A Risk Assessment of Potential Contamination of Surface Water by Agrichemicals in Northland

NIWA Client Report: HAM2008-010
February 2008

NIWA Project: ELF08203

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M. Stewart

Prepared for

Northland Regional Council

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Executive Summary

Northland Regional Council (NRC) commissioned the National Institute of Water & Atmospheric Research (NIWA), under the EnviroLink programme, to carry out a two part study to answer whether there is a need to carry out environmental monitoring for pesticides in surface water in Northland. The first part was in the form of a questionnaire which was sent to 32 pesticide spray contractors in Northland (Appendix 1). The second part was a risk assessment of the data (Appendix 2), which comprises this report.

The following risk assessment was potentially compromised due to:

- A very low percentage of questionnaires returned (28%), with the associated danger that the data is not representative of Northland as a whole.

- Some who didn't return questionnaires may not be following guidelines for usage of agrichemicals.

- Of the questionnaires returned, most did not have full or appropriate data to accurately document.

Notwithstanding these concerns, the risk assessment was undertaken. The 9 surveys returned were reasonably varied and represented both aerial and ground spray contractors, controlling predominantly weeds, and much more localised greenhouse and orchard sprayers that primarily targeted insects and fungal pathogens.

The questionnaires revealed the usage of 46 different agrichemicals and these were documented, noting such information as active ingredient (a.i.) present in the formulation, chemical class and area sprayed. From a.i./hectare and total area sprayed, further data was calculated (where possible) for the total amount of a.i. used per application. To estimate loads to the aquatic receiving environment, conversion of a.i./hectare to concentration (ppb) of agrichemical in water was undertaken, using values for a "typical" stream and catchment.

An assessment of the ecological risk of these agrichemicals was undertaken by comparing with ANZECC "trigger" value guidelines. Of the 46 agrichemicals revealed from the surveys, only 11 had documented "trigger" values. Of the 11 agrichemicals that had trigger values to compare with, 4 have been flagged as being potentially present in the aquatic environment in ecologically harmful amounts.

This two phase exercise has been useful in documenting information on some of the agrichemicals that are being used in Northland, even if the data is not necessarily representative of Northland or can be trusted to make any concrete conclusions.

The primary recommendation is that analytical measurements need to be obtained in areas of potentially high risk, especially where streams are nearby to large horticultural areas. This could be achieved by a series of focused monitoring programmes, which would provide reliable data that can be used as the basis for future monitoring decisions.

1. Introduction

NIWA has been asked by Northland Regional Council (NRC) to give advice on pesticide use in Northland and whether there is a need to carry out State of the Environment monitoring for pesticides in surface water.

This was addressed by way of two small EnviroLink projects; the first being the design of a pesticide user survey, which was carried out previously (ELF07201/NLRC41, see Appendix 1) and the second being a risk assessment on the available data, which is the purpose of this report.

2. Survey of Pesticide Use

NRC sent out 32 questionnaires in an almost exact 1/3 split of aerial contractors, ground contractors and orchardists/market gardeners in an attempt to get a broad range of responses that would be indicative of what pesticides are being applied in Northland.

Due to the potentially high emotive response to this questionnaire, the option was given to remain anonymous. However, the response from the survey was low with only 9 (28%) returned. These are summarised in Table 1. Of those that didn't return surveys, 3 sent unofficial replies. To keep anonymity these will be called Contractor A, B and C. Their replies are as follows:

Contractor A answered with "I do not grow anything or use any sprays".

Contractor B expressed concerns about their ability to accurately fill in the survey as: (a) Their work is so varied with many contracts coming and going; (b) they do mainly road spraying for councils (not urban) so the measures are more in kilometres than hectares. Also they work over a large geographical area; (c) would take ages to look back over the past records to try and get some accurate data.

Contractor C uses the fungicide Botran 75 WP (containing 750 g/kg dicloran) to control Rhizopus. This operation does not add any agrichemical to the water table as it is filtered through a recycling facility. For this reason, it is not applicable to this survey.

The 9 formal and 3 informal responses still constitute a low response (<38%) and serious doubts must be raised as to whether the data that follows is sufficiently representative of a "Northland wide picture". As Table 1 shows, large aerial and ground spray contractors and smaller ground spray contractors, controlling predominantly weeds are represented, as is much more localised greenhouse and orchard sprayers that primarily target insects and fungal pathogens.

Apart from the low response to the survey, another consideration that should be taken into account is that NRC has at some stage taken legal action against many of the aerial spray contractors in Northland and if a contractor is not following spray guidelines for safe use of agrichemicals, they are unlikely to have contributed to this survey. This could quite possibly bias results.

Table 1: Summary of Returned Surveys.

Survey#	Type	Area	Primary Function
1	Aerial spraying	Mainly Whangarei District but all over Northland	Weed control Insecticides
2	Ground spraying	Large area in central Northland	Weed control
3	Aerial and ground	Localised area in central Northland	Weed control Insecticides
4	Not specified	Large area around Whangarei	Weed control
5	Ground spraying	3 localised areas	Gorse control
6	Ground spraying	Large area around Whangarei	Weed control
7	Greenhouse	Whangarei district	Insecticides and fungicides
8	Greenhouse	Whangarei district	Insecticides and fungicides
9	Orchard	Whangarei district	Insecticides and fungicides

3. Risk Assessment

3.1 Survey Collation

The 9 surveys from which responses were obtained were collated into a table (Appendix 2) noting such information as spray month, target crop, target disease/pest and trade name. By consulting the Environmental Risk Management Authority of New Zealand (ERMANZ) website (http://www.ermanz.govt.nz/hs/index.html) information on the active ingredient (a.i.) and a.i. amount (in formulation) was ascertained, if possible. Occasionally this was not possible due to insufficient information in the survey reply. Further chemical information was obtained from either Pesticide Action Network North America (PAN) (http://www.pesticideinfo.org/List_ChemicalsAlpha.jsp) or Sigma-Aldrich (http://www2.sigmaaldrich.com/suite7/Area_of_Interest/Asia__Pacific_Rim/New_Zealand.html), most commonly chemical class and CAS number, which is a unique identifier for each chemical.

From the data available on the amount of active ingredient, amount/hectare and total area sprayed, further data were calculated (where possible) for total amount of active ingredient used per application and amount a.i./hectare.

From the amount of active ingredient/hectare used, potential concentrations in streams were estimated as follows:

If we assume a single catchment with an application of, say 5 kg/ha onto land with a stream density of 20 m/ha and an average stream width of 5 m, then:-

(1) The stream channel area is:

$$5 \text{ x } 20 = 100 \text{ m}^2/\text{ha}$$
$$= 10^{-2} \text{ ha/ha}$$

(2) The mass of a.i. on stream channel is:

$$5 \text{ kg/ha x } 10^{-2} \text{ ha/ha} = 0.05 \text{ kg a.i./ha}$$
$$= 50 \text{ g a.i./ha on waterways}$$

(3) Assume an average stream depth of 1m gives a total volume of 1000m^3

(4) Average concentration is:

$$50g/1000m^3 = 50 \times 10^6\ \mu g/10^6\ L$$
$$= 50\ \mu g/L$$
$$= 50\ ppb$$

If we change the amount of a.i. to a value (*x* kg/ha) but assume the other variables are the same, this gives an average stream concentration of 10*x* ppb. This does assume rapid dispersion and dilution, and is not a typical situation for all streams or all catchments. It is also important to note that this is a very rough estimation of stream concentrations.

