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PATTERNS OF PESTICIDE USE IN NEW ZEALAND PART 2. SOUTH ISLAND 1986-1989

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PATTERNS OF PESTICIDE USE IN NEW ZEALAND PART 2.SOUTH ISLAND 1986 - 1989

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ABSTRACT

The use of pesticides (including herbicides, fungicides and insecticides) in the South Island, New Zealand, has been surveyed for the period 1986 - 1989. The survey follows an earlier one for the North Island, 1985 - 1988, and merges information from the two surveys. The principal technique used to acquire data was by direct approach to expert advisors, and users of pesticides, in each of the major regions of the South Island. MAFTech horticultural consultants, local authority noxious plants officers, and the New Zealand Forest Service were consulted. Agricultural statistics compilations were used to define land use, in counties. Data is tabulated by individual counties and has been summarised for the main growing regions. Pesticide active ingredients, areas and rates of application, are given, as well as LC50 values for rainbow trout (*Oncorhynchus mykiss*).

A comparison was made between the combined results of this survey and the previous North Island survey, with independently obtained data based on pesticide sales for all of New Zealand. Twelve classes of pesticides were compared and there was good agreement between the two surveys, with the exception of data for non-selective weedkillers (which include amitrole and glyphosphate) and organophosphate insecticides.

About 1100 tonnes of pesticide active ingredients were applied annually in the South Island, with 60% of this being herbicide and the remainder being fungicide and insecticide. On average, 3-8 kg/ha.yr of insecticides, and 6-20 kg/ha.yr of fungicides, were applied to horticulture. Cereal crops in the eastern and southern regions of the South Island received on average 1-2 kg/ha.yr of herbicides applied to a total area of c.300,000 ha.

A simple screening test was applied to determine which pesticides might present a hazard to aquatic biota, as a result of runoff from their use on land. Some moderately persistent chemicals used in horticulture, notably carbaryl, chlorothalonil, chlorpyrifos, copper, isazophos and oryzalin, were identified as potentially harmful. Benomyl, dinoseb and trifluralin, applied to grain crops, were also identified.

Keywords: fungicide, herbicide, insecticide, pesticide, runoff, survey, toxicity, water pollution

INTRODUCTION

There has been a dramatic increase in the use of chemicals in agriculture throughout the world over the past 30-40 years. Pesticides (viz. herbicides, fungicides and insecticides) are widely used in modern primary production, often with striking results. For example, the use of herbicides in minimal tillage practices has been a major advance in soil conservation in the USA (Overcash and Davidson 1980; Hileman 1982; OECD 1984). The challenge is to manage the use of pesticides in order to balance the benefits of improved and more profitable production, and soil conservation, against the disadvantages of environmental contamination and risk of damage to public health (Hileman 1982). The study reported here is one of a number of investigations being carried out at the Water Quality Centre examining the effects, or potential effects, of pesticide use on the aquatic environment in New Zealand. It was recognised early on in these studies that it would be helpful to have an understanding of the patterns of pesticide use in New Zealand so that efficient monitoring programmes could be implemented. This report follows an earlier review of pesticide use in the North Island of New Zealand, over the period 1985 to 1988 (Wilcock 1989). Like that report, this study deals with pesticide losses in surface runoff and does not address other aspects of pesticide entry to the aquatic environment, such as from spills or leakage from storage areas. Losses to groundwater are not assessed here, nor are public health aspects.

Information about the amounts of pesticide being used and their areas of application has been difficult to quantify. The combination of prolonged drought conditions for the eastern regions of the South Island, the farming recession, and the removal of subsidies for herbicides has meant that pesticide use has varied markedly from year to year over the period 1986 - 1989. For that reason pesticide use data was either obtained for several seasons, and then averaged, or was provided at our request in an averaged form. Data for horticulture and cropping relates mainly to the period 1986-1987, but is considered relevant to the whole survey period. Because of previous difficulties in getting information from manufacturers and distributors of pesticides (Wilcock 1989), we directed our survey mainly at local MAF horticultural consultants, and local authority noxious plant officers. This proved to be an effective method for the most part although, as was found previously, some county herbicide loads had to be inferred from surrounding areas.

This project was initiated with the objective of providing a data base from which an assessment might be made of the pesticides having the greatest potential for environmental damage, and their geographical distribution. The means used to acquire information and the checks for accuracy that were employed in this study are similar to those

reported in the earlier report on the North Island patterns of pesticide use (Wilcock 1989). As in that report, an assessment is made of the potential for damage to the aquatic environment, using criteria based upon extent of application (area), loading intensity (kg/ha), persistence, runoff properties and toxicity to aquatic life. Some changes in pesticide data have been made since publication of the earlier report, in the light of more recent data. The changes are: - chlorothalonil is now classified as an organohalogen compound; triclopyr is no longer classified as an organohalogen compound; the LC50 for triclopyr (taking into account the various ester formulations, and the free acid) is 2.2 mg/l (Servizi *et al.* 1987), and not 120 mg/l as cited previously.

The data from this survey have been merged with that from the earlier North Island survey, which covered the period 1985-88. It is hoped that this detailed picture of pesticide use in New Zealand over the period 1985-90 will be helpful to other researchers and environmental management agencies and that it may provide a basis for comparison with future surveys.

SURVEY DESIGN

Data were gathered from 1986 to mid-1989 and are expressed as being for an average year in that period. Some of the data was obtained at the start of the project while other data was collected towards the end of 1989. Patterns of pesticide use are ever changing; especially in recent years as the New Zealand economy has contracted and subsidies to farmers for noxious weed control have been removed. Thus, even if it was possible to have accurate data for a given year it would not necessarily be accurate for the following or preceding years. For this reason, key informants approached in this survey were asked to base their estimates of annual usage on an average of the last 2-3 years, or to give data for each of the last 3 years so that we might average it.

Pesticide data has been compiled for individual local government regions, labelled collectively here as "counties", since that is how most land use information is tabulated (Department of Statistics 1988). Where possible, pesticide use by municipal authorities has been included in the compilations of adjoining counties. Thus, some urban uses of pesticides, such as on golf courses, are included in the inventories for Christchurch and Dunedin. Summaries are given for agricultural regions rather than the new local authority regions that were established in November 1989.

The pesticides referred to are used principally for plant protection or plant eradication and are those listed in the New Zealand Agrichemical Manual (1987 and 1990 editions) (O'Connor 1987).

Chemicals used for noxious animal control (e.g. cyanide and 1080), and industrial uses of pesticides, are not included here. Herbicide use by catchment authorities for the clearance of drainage ditches is mostly excluded from this survey, although some noxious plants authorities have included this in their estimates. Small-scale use of pesticides, such as in private gardens and glasshouses, is not included here.

SOURCES OF INFORMATION

1. Agricultural Statistics 1986 - 87 June Year: Published by Department of Statistics, Wellington. This document and its preceding issue (1982-83) were used as sources of land use information. Ministry of Agriculture and Fisheries (MAF) horticultural consultants have amended old or incorrect entries for horticulture and crops, when consulted.

2. Noxious plants officers: Local-body noxious plants officers were asked to identify the main problem weeds in their districts, to estimate the extent of each (area being treated) and to estimate or calculate the amounts of the principal herbicides (and in some cases, insecticides) used. Twenty out of 31 of those surveyed were able to provide this information. Some based their estimates on local knowledge, while others had access to sales figures.

3. MAF horticultural consultants: MAF horticulture and crop specialisists located at Lincoln and Nelson were asked to verify, and if necessary amend, land use data. They provided pesticide spray programmes for the major crops grown in their regions and based their estimates of annual application rates on local knowledge of growers' preferences.

4. New Zealand Forest Service: Data has been provided by the Forest Service, in response to the authors' request, listing the total areas of problem weeds and the amounts of chemicals used for each of the seven conservancies of New Zealand. The survey includes copper use for the control of *Dothistroma*. Data (i.e. areas and amounts treated annually) were averaged for the period 1980-1985. There have been a number of important developments since this survey was made. For example, 2,4,5-T has been withdrawn from the market and replaced by products based on triclopyr. Some allowance has been made in this report for these changes but, because the plantation areas were generally very small in the South Island, they are minor.

5. New Zealand Agrichemical Manual 1987, 1990: These documents and their Update issues (O'Connor 1987,1990) have provided the salient information about product formulations. Printouts of Registered Pesticides (The Pesticides Board) were also used for information about product composition.

6. Agcarm survey December 1983 - December 1987: The Agricultural Chemical & Animal Remedies Manufacturers' Association of New Zealand, Agcarm, surveyed pesticide wholesale returns and gave this data to the Lincoln College study, "Pesticide: Issues and Options for New Zealand" (MacIntyre *et al.* 1989). The Centre for Resource Management, Lincoln College, and Agcarm have allowed the data to be used here.

METHODS FOR ESTIMATING PESTICIDE LOADS

A detailed account of the methods used is given in Part 1. (Wilcock 1989). Briefly, spray schedules for each land use (such as pasture, pipfruits etc.) in a given county were combined with land area data to produce tables of masses used and areas of application for the principal pesticides. These were aggregated to give pesticide load tables for each county, listing each pesticide active ingredient used, its combined area of application for all purposes, and its total mass applied annually. Information about the chemical nature and toxicity of each pesticide used, and its average annual areal rate of application (ie. kg/ha.yr), is also given in the county tables, which are listed in the Appendix.

As with the North Island survey (Wilcock 1989), some difficulty was experienced in obtaining information about herbicide use for noxious weed control in some counties (most notably, Southland) where survey information was not provided. Estimates for these counties were made by taking geometric means values from neighbouring counties having similar patterns of land use. In these calculations target areas were expressed as fractions of the total area in pasture, while loads were expressed as masses of pesticide applied per unit target area, for each county. Forestry loads were calculated for each county using average area and load (kg/yr) data for the relevant NZFS Conservancy regions, as described previously (Wilcock 1989).

TOXICITY TO AQUATIC ORGANISMS

Aquatic toxicity information about pesticides is included in the Appendix tables for use in determining potential harm to aquatic life. Toxicities are expressed as LC50 values, i.e. the concentration of active ingredient that will kill 50% of a sample of given test animals in a given time. LC50 values cited here are for an exposure time of 96 hours. The test animal referred to here is the rainbow trout (*Oncorhynchus mykiss*, previously *Salmo gairdneri* (McDowall 1988)); chosen because there is a lot of data available about its sensitivity to toxic substances and because of its importance in other pollution-response tests. The relationship between LC50 values for rainbow trout and other freshwater organisms is discussed by Mayer and Ellersiek (1986).

The LC50 values listed here (Appendix) have come from the following sources: Alabaster (1969), Pimental (1971), Tooby *et al.* (1975), Kenega (1979), Worthing and Walker (1983) and Mayer and Ellersiek (1986). The data have been supplemented by the tabulations of toxicities given annually in the June issues of Journal of the Water Pollution Federation (1980-1989). There are sometimes discrepancies between different reported LC50 values. Sprague (1988) in a recent review stated that "as usual, the between-species variation in LC50 was not much greater than the within-species variation from work of different investigators". The 96-hour LC50 test is mainly a screening test for acute lethality that provides a coarse measure of environmental damage, and should perhaps be regarded as a starting point for the setting of upper limits for concentrations of potential toxicants in receiving waters. The Australian Water Quality Criteria for Organic Compounds addresses the aspects of safety margins and sub-lethal effects by defining environmental protection criteria as being the product: LC50 x application factor. The application factors that they chose were 0.1 for compounds which do not accumulate and 0.01 for compounds which do. (Nicholson 1984).

CHECKS FOR ACCURACY

A major problem with carrying out a survey of this kind is describing an average year for pesticide use when there have been large variations from year to year; for any given region and for the whole country. The amounts of herbicides used by farmers to control nuisance weeds were difficult to estimate accurately. Thus, herbicides used for weed control in pasture (coded P in the Appendix tables) may in some cases only be within 50% of the "true" values. An attempt has been made to ensure that the total amounts (ie. summed for all counties in the survey) of each active ingredient or pesticide class are in agreement with other, accurate surveys. In some cases confidential sales data have been provided by manufacturer companies and been used to adjust the amounts and areas of particular active ingredients by a common factor so that the total amounts agree.

The accuracy of data gathered for horticulture and cropping was much better than for other principal uses of pesticides. Growers of export crops generally abided by the MAF spray programmes. Those who produced crops for the domestic market used much less pesticide material than the exporters, but this difference was allowed for in the MAF survey data. The overall uncertainty is unlikely to be greater than 20%.

