

# Determination of Pre Harvest Intervals for a range of insecticides in salad leaf

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## 1. Introduction

This report summarises a salad leaf pre harvest interval (PHI) trial conducted in Gisborne during February and March 2014 on five varieties of salad leaf.

This trial was carried out to determine the residue decay curves resulting from a single application of 11 commonly used insecticides on salad leaf. This enables PHIs to be established which will allow growers to meet either the set or the default off label maximum residue limit (MRL of 0.1 mg/kg) for each compound trialled. Table 1 outlines the set or default MRL applicable to each compound.

Table 1: Set or default MRLs for each compound for salad leaf

Compound	Crop / crop group	MRL (mg/kg)
Abamectin	Off label	0.1
Acephate	Leafy vegetables	6
Chlorantraniliprole	Baby leaf	20
Chlorpyrifos	Off label	0.1
Dichlorvos	Vegetables	2
Indoxacarb <sup>1</sup>	Off label	0.1
Lambda Cyhalothrin	Off label	0.1
Malathion / Maldison	Vegetables <sup>2</sup>	8
Methamidophos <sup>3</sup>	Leafy vegetables	0.5
Methomyl	Off label	0.1
Spinosad	Off label	0.1
Spirotetramat	Off label	0.1

Results for each of the five salad leaf varieties are summarised along with a PHI table that should help growers plan the application of these insecticides in order to ensure that the respective MRLs are not exceeded.

The five varieties of salad leaf trialled were: mizuna, tatsoi, red beet, red tatsoi and spinach

## 2. Application Data

A single application of 11 insecticides were applied to each of 10 trial plots at the equivalent water rate of 250 L/ha water to ensure even coverage of rows. All plots were sprayed once, 9, 7, 5, 3 or 1 days before commercial harvest. There was also one untreated control plot.

<sup>1</sup> Expected to be submitted for registration Q3 2014 to set an MRL for leafy vegetables

<sup>2</sup> The MRL may change in 2014 due to ADI issues

<sup>3</sup> Methamidophos was not directly used, however as methamidophos is a primary metabolite of acephate and residues were detected, this compound is included in this report

### 3. Residue summary

Multi residue analysis was completed by Hill Laboratory as per their multi pesticide residue screen (LC and GC+LC) with the limit of detection (LOD) for all compounds being 0.01mg/kg.

All residue samples for the trial were collected on the 13<sup>th</sup> of March 2014. This was 1, 3, 5, 7 or 9 days after treatment.

Table 2: Summary of residues (mg/kg) following one application of the insecticides listed.

Figures in green text are where the residue result **first** falls at or below the 0.1 mg/kg default or set MRL for each variety of salad leaf.

Days before harvest (DBH) – Residues (mg/kg)					
<b>abamectin (MRL = 0.1)</b>					
Variety	1	3	5	7	9
Mizuna	0.07	ND	ND	ND	ND
Tatsoi	0.08	ND	ND	ND	ND
Red beet	0.16	0.02	ND	ND	ND
Red tatsoi	0.06	0.01	0.01	ND	0.03
Spinach	0.15	0.02	ND	ND	ND
<b>acephate (MRL = 6)</b>					
Variety	1	3	5	7	9
Mizuna	11.50	5.10	4.10	1.40	0.77
Tatsoi	14.40	16.30	1.36	0.67	ND
Red beet	16.90	20.00	7.00	2.90	0.01
Red tatsoi	8.10	11.40	3.50	1.63	0.97
Spinach	13.90	28.00	6.50	7.20	3.00
<b>chlorantraniliprole (MRL = 20 proposed)</b>					
Variety	1	3	5	7	9
Mizuna	0.68	0.77	0.30	0.20	0.10
Tatsoi	0.66	0.70	0.27	0.14	ND
Red beet	0.86	0.66	0.08	0.07	ND
Red tatsoi	0.73	0.60	0.27	0.16	0.14
Spinach	0.89	0.71	0.13	0.15	0.06
<b>chlorpyrifos (MRL = 0.1)</b>					
Variety	1	3	5	7	9
Mizuna	3	1.01	1.33	0.54	0.17
Tatsoi	4.10	2.70	1.21	0.57	ND
Red beet	4.40	4.10	0.60	0.19	ND
Red tatsoi	2.30	2.90	0.73	0.28	0.13
Spinach	4.20	7.70	0.92	0.66	0.19
<b>dichlorvos (MRL = 2)</b>					
Variety	1	3	5	7	9
Mizuna	0.10	ND	ND	ND	ND
Tatsoi	0.12	0.07	ND	ND	ND
Red beet	0.21	0.13	ND	ND	ND
Red tatsoi	0.03	0.03	ND	ND	ND
Spinach	0.52	0.19	ND	ND	ND