3.2 Ecological Relevance

To assess which agrichemicals might be a possible environmental hazard in the stream water, the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines for fresh and marine water quality were consulted (http://www.mfe.govt.nz/publications/water/anzecc-water-quality-guide-02/index.html).

The guidelines use "trigger" values to afford protection to a percentage of species and these were set at 99%, 95%, 90% and 80%, where the value represents the percentage expected to be protected (http://www.mfe.govt.nz/publications/water/trigger-values-rivers-may00/index.html, modified as Table 2). Generally a 95% protection level is set although a higher protection (99%) can be applied if the management goal is no change in biodiversity, and/or the ecosystem has high conservation value. The recommended "trigger" value for each chemical is shaded grey (Tables 2 and 3). It should be noted that "only high and moderate reliability "trigger" values are reported".

3.3 Interpretation of Data

Of the 46 agrichemicals revealed in the surveys, only 11 have ANZECC "trigger" values, 4 were on the list but had insufficient data to assign "trigger" values and the remaining 31 were not on the list (Table 2).

Those with established "trigger" values were summarised separately (Table 3) using the available data to give the rate of application per hectare of each active ingredient, months of application and number of sites that have used this chemical (and hence indication of how widespread the use). Also, an estimated concentration of active ingredient in stream water was calculated using the assumptions and formula in section 3.1.

The agrichemicals which have very low “trigger” values and are therefore of greatest ecological concern, are various classes of insecticide and fungicide (the top 6 in Table 3). However when the estimated water concentrations of each of the chemicals in Table 3 are compared with the ecological “trigger” values, there are 4 possible chemicals of concern, and these are summarised below.

Chlorpyrifos has an estimated water concentration of 3.8 ppb, which is 380 times higher than the 95% “trigger” value of 0.01 ppb. Chlorpyrifos was used at 3 sites, however only one site (survey 1) gave data for amount of a.i/ha, from which the above concentration was calculated. This is of possible concern as the application of chlorpyrifos was carried out by aerial spraying at this site. Another site (survey 3) carries out both aerial and ground spraying, but the a.i. amount was not given.

Malathion was applied over 2 months (May and June), with the application amount given as 0.25 kg/ha. The estimated concentration in stream water was 2.5 ppb, which is 50 times higher than the 95% “trigger” value of 0.05 ppb. This site was an orchard and so reasonably contained. The estimated concentration might not apply in this case, as the orchard may be some distance from any water way.

Endosulfan was applied over August only, at the same orchard as malathion, however on a different area of the orchard. The estimated concentration in stream water was 87.5 ppb, which is 3000 times higher than the 99% “trigger” value of 0.03 ppb. Again, the geographical location of this orchard is unknown, to decide whether this could be an issue.

Copper was used in 2 different formulations, copper hydroxide and copper:lime mix. The estimated concentration in stream water was 10.5 ppb and 160 ppb respectively, which is substantially above the 95% “trigger” value of 1.4 ppb. This was used at the same orchards as malathion and endosulfan.

Table 2: ANZECC Water Quality Guideline "Trigger" Values for New Zealand Rivers for 46 Agrichemicals Found From Survey (modified from ANZECC guidelines)[1]

				"Trigger" Values for Freshwater (ppb)			
				Level of Protection (% species)			
Active Ingredient (a.i.)	**A.I. #**	**Compound Class**	**CAS #**	**99%**	**95%**	**90%**	**80%**
diazinon	46	Organophosphate insecticide	333-41-5	0.00003	0.01	0.2[A]	2[A]
chlorpyrifos	3	Organophosphate insecticide	2921-88-2	0.00004	0.01	0.11[A]	1.2[A]
malathion	29	Organophosphate insecticide	121-75-5	0.002	0.05	0.2	1.1[A]
thiram	20	Dithiocarbamate fungicide	137-26-8	0.01	0.2	0.8[C]	3[A]
endosulfan	36	Organochlorine fungicide	115-29-7	0.03	0.2[A]	0.6[A]	1.8[A]
methomyl	19	N-methyl-carbamate insecticide	16752-77-5	0.5	3.5	9.5	23
atrazine	11	Triazine herbicide	1912-24-9	0.7	13	45[C]	150[C]
copper	27	Inorganic copper fungicide	20427-59-2	1.0	1.4	1.8 [C]	2.5 [C]
2,4-D ester	7	Chlorophenoxy herbicide	94-75-7 (2,4-D)	140	280	450	830
2,4-D amine	9	Chlorophenoxy herbicide	94-75-7 (2,4-D)	140	280	450	830
glyphosate	13	Phosphonoglycine herbicide	1071-83-6	370	1200	2000	3600[A]
metsulfuron	1	Sulfonylurea herbicide	79510-48-8	ID	ID	ID	ID
hexazinone	6	Triazinone herbicide	51235-04-2	ID	ID	ID	ID
MCPA	8	Chlorophenoxy herbicide	94-74-6	ID	ID	ID	ID
metsulfuron-methyl	18	Sulfonylurea herbicide	74223-64-6/5585-64-8	ID	ID	ID	ID
organosilicone	2	Adjuvant polymer	67762-85-0	NT	NT	NT	NT
picloram	4	Pyridinecarboxylic acid pesticide	1918-02-1	NT	NT	NT	NT
triclopyr	5	Pyridinecarboxylic acid pesticide	55335-06-3	NT	NT	NT	NT
terbuthylazine	10	Triazine herbicide	5915-41-3	NT	NT	NT	NT
tribenuron methyl	12	Sulfonylurea herbicide	101200-48-0	NT	NT	NT	NT