Sales return data collected by Agcarm was converted from dollar values to total masses of active ingredient sold for each year in the review period, using wholesale prices. This was done for twelve groups of products that were each comprised principally of just one or two active ingredients. For example, the C17 group (bipyridyl weedkillers) comprised sales of paraquat and diquat, only. The masses of principal pesticides used for each of the twelve product groups were summed for all the counties (Appendix) and added to the amounts previously summed for the North Island (Wilcock 1989) to give mass totals for all of New Zealand, averaged over the period 1986 - 1989. Figure 1 shows a comparison of the Agcarm - derived data and the combined survey estimates.

DISCUSSION

Comparison between surveys

The comparison in Fig.1 between the total masses estimated from this study and the earlier North Island survey, and the total masses obtained from Agcarm sales invoices, shows good agreement for 11 classes and some disparity for class C20 (non-selective weedkillers). The least squares slope is 0.96, and R^2 is 0.91, for n=12. Class C20 includes glyphosate and amitrole, principally, but also includes a diverse range of less commonly used substances, eg. bromacil, dalapon, dinoseb and diuron. This class was underestimated, by comparison with the Agcarm data in the North Island survey and that disparity is reflected again, here, in Fig.1. Organophosphates were overestimated by our surveys. The relationship reported earlier, comparing just North Island data with Agcarm national sales data (Fig.1 in Wilcock 1989), has been improved significantly by the addition of the South Island data. The South Island usage for these 12 classes of pesticide was about 36% of the corresponding North Island amount.

Regional loads

The pesticide load tables in the Appendix show that between 10 and 94 (and on average, about 40) different active ingredients were used in each county, depending on the land-use activities. Annual amounts used varied from a few kilograms to many tonnes (e.g. about 3.6 tonne/yr of metam sodium were used in Waimea County, principally on tobacco). The county boundaries are shown in Fig.2.

For the purposes of examining regional patterns of pesticide use, the South Island has been divided into four regions (Fig.2): Nelson-Marlborough; West Coast-Buller; Canterbury- South Canterbury; Otago-Southland. The total amounts of herbicides, fungicides and insecticides have been summed for each of these regions, and are listed in Table 1. The proportions of phenoxy herbicides, copper and organo-phosphates, for these pesticide classes,are also given.

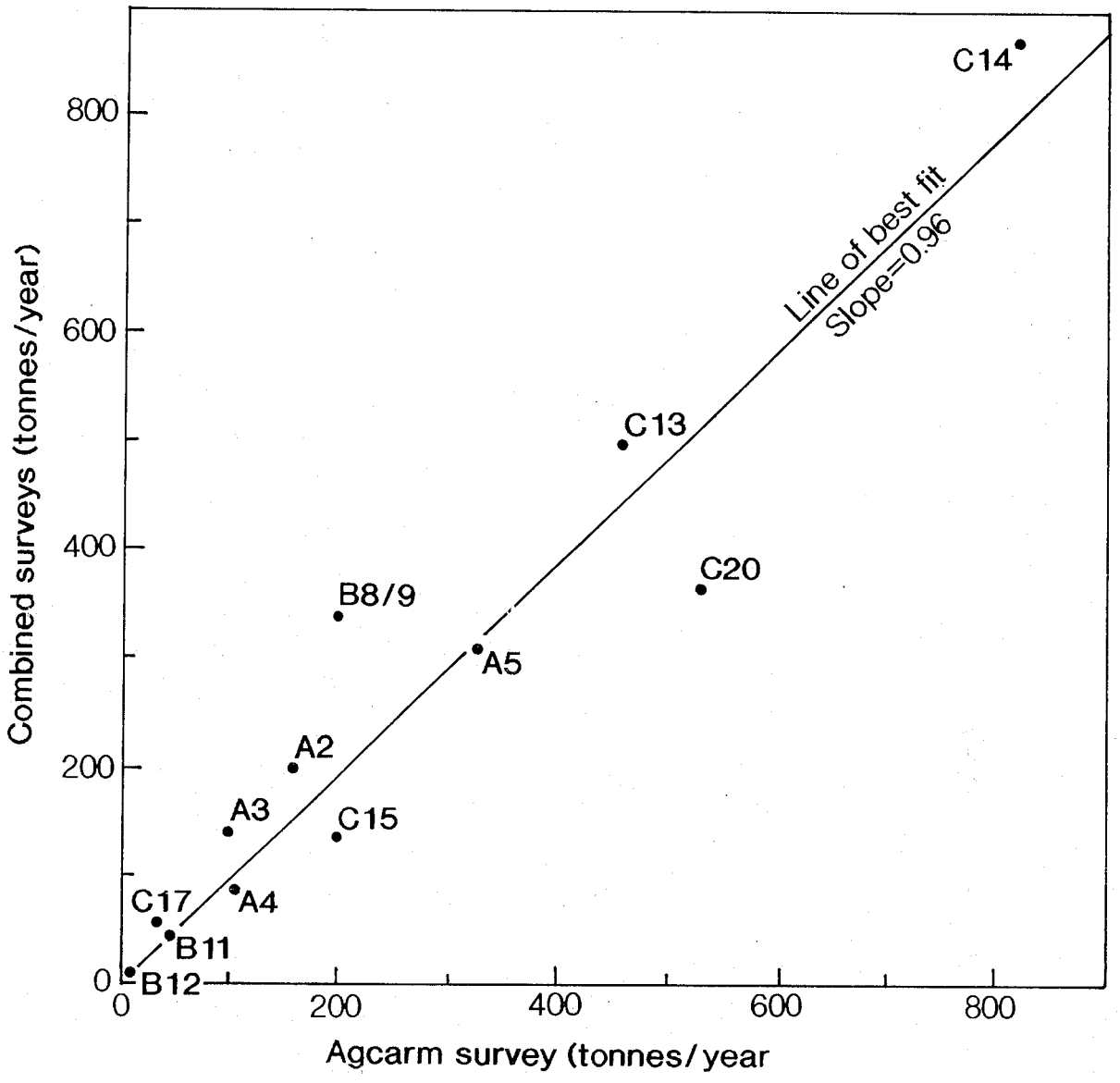

Figure 1. Comparison between combined surveys (North Island 1985–1988 and South Island 1986–89)and the Agcarm survey(all New Zealand 1985–89) of total amounts used annually of 12 classes of pesticides. Agcarm codes: A2=dithiocarbamates (mancozeb, maneb); A3=cyclimides (captan); A4=systemics (vinclozin, iprodione); A5=other fungicides (incl. copper); B8/9=organophosphates; B11=carbamates (carbaryl); B12=synthetic pyrethroids (permethrin); C13=brushkillers (2,4,5–T); C14=other phenoxyherbicides (2,4–D, MCPA); C15=triazines (simazine, atrazine); C17=bipridyl (diquat, paraquat); C20=non-selective weed killers (amitrole, glyphosphate)

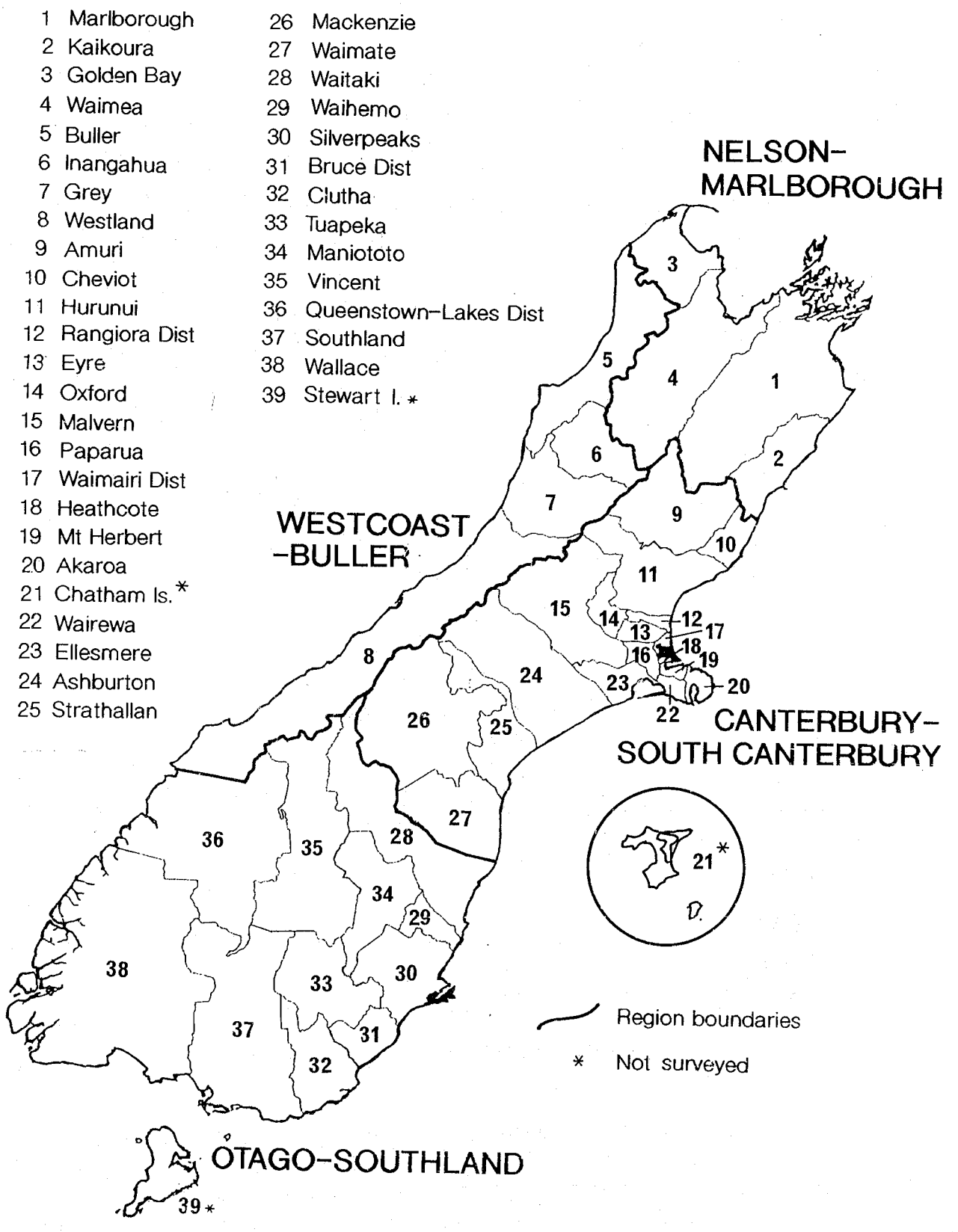

Figure 2. Counties and regions in pesticide survey

Table 1.Regional Summaries of South Island Pesticide Loads (tonnes a.i./yr)[+]

Region (area,ha)	Herbicide (% phenoxy)	Insecticide (% org-phos)	Fungicide (%copper)	Total
Nelson Marlborough (1,264,000)	64 (19)	55 (57)	160 (1)	279
West Coast Buller (451,000)	9 (53)	0.1 (97)	0.4 (100)	9
Canterbury Sth Canterbury (3,092,000)	428 (52)	28 (46)	69 (42)	525
Otago Southland (4,384,000)	195 (52)	27 (49)	81 (53)	303
Total	696 (49)	110 (52)	310 (24)	1,116

Note: Counties in each region are shown in Fig.2.
[+] a.i. = active ingredient

Comparison of the entries in Table 1 with corresponding values for the North Island (Wilcock 1989) reveals the following points:

1 Total pesticide use (mass of a.i.) in the South Island is about 40% of that for the North Island.

2. Total annual average use of herbicides, insecticides and fungicides in the South Island are 40%, 20% and 47% respectively, of the North Island values.

3. Phenoxyalkanoic herbicides (2,4-D, 2,4,5-T, MCPA, MCPB and mecoprop) were 49% of the total herbicide figure, compared to 56% for the North Island.

4. Organophosphates comprise 52% of the total amount of insecticide used annually, compared to 94% for the North Island. Carbamate insectides (eg. carbaryl, pirimicarb) comprise 33% of the South Island total, compared to 2% for the North Island. In general, organophosphates have a higher acute toxicity to aquatic life than the carbamates, and some are extremely toxic to juvenile fish in particular (Murty 1986).

5. Copper based fungicides were a significant percentage of both the South Island total (24%) and the North Island total (30%).