indoxacarb (MRL = 0.1)					
Variety	1	3	5	7	9
Mizuna	2.30	1.51	0.56	0.93	0.55
Tatsoi	3.50	3.80	0.57	0.92	ND
Red beet	3.50	4.20	0.30	0.42	ND
Red tatsoi	1.83	2.90	0.50	1.19	0.68
Spinach	3.00	5.30	0.36	1.00	0.41
lambda cyhalothrin (MRL = 0.1)					
Variety	1	3	5	7	9
Mizuna	0.15	0.16	0.19	0.09	0.04
Tatsoi	0.52	0.05	ND	0.11	0.01
Red beet	0.51	0.82	0.09	0.03	ND
Red tatsoi	0.29	0.43	0.13	0.06	0.06
Spinach	0.86	0.83	0.10	0.06	0.03
malathion (MRL = 8)					
Variety	1	3	5	7	9
Mizuna	34	8.10	10.40	0.61	0.02
Tatsoi	47	31	5.60	0.22	ND
Red beet	34	39	0.02	ND	ND
Red tatsoi	30	39	9.10	0.24	0.01
Spinach	42	28	0.02	0.01	ND
methamidophos <sup>4</sup> (MRL = 0.5)					
Variety	1	3	5	7	9
Mizuna	0.04	0.07	0.15	0.09	0.07
Tatsoi	0.04	0.08	0.10	0.07	ND
Red beet	0.06	0.09	0.10	0.08	ND
Red tatsoi	0.03	0.08	0.13	0.07	0.05
Spinach	0.08	0.15	0.11	0.13	0.09
methomyl (MRL = 0.1)					
Variety	1	3	5	7	9 <sup>5</sup>
Mizuna	5.20	2.10	0.33	0.10	No methomyl applied to 9 DBH plot
Tatsoi	4.80	0.86	0.20	0.19	
Red beet	10.80	6.30	1.13	0.84	
Red tatsoi	6.80	3.10	0.56	0.49	
Spinach	8.40	4.80	0.55	0.36	
spinosad (MRL = 0.1)					
Variety	1	3	5	7	9
Mizuna	0.65	0.40	0.06	0.06	0.01
Tatsoi	0.54	0.37	0.05	0.03	ND
Red beet	0.77	0.31	0.02	ND	ND
Red tatsoi	0.52	0.22	0.04	0.05	0.01
Spinach	0.74	0.29	0.04	0.04	0.01

<sup>4</sup> Methamidophos was not directly used, however methamidophos is a primary metabolite of acephate so residues detected are included in this table.

<sup>5</sup> Methomyl was not applied to these samples.

spirotetramat (MRL = 0.1)					
Variety	1	3	5	7	9
Mizuna	3.54	2.59	0.10	0.09	0.07
Tatsoi	2.37	0.93	0.06	0.04	ND
Red beet	4.63	3.40	0.06	0.08	ND
Red tatsoi	3.01	1.59	0.14	0.13	0.12
Spinach	4.51	2.02	0.04	0.03	0.01

#### Notes:

1. ND = analyte not detected.
2. For MRL compliance, the residue definition for spirotetramat is the sum of spirotetramat and its enol metabolite, expressed as spirotetramat. The above table combines the parent and metabolite.

#### 4. Results

Residues of all compounds declined over the sampling period (see table 3 below) but for some varieties of salad leaf, chlorpyrifos, indoxacarb and spirotetramat were still above the set or default MRL at 9 days after one application. It is recommended that growers be very cautious when using products containing these compounds and only use them very early in the season or not at all. For methomyl, it is not possible to ascertain if a 9 day PHI would be sufficient to meet the 0.1 MRL as this compound was not applied to the 9 DBH plot. For the mizuna variety, residue results show that levels were below the 0.1mg/kg off label MRL at 7 DBH. Further trials with methomyl are needed to determine if a PHI of more than 9 days would comply with the default MRL.

Two compounds (chlorantraniliprole and dichlorvos) had the lowest residues and both met the set or default MRL within 1 day following application.

The registered withholding period / PHI on the labels for two compounds (chlorantraniliprole and dichlorvos) are supported by the residue data generated in this trial. However, for maldison, the registered PHI on the label is 3 days for vegetables, and data from this trial suggests that at least a 7 day PHI should be observed in order to meet the 'vegetable' MRL. This demonstrates that caution is needed even when following labelled PHIs as shorter PHIs could cause residue issues in some instances.

Interestingly there are some marked differences in residue levels for each compound between the five varieties. The varieties mizuna and tatsoi had a lower average PHI (of 5 days) across all of the compounds. Whilst red tatsoi had a higher average PHI (an average of 5.7 days). This variance in residue profile across different varieties is an extra complication for growers when trying to estimate a PHI to meet the set or default MRLs in a spray programme. This could be due to the differences in size and shape of the different varieties as this can have an influence over the residue profile. There may also be differences in initial deposition of the product/s and uptake of residues due to the differences in leaf angle, waxiness, hairiness and stomatal density. The apparent differences in the rate of residue decline may be due to the relative growth rate affecting the rate of dilution.