Active Ingredient (a.i.)	A.I. #	Compound Class	CAS #	"Trigger" Values for Freshwater (ppb) Level of Protection (% species) 99%	95%	90%	80%
flumetsulam	14	Triazolopyrimidine herbicide	98967-40-9	NT	NT	NT	NT
clopyralid	15	Pyridinecarboxylic acid pesticide	1702-17-6	NT	NT	NT	NT
acetochlor	16	Chloroacetanilide herbicide	34256-82-1	NT	NT	NT	NT
thifensulfuron-methyl	17	Sulfonylurea herbicide	79277-27-3	NT	NT	NT	NT
chlorothalonil	21	substituted benzene fungicide	1897-45-6	NT	NT	NT	NT
phosphorous acid	22	Inorganic fungicide	13598-36-2	NT	NT	NT	NT
azocyclotin	23	Organotin insecticide	41083-11-8	NT	NT	NT	NT
clofentezine	24	Tetrazine insecticide	74115-24-5	NT	NT	NT	NT
tau-fluvalinate	25	Pyrethroid insecticide	102851-06-9	NT	NT	NT	NT
carbendazim	26	Benzimidazole fungicide	10605-21-7	NT	NT	NT	NT
mancozeb	28	Dithiocarbamate fungicide	8018-01-7	NT	NT	NT	NT
iprodine	30	Dicarboximide fungicide	36734-19-7	NT	NT	NT	NT
dodine	31	Guanidine fungicide	2439-10-3	NT	NT	NT	NT
captan	32	Thiophthalimide fungicide	133-06-2	NT	NT	NT	NT
tebufenozide	33	Diacylhydrazine insecticide	112410-23-8	NT	NT	NT	NT
triforine	34	fungicide/insecticide	26644-46-2	NT	NT	NT	NT
tolyfluanid	35	fungicide/insecticide	731-27-1	NT	NT	NT	NT
tebuconazole	37	Azole fungicide	107534-96-3	NT	NT	NT	NT
metiram	38	Dithiocarbamate fungicide	9006-42-2	NT	NT	NT	NT
myclobutanil	39	Dithiocarbamate fungicide	88671-89-0	NT	NT	NT	NT
thiacloprid	40	Chloro-nicotinyl insecticide	111988-49-9	NT	NT	NT	NT
carbaryl	41	N-methyl-carbamate insecticide	63-25-2	NT	NT	NT	NT
carbendazim	42	Benzimidazole fungicide	10605-21-7	NT	NT	NT	NT

Active Ingredient (a.i.)	A.I. #	Compound Class	CAS #	“Trigger” Values for Freshwater (ppb) Level of Protection (% species) 99%	95%	90%	80%
hydrogen cyanamide	43	Inorganic herbicide	420-04-2	NT	NT	NT	NT
bifenthrin	44	Pyrethroid insecticide	82657-04-3	NT	NT	NT	NT
methoxyfenozide	45	Diacylhydrazine insecticide	161050-58-4	NT	NT	NT	NT

[1]http://www.mfe.govt.nz/publications/water/anzecc-water-quality-guide-02/index.html
[A] Concentration may not protect key test species from acute toxicity (and chronic). ‘A’ indicates that trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure.
[B] Chemicals for which possible bioaccumulation and secondary poisoning effects should be considered.
[C] Figure may not protect key test species from chronic toxicity (this refers to experimental chronic figures or geometric mean for species).
[ID] Insufficient data to derive a reliable trigger value.
[NT] Agrichemical not in the original table.

Table 3: Summary of Agrichemical Usage for Those with "Trigger" Values.

Active Ingredient (a.i.)	A.I. #	Compound Class	"Trigger" Values for Freshwater (ppb) Level of Protection (% species) 99%	95%	Summary	Calculated average conc. of a.i. (ppb)§	Survey Site
Diazinon	46	Organophosphate insecticide	0.00003	0.01	0.0003kg/ha Dec-Jan-Feb	0.003	9c
Chlorpyrifos	3	Organophosphate insecticide	0.00004	0.01	0.38kg/ha Jan-Feb-Oct	**3.8**	1, 3 ,9c
Malathion	29	Organophosphate insecticide	0.002	0.05	0.25kg/ha May-Jun	**2.5**	9a
Thiram	20	Dithiocarbamate fungicide	0.01	0.2	no data greenhouse all year	-	7
Endosulfan	36	Organochlorine fungicide	0.03	0.2[A]	8.75kg/ha August	**87.5**	9b
Methomyl	19	N-methyl-carbamate insecticide	0.5	3.5	no data greenhouse all year	-	7
Atrazine	11	Triazine herbicide	0.7	13	1L/ha December	-	1
Copper	27	Inorganic copper fungicide	1.0	1.4	1.05kg/ha Feb to Aug 16 kg/ha May-Jun-Aug	**10.5** **160**	9a 9b
2,4-D Ester	7	Chlorophenoxy herbicide	140	280	1kg/ha winter months	10	1,2,4
2,4-D Amine	9	Chlorophenoxy herbicide	140	280	1.2kg/ha all year	12	1,2,4,6,9a
Glyphosate	13	Phosphonoglycine herbicide	370	1200	1.8kg/ha all year	18	2,3,4,8,9c

[A] Figure may not protect key test species from acute toxicity (and chronic). 'A' indicates that trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure.
§ Using calculations from section 3.1

4. Conclusions and Recommendations

The risk assessment carried out, using data from previous questionnaires, has identified the *possibility* that certain agrichemicals are being applied in Northland at levels that may lead to stream water concentrations that exceed the ANZECC water quality guidelines. Those that were flagged by this risk assessment were chlorpyrifos, malathion, endosulfan and copper.

Malathion, endosulfan and copper were used at one orchard and so further investigations could be made in the form of a localised monitoring programme, especially if there are catchments and streams nearby.

A greater concern might be with chlorpyrifos which was used at 3 separate sites, however only 1 site gave sufficient information to estimate the potential environmental levels.

Both these examples highlight the concern that many more agrichemicals are being used at potentially damaging amounts, and were not identified by this risk assessment due to the incomplete data that was obtained. This is supported by the result that of the 11 agrichemicals with established trigger values (Table 3), there was insufficient data to calculate the average concentration of active ingredient for three of these (thiram, methomyl and atrazine).

Whether these estimated stream level values are accurate enough to make any conclusions is open to debate. They obviously cannot be representative of every scenario and might be out by orders of magnitude in some cases.

What is very clear from the risk assessment is the need for real analytical data. With the obvious resistance of many pesticide contractors to fill out voluntary questionnaires and the limited value that these data contain, there appears to be a need to carry out some pesticide monitoring, even if only in areas of potentially high risk, i.e., streams near large horticultural areas. In the first instance, this could comprise of a few analyses, at high risk sites, carried out by sampling stream water following an application of an agrichemical.

The added bonus to acquiring analytical data is that many agrichemicals can be detected in a few analyses as commercial analytical laboratories will give data for a whole suite of metabolites. For example, a typical analysis for organonitro & phosphorous pesticides at RJ Hill Laboratories, in Hamilton will give water concentrations for 90 pesticides. This list includes diazinon, chlorpyrifos, malathion and atrazine (from Table 3), with detection limits well below the ANZECC water quality guidelines. It would also allow detection of many other potentially harmful pesticides, not flagged by this risk assessment, but with water levels higher than the ANZECC water quality guidelines.

5. Appendix 1: Survey Prepared for Northland Regional Council by NIWA

A Questionnaire of Agrichemical Spray Contractors to Gain Knowledge of the Usage of Agrichemicals in the Northland Region

Prepared by

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1. Introduction

This is a *voluntary* survey of local agrichemical (pesticide and herbicide) spray contractors about their uses of agrichemicals. The aim of this survey is to build up a Northland-wide picture of agrichemical usage, taking into account:

(a) what chemicals/formulations are used (Trade names, active ingredients, if known?)

(b) how much of each is used (i.e., Total amount/hectare)?