6. In both islands, herbicides represented about 60% of the total pesticide usage, reflecting that pastoral farming is the principal land use in New Zealand and that nuisance weed control is an important aspect of farm management. Grain crops in the east and south of the South Island were also major areas for herbicide use. Thus, herbicides were the predominant pesticides used in all regions because of the large areas over which they were applied. Application rates for (all) pastoral use of herbicides were often less than 1 kg/ha.yr, which was much less than the rates for fungicides (up to 60 kg/ha.yr in some cases), or insecticides (up to 16 kg/ha.yr). Combined herbicide use on grain crops averaged 2 kg/ha.yr.

7. Areas of intensive fruit or vegetable cultivation such as Christchurch, Nelson and Central Otago, had correspondingly high loads of insecticide and fungicide. These contrast with counties in the West Coast-Buller region, with about 0.05% of the land area in horticulture (compared to 2% for Waimea County and 5%in the Christchurch area), which had very low average annual loading of insecticides and fungicides.

Combined herbicide,insecticide and fungicide loads for each of the four regions were plotted against specific major land use areas in order to obtain average application rates. Details of these plots are given in Table 2, in which "horticulture" includes pipfruit, stonefruit, subtropical fruit, grapes, hops, tobacco, citrus fruit, berry fruit, and vegetables (Dept. of Statistics 1988). The "grain" crops referred to in Table 2 include wheat, barley, oats and peas. These smoothed rates typify the annual masses of active ingredients applied in each region to horticultural and grain crops, for which pesticide application programmes were homogeneous.

Table 2.Average Rates (kg/ha.yr) for Pesticide Loads on Major Land Use Areas

Region	Pesticide	Rate	Land Use
Nelson	I	8	horticulture
Marlborough	F	20	horticulture
Westland	very low total use of pesticides		
Buller			
Canterbury	I	3	horticulture
Sth Canterbury	F	6	horticulture
	H	2	grain
Otago	F	24	horticulture
Southland	H	1	grain

F = fungicide; I = insecticide; H = herbicide

Herbicide use on pasture varied markedly within each of the regions so that there were no consistent patterns of use for the respective counties. The amounts used on grain crops in the Canterbury-South Canterbury and Otago-Southland regions were reasonably consistent, averaging 1-2 kg/ha.yr for a crop area of c.300,000 ha.

Insecticide loads applied to horticulture ranged from 3 to 8 kg/ha.yr. The low rates in the Canterbury-South Canterbury region occurred because of applications to market garden vegetables and other crops having lighter application rates than tree crops. The high rate for the Nelson-Marlborough region was because of the extensive horticulture in Waimea County, which had 2500 ha in apples and 1000 ha in kiwifruit. The amount of insecticide used per hectare in Waimea County was 3 times that of the other counties in the region, and was the highest rate for all counties in the South Island.

The fungicide application rates ranged from 6 to 20 kg/ha.yr with the highest values being on apples and kiwifruit in the Nelson-Marlborough region (particularly, Waimea County), and on pipfruit and stonefruit in Tuapeka and Vincent counties of the Otago-Southland region.

EFFECTS ON AQUATIC ORGANISMS

During the period of this study, 1986-1989, the total number of individual substances registered for use in New Zealand as pesticides was about 260. While most of these materials have known toxicities to aquatic organisms (Mayer

and Ellersieck 1986, Worthing and Walker 1983) it is likely that only a few of these would cause environmental damage through normal, sensible practices. Thus, it was necessary to derive a simple screening test to isolate those pesticides for which there might be a potential for damage to aquatic biota, resulting from their residues in runoff from land. In the report on North Island pesticide use (Wilcock 1989) a screening test was developed which was based upon the area of use (extent), the application rate in kg/ha.yr, the leachability of the chemicals and their soil persistance (half-life), and the toxicities of the pesticides to rainbow trout. An equation was derived for the critical load to produce an adverse water concentration, which included in the denominator the term, average annual rainfall minus evapotranspiration (P-E). The equation could not be used here because the areas of most intensive pesticide use were in the north and east of the South Island. For these dry areas the term P-E was frequently close to zero, or negative, so that there was insufficient annual runoff to compute surface water concentrations. To overcome this difficulty the argument has been modified to address the effect of pesticide runoff resulting from a single storm event occuring within the first two weeks after application. Wauchope (1978) defines runoff events in this period, as *critical*, if more than 1 cm of rain falls and the runoff volume is at least 50% of this. Such events "almost always produce the bulk of the runoff losses observed for an entire season unless the chemical is incorporated or is extremely persistent" (Wauchope 1978). Larger storms may wash off substantially more pesticide but would also dilute the runoff concentration. Thus, the revised screening test is as follows:

Pesticide loading rate, L (kg/ha.yr) x % runoff loss,r, /100 = load delivered to waterway, D (kg/ha). This assumes that a given pesticide is applied only once a year.

Runoff volume, V, must > 0.5 cm, or 50 m^3/ha

The mean pesticide concentration in this runoff event, C_r, is thus

$$C_r = 10^6 D/V \ (mg/m^3)$$

$$= 10^4 Lr/V \qquad (1)$$

For a risk of environmental damage to exist, C_r must exceed a critical value, given by

$$C_r > 10^3 (LC50)/F \qquad (2)$$

where the numerical value of 10^3 converts LC50 values from mg/l to mg/m^3, and F is a factor that takes into account sublethal effects of pesticides. Thus, combining Eqs. (1) and (2) gives

$$L > V(LC50)/10rF \qquad (3)$$

To use Eq.(3) V was given a value of 50 m^3/ha and F was set at 10, the figure adopted by Nicholson (1984) for sublethal effects resulting from non-accumulating toxins. Values of L and LC50 are listed in the Appendix (L=rate), and estimates of percentage runoff loss (r) for different classes of pesticides are given by Wauchope (1978). This then gave

$$L > LC50/2r \qquad (4)$$

As an example of the screening test: let L = 5 kg/ha yr; LC50 = 1 mg/l; and r = 0.5% . Thus, (LC50)/2r = 1.0 (< L) and on the bases of load intensity, toxicity and runoff there is a risk of environmental damage.

The screening test was applied to each of the county load tables in the Appendix, and the results are summarised in Table 3, for each of the major regions. Two other criteria were invoked, as well as Eq.4. Firstly, for a pesticide to present a potential hazard it had to be applied to an area of 1000 ha, or 1% of the county area, whichever was smaller. Secondly, each pesticide had to have a soil half-life of at least 10 days, to persist long enough for there to be runoff residues. Pesticide decay patterns are discussed by Wauchope and Leonard (1980). Soil half-lives for some pesticides are given by Nash (1980) and by Willis and McDowell (1982). The areas listed in Table 3 refer only to those areas (of counties) identified by the screening test as having a potential for harming aquatic organisms. They are not the total areas treated with the respective pesticides in the regions. Only principal crops are cited in Table 3.

Table 3 shows that the most intensively applied chemicals, having a potential for causing harm to aquatic life, were insecticides and fungicides applied to horticultural crops. The toxicity of copper (applied on tree crops near Nelson at 11 kg/ha.yr) is increased by decreases in water hardness and dissolved oxygen, and decreased in the presence of chelating agents, humic acids, amino acids and suspended solids (Alabaster and Lloyd 1982). There is some uncertainty about the effects of regular pulses of copper entering the aquatic environment, because of the competing effects of chemical deactivation through complexation and precipitation and reactivation by organisms (CCREM 1987). Other intensively applied materials were mancozeb, carbaryl and oryzalin, with a soil half-life of c. 100 days reported for the latter (Nash 1980). Carbaryl is moderately stable in many soil types; up to 116 days in some cases (Mount and Oehme 1981). In cool water it is slowly hydrolysed to 1-naphthol, when contact with sediment is prevented. Otherwise its hydrolysis is rapid, although it may persist in sediment muds for 2-6 weeks. 1-naphthol is generally less toxic than carbaryl (Mount and Oehme 1981).

The most extensively used of the pesticides listed in Table 3 were applied to cereal crops, principally in the eastern and southern areas of the South Island. Benomyl, a fungicide, has been reported as having a soil half-life in excess of 100 days (Nash 1980) and is moderately toxic to rainbow trout (Mayer and Ellersieck 1986). Dinoseb and trifluralin, both herbicides, were each applied to about 10,000 ha at rates sufficient to suggest potential harm to freshwater organisms (Eq 4). In Scotland, dinoseb and MCPA washed by rain from fields soon after application, have been thought to be responsible for fishkills in small streams (Holden 1972). Reduced growth of lake trout fry has been attributed to low, sublethal, concentrations of dinoseb (Woodward 1976). Dinoseb is not highly bioconcentrated in fish tissue, and small amounts that may accumulate are readily eliminated when the exposure ends, although adverse effects have been observed for fathead minnows (*Pimephales promelas*) exposed to concentrations as low as 0.05 mg/l (Call *et al.* 1984). There is some uncertainty about the stability of dinoseb in natural waters and thus, the long term effects of intermittent exposures to aquatic organisms.

Trifluralin is toxic to aquatic life at concentrations of 0.1 mg/l or less, and has well known sublethal effects at much lower concentrations (Mayer and Ellersieck 1986, Murty 1986). Dissipation rates measured in a variety of soil types (Nash 1980) imply an average soil half-life of about 55 days. Trifluralin is regarded by Rao and Davidson (1980) as being soil-persistent, having a half-life > 100 days for laboratory incubation conditions. These data suggest that trifluralin will also be similarly stable in water and may thus be a significant pollutant when runoff events occur soon after its application.

Table 3. Pesticides with a Potential for Damage to the Aquatic Environment[+]

Region	Pesticide	Crop[++]	Area (ha)	Rate, L[+++] (kg/ha.yr)
Nelson	azinphos-CH_3	hort.	2940	3.35
Marlborough	chlorpyrifos	hort.	5200	2.50
	copper	hort.	1320	11.04
	diazinon	hort.	1150	1.71
	dodine(?)	hort.	2534	2.30
	mancozeb	hort.	4580	9.47
	permethrin	hort.	1362	0.14
	pirimiphos-CH_3	hort.	1153	2.35
Westland	no significant runoff risk identified			
Buller				
Canterbury	azinphos-CH_3	hort.	690	3.08

Sth Canty	azocyclotin	hort.	655	1.11
	carbaryl	hort.	680	8.09
	chlorothalonil	hort.	800	1.63
	chlorpyrifos	hort	570	0.96
	diazinon	hort.	500	0.40
	dinoseb (?)	cereal	9840	0.66
	dodine(?)	hort.	590	0.90
	endosulfan	hort.	570	0.24
	oryzalin	hort.	490	5.63
	phorate	hort.	485	2.21
	trifluralin	cereal	10030	0.17
Otago Southland	benomyl	cereal	14320	0.25
	dinoseb (?)	cereal	1130	0.72
	trifluralin	cereal	1400	0.31

+ Based on Eq. 4 and on land area and soil half-life criteria (see text).

++ "hort." includes pipfruit, stonefruit, subtropical fruit(Nelson) and vegetables (Christchurch); "cereal" refers to wheat, barley, oats and peas.

+++ Rate,L = The average application rate in each region for counties having a potential for environmental damage.

(?) Refers to pesticides with unknown soil half-lives.

Some pesticides are in Table 3, mainly because of their very low LC50 values (commonly about 0.001 mg/l). Most of the organophosphates and pyrethroids are not sufficiently stable in the aquatic environment to present a serious hazard (Murty 1986). However, chlorpyrifos is persistent in soils for 60-120 days (Worthing and Walker 1983) and may persist in aquatic systems too. Azinphos-methyl and diazinon have soil half lives of about 3 weeks (Nash 1980) and would pose less of a hazard to aquatic life. Endosulfan was applied to berries and vegetables near Christchurch. It is a persistent, organochlorine insecticide that is highly toxic to fish (Worthing and Walker 1983). The scale of its use is not sufficient for it to be regarded a major contaminant. Chlorthalonil is a persistent, organochlorine fungicide and there may be some localised problems associated with its use on orchard and vegetable crops (Davies and White 1985, Davies 1988).

Table 4 summarises some of the properties of the pesticides having the greatest potential for harming aquatic animals (damage to aquatic plant life has not been assessed here) that were used in the South Island during 1986-89.

