back foliar applications from each group <sup>2</sup>				

<sup>1</sup> Synthetic pyrethroids should be used when the lettuce aphid is flying because they repel aphids.

<sup>2</sup> The chance of resistance developing is reduced if a group is used less frequently.

<sup>3</sup> Note these are not in order of use. Order of use will be determined by other pests present, withholding period and mode of action.