(c) what time(s) of the year these chemicals are sprayed (broken down into months or seasons)?

(d) which areas are sprayed (see map)?

The information obtained from this survey will be used to give us a better understanding of whether there is a potential issue of agrichemical use in Northland. This survey has a State of the Environment focus and does not have anything to do with compliance. The data will help us decide, if necessary, whether a monitoring programme is needed to check the extent of this issue.

This survey will be carried out in the strictest confidence, Northland Regional Council stress that this is an information gathering exercise only and that none of the information supplied will be used against that person. If desirable, the survey can be run anonymously.

1.1 A general overview

What method of spray do you use? i.e., aerial, ground?

What area (district) do you predominantly spray in?

Below are four boxes divided into seasons. Please give a general overview of what spraying you do in each season.

Summer	Autumn
Spring	Winter

1.2 More detail

The following table has been divided into months of the year. Please add whatever information you have for each month with regards to:

(a) What spraying is carried out (if any).

(b) What is the target crop (if applicable).

(c) What are the target pests or diseases.

(d) What product is used, with amount of active ingredient (if known).
(e) Amount sprayed/hectare (*volume* or *known amount* of active ingredient).

(f) Area of land sprayed (hectares).

(g) Location (see map). This can be done either by:

-placing a symbol (e.g., "X" or "June") on the map and corresponding symbol in the table

OR

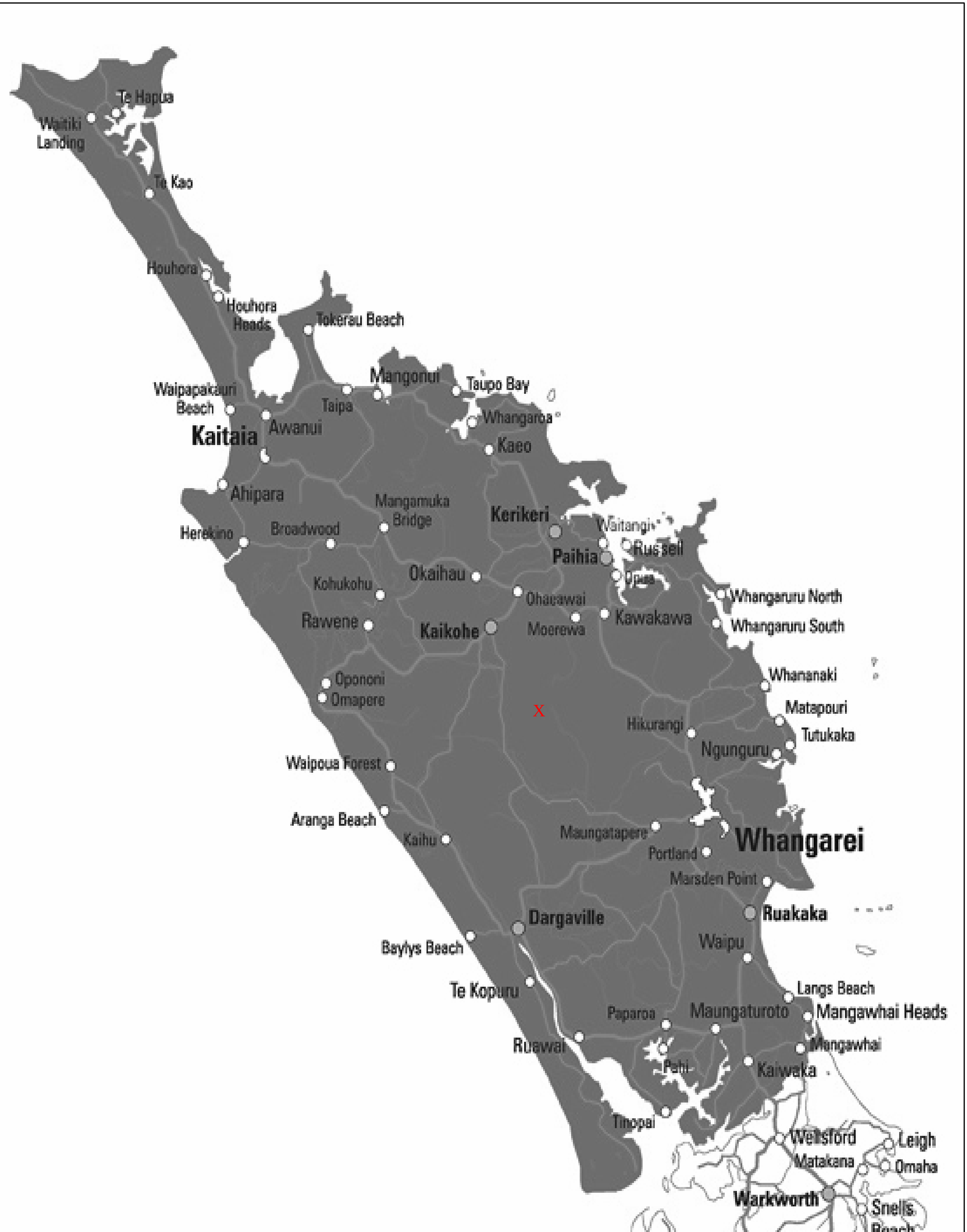
-a place name, landmark or nearest town where the spraying was carried out.

At the end of the table are 3 examples of how to fill in the table and map.

Month	Target Crop	Disease/ Pest	Product (active ingredient amount, if known?)	Amount/ ha	Total ha sprayed	Location (see map)
January						
February						
March						
April						
May						
June						

Month	Target Crop	Disease/ Pest	Product (active ingredient amount, if known?)	Amount/ ha	Total ha sprayed	Location (see map)
July						
August						
September						
October						
November						
December						

Examples						
Month	**Target Crop**	**Disease/ Pest**	**Product (active ingredient amount, if known?)**	**Amount/ ha**	**Total ha sprayed**	**Location (see map)**
January	*Total vegetation*	*Total vegetation*	*Glyphosate360 (1% solution)*	*5L*	*20*	*See X*
Before planting	*Kumara*	*Root knot nematode*	*Nemacur (400g/L)*	*20L*	*10*	*Ruawai*
Monthly from flowering until harvest	*Avocado*	*Anthracnose*	*Cuprofix (200g/kg)*	*8kg*	*10*	*Tara*


Te Hapua
Waitiki Landing
Te Kao
Houhora
Houhora Heads
Tokerau Beach
Waipapakauri Beach
Mangonui
Taupo Bay
Taipa
Whangaroa
Kaitaia
Awanui
Kaeo
Ahipara
Mangamuka Bridge
Kerikeri
Herekino
Broadwood
Waitangi
Russell
Paihia
Okaihau
Opua
Kohukohu
Ohaeawai
Whangaruru North
Rawene
Kaikohe
Moerewa
Kawakawa
Whangaruru South
Opononi
Omapere
Whananaki
X
Matapouri
Hikurangi
Tutukaka
Ngunguru
Waipoua Forest
Aranga Beach
Kaihu
Maungatapere
Whangarei
Portland
Marsden Point
Ruakaka
Dargaville
Waipu
Baylys Beach
Te Kopuru
Langs Beach
Paparoa
Maungaturoto
Mangawhai Heads
Ruawai
Mangawhai
Pahi
Kaiwaka
Tinopai
Wellsford
Leigh
Matakana
Omaha
Warkworth
Snells Beach

1.3 Any further comments?

Your Contact details *(optional)*

This is optional, you can remain anonymous if you would prefer. Your contact details will be used to determine what industries we have received feedback, to ensure we have good coverage of the different agrichemical users. It will also be used if we need to contact you to clarify any of the information or comments you have provided.