Table 4. Properties of Potentially Harmful Pesticides Used in the South Island

Pesticide	Soil half-life (days)[a]	LC50[b] (mg/l)	test animal
benomyl	>100	0.17	rainbow trout[c]
		0.64	waterflea[d]
carbaryl	25-116	4.38	rainbow trout[e]
		0.006	waterflea[e]
chlorothalonil	80-100	0.02	rainbow trout[f]
chlorpyrifos	60-120	0.003	rainbow trout[c]
		0.0017	waterflea[g]
copper	persistent	9.6	rainbow trout[h]
		0.07	snail[i]
dinoseb	(?)	0.14	rainbow trout[g]
		0.68	waterflea[g]
oryzalin	100	1.0	rainbow trout[c]
trifluralin	>55	0.1	rainbow trout[j]
		0.56	waterflea[g]

[a]Typical values from sources cited in the text; [b]LC50 = concentration lethal to 50% of test animals within a given time (96 hours); [c]Worthing and Walker 1983; [d]Pimental 1971; [e]Mount and Oehme 1981; [f]Davies and White 1985; [g]Kenega 1979; [h]Tooby *et al.* 1975; [i]Watton and Hawkes 1984; [j]Mayer and Ellersieck 1986.(?) Pesticides with unknown soil half-life.

The preceding analysis of county loads shown in Table 3 has a number of points that preclude its use other than as a simple means of gauging **potential** for water pollution. It might be argued that pesticides that are soil-persistent might be "fixed" so that they are not easily washed out of soils, or if they do enter water bodies in runoff are too insoluble to exert a toxic effect. The runoff factor, r, in Eqs.3 and 4 includes particulate and dissolved material, and thus overcomes the first problem. Sediment suspension in the water column and the interactions of aquatic organisms help make "available" particulate pesticides.

The proximity of target areas to sensitive receiving waters was not taken into account in the screening test for potential environmental damage. Also, seasonal effects (such as time of application in relation to typical stream flows and rainfall patterns) have not been taken into account. To overcome some of these deficiencies it would be necessary to have much more detailed information about pesticide formulations, the local conditions where they are applied, and the waterways into which the runoff flows. Another approach might be to give index values to the loading rate (L), the area of application, the soil persistence, the toxicity and the runoff characteristics, of each pesticide in the relevant areas of use.

CONCLUSIONS

A survey was conducted to determine average annual pesticide use in counties of the South Island during 1986-1989. Data is tabulated for pesticide active ingredients. A comparison was made between the combined results of this survey and an earlier survey for the North Island (1985-88), and an independent survey of sales returns throughout New Zealand (by Agcarm), for 12 classes of pesticides. Good agreement was obtained. The major discrepancies were an underestimate of non-specific herbicides, including glyphosate, and an overestimate of total organophosphates, for the combined surveys with respect to the Agcarm data.

About 1100 tonnes of pesticides were used annually in the South Island (ie. about 30% of the total for New Zealand), with 700 tonnes being herbicides. The amounts of total insecticides and fungicides used in individual counties correlated well with the respective areas of horticulture. Insecticides were used at (total) rates of 3-8 kg/ha.yr and fungicides were used at (total) rates of 6-20 kg/ha.yr. Total herbicide usage correlated well with areas of grain crops, for eastern and southern areas, where (total) application rates were 1-2 kg/ha.yr.

A simple screening test was used to identify pesticides whose use may be potentially harmful to aquatic organisms, for each of the counties. The test was based on: intensity of application, extent of use, soil persistence, runoff potential and toxicity to rainbow trout. Pesticides identified were: carbaryl, chlorpyrifos, copper, chlorothalonil and oryzalin used in horticulture, and benomyl, dinoseb and trifluralin used on grain crops. Appropriate monitoring programmes may be needed to verify if there is a real threat.

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APPENDIX

The following tables list average annual pesticide loads in specified counties. Abbreviations used are as follows:-

Code 1st column: H = herbicide; I = insecticide; F = fungicide; X = other

2nd column: A = cyclic diazine or triazine; O = organohalogen; P = organophosphate; C = carbamate; F = phenoxyalkanoic herbicide; X = other

3rd column: s = applied to soil; f = applied to foliage

Land Use Code: P = pasture; PF = pipfruit; SF = stonefruit;
C = citrus; B = berry; S = subtropical (avocado,kiwifruit,tamarillo,nuts); G = grape; V = vegetables; M = maize; F = forest;
CR = cereal cash crops (wheat,oats;barley);
PC = processing crops (peas, beans,tomatoes)
H = hops; T = tobacco

Rate: Refers to the average annual load applied to target areas and is calculated by dividing mass (kg) by area (ha) for each pesticide entry.

LC50: Is the concentration that kills 50 % of a test population (rainbow trout) within a given time (96 hours).

Nelson - Malborough Region

Golden Bay, Kaikoura, Marlborough, Waimea

PESTICIDE LOADS : GOLDEN BAY

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	40	P	50	1.25	2
2,4,5-T	HFf	1000	F/P	1520	1.52	20
alachlor	HXs	20	V	35	1.75	1.8
azinphos methyl	IPf	40	PF	140	3.50	.014
bromacil	HXf	8	C	20	2.50	75
captafol	FXf	8	C	10	1.25	.5
captan	FXf	38	PF	440	11.58	.3
carbaryl	ICf	38	PF	110	2.89	4.34
chloramben	HXf	20	V	35	1.75	4.2
chlorothalonil	FOf	20	V	10	.50	.02
chlorpyrifos	IPf	244	C/PF/S	380	1.56	.003
clofentezine	HXf/s	58	PF	20	.34	
copper	FXf	20	C/F	250	12.50	9.6
diazinon	IPf	30	C/V	410	13.67	.09
dimethirimol	FAf	20	V	2	.10	28
dimethoate	IPf	8	C	5	.63	8.5
diquat	HXf	40	PF/F	12	.35	10
diuron	HXs	8	C	20	2.50	20
dodine	FXf	38	PF	90	2.37	.6
folpet	FXf	8	C	20	2.50	
glyphosate	HXf	60	F/PF/S	250	4.17	86
iprodione	FXf	198	S	150	.76	
mancozeb	FXf	58	PF	440	7.59	4
MCPA	HFf	40	P/CR	40	1.00	10
MCPB	HFf	74	P	120	1.62	10
mecoprop	HFf	10	CR	6	.60	230
methazole	HXf	20	V	8	.40	4
metiram	FXf	38	PF	550	14.47	17
paraquat	HXf	60	PF/V	20	.33	32
penconazole	FAf	60	PF/V	10	.17	
permethrin	IXf	198	S	30	.15	.009
picloram	HOf	40	F/P	12	.30	20
pirimiphos-methyl	IPf	198	S	560	2.83	.02
prochloraz	FAf	10	CR	4	.40	1
propargite	IXf	38	PF	10	.26	.12
simazine	HAf/s	8	C	5	.63	100
terbumeton	HAf	38	PF	80	2.10	14
terbuthylazine	HAf	38	PF	80	2.10	4.6
triadimefon	FAf	58	PF/V	10	.17	25
triclopyr	HXf	205	P	330	1.61	2.2

PESTICIDE LOADS : KAIKOURA

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	260	P	390	1.50	2
2,4,5-T	HFf	120	P	450	3.75	20
alachlor	HXs	7	V	12	1.71	1.8
amitrole	HAf	40	P	115	2.88	50
ammonium thiocyanate	XXf	25	P	20	.80	10
asulam	HCf	25	P	80	3.20	5000
bentazone	HXf	80	CR	8	.10	
chloramben	HXf	7	V	15	2.14	4.2
chlormequat	HXf	80	CR	10	.13	
chlorpropham	HCs	5	V	5	1.00	>5
chlorpyrifos	IPf	9	S	9	1.00	.003
chlorthal-dimethyl	HXs	5	V	10	2.00	
clopyralid	HXf	90	P	15	.17	104
copper	FXf	80	CR	20	.25	9.6
dalapon	HXf	15	P	70	4.67	100
diazinon	IPf	9	S	18	2.00	.09
diclofop-methyl	HXf	80	CR	8	.10	.35
dinoseb	HXf	80	CR	30	.38	.14
glyphosate	HXf	170	P/S	240	1.41	86
iprodione	FXf	9	S	7	.78	
maleic hydrazide	HAf	5	V	10	2.00	1435
mancozeb	FXf	5	V	50	10.00	4
MCPA	HFf	180	CR/P	200	1.11	10
MCPB	HFf	290	CR/P	300	1.03	10
mecoprop	HFf	80	CR	50	.63	230
methabenzthiazuron	HXf	5	V	10	2.00	15.9
metribuzin	HAf	5	V	4	.80	76
metsulfuron	HAf	130	P	10	.08	
paraquat	HXf	40	P	30	.75	32
picloram	HOf	210	P	75	.36	20
pirimiphos-methyl	IPf	9	S	25	2.78	.02
prochloraz	HAf	80	CR	30	.38	3
propiconazole	FXf	80	CR	10	.13	100
simazine	HAf/s	120	P	110	.92	100
triclopyr	HXf	10	P	50	5.00	2.2

PESTICIDE LOADS : MARLBOROUGH

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4,5-T	HFf	615	F/P	2660	4.33	20
alachlor	HXs	35	V	60	1.71	1.8
amitrole	HAf	1550	G/P	4260	2.75	50
ammonium thiocyanate	XXf	970	G	490	.51	10
asulam	HCf	15	F	85	5.67	5000
azinphos methyl	IPf	622	B/PF/SF	1760	2.83	.014
azocyclotin	IAf	283	SF	130	.46	.018
benomyl	FCf	338	SF/V	190	.56	.17
bitertanol	FAf	70	SF	100	1.43	2.5
bromacil	HXf	21	C/V	40	1.90	75
bromoxynil	HOf	55	V	25	.45	.15
captafol	FXf	8	C	12	1.50	.5
captan	FXf	395	B/PF/V	3833	9.70	.3
carbaryl	ICf	622	B/PF/SF	2300	3.70	4.34
chloramben	HXf	35	V	65	1.86	4.2
chlorbufam	HCs	16	V	10	.63	
chloridazon	HXf/s	16	V	10	.63	
chlorothalonil	FOf	470	SF/V	2630	5.60	.02
chlorpropham	HCs	16	V	12	.75	>5
chlorpyrifos	IPf	1570	C/G/PF/SF/S	2475	1.58	.003
chlorsulfuron	HXf	3770	CR	35	.01	250
chlorthal-dimethyl	HXs	16	V	35	2.19	
clofentezine	HXf/s	339	B/PF	105	.31	
clopyralid	HXf	3770	CR	80	.02	104
copper	FXf	1320	B/C/F/G/SF	14570	11.04	9.6
chlormequat	HXf	3770	CR	424	.11	
cypermethrin	IXf	970	G	10	.01	.001
demeton-S-methyl	IPf	225	SF/V	60	.27	4.3
diazinon	IPf	210	C/S/V	140	.67	.09
dicamba	HOf	3770	CR	75	.02	135
dichlofluanid	FXf	1000	B/G/V	1000	1.00	5
dichlorvos	IPf	110	B/V	5	.05	.5
difenzoquat	HAf	3770	CR	190	.05	694
dimethirimol	FAf	35	V	4	.11	28
dimethoate	IPf	28	C/V	9	.32	8.5
diquat	HXf	2760	C/G/P/PF/V	500	.18	10
diuron	HXs	21	C/V	42	2.00	20
dodine	FXf	330	PF	755	2.29	.6
endosulfan	IOf	154	V	40	.26	.0012
EPTC	HCs	100	V	420	4.20	19
fenamiphos	IPf	55	V	205	3.73	.11
fenarimol	FAf	970	G	30	.03	.91
fluazifop-butyl	HXf	100	V	12	.12	1.37
fluvalinate	IXf	280	SF	90	.32	.014
folpet	FXf	8	C	20	2.50	
glyphosate	HXf	4110	C/F/P/PF/S	5780	1.41	86
hexazinone	HAf	10	F	50	5.00	300
ioxynil	HXf	72	V	34	.47	4
iprodione	FXf	1365	B/G/S/SF/V	2130	1.56	
isazophos	IPs	255	M	230	.90	.008
lindane	IOf	214	SF	320	1.50	.025
linuron	HXs	20	V	15	.75	16
maleic hydrazide	HAf	72	V	70	.97	1435
mancozeb	FXf	1460	B/G/PF/V	10500	7.19	4
maneb	FXf	35	V	25	.71	.53
MCPA	HFf	3770	CR	2300	.61	10
mecoprop	HFf	3770	CR	2375	.63	230
metalaxyl	FXf	130	V	20	.15	100
methabenzthiazuron	HXf	1220	V	1200	.98	15.9
methazole	HXf	107	V	25	.23	4
methomyl	ICf	12	B	3	.25	3.4
metiram	FXf	330	PF	4720	14.30	17
metolachlor	HXf	255	M	820	3.21	2
metribuzin	HAf	1170	V	240	.21	76
metsulfuron	HAf	3000	P	180	.06	
omethoate	IPf	970	G	280	.29	10
paraquat	HXf	2760	C/G/PF/P	1000	.36	32
parathion methyl	IPf	123	B/V	10	.08	2.7
penconazole	FAf	1300	G/PF	105	.08	
pendimethalin	HXf/s	72	V	20	.27	.4
permethrin	IXf	190	S/SF/V	20	.11	.009
phorate	IPs	100	V	215	2.15	.01
picloram	HOf	615	F/P	615	1.00	20
pirimicarb	ICf	130	V	10	.08	29
pirimiphos-methyl	IPf	190	S/SF/V	335	1.76	.02
procymidone	FXf	55	V	5	.09	10
prometryne	HAf	20	V	10	.44	2.5
propachlor	HXs	16	V	9	.56	.17
propargite	IXf	340	B/PF	40	.12	.12
propiconazole	FXf	3825	CR/V	410	.11	100
simazine	HAf/s	3035	C/G/V	4480	1.48	100
terbumeton	HAf	330	PF	655	1.98	14
terbuthylazine	HAf	580	PF	1115	1.92	4.6