There were no residues detected in any of the five untreated control samples.

In terms of crop safety and phytotoxicity, at harvest (13/03/2014) the field provider observed slight leaf pitting on all varieties (especially spinach) on plots 1 - 5 treated with tank mix 1. This may be due to the tank mix of insecticides applied and further investigation is needed with compounds being used alone (as would be normal grower practice) as opposed to a tank mix of several compounds.

## 5. Discussion

Information from this trial should help growers make informed decisions on the application of these insecticides to ensure that the default or set MRL is not breached. Salad leaf is a fast growing crop and as such there is limited opportunity for insecticide residues to degrade during the growth cycle. To avoid non-compliance, it is recommended residue tests are carried out pre harvest.

Residues in this trial were generated from a single application at five different times (1, 3, 5, 7 or 9 days before harvest) during March 2014. Where grower practice is to make an application earlier in the crop cycle, lower residue levels at harvest would be expected due to both residue decay over a longer time period and dilution through crop growth.

Further residue trials may be needed to confirm PHIs for the compounds that showed significant differences (such as acephate, lambda cyhalothrin and spirotetramat) where there are inconsistencies between the five different varieties and the number of days taken to reach the MRL.

Some of these compounds are organophosphates and under regulatory scrutiny through the Environmental Protection Authority (EPA) and the Ministry for Primary Industries (MPI) and their future use is uncertain. As a result the use of these compounds may become restricted and not able to be used on salad leaf crops.

While multi residue trials provide a guideline for determining PHIs from decay curves, more robust data can be achieved through a data base of grower's pre-harvest residue analyses and spray diaries. Incorporating information derived from actual applications enables the risk of residue detections (such as in MPIs FRSP<sup>6</sup> and supermarket programs) to be monitored and more accurate conclusions drawn. This trial shows that more trials are needed in order to determine PHIs with a degree of accuracy and confidence for products that may be applied more than once per crop cycle (especially for those compounds that have persistent or cumulative residues).

### Suggested PHIs for salad leaf

This table provides suggestions on when to apply these products based on the results from this trial where the residue level is at or below the default or set MRL for each variety of salad leaf.

Table 3: Suggested PHIs for salad leaf

Compound	Trade name <sup>7</sup> (ai conc g/L)	Active rate /ha	Product Rate /ha	PHI (days before harvest)*							
				Mizuna	Tatsoi	Red beet	Red tatsoi	Spinach	Range	Labelled PHI	Grouped PHI
Abamectin	Avid (18)	11 g	600 ml	1	1	3	1	3	1-3	OL	3
Acephate	Orthene WSG (985)	388 g	400 g	3	5	7	5	9	3-9 <sup>8</sup>	OL <sup>9</sup>	9
Chlorantraniliprole	Coragen (200)	20 g	100 ml	1	1	1	1	1	1	3	1
Chlorpyrifos	Lorsban 50 EC (500)	334 g	667 ml	NS	9	9	NS	NS	9-NS	OL	NS
Dichlorvos	Nuvos EC (1000)	500 g	500 ml	1	1	1	1	1	1	3	1
Indoxacarb	Steward 150 SC (150)	75 g	500 ml	NS	9	9	NS	NS	9-NS	OL	NS
Lambda Cyhalothrin	Karate Zeon (250)	10 g	40 ml	7	9	9	7	5	5-9	OL	9
Malathion / Maldison	Fyfanon 440 EW (440)	1500 g	3400 ml	7	5	5	7	5	5-7	3	7
Methomyl	Lannate L (200)	400 g	2000 ml	7	NS	NS	NS	NS	NS	OL	NS
Spinosad	Success Naturalyte (120)	48 g	400 ml	5	5	5	5	5	5	OL	5
Spirotetramat	Movento OD (150)	84 g	560 ml	5	5	5	NS	5	5-NS	OL	NS

OL = off label use (no labelled PHI)

NS = no PHI set as data does not extend beyond 9 days

\*Disclaimer: These suggestions are solely based on the field trial SFF11-053/2013-04 carried out in Gisborne during March 2014. While this information is based on the best data available, it is not possible to guarantee the accuracy of this information. For this reason, and because of variations in GAP, climatic conditions etc. Market Access Solutionz, the Sustainable Farming Fund of MPI and Vegetables New Zealand does not accept any liability in respect of loss or damage arising from the use of information contained in this report.

A full report that presents a more detailed summary and all raw data is available upon request from John Seymour at Vegetables NZ (John.Seymour@hortnz.co.nz).

<sup>7</sup> Trade names of the products used in trials

<sup>8</sup> Variable PHI indicated from 3 to 9 days. Previous trials using the same application rate have shown residues above MRL out to 14+ days particularly on spinach

<sup>9</sup> Whilst there is an MRL set for 'leafy vegetables', there is no specific leafy vegetable PHI listed on the label