Company name:

Contact person:

Phone number:

6. Appendix 2: Data Used In This Risk Assessment

Month	Target Crop	Disease/ Pest	Trade Name	Active Ingredient (a.i.)	a.i amount	A.I. #	CAS # (if known)	Amount/ ha	Total ha sprayed	Total amount a.i. (kg or L)	Amount a.i./ha (kg/ha) or (L/ha)	Survey #	Site	Comments
Jan	Pasture/Scrub land	Gorse	Meturon	metsulfuron	600g/kg	1	79510-48-8	500g	67.7	20.31	0.30	1	1	
Feb	Pasture/Scrub land	Gorse	Meturon	metsulfuron	600g/kg	1	79510-48-8	500g	264.8	79.44	0.30	1	2	
Mar	Pasture/Scrub land	Gorse	Meturon	metsulfuron	600g/kg	1	79510-48-8	500g	63	18.90	0.30	1	3	
May	Forestry	pre-plant (pines)		metsulfuron	600g/kg	1	79510-48-8	500g	600	180.00	0.30	1	P	
Jul	Pasture	Ragwort	Meturon	metsulfuron	600g/kg	1	79510-48-8	5g	266	7.98	0.03	1	7	
Nov	Pasture	Gorse	Meturon	metsulfuron	600g/kg	1	79510-48-8	500g	19	5.70	0.30	1	5	
Dec	Pasture/Scrub land	Gorse	Meturon	metsulfuron	600g/kg	1	79510-48-8	500g	127.5	38.25	0.30	1	4	
Jan	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	27	1.22	0.05	2		
Jan	Total vegetation		Meturon?	metsulfuron	600g/kg	1	79510-48-8	10	33	0.33	0.01	2		
Feb	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	21	0.95	0.05	2		
Feb	Total vegetation		?	metsulfuron	200g/kg	1	79510-48-8	30	240	1.44	0.01	2		
Mar	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	23	1.04	0.05	2		
Mar	Total vegetation		?	metsulfuron	200g/kg	1	79510-48-8	30	222	1.33	0.01	2		
Apr	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	19	0.86	0.05	2		
Apr	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	600g/kg	1	79510-48-8	100g	2	0.14	0.07	2		
Apr	Total vegetation		?	metsulfuron	600g/kg	1	79510-48-8	10	124	0.74	0.01	2		
May	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	14	0.63	0.05	2		

Month	Target Crop	Disease/ Pest	Trade Name	Active Ingredient (a.i.)	a.i amount	A.I. #	CAS # (if known)	Amount/ ha	Total ha sprayed	Total amount a.i. (kg or L)	Amount a.i./ha (kg/ha) or (L/ha)	Survey #	Site	Comments
May	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	600g/kg	1	79510-48-8	100g	2	0.21	0.10	2		
May	Total vegetation		?	metsulfuron	600g/kg	1	79510-48-8	10	36	0.36	0.01	2		
Jun	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	1	0.05	0.05	2		
Jul	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	39	1.76	0.05	2		
Aug	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	6	0.27	0.05	2		
Sep	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	9	0.41	0.05	2		
Oct	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	27	1.22	0.05	2		
Nov	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	46	2.07	0.05	2		
Nov	Total vegetation		?	metsulfuron	600g/kg	1	79510-48-8	10	102	0.61	0.01	2		
Dec	Pasture/bush/ roadside	Brushweeds	?	metsulfuron	200g/kg	1	79510-48-8	225g	49	2.21	0.05	2		
Dec	Total vegetation		?	metsulfuron	600g/kg	1	79510-48-8	10	80	0.48	0.01	2		
Jan-Jun	Total vegetation		?	metsulfuron urea		1		?	?	14	?	4		Over 6 months
Nov-Dec	Total vegetation			metsulfuron urea		1		?	?	4	?	4		Over 2 months
Jan	Pasture/Scrub land	Gorse		organosilicone		2	67762-85-0	2L	67.7	135.40	2.00	1	1	
Feb	Pasture/Scrub land	Gorse		organosilicone		2	67762-85-0	2L	264.8	529.60	2.00	1	2	
Mar	Pasture/Scrub land	Gorse		organosilicone		2	67762-85-0	2L	63	126.00	2.00	1	3	

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Jan-Jun	Total vegetation		?	organosilicone		2	67762-85-0	?	?	*140*	?	4		Over 6 months
Nov-Dec	Total vegetation			organosilicone		2	67762-85-0	?	?	*50*	?	4		Over 2 months
Jan	Maize	army worm, corn ear worm	Lorsban750	chlorpyrifos	750g/L	3	2921-88-2	500mL	8	3.00	0.38	1	1	Organophosphate
Feb	Maize	army worm, corn ear worm	Lorsban750	chlorpyrifos	750g/L	3	2921-88-2	500mL	58	21.75	0.38	1	2	Organophosphate
Jan	Maize	army worm, corn ear worm	Lorsban750	chlorpyrifos	750g/L	3	2921-88-2	?	30	?	?	3	A	Organophosphate
Oct	Kiwifruit	scale leaf roller	Lorsban 50EC	chlorpyrifos	500g/L	3	2921-88-2		10.5*	0.001		9c		Organophosphate
Mar	Pasture/Scrub land	Blackberry, Tobacco weed	Picker	picloram	100g/L	4	1918-02-1	8L	63	50.40	0.80	1	3	pyridinecarboxylic acid
May	Forestry	pre-plant (pines)	Picker	picloram	100g/L	4	1918-02-1	8L	600	480.00	0.80	1	P	pyridinecarboxylic acid
Dec	Pasture/Scrub land	Tabacco weed	Picker	picloram	100g/L	4	1918-02-1	8L	127.5	102.00	0.80	1	4	pyridinecarboxylic acid
Dec	Forestry	Gorse (pine tree release)	Picker	picloram	100g/L	4	1918-02-1	1L	30	3.00	0.10	1	R	pyridinecarboxylic acid
Jan	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	4	1.00	0.25	2		pyridinecarboxylic acid
Feb	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	15	3.75	0.25	2		pyridinecarboxylic acid
Mar	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	10	2.50	0.25	2		pyridinecarboxylic acid
Apr	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	36	9.00	0.25	2		pyridinecarboxylic acid