triadimefon	FAf	420	PF/V	62	.15	25
triallate	HCs	3770	CR	300	.08	1.2
triclopyr	HXf	400	P	720	1.80	2.2
trifluralin	HXs	96	V	50	.52	.1
triforine	FXf	283	SF	240	.85	1000
vinclozolin	FXf	1111	G/SF/V	885	.80	52.5
zineb	FCf	100	V	40	.40	250

PESTICIDE LOADS : WAIMEA

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
1,2-D	IXs	325	T	4968	15.28	4
2,4-D(all forms)	HFf	70	P	80	1.14	2
2,4,5-T	HFf	210	F	800	3.81	20
acephate	IPf	362	T/V	280	.77	1000
alachlor	HXs	62	V	131	2.11	1.8
amitrole	HAf	40	G	79	1.98	50
ammonium thiocyanate	XXf	40	G	500	12.50	10
asulam	HCf	40	F	255	6.38	5000
azinphos methyl	IPf	2940	PF/SF/B	9850	3.35	.014
azocyclotin	IAf	91	SF	34	.37	.018
benomyl	FCf	453	SF/V/T	108	.24	.17
bromacil	HXf	129	C/V	202	1.57	75
captafol	FXf	21	C	32	1.52	.5
captan	FXf	2704	PF/B	29240	10.81	.3
carbaryl	ICf	2940	PF/SF/B	8410	2.86	4.34
chloramben	HXf	62	V	140	2.25	4.2
chlorbufam	HCs	43	V	22	.51	
chloridazon	HXf/s	43	V	22	.51	
chlorothalonil	FOf	346	SF/V	1336	3.86	.02
chlorpropham	HCs	80	V	72	.90	>5
chlorpyrifos	IPf	3630	C/G/PF/SF/S	10500	2.89	.003
chlorthal-dimethyl	HXs	43	V	90	2.09	
clofentezine	HXf/s	2704	B/PF	803	.30	
copper	FXf	600	B/C/F/G/SF	5670	9.45	9.6
deltamethrin	IXf/s	368	T	4	.01	.005
demeton-S-methyl	IPf	128	V	10	.08	4.3
diazinon	IPf	1150	C/S/V	1965	1.71	.09
dichlofluanid	FXf	400	B/G/V	960	2.40	5
dichlorvos	IPf	376	B/V	200	.53	.5
dimethirimol	FAf	62	V	8	.13	28
dimethoate	IPf	37	C/V	16	.43	8.5
diquat	HXf	3420	B/C/G/H/PF/T/V	780	.23	10
diuron	HXs	129	C/V	230	1.78	20
dodine	FXf	2534	PF	5840	2.30	.6
endosulfan	IOf	156	V	35	.22	.0012
fenamiphos	IPs	325	T	663	2.04	.11
fensulfothion	IPs	325	T	143	.44	8.8
fluvalinate	IXf	91	SF	26	.29	.014
folpet	FXf	21	C	53	2.52	
glufosinate-ammon.	HPf	143	B	215	1.50	580
glyphosate	HXf	3520	C/F/P/PF/S	3860	1.10	86
hexazinone	HAf	30	F	150	5.00	300
ioxynil	HXf	43	V	24	.56	4
iprodione	FXf	1386	B/G/S/SF	1700	1.22	
isazophos	IPs	236	M	130	.55	.008
lindane	IOf	137	SF	90	.66	.025
linuron	HXs	16	V	12	.75	16
maleic hydrazide	HAf	43	V	77	1.79	1435
mancozeb	FXf	3120	B/G/PF/V	32850	10.53	4
maneb	FXf	62	V	52	.84	.53
MCPA	HFf	600	P/CR	640	1.07	10
MCPB	HFf	30	P	50	1.67	10
metalaxyl	FXf	150	V	110	.73	100
metam sodium	ICs	325	T	3640	11.20	
methazole	HXf	105	V	40	.38	4
methomyl	ICf	171	B	40	.23	3.4
metiram	FXf	2530	PF	36500	14.43	17
metolachlor	HXf	236	M	754	3.19	2
metribuzin	HAf	466	CR/V	135	.29	76
omethoate	IPf	40	G	12	.30	10
paraquat	HXf	3400	B/G/F/H/PF/T/V	1615	.48	32
parathion methyl	IPf	550	B/V	480	.87	2.7
penconazole	FAf	2635	G/PF	610	.23	
pendimethalin	HXf/s	43	V	23	.53	.4
permethrin	IXf	1362	S/V	190	.14	.009
picloram	HOf	200	F/P	50	.25	20
pirimicarb	ICf	100	V	2	.02	29
pirimiphos-methyl	IPf	1153	S/V	2715	2.35	.02
prometryne	HAf	16	H	7	.44	2.5
propachlor	HXs	43	V	60	1.40	.17
propyzamide	HXs	37	V	14	.38	
simazine	HAf/s	332	B/C/G	930	2.80	100
terbumeton	HAf	2534	PF	5070	2.00	14
terbuthylazine	HAf	2780	M/PF	5490	1.97	4.6
triadimefon	FAf	2596	PF/V	460	.18	25
triclopyr	HXf	560	P	1180	2.27	2.2
trifluralin	HXs	112	V	40	.36	.1
triforine	FXf	91	V	50	.55	1000
vinclozolin	FXf	120	G/V	45	.38	52.5
zineb	FCf	37	V	24	.65	250

West Coast - Buller Region

Buller, Grey, Inangahua, Westland

PESTICIDE LOADS : BULLER

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	400	P	130	.33	2
2,4,5-T	HFf	450	P	1460	3.24	20
bromacil	HXf	20	P	80	4.00	75
chlorpyrifos	IPf	25	S	25	1.00	.003
copper	FXf	10	F	22	2.20	9.6
dalapon	HXf	25	P	220	8.80	100
diazinon	IPf	25	S	50	2.00	.09
diquat	HXf	5	F	10	2.00	10
diuron	HXs	20	P	80	4.00	20
glyphosate	HXf	800	P/S	570	4.17	86
iprodione	FXf	25	S	20	.80	
MCPA	HFf	550	P	130	.24	10
metsulfuron	HAf	100	P	10	.10	
permethrin	IXf	25	S	4	.16	.009
picloram	HOf	250	P	170	.68	20
pirimiphos-methyl	IPf	25	S	70	2.80	.02
simazine	HAf/s	40	P	200	5.00	100

PESTICIDE LOADS : GREY

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	400	P	410	1.03	2
2,4,5-T	HFf	155	F/P	335	2.16	20
amitrole	HAf	10	P	10	1.00	50
copper	FXf	140	F	290	2.07	9.6
dalapon	HXf	10	P	15	1.50	100
diquat	HXf	30	F	60	2.00	10
glyphosate	HXf	30	P	20	.67	86
MCPB	HFf	5	F	20	4.00	10
picloram	HOf	55	P/F	35	.64	20
simazine	HAf/s	10	P	25	2.50	100
triclopyr	HXf	100	P	170	1.70	2.2

PESTICIDE LOADS : INANGAHUA

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	330	P	200	.61	2
2,4,5-T	HFf	220	P	715	3.25	20
bromacil	HXf	20	P	80	4.00	75
dalapon	HXf	20	P	180	9.00	100
diuron	HXs	20	P	80	4.00	20
glyphosate	HXf	715	P	490	.69	86
MCPA	HFf	110	CR/P	60	.55	10
MCPB	HAf	30	P	50	1.67	10
mecoprop	HFf	8	CR	5	.63	230
metsulfuron	HAf	80	P	60	.75	
picloram	HOf	540	P	140	.26	20
prochloraz	HAf	8	CR	3	.38	1
simazine	HAf/s	40	P	200	5.00	100
triclopyr	HXf	365	P	830	2.27	2.2

PESTICIDE LOADS : WESTLAND

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	700	P	720	1.03	2
2,4,5-T	HFf	255	P	560	2.20	20
amitrole	HAf	10	P	10	1.00	50
copper	FXf	50	F	110	2.20	9.6
dalapon	HXf	10	P	25	2.50	100
diquat	HXf	12	F	24	2.00	10
glyphosate	HXf	50	P	40	.80	86
picloram	HOf	85	P	50	.59	20
simazine	HAf/s	10	P	40	4.00	100
triclopyr	HXf	170	P	300	1.76	2.2

Canterbury - South Canterbury Region

Akaroa etc, Amuri, Ashburton, Cheviot, Christchurch etc, Ellesmere, Hurunui, MacKenzie, Malvern, Rangiora etc, Strathallan, Waimate

PESTICIDE LOADS : AKAROA, MT HERBERT AND WAIREWA

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	110	P	140	1.27	2
2,4,5-T	HFf	80	P	330	4.13	20
asulam	HCf	15	P	40	2.67	5000
bentazone	HXf	50	CR	10	.67	
bromacil	HXf	10	V	14	1.40	75
chloridazon	HXf/s	20	V	10	.50	
chlormequat	HXf	320	CR	40	.13	
clopyralid	HXf	320	CR	20	.06	104
copper	FXf	50	CR	25	.50	9.6
diclofop-methyl	HXf	50	V	10	.20	.35
dinoseb	HXf	50	CR	40	.80	.14
diuron	HXs	10	V	20	2.00	20
EPTC	HCs	10	V	45	4.50	19
glyphosate	HXf	125	P	120	.96	86
mancozeb	FXf	10	V	80	8.00	4
MCPA	HFf	480	P/CR	390	.81	10
MCPB	HFf	110	P/CR	100	.91	10
mecoprop	HFf	320	CR	200	.63	230
metalaxyl	FXf	10	V	10	1.00	100
methabenzthiazuron	HXf	10	V	20	2.00	15.9
metsulfuron	HAf	70	P	50	.71	
phorate	IPs	10	V	20	2.00	.01
picloram	HOf	140	P	80	.57	20
prochloraz	HAF	320	CR	120	.38	3
propiconazole	FXf	320	CR	35	.11	100
triclopyr	HXf	20	P	120	6.00	2.2
trifluralin	HXs	50	CR	10	.20	.1

PESTICIDE LOADS : AMURI

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	230	P	250	1.09	2
2,4,5-T	HFf	440	F/P	1870	4.25	20
amitrole	HAf	100	P	30	.30	50
atrazine	HAf	20	F	4	.20	8
bentazone	HXf	141	CR	30	.21	
chlormequat	HXf	3470	CR	380	.11	
chlorsulfuron	HAf	3470	CR	30	.09	.3
clopyralid	HXf	3470	CR	70	.02	104
copper	FXf	141	CR	70	.50	9.6
dalapon	HXf	105	F/P	90	.86	100
dicamba	HOf	3470	CR	70	.02	135
diclofop-methyl	HXf	141	CR	30	.21	.35
difenzoquat	HAF	3470	CR	170	.05	694
dinoseb	HXf	141	CR	100	.71	.14
diquat	HXf	141	CR	10	.07	10
glyphosate	HXf	600	P	360	.60	86
MCPA	HFf	5000	CR/P	3545	.71	10
MCPB	HFf	250	F/CR/P	230	.92	10
mecoprop	HFf	3470	CR	560	.16	230
methabenzthiazuron	HXf	70	V	55	.79	15.9
metribuzin	HAf	70	V	10	.14	76
picloram	HOf	430	F/P	350	.81	20
prochloraz	HAf	3470	CR	1330	.38	3
propiconazole	FXf	3470	CR	370	.11	100
simazine	HAf/s	120	F/P	100	.83	100