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May	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	36	9.00	0.25	2		pyridinecarboxylic acid
Jun	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	51	12.75	0.25	2		pyridinecarboxylic acid
Jul	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	42	10.50	0.25	2		pyridinecarboxylic acid
Aug	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	35	8.75	0.25	2		pyridinecarboxylic acid
Sep	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	33	8.25	0.25	2		pyridinecarboxylic acid
Oct	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	38	9.50	0.25	2		pyridinecarboxylic acid
Nov	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	63	15.75	0.25	2		pyridinecarboxylic acid
Dec	Pasture/bush/ roadside	Brushweeds	TordonBK	picloram	100g/L	4	1918-02-1	2.5L	31	7.75	0.25	2		pyridinecarboxylic acid
Mar	Pasture/Scrub land	Blackberry, Tobacco weed	Picker	triclopyr	300g/L	5	55335-06-3	8L	63	151.20	2.40	1	3	pyridinecarboxylic acid
May	Forestry	pre-plant (pines)	Picker	triclopyr	300g/L	5	55335-06-3	8L	600	1440.00	2.40	1	P	pyridinecarboxylic acid
Dec	Pasture/Scrub land	Tabacco weed	Picker	triclopyr	300g/L	5	55335-06-3	8L	127.5	306.00	2.40	1	4	pyridinecarboxylic acid
Dec	Forestry	Gorse (pine tree release)	Picker	triclopyr	300g/L	5	55335-06-3	1L	30	9.00	0.30	1	R	pyridinecarboxylic acid
Jan	Pasture/bush/ roadside	Brushweeds	Grazon	triclopyr	600g/L	5	55335-06-3	2.5L	2	3.00	1.50	2		
Jan	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	4	3.00	0.75	2		
Feb	Pasture/bush/ roadside	Brushweeds	Grazon	triclopyr	600g/L	5	55335-06-3	2.5L	1	1.50	1.50	2		

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Feb	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	15	11.25	0.75	2		
Mar	Pasture/bush/ roadside	Brushweeds	Grazon	triclopyr	600g/L	5	55335-06-3	2.5L	1	1.50	1.50	2		
Mar	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	10	7.50	0.75	2		
Apr	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	36	27.00	0.75	2		
May	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	36	27.00	0.75	2		
Jun	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	51	38.25	0.75	2		
Jul	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	42	31.50	0.75	2		
Aug	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	35	26.25	0.75	2		
Sep	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	33	24.75	0.75	2		
Oct	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	38	28.50	0.75	2		
Nov	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	63	47.25	0.75	2		
Nov	Pasture/bush/ roadside	Brushweeds	Grazon	triclopyr	600g/L	5	55335-06-3	2.5L	2	3.00	1.50	2		
Dec	Pasture/bush/ roadside	Brushweeds	TordonBK	triclopyr	300g/L	5	55335-06-3	2.5L	31	23.25	0.75	2		
May	Forestry	pre-plant (pines)	Hexagran	hexazinone	750g/kg	6	51235-04-2	3kg	600	1350.00	2.25	1	P	triazinone
Dec	Forestry	Gorse (pine tree release)	Hexagran	hexazinone	750g/kg	6	51235-04-2	3kg	30	67.50	2.25	1	P	triazinone
Jun	Pasture	Broadleaf weeds	Thistle Killem	2,4-D ester	520g/L	7		2L	4000	4160.00	1.04	1	6	

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Jul	Pasture	Broadleaf weeds	Thistle Killem	2,4-D ester	520g/L	7		1-2L	2717	2825.68	1.04	1	7	Using 2L/ha in calculation
Aug	Pasture	Broadleaf weeds	Thistle Killem	2,4-D ester	520g/L	7		2-3L	1625	2535.00	1.56	1	8	Using 3L/ha in calculation
May	Pasture	Broadleaf/Th istle	?	2,4-D ester	680g/L	7		1.5L	28	28.56	1.02	2		
Jun	Pasture	Broadleaf/Th istle	?	2,4-D ester	680g/L	7		1.5L	112	114.24	1.02	2		
Jul	Pasture	Broadleaf/Th istle	?	2,4-D ester	680g/L	7		1.5L	80	81.60	1.02	2		
Aug	Pasture	Broadleaf/Th istle	?	2,4-D ester	680g/L	7		1.5L	46	46.92	1.02	2		
Jul-Oct		Broadleaf	Pasture Kleen Extra	2,4-D ester	520g/L	7		?	?	*40*	?	4		Over 3 months
Jun	Pasture	Broadleaf weeds	Clean Sweep	MCPA	375g/L	8	94-74-6	4L	4000	6000.00	1.50	1	6	Chlorophenoxy compound
Jul	Pasture	Broadleaf weeds	Agritone720	MCPA	720g/L	8	94-74-6	2L	192	276.48	1.44	1	7	Chlorophenoxy compound
Jun	Pasture	Broadleaf weeds	Baton	2,4-D amine	800g/kg	9		1.5kg	4000	4800.00	1.20	1	6	
Aug	Pasture	Broadleaf weeds	Baton	2,4-D amine	800g/kg	9		2kg	1625	2600.00	1.60	1	8	
Oct	Pasture	Broadleaf weeds	Baton	2,4-D amine	800g/kg	9		2kg	250	400.00	1.60	1	8	
Nov	Pasture	Broadleaf weeds	Baton	2,4-D amine	800g/kg	9		2kg	65	104.00	1.60	1	11	
Jan	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	4	4.80	1.20	2		
Feb	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	5	6.00	1.20	2		
Mar	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	5	6.00	1.20	2		
Apr	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	4	4.80	1.20	2		
May	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	7	8.40	1.20	2		

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Jun	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	6	7.20	1.20	2		
Jul	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	2	2.40	1.20	2		
Aug	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	30	36.00	1.20	2		
Sep	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	137	164.40	1.20	2		
Oct	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	115	138.00	1.20	2		
Nov	Pasture	Broadleaf	Baton	2,4-D amine	800g/kg	9		1.5kg	16	19.20	1.20	2		
Jul-Oct		Broadleaf		2,4-D amine		9		?	?	*360*	?	4		Over 3 months
May	Pasture	Weeds, thistles, ragwort	Baton	2,4-D amine	800g/kg	9		1.5kg	25	30.00	1.20	6	X	
Aug	Pasture	Weeds, thistles, ragwort	Baton	2,4-D amine	800g/kg	9		1.5kg	20	24.00	1.20	6	X	
Sep	Pasture	Weeds, thistles, ragwort	Baton	2,4-D amine	800g/kg	9		1.5kg	30	36.00	1.20	6	X	
Jan	Citrus	Stop Drop	Stop Drop	2,4-D amine		9		800µg	4.6	0.00368	800µg	9a		
Dec	Crop	Weeds, post emergance	Terbuthylazine	Terbuthylazine	?	10	5915-41-3	3L	10	*30.00*	*3.00*	1	C	
Dec	Maize		Atranex WG Herbicide?	atrazine	?	11	1912-24-9	1L	10	*10.00*	*1.00*	1	C	Triazine compound
Jan	Total vegetation		Granstar	Tribenuron methyl	750g/kg	12	101200-48-0		8	0.08	0.01	2		sulfonylurea
Mar	Total vegetation		Granstar	Tribenuron methyl	750g/kg	12	101200-48-0		66	0.50	0.01	2		sulfonylurea
May	Total vegetation		Granstar	Tribenuron methyl	750g/kg	12	101200-48-0		3	0.16	0.05	2		sulfonylurea
Jan	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		76	34.20	0.45	2		Is this diluted??

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Feb	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		240	431.64	1.80	2		Is this diluted??
Mar	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		288	518.85	1.80	2		Is this diluted??
Apr	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		124	223.88	1.81	2		Is this diluted??
May	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		39	70.65	1.81	2		Is this diluted??
Jun	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		23	40.95	1.78	2		Is this diluted??
Jul	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		23	41.18	1.79	2		Is this diluted??
Aug	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		13	23.40	1.80	2		Is this diluted??
Sep	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		40	72.00	1.80	2		Is this diluted??
Oct	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		272	489.38	1.80	2		Is this diluted??
Nov	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		227	409.28	1.80	2		Is this diluted??
Dec	Total vegetation		?	Glyphosate	450g/L	13	1071-83-6		119	213.30	1.79	2		Is this diluted??
May	Weeds		G360	Glyphosate	?	13	1071-83-6	3	90	?	?	3	A	Is this diluted??
Oct	Grass		G360	Glyphosate	?	13	1071-83-6	6	90	?	?	3	A	Is this diluted??
Jan-Jun	Total vegetation		?	Glyphosate	510g/L	13	1071-83-6	?	?	408	?	4		Over 6 months
Nov-Dec	Total vegetation			Glyphosate	510g/L	13	1071-83-6	?	?	102	?	4		Over 2 months
Jan			?	Glyphosate	?	13	1071-83-6	1%	?	?	?	8		Weeds, spot spraying
Oct	Kiwifruit	weeds	Roundup	Glyphosate	?	13	1071-83-6		10.5*	*17.5L*		9c		

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Feb	Kiwifruit	weeds	Roundup	Glyphosate	?	13	1071-83-6		10.5*	*17.5L*		9c		
May	Pasture	Broadleaf	Preside	flumetsulam	800g/kg	14	98967-40-9		2	0.12	0.06	2		
Jun	Pasture	Broadleaf	Preside	flumetsulam	800g/kg	14	98967-40-9		10	0.50	0.05	2		
Aug	Pasture	Broadleaf	Preside	flumetsulam	800g/kg	14	98967-40-9		5	0.20	0.04	2		
Sep	Turf	Broadleaf/Onehunga	Versatill	clopyralid	300g/L	15	1702-17-6		18	5.25	0.29	2		pyridinecarboxylic acid
Oct	Turf	Broadleaf/Onehunga	Versatill	clopyralid	300g/L	15	1702-17-6		21	6.3	0.30	2		pyridinecarboxylic acid
Nov	Reserve	Chinese Mugwort	Versatill	clopyralid	300g/L	15	1702-17-6		28	8.43	0.30	2		pyridinecarboxylic acid
Nov	Weeds		TrophyNF	acetochlor	781g/L	16	34256-82-1	3	90	210.87	2.343	3	A	
Jul-Oct		Broadleaf	Harmony	thifensulfuron-methyl	750g/kg	17	79277-27-3	?	?	0.375	?	4		Over 3 months, sulfonylurea
Jan-Dec	Pasture	Gorse	Answer	metsulfuron-methyl	200g/kg	18	74223-64-6/5585-64-8	?	?	?	?	5	XYZ	Over 12 months, amounts not given
Jan-Dec	Tomato/Cucumber	White Fly/Botrytis	?	Methomyl	?	19	16752-77-5	?	1	?	?	7	Green-house	N-methyl carbamate Insecticide
Jan-Dec	Tomato/Cucumber	White Fly/Botrytis	?	Thiram	?	20	137-26-8	?	1	?	?	7	Green-house	dithiocarbamate fungicide
Jan-Dec	Tomato/Cucumber	White Fly/Botrytis	?	Chlorothalonil	?	21	1897-45-6	?	1	?	?	7	Green-house	substituted benzene fungicide
Mar	Orchids	Phytophora, root rot	Foschek	Phosphorous acid	400g/L	22	13598-36-2	10L	0.4	1.6	4	8	Green-house	
Apr	Orchids	Mites	Peropal	azocyclotin	250g/kg	23	41083-11-8	4kg	0.2	0.2	1	8	Green-house	Organotin
Dec	Orchids	Mites	Peropal	azocyclotin	250g/kg	23	41083-11-8	4kg	0.2	0.2	1	8	Green-house	Organotin
Apr	Orchids	Mites	Apollo	clofentezine	500g/L	24	74115-24-5	1.8L	0.2	0.18	0.9	8	Green-house	tetrazine insecticide

Month	Target Crop	Disease/ Pest	Trade Name	Active Ingredient (a.i.)	a.i amount	A.I. #	CAS # (if known)	Amount/ ha	Total ha sprayed	Total amount a.i. (kg or L)	Amount a.i./ha (kg/ha) or (L/ha)	Survey #	Site	Comments
May-Oct	Orchids	Mites	Mavrik	Tau-fluvalinate	?	25	102851-06-9	*0.4*	1.2	?	?	8	Green-house	pyrethroid over 6 months
May-Oct	Orchids	Botrytis	Carbendazim	Carbendazim	?	26	10605-21-7	*1*	1.2	?	?	8	Green-house	benzimidazole over 6 months
Feb-Aug	Citrus	Verricosis Brown Rot	Kocide	copper hydroxide	350-500g/kg	27	20427-59-2	1.05kg	8.4	4.41	1.05	9a		Not accurate records but 1.05kg/ha is usual application rate
Jun	Pip&Stone Fruit		Bordeaux	copper:lime 10:8	200g/kg	27		36kg	8.44	33.42	3.96	9b		
May	Pip&Stone Fruit	Fungi and Bacteria	Bordeaux	copper:lime 6:8	200g/kg	27		28kg	1.02	2.46	2.41	9b		
Aug	Pip&Stone Fruit	Fungi	Bordeaux	copper:lime 8:6	200g/kg	27		28kg	0.76	2.43	3.19	9b		
Feb/Mar/ Jun/Aug/ Oct/Nov/ Dec	Citrus	Glomerella/Brown Rot	Dithane	mancozeb	750-800g/kg	28	8018-01-7	3.2	?	?	3.2	9a		dithiocarbamate. Not accurate records but 3.2kg/ha is usual application rate
Jan	Pip&Stone Fruit	Glomerella	Manzate	mancozeb	750g/kg	28	8018-01-7	3kg	8.44	18.99	2.25	9b		includes calcium chloride
May/Jun	Citrus	Thrips	Maldison	malathion	?	29	121-75-5	5L	0.6	?	*3*	9a		Not accurate records but 0.25kg/ha appears to be application rate
Jan	Pip&Stone Fruit	Brown Rot	Rovral Flo	iprodine	25%	30	36734-19-7	3L	0.35	0.2625	0.75	9b		dicarboximide fungicide
Mar	Pip&Stone Fruit	Brown Rot	Rovral Flo	iprodine	25%	30	36734-19-7	3L	0.7	0.525	0.75	9b		dicarboximide fungicide
Sep	Pip&Stone Fruit	Brown Rot	Rovral Flo	iprodine	25%	30	36734-19-7	3L	0.76	0.57	0.75	9b		dicarboximide fungicide