PESTICIDE LOADS : ASHBURTON

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	290	P	1100	3.79	2
2,4,5-T	HFf	820	P/F	2500	3.05	20
alachlor	HXs	40	V	70	1.75	1.8
amitrole	HAf	75	P/PF	460	6.13	50
azinphos methyl	IPf	310	B/PF/SF	685	2.20	.014
azocyclotin	IAf	70	PF	80	1.14	.018
bentazone	HXf	20600	CR	4000	.19	
bitertanol	FAf	50	PF	56	1.12	2.5
bromacil	HXf	45	P/V	75	1.67	75
captan	FXf	110	PF/SF	160	1.45	.3
carbaryl	ICf	130	B/PF/SF	700	5.38	4.34
chloramben	HXs	40	V	75	1.88	4.2
chlormequat	HXf	52800	CR	5900	.11	
chlorothalonil	FOf	740	B/SF/V	440	.59	.02
chlorpyrifos	IPf	250	B/PF/SF	125	.50	.003
chlorsulfuron	HXf	52800	CR	500	.01	250
clofentezine	HXf/s	240	B	15	.06	
clopyralid	HXf	53000	CR/P	1400	.03	104
copper	FXf	21000	B/CR/PF/SF	11500	.55	9.6
dalapon	HXf	10	P	70	7.00	100
demeton-S-methyl	IPf	480	V	60	.13	4.3
dicamba	HOf	52800	CR	1000	.02	135
dichlofluanid	FXf	60	B	120	2.00	5
dichlorvos	IPf	280	B	30	.11	.5
diclofop-methyl	HXf	20600	CR	3900	.19	.35
difenzoquat	HAf	52800	CR	2600	.05	694
dinoseb	HXf	20900	CR	15100	.72	.14
diquat	HXf	20700	CR/PF	1500	.07	10
diuron	HXs	45	P/V	85	1.89	20
dodine	FXf	50	PF	40	.80	.6
endosulfan	IOf	680	V	170	.25	.0012
EPTC	HCs	480	V	2080	4.33	19
fluazifop-butyl	HXf	480	V	60	.12	1.37
flusilazol	FAf	50	PF	10	.20	.25
glyphosate	HXf	3700	P/PF	3200	.86	86
iprodione	FXf	260	B	130	.50	
lindane	IOf	20	V	30	1.50	.025
mancozeb	FXf	750	B/V	2190	2.92	4
maneb	FXf	40	V	30	.75	.53
MCPA	HFf	56000	CR/P	35500	.63	10
MCPB	HFf	22000	CR/P	7200	.33	10
mecoprop	HFf	52800	CR	33300	.63	230
metalaxyl	FXf	500	V	50	.10	100
methabenzthiazuron	HXf	510	V	870	1.71	15.9
metiram	FXf	50	PF	700	14.00	17
metribuzin	HAf	780	V	300	.38	76
metsulfuron	HAf	120	P	26	.22	
oryzalin	HXs	50	PF	280	5.60	1
paraquat	HXf	50	PF	70	1.40	32
parathion methyl	IPf	300	B	280	.93	2.7
phorate	IPs	480	V	1060	2.21	.01
picloram	HOf	900	P/F	400	.44	20
pirimicarb	ICf	660	B/V	80	.12	29
prochloraz	HAF	52800	CR	20000	.38	3
propiconazole	FXf	52800	CR	5600	.11	100
simazine	HAf/s	60	P/PF	160	2.67	100
triadimefon	FAf	90	PF	20	.22	25
triallate	HCs	52800	CR	4200	.08	1.2
triclopyr	HXf	320	P	1150	3.60	2.2
trifluralin	HXs	20600	CR	3300	.16	.1
triforine	FXf	20	SF	10	.50	1000
zineb	FCf	480	V	180	.38	24

PESTICIDE LOADS : CHEVIOT

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	114	P	144	1.26	2
2,4,5-T	HFf	84	P	330	3.93	20
amitrole	HAf	30	P	30	1.00	50
ammonium thiocyanate	XXf	15	P	12	.80	10
asulam	HCf	15	P	45	3.00	5000
bentazone	HXf	102	CR	20	.20	
chlormequat	HXf	483	CR	60	.12	
clopyralid	HXf	483	CR	10	.02	104
copper	FXf	102	CR	50	.49	9.6
dalapon	HXf	30	P	20	.67	100
dicamba	HOf	483	CR	10	.02	135
diclofop-methyl	HXf	102	CR	20	.20	.35
difenzoquat	HAF	483	CR	25	.05	694
dinoseb	HXf	102	CR	70	.69	.14
glyphosate	HXf	125	P	120	.96	86
MCPA	HFf	640	CR/P	480	.75	10
MCPB	HFf	160	CR/P	120	.75	10
mecoprop	HFf	483	CR	300	.62	230
methabenzthiazuron	HXf	25	V	20	.80	15.9
metsulfuron	HAf	70	P	50	.71	
paraquat	HXf	20	P	15	.67	32
picloram	HOf	140	P	80	.57	20
prochloraz	HAf	483	CR	185	.38	3
propiconazole	FXf	483	CR	50	.10	100
simazine	HAf/s	30	P	30	1.00	100
triclopyr	HXf	20	p	120	6.00	2.2
trifluralin	HXs	102	CR	20	.20	.1

PESTICIDE LOADS : CHRISTCHURCH, HEATHCOTE, PAPARUA AND WAIMAIRI

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	110	P	115	1.05	2
2,4,5-T	HFf	130	P	160	1.23	20
alachlor	HXs	140	V	250	1.79	1.8
amitrole	HAf	770	P/PF	2160	2.81	50
ammonium thiocyanate	XXf	50	P	50	1.00	10
asulam	HCf	6	B	2	.33	5000
atrazine	HAf	4	P	3	.75	8
azinphos methyl	IPf	690	PF/SF/V	2125	3.08	.014
azocyclotin	IAf	655	PF/SF	725	1.11	.018
benomyl	FCf	50	SF/V	40	.80	.17
bentazone	HXf	600	CR	115	.19	
bitertanol	FAf	500	B/PF/SF	550	1.10	2.5
bromacil	HXf	20	V	30	1.50	75
bromoxynil	HOf	10	P	2	.20	.15
bupirimate	FAf	110	PF	35	.32	1.7
captan	FXf	630	B/PF	1760	2.79	.3
carbaryl	ICf	680	B/PF/SF	5500	8.09	4.34
chloramben	HXs	130	V	100	.77	4.2
chlorbufam	HCs	120	V	60	.50	
chloridazon	HXf/s	120	V	60	.50	
chlorothalonil	FOf	800	SF/V	1300	1.63	.02
chlorpyrifos	IPf	570	P/PF/SF	550	.96	.003
chlorsulfuron	HXf	3100	CR	30	.01	250
chlorthal-dimethyl	HXs	120	V	250	2.08	
chlorpropham	HCs	150	V	165	1.10	>5
clopyralid	HXf	3125	B/CR/P	70	.02	104
copper	FXf	1300	B/CR/PF/SF	3560	2.74	9.6
dalapon	HXf	120	P	14	.12	100
demeton-S-methyl	IPf	570	SF/V	70	.12	4.3
diazinon	IPf	500	P/V	200	.40	.09
dicamba	HOf	3200	P/CR	80	.03	135
dichlofluanid	FXf	175	B/V	150	.86	5
dichlorprop	HFf	160	P	35	.22	165
dichlorvos	IPf	220	B	40	.18	.5
diclofop-methyl	HXf	60	V	110	1.83	.35
difenzoquat	HAf	3100	CR	155	.05	694
dimethoate	IPf	90	V	20	.22	8.5
dinoseb	HXf	600	V	430	.72	.14
diquat	HXf	1300	P/PF/V	490	.38	10
diuron	HXs	25	P/V	70	2.80	20
dodine	FXf	590	PF	530	.90	.6
endosulfan	IOf	570	B/V	135	.24	.0012
EPTC	HCs	485	V	2100	4.33	19
fenarimol	FXf	480	PF	40	.08	.91
fensulfothion	IPs	14	V	5	.36	8.8
fluazifop-butyl	HXf	485	V	60	.12	1.37
flusilazol	FAF	480	PF	108	.23	
fluvalinate	IXf	30	SF	10	.33	.014
glyphosate	HXf	1050	P/PF/B/V	2700	2.57	86
ioxynil	HXf	120	V	70	.58	4
iprodione	FXf	120	B/SF	170	1.42	
lindane	IOf	35	SF	55	1.57	.025
linuron	HXs	90	V	75	.83	16
maleic hydrazice	HAf	20	V	30	1.50	1435
mancozeb	FXf	500	B/V	1000	2.00	4
maneb	FXf	150	V	100	.67	.53
MCPA	HFf	3530	P/CR/V	2200	.62	10
MCPB	HFf	825	P/V	350	.42	10
mecoprop	HFf	3280	P/CR	2040	.62	230
metalaxyl	FXf	525	V	45	.09	100
methabenzthiazuron	HXf	525	V	900	1.71	15.9
methamidophos	IPf	14	V	12	.86	51
methazole	HXf	275	PF/V	90	.33	4
methomyl	ICf	30	B	6	.20	3.4
metiram	FXf	600	PF	8120	13.53	17
metribuzin	HAf	510	V	260	.51	76
myclobutanil	FAf	110	PF	24	.22	
nitrothal-isopropyl	FXf	110	PF	75	.68	
oryzalin	HXs	490	PF	2760	5.63	1
oxyfluorfen	HXs	110	PF	13	.12	
paraquat	HXf	850	P/PF	830	.98	32
parathion methyl	IPf	700	B/V	200	.29	2.7
pendimethalin	HXf/s	120	V	60	.50	.4
permethrin	IXf	680	CR/SF/V	15	.02	.009
phorate	IPs	485	V	1070	2.21	.01
picloram	HOf	220	P	70	.32	20
pirimicarb	ICf	555	V	50	.09	29
pirimiphos-methyl	IPf	400	SF/V	70	.18	.02
prochloraz	HAF	3100	CR	1190	.38	3
propachlor	HXs	120	V	160	1.33	.17
propiconazole	FXf	3100	CR	330	.11	100
propyzamide	HXs	25	V	30	1.20	

simazine	HAf/s	620	P/PF	775	1.25	100
TCA	HXf/s	40	P	120	3.00	100
terbuthylazine	HAf	4	F	20	5.00	4.6
thiram	FXf	44	P	32	.73	.13
thiometon	IPf	30	V	3	.10	13
triadimefon	FAf	510	PF/V	200	.39	25
triallate	HCs	3100	CR	250	.08	1.2
triclopyr	HXf	60	P	150	2.50	2.2
trifluralin	HXs	660	CR/V	120	.18	.1
triforine	FXf	55	SF	40	.73	1000
vinclozolin	FXf	140	B/SF/V	40	.29	52.5
zineb	FCf	510	V	200	.39	24

PESTICIDE LOADS : ELLESMERE

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	440	P	790	1.18	2
2,4,5-T	HFf	130	F/P	570	4.38	20
alachlor	HXs	130	V	230	1.77	1.8
amitrole	HAf	110	P/PF	390	3.55	50
azinphos methyl	IPf	200	B/PF/SF	500	2.50	.014
azocyclotin	IAf	100	PF	1400	1.40	.018
bentazone	HXf	2660	CR	510	.19	
bitertanol	FAf	100	PF	110	1.10	2.5
captan	FXf	110	B/PF	350	3.18	.3
carbaryl	ICf	190	PF/SF	1140	6.00	4.34
chloramben	HXs	130	V	240	1.85	4.2
chlorbufam	HCs	40	V	20	.50	
chloridazon	HXf/s	40	V	20	.50	
chlormequat	HXf	11600	CR	1310	.11	
chlorothalonil	FOf	520	B/SF/V	670	1.29	.02
chlorpyrifos	IPf	130	PF/SF	180	1.38	.003
chlorthal-dimethyl	HXs	40	V	80	2.00	
chlorpropham	HCs	40	V	30	.75	>5
clopyralid	HXf	11900	CR/P	350	.03	104
copper	FXf	2800	CR/PF/SF	3070	1.10	9.6
dalapon	HXf	10	P	50	5.00	100
demeton-S-methyl	IPf	230	V	30	.13	4.3
diazinon	IPf	150	V	50	.33	.09
dicamba	HOf	11600	CR	230	.02	135
diclofop-methyl	HXf	2660	CR	500	.19	.35
difenzoquat	HAf	11600	CR	580	.05	694
dinoseb	HXf	2660	CR	1920	.72	.14
diquat	HXf	2700	CR/PF	260	.01	10
dodine	FXf	100	PF	80	.80	.6
endosulfan	IOf	370	B/V	90	.24	.0012
EPTC	HCs	230	V	990	4.30	19
fluazifop-butyl	HXf	230	V	30	.13	1.37
flusilazol	FAF	100	PF	25	.25	
glyphosate	HXf	2550	P/PF	3000	1.18	86
ioxynil	HXf	40	V	20	.50	4
iprodione	FXf	70	B	130	1.86	
lindane	IOf	30	SF	45	1.50	.025
maleic hydrazice	HAf	40	V	70	1.75	1435
mancozeb	FXf	325	B/V	550	1.69	4
maneb	FXf	130	V	90	.69	.53
MCPA	HFf	13000	P/CR	9000	.69	10
MCPB	HFf	3700	P/CR	2300	.62	10
mecoprop	HFf	11600	CR	7300	.63	230
metalaxyl	FXf	230	V	10	.04	100
methabenzthiazuron	HXf	790	V	890	1.13	15.9
methazole	HXf	130	V	50	.38	4
metiram	FXf	100	PF	1400	14.00	17
metribuzin	HAf	580	V	210	.36	76
metsulfuron	HAF	10	P	2	.20	
oryzalin	HXs	100	PF	560	5.60	1
paraquat	HXf	100	PF	140	1.40	32
parathion methyl	IPf	260	B/V	100	.38	2.7
pendimethalin	HXf/s	40	V	20	.50	.4
phorate	IPs	230	V	510	2.21	.01
picloram	HOf	70	P/F	60	.86	20
pirimicarb	ICf	230	V	20	.09	29
pirimiphos-methyl	IPf	70	V	14	.20	.02
prochloraz	HAF	11600	CR	4400	.38	3
propachlor	HXs	40	V	50	1.25	.17
propiconazole	FXf	11600	CR	1230	.11	100
simazine	HAf/s	110	P/PF	200	1.82	100
triadimefon	FAf	100	PF	40	.40	25
triallate	HCs	11600	CR	580	.05	1.2
triclopyr	HXf	20	P	60	3.00	2.2
trifluralin	HXs	2730	CR/B	455	.17	.1
triforine	FXf	30	SF	20	.67	1000
zineb	FCf	230	V	90	.39	24

PESTICIDE LOADS : HURUNUI

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	430	P	510	1.19	2
2,4,5-T	HFf	70	F	340	4.86	20
amitrole	HAf	55	G/P	100	1.82	50
atrazine	HAf	20	F	5	.25	8
azinphos methyl	IPf	170	PF/SF	560	3.29	.014
azocyclotin	IAf	170	PF/SF	210	1.23	.018
bentazone	HXf	314	CR	60	.19	
bitertanol	FAf	140	PF	160	1.14	2.5
bromacil	HXf	10	P	24	2.40	75
captan	FXf	140	PF	420	3.00	.3
carbaryl	ICf	170	PF/SF	1545	9.08	4.34
chlormequat	HXf	6720	CR	760	.11	
chlorothalonil	FXf	60	SF/V	320	5.33	.02
chlorpyrifos	IPf	190	PF/SF/G	220	1.16	.003
chlorsulfuron	HXf	6720	CR	60	.01	250
clopyralid	HXf	6720	CR	130	.02	104
copper	FXf	480	CR/PF/SF	2050	4.27	9.6
dalapon	HXf	25	P	50	2.00	100
dicamba	HOf	6720	CR	130	.02	135
dichlofluanid	FXf	15	G	15	1.00	5
diclofop-methyl	HXf	314	CR	60	.19	.35
difenzoquat	HAf	6720	CR	340	.05	694
dinoseb	HXf	314	CR	230	.73	.14
diquat	HXf	450	CR/PF	170	.38	10
diuron	HXs	10	P	48	4.80	20
dodine	FXf	140	PF	110	.79	.6
EPTC	HCs	25	V	110	4.40	19
fenarimol	FXf	160	PF/G	50	.31	.91
flusilazol	FAF	140	PF	30	.21	
fluvalinate	IXf	30	SF	10	.33	.014
glyphosate	HXf	1840	P/PF	2300	1.25	86
mancozeb	FXf	40	G/V	130	3.25	4
MCPA	HFf	8960	P/CR	6240	.70	10
MCPB	HFf	960	F/P/CR	860	.90	10
mecoprop	HFf	6720	CR	4230	.63	230
methabenzthiazuron	HXf	50	V	65	1.30	15.9
metiram	FXf	140	PF	1960	14.00	17
metribuzin	HAf	50	V	20	.40	76
metsulfuron	HAf	360	P	105	.29	
oryzalin	HXs	140	PF	1470	10.50	1
paraquat	HXf	640	G/P/PF	350	.55	32
phorate	IPs	25	V	55	2.20	.01
picloram	HOf	290	P/F	145	.50	20
prochloraz	HAf	6720	CR	2570	.38	3
propiconazole	FXf	6720	CR	710	.11	100
simazine	HAf/s	45	F/G/P	150	3.33	100
triadimefon	FAf	140	PF	800	5.71	25
triallate	HCs	6720	CR	540	.08	1.2
triclopyr	HOf	480	P	1320	2.75	120
trifluralin	HXs	314	CR	50	.16	.1
triforine	FXf	30	SF	20	.67	1000
vinclozolin	FXf	15	G	25	1.67	52.5
zineb	FCf	25	V	10	.40	250

PESTICIDE LOADS : MACKENZIE

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	400	P	1140	2.85	2
2,4,5-T	HFf	1730	P/F	2860	1.65	20
chlormequat	HXf	330	CR	40	.12	
clopyralid	HXf	50	P	14	.03	104
copper	FXf	30	CR	15	.50	9.6
difenzoquat	HAf	330	CR	20	.06	694
dinoseb	HXf	30	CR	20	.67	.14
glyphosate	HXf	1500	P	1080	.72	86
MCPA	HFf	1700	CR/P	1700	1.00	10
MCPB	HFf	430	CR/P	510	1.19	10
mecoprop	HFf	330	CR	210	.64	230
metsulfuron	HAf	10	P	10	1.00	
picloram	HOf	1800	P/F	400	.22	20
prochloraz	HAF	330	CR	130	.39	3
propiconazole	FXf	330	CR	35	.11	100
triallate	HCs	330	CR	30	.09	1.2
triclopyr	HXf	120	P	470	3.92	2.2

Otago - Southland Region

Bruce, Clutha, Lake, Maniototo, Silverpeaks, Southland, Tuapeka, Vincent, Waihemo, Waitaki, Wallace

PESTICIDE LOADS : BRUCE

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	20	F	60	3.00	2
2,4,5-T	HFf	8800	P/F	2000	.23	20
asulam	HCf	10	F	70	7.00	5000
chlormequat	HXf	800	CR	90	.11	
chlorothalonil	FOf	230	V	260	1.13	.02
chlorpropham	HCs	10	V	20	2.00	>5
clopyralid	HXf	800	CR	20	.03	104
copper	FXf	30	CR	15	.50	9.6
demeton-S-methyl	IPf	160	V	20	.13	4.3
diazinon	IPf	80	V	30	.38	.09
dicamba	HOf	800	CR	20	.03	135
dinoseb	HXf	30	CR	20	.67	.14
difenzoquat	HAf	800	CR	40	.05	694
endosulfan	IOf	230	V	60	.26	.0012
EPTC	HCs	160	V	700	4.38	19
fluazifop-butyl	HXf	160	V	20	.13	1.37
glyphosate	HXf	500	F/P	700	1.40	86
mancozeb	FXf	170	V	140	.82	4
MCPA	HFf	2870	CR/P	2680	.93	10
mecoprop	HFf	800	CR	500	.63	230
methabenzthiazuron	HXf	160	V	280	1.75	15.9
metribuzin	HAf	160	V	80	.50	76
metsulfuron	HAf	630	P	30	.05	
phorate	IPs	160	V	350	2.19	.01
picloram	HOf	3070	P/F	500	.06	20
pirimiphos-methyl	IPf	70	V	15	.21	.02
prochloraz	HAF	800	CR	300	.38	3
propiconazole	FXf	800	CR	90	.11	100
triallate	HCs	800	CR	60	.08	1.2
triclopyr	HXf	3070	P	500	.16	2.2
trifluralin	HXs	70	V	30	.43	.1
zineb	FCf	160	V	60	.38	24

PESTICIDE LOADS : STRATHALLAN

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	100	P	720	7.20	2
2,4,5-T	HFf	330	P/F	1800	5.45	20
alachlor	HXs	50	V	90	1.80	1.8
amitrole	HAf	70	PF	250	3.57	50
azinphos methyl	IPf	180	B/PF	470	2.61	.014
azocyclotin	IAf	70	PF	100	1.43	.018
bentazone	HXf	1700	CR	330	.19	
bitertanol	FAf	70	PF	80	1.14	2.5
bromacil	HXf	50	V	70	1.40	75
captan	FXf	70	PF	210	3.00	.3
carbaryl	ICf	105	B/PF/SF	810	7.71	4.34
chloramben	HXs	50	V	100	2.00	4.2
chlormequat	HXf	15000	CR	1700	.11	
chlorothalonil	FOf	650	B/SF/V	380	.58	.02
chlorpyrifos	IPf	85	PF/SF	110	1.29	.003
chlorsulfuron	HXf	15000	CR	135	.01	250
chlorthal-dimethyl	HXs	10	V	20	2.00	
clofentezine	HXf/s	110	B	60	.55	
clopyralid	HXf	15500	CR/P	330	.02	104
copper	FXf	1900	B/CR/PF/SF	1800	.95	9.6
demeton-S-methyl	IPf	560	V	70	.13	4.3
diazinon	IPf	75	V	70	1.07	.09
dicamba	HOf	15000	CR	290	.02	135
dichlofluanid	FXf	20	B	40	2.00	5
diclofop-methyl	HXf	1700	CR	320	.19	.35
difenzoquat	HAf	15000	CR	1200	.08	694
dimethoate	IPf	75	V	15	.20	8.5
dinoseb	HXf	1700	CR	1220	.72	.14
diquat	HXf	1800	CR/PF	200	.11	10
diuron	HXs	50	V	80	1.60	20
dodine	FXf	70	PF	60	.85	.6
endosulfan	IOf	480	V	110	.23	.0012
EPTC	HCs	480	V	2070	4.31	19
fluazifop-butyl	HXf	480	V	60	.12	1.37
flusilazol	FAf	70	PF	16	.23	.25
glyphosate	HXf	3600	P/PF	4800	1.26	86
iprodione	FXf	130	B/SF	65	.50	
linuron	HXs	75	V	60	.80	16
maleic hydrazide	HAf	10	V	20	2.00	1435
mancozeb	FXf	1700	B/V	750	2.27	4
maneb	FXf	50	V	35	.70	.53
MCPA	HFf	18750	CR/P	14700	.79	10
MCPB	HFf	3000	CR/P	4000	1.33	10
mecoprop	HFf	15000	CR	9450	.63	230
metalaxyl	FXf	530	V	70	.13	100
methabenzthiazuron	HXf	1300	V	1500	1.15	15.9
methazole	HXf	50	V	20	.40	4
metiram	FXf	70	PF	400	14.00	17
metribuzin	HAf	1360	V	280	.21	76
metsulfuron	HAf	150	P	30	.20	
oryzalin	HXs	70	PF	400	5.71	1
paraquat	HXf	70	PF	100	1.43	32
parathion methyl	IPf	110	B	130	1.18	2.7
phorate	IPs	480	V	1060	2.21	.01
picloram	HOf	330	P/F	320	.97	20
pirimicarb	ICf	480	V	40	.08	29
prochloraz	HAF	15000	CR	5750	.38	3
prometryne	HAf	75	V	30	.40	2.5
propiconazole	FXf	15000	CR	1600	.11	100
simazine	HAf/s	70	PF	90	1.29	100
triadimefon	FAf	70	PF	400	5.71	25
triallate	HCs	15000	CR	1200	.08	1.2
triclopyr	HXf	300	P	1350	4.50	2.2
trifluralin	HXs	1700	CR	270	.16	.1
zineb	FCf	480	V	180	.38	24