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Nov	Pip&Stone Fruit	Brown Rot	Rovral Flo	iprodine	25%	30	36734-19-7	3L	0.2	0.15	0.75	9b		dicarboximide fungicide
Dec	Pip&Stone Fruit	Brown Rot	Rovral Flo	iprodine	25%	30	36734-19-7	3L	0.9	0.675	0.75	9b		dicarboximide fungicide
Jan	Pip&Stone Fruit	Black Spot	Dodine	dodine	?	31	2439-10-3	*1.6*	0.45	*0.72*	*1.6*	9b		guanidine
Sep	Pip&Stone Fruit	Black Spot	Sylit	dodine		31	2439-10-3	*11.6*	0.9	*10.44*	*11.6*	9b		guanidine
Dec	Pip&Stone Fruit	Black Spot	Dodine	dodine	?	31	2439-10-3	*1.6*	8.44	*13.504*	*1.6*	9b		guanidine
Jan	Pip&Stone Fruit	Glomerella	Captan Flo	captan	480g/L	32	133-06-2	3L	0.9	1.296	1.44	9b		Thiophthalimide fungicide
Mar	Pip&Stone Fruit	Glomerella	Captan Flo	captan	480g/L	32	133-06-2	3L	2.68	3.8592	1.44	9b		Thiophthalimide fungicide
Oct	Pip&Stone Fruit	Brown Rot	Captan Flo	captan	480g/L	32	133-06-2	3L	0.9	1.296	1.44	9b		Thiophthalimide fungicide
Jan	Pip&Stone Fruit	Leaf Roller	Mimic	tebufenozide	?	33	112410-23-8	0.17	0.9	?	?	9b		diacylhydrazine
Feb	Pip&Stone Fruit	Glomerella & Leafroller	Mimic	tebufenozide	?	33	112410-23-8	0.17	7.09	?	?	9b		diacylhydrazine
Nov	Pip&Stone Fruit	Leaf Roller	Mimic	tebufenozide	?	33	112410-23-8	0.17	7.92	?	?	9b		diacylhydrazine
Feb	Pip&Stone Fruit	Brown Rot	Saprol	triforine	?	34	26644-46-2/37273-84-0	*1.5*	1.06	*1.59*	*1.5*	9b		fungicide
Feb	Pip&Stone Fruit	Glomerella	Euparen Multi	tolyfluanid	500g/kg	35	731-27-1	2kg	8.44	8.44	1	9b		fungicide
Dec	Pip&Stone Fruit	Black Spot & Glomerella	Euparen Multi	tolyfluanid	500g/kg	35	731-27-1	2kg	8.44	8.44	1	9b		fungicide
Aug	Pip&Stone Fruit	Fungi	Hicane	endosulphan	350g/L	36	115-29-7	25L	2	17.5	8.75	9b		Organochlorine
Sep	Pip&Stone Fruit	Brown Rot	Folicar	tebuconazole	250g/kg	37	107534-96-3	0.8	1.016	0.2032	0.2	9b		Azole

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Sep	Pip&Stone Fruit	Black Spot	Polyram	metiram	700g/kg	38	9006-42-2	3kg	7.48	15.708	2.1	9b		dithiocarbamate fungicide
Oct	Pip&Stone Fruit	Black Spot	Polyram	metiram	700g/kg	38	9006-42-2	3kg	16.88	35.448	2.1	9b		dithiocarbamate fungicide
Nov	Pip&Stone Fruit	Black Spot	Polyram	metiram	700g/kg	38	9006-42-2	3kg	8.44	17.724	2.1	9b		dithiocarbamate fungicide
Nov	Pip&Stone Fruit	Black Spot	Polyram	metiram	700g/kg	38	9006-42-2	3kg	8.44	17.724	2.1	9b		dithiocarbamate fungicide
Oct	Pip&Stone Fruit	Black Spot	Systhane	myclobutanil	400g/kg	39	88671-89-0	0.24	16.88	1.62048	0.096	9b		Azole
Nov	Pip&Stone Fruit	Black Spot	Systhane	myclobutanil	400g/kg	39	88671-89-0	0.24	8.44	0.81024	0.096	9b		Azole
Oct	Pip&Stone Fruit	Bronze Beetle	Calypso	thiacloprid	480g/L	40	111988-49-9	0.6L	1.92	0.55296	0.288	9b		chloro-nicotinyl insecticide
Nov	Pip&Stone Fruit	Bronze Beetle	Calypso	thiacloprid	480g/L	40	111988-49-9	0.6L	7.92	2.28096	0.288	9b		chloro-nicotinyl insecticide
Nov	Pip&Stone Fruit	Apple Thinning	Carbaryl	carbaryl	500g/L	41	63-25-2	1.6L	0.58	0.464	0.8	9b		N-Methyl Carbamate
Dec	Pip&Stone Fruit	Cherry Slug	Carbaryl	carbaryl	500g/L	41	63-25-2	1.6L	0.4	0.32	0.8	9b		N-Methyl Carbamate
Nov	Pip&Stone Fruit	Black Spot	Prolific	carbendazim	500g/L	42	10605-21-7	0.5L	8.44	2.11	0.25	9b		benzimidazole fungicide
Aug	Kiwifruit	bud breaking	Hydrogen Cyanamide	Hydrogen Cyanamide	520g/L	43	420-04-2		10.5*	9.36		9c		* total area, need to find exact area
Nov	Kiwifruit	scale	Talstar 100EC	bifenthrin	100g/L	44	82657-04-3		10.5*	0.4		9c		pyrethroid insecticide
Nov	Kiwifruit	leaf roller	Prodigy	methoxyfenozide	240g/L	45	161050-58-4		10.5*	*0.0004L*		9c		Kiwifruit 0.10 kg ai/ha per application
Dec	Kiwifruit	scale	DEW 500	Diazinon	500-600g/L	46	333-41-5		10.5*	3.0-3.6g		9c		organophosphate insecticide

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Jan	Kiwifruit	scale	DEW 500	Diazinon	500-600g/L	46	333-41-5		10.5*	3.0-3.6g		9c		organophosphate insecticide
Feb	Kiwifruit	scale	DEW 500	Diazinon	500-600g/L	46	333-41-5		10.5*	3.0-3.6g		9c		organophosphate insecticide
Jan	Kiwifruit	leaf roller	Delfin	Bacteria	37,000 ITU/mg	NA			10.5*	NA		9c		Water dispersible granule containing 37,000 ITU/mg of Bacillus thuringiensis sub-species kurstaki