PESTICIDE LOADS : WAIMATE

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	110	P	700	6.73	2
2,4,5-T	HFf	600	P/F	1800	3.00	20
amitrole	HAf	20	PF	70	3.50	50
azinphos methyl	IPf	70	B/PF/SF	150	2.14	.014
azocyclotin	IAf	20	PF	30	1.50	.018
bentazone	HXf	830	CR	160	.19	
bitertanol	FAf	20	PF	20	1.00	2.5
bromacil	HXf	10	V	14	1.40	75
captan	FXf	30	B/PF	100	3.33	.3
carbaryl	ICf	40	B/PF/SF	270	6.75	4.34
chlormequat	HXf	13600	CR	1530	.11	
chlorothalonil	FOf	335	SF/V	255	.76	.02
chlorpyrifos	IPf	30	PF/SF	50	1.67	.003
chlorsulfuron	HXf	13600	CR	120	.01	250
clopyralid	HXf	13700	CR/P	280	.02	104
copper	FXf	860	CR/PF/SF	935	1.09	9.6
demeton-S-methyl	IPf	300	V	40	.13	4.3
diazinon	IPf	10	V	10	1.00	.09
dicamba	HOf	13600	CR	270	.02	135
diclofop-methyl	HXf	830	CR	110	.13	.35
difenzoquat	HAf	13600	CR	680	.05	694
dinoseb	HXf	830	CR	600	.72	.14
diquat	HXf	830	CR	60	.07	10
diuron	HXs	10	V	17	1.70	20
dodine	FXf	20	PF	16	.80	.6
endosulfan	IOf	300	V	70	.23	.0012
EPTC	HCs	300	V	1300	4.33	19
fluazifop-butyl	HXf	300	V	40	.13	1.37
glyphosate	HXf	1760	P/PF	1780	1.01	86
iprodione	FXf	50	B/SF	50	1.00	
mancozeb	FXf	360	B/V	430	1.19	4
MCPA	HFf	15300	CR/P	10500	.68	10
MCPB	HFf	1430	CR/P	1100	.77	10
mecoprop	HFf	13600	CR	8600	.63	230
metalaxyl	FXf	310	V	25	.08	100
methabenzthiazuron	HXf	410	V	590	1.44	15.9
metiram	FXf	20	PF	280	14.00	17
metribuzin	HAf	410	V	180	.44	76
metsulfuron	HAf	30	P	10	.33	
oryzalin	HXs	20	PF	110	5.50	1
paraquat	HXf	20	PF	30	1.50	32
parathion methyl	IPf	30	B	30	1.00	2.7
phorate	IPs	300	V	700	2.33	.01
picloram	HOf	600	P/F	300	.50	20
pirimicarb	ICf	300	V	25	.08	29
prochloraz	HAF	13600	CR	5200	.38	3
propiconazole	FXf	13600	CR	1400	.10	100
simazine	HAf/s	20	PF	25	1.25	100
triallate	HCs	13600	CR	1090	.08	1.2
triclopyr	HXf	140	P	590	4.21	2.2
trifluralin	HXs	850	CR/V	140	.16	.1
zineb	FCf	300	V	110	.37	24

PESTICIDE LOADS : MALVERN

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	600	P	860	1.43	2
2,4,5-T	HFf	30	F	150	5.00	20
amitrole	HAf	20	P	80	1.33	50
azinphos methyl	IPf	20	PF/SF	50	2.50	.014
azocyclotin	IAf	10	PF	14	1.40	.018
bentazone	HXf	3130	CR	600	.19	
bitertanol	FAf	10	PF	10	1.00	2.5
bromacil	HXf	10	P	25	2.50	75
captan	FXf	10	PF	30	3.00	.3
carbaryl	ICf	20	PF/SF	150	9.08	4.34
chlormequat	HXf	11860	CR	1340	.11	
chlorothalonil	FXf	10	SF	100	10.00	.02
chlorpyrifos	IPf	20	PF/SF	45	2.25	.003
chlorsulfuron	HXf	11860	CR	110	.01	250
clopyralid	HXf	11860	CR	250	.02	104
copper	FXf	3150	CR/PF/SF	2050	.65	9.6
dalapon	HXf	10	P	40	4.00	100
dicamba	HOf	11860	CR	240	.02	135
diclofop-methyl	HXf	3130	CR	590	.19	.35
difenzoquat	HAf	11860	CR	590	.05	694
dinoseb	HXf	3130	CR	2250	.72	.14
diquat	HXf	3500	CR/PF/V	250	.07	10
diuron	HXs	10	P	50	5.00	20
dodine	FXf	10	PF	8	.80	.6
glyphosate	HXf	5010	P/PF	2750	.55	86
lindane	IOf	10	SF	15	1.50	.025
mancozeb	FXf	374	V	4040	10.80	4
MCPA	HFf	15360	CR/P	9840	.64	10
MCPB	HFf	4330	CR/P	2280	.53	10
mecoprop	HFf	11860	CR	7470	.63	230
methabenzthiazuron	HXf	110	V	85	.77	15.9
metiram	FXf	10	PF	140	14.00	17
metribuzin	HAf	490	V	150	.31	76
metsulfuron	HAf	500	P	30	.06	
oryzalin	HXs	10	PF	60	6.00	1
paraquat	HXf	385	PF/V	50	.13	32
permethrin	IXf	374	V	190	.51	.009
picloram	HOf	710	F/P	260	.37	20
prochloraz	HAf	11860	CR	4540	.38	3
propiconazole	FXf	11860	CR	1260	.11	100
simazine	HAf/s	10	P	70	7.00	100
triallate	HCs	11860	CR	100	.01	1.2
triclopyr	HOf	470	P	1300	2.77	120
trifluralin	HXs	3130	CR	500	.16	.1

PESTICIDE LOADS : RANGIORA-EYRE-OXFORD

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	200	P	220	1.10	2
2,4,5-T	HFf	350	F/P	1000	2.86	20
alachlor	HXs	130	V	225	1.73	1.8
amitrole	HAf	50	PF	180	3.60	50
azinphos methyl	IPf	120	PF/SF	270	2.25	.014
azocyclotin	IAf	120	PF/SF	100	.83	.018
bentazone	HXf	920	CR	180	.19	
bitertanol	FAf	50	PF	55	1.10	2.5
bromacil	HXf	40	V	60	1.50	75
captan	FXf	50	PF	150	3.00	.3
carbaryl	ICf	120	PF/SF	840	7.00	4.34
chloramben	HXf	130	V	240	1.85	4.2
chlorbufam	HCs	60	V	30	.50	
chloridazon	HXf/s	60	V	30	.50	
chlormequat	HXf	9724	CR	1100	.11	
chlorothalonil	FXf	470	SF/V	1000	2.13	.02
chlorpropham	HCs	60	V	40	.67	>5
chlorpyrifos	IPf	120	PF/SF	280	2.33	.003
chlorsulfuron	HXf	9724	CR	90	.01	250
chlorthal-dimethyl	HXs	60	V	120	2.00	
clopyralid	HXf	9724	CR	200	.02	104
copper	FXf	1040	CR/PF/SF	3820	3.67	9.6
demeton-S-methyl	IPf	134	V	20	.15	4.3
diazinon	IPf	220	V	80	.36	.09
dicamba	HOf	9724	CR	200	.02	135
dichlofluanid	FXf	60	V	10	.17	5
diclofop-methyl	HXf	920	CR	170	.18	.35
difenzoquat	HAf	9724	CR	500	.05	694
dimethirimol	FXf	130	V	15	.11	28
dimethoate	IPf	46	V	10	.22	8.5
dinoseb	HXf	920	CR	660	.72	.14
diquat	HXf	970	CR/PF	100	.10	10
diuron	HXs	40	V	65	1.30	20
dodine	FXf	50	PF	40	.80	.6
endosulfan	IOf	230	V	55	.24	.002
EPTC	HCs	134	V	580	4.33	19
fluazifop-butyl	HXf	134	V	20	.15	1.37
fluvalinate	IXf	70	SF	20	.29	.014
glyphosate	HXf	650	P/PF	1500	2.30	86
ioxynil	HXf	60	V	30	.50	4
lindane	IOf	70	SF	105	1.50	.025
linuron	HXs	50	V	35	.70	16
maleic hydrazide	HAf	60	V	100	1.67	1435
mancozeb	FXf	280	V	535	1.91	4
maneb	FXf	130	V	90	.69	.53
MCPA	HFf	10420	CR/P	6860	.66	10
MCPB	HFf	1700	CR/P	860	.51	10
mecoprop	HFf	9724	CR	6130	.63	230
metalaxyl	FXf	510	V	60	.12	100
methabenzthiazuron	HXf	310	V	440	1.42	15.9
methazole	HXs	190	V	60	.32	4
metiram	FXf	50	PF	700	14.00	17
metribuzin	HAf	300	V	100	.33	76
oryzalin	HXs	50	PF	280	5.60	1
paraquat	HXf	250	P/PF	130	.52	32
pendimethalin	HXf/s	60	V	30	.50	.4
phorate	IPS	134	V	300	2.24	.01
picloram	HOf	340	F/P	250	.74	20
pirimicarb	ICf	134	V	10	.07	29
pirimiphos-methyl	IPf	40	V	10	.25	.02
prochloraz	HAf	9724	CR	3720	.38	3
prometryne	HAf	50	V	20	.40	2.5
propachlor	HXs	60	V	80	1.33	.17
propiconazole	FXf	9724	CR	1030	.11	100
simazine	HAf/s	50	P/F	60	1.17	100
triadimefon	FAf	50	PF	20	.40	25
triallate	HCs	9724	CR	780	.01	1.2
triclopyr	HOf	150	P	350	2.33	120
trifluralin	HXs	960	CR/V	170	.18	.1
triforine	FXf	70	SF	40	.57	1000
vinclozolin	FXf	60	V	10	.17	52.5
zineb	FCf	134	V	10	.17	24

PESTICIDE LOADS : CLUTHA

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4,5-T	HFf	19000	F/P	2300	1.21	20
bentazone	HXf	110	CR	20	.19	
chlormequat	HXf	4830	CR	550	.11	
chlorsulfuron	HXf	4830	CR	40	.01	250
clopyralid	HXf	4830	CR	100	.02	104
copper	FXf	120	CR/F	75	.63	9.6
dicamba	HOf	4830	CR	100	.02	135
diclofop-methyl	HXf	100	CR	20	.19	.35
difenzoquat	HAf	4830	CR	240	.05	694
dinoseb	HXf	100	CR	80	.72	.14
glyphosate	HXf	640	P	690	1.08	86
MCPA	HFf	4830	CR	3000	.62	10
MCPB	HFf	100	CR	30	.27	10
mecoprop	HFf	4830	CR	3040	.63	230
metsulfuron	HAf	380	P	20	.05	
picloram	HOf	12700	P	250	.02	20
prochloraz	HAF	4830	CR	1850	.38	3
propiconazole	FXf	4830	CR	550	.11	100
triallate	HCs	4830	CR	390	.08	1.2
triclopyr	HXf	6400	P	1000	.16	2.2
trifluralin	HXs	110	CR	20	.19	.1

PESTICIDE LOADS : LAKE

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4,-D(all forms)	HFf	100	P	255	2.55	2
2,4,5-T	HFf	10	F	20	2.00	20
amitrole	HAf	10	P/F	40	4.00	50
azinphos-methyl	IPf	10	PF	40	4.00	.014
azocyclotin	IAf	10	PF	14	1.40	.018
bitertanol	FAf	10	PF	10	1.00	2.5
captan	FXf	10	PF	30	3.00	.3
carbaryl	ICf	10	PF	100	10.00	4.34
chlormequat	HXf	430	CR	50	.12	
chlorsulfuron	HXf	240	P	5	.02	250
copper	FXf	35	CR/F/PF	60	1.71	9.6
difenzoquat	HAf	430	CR	215	.05	694
dinoseb	HXf	15	CR	10	.67	.14
glyphosate	HXf	1710	P/PF	2000	1.17	86
MCPA	HFf	2630	CR/P	2530	.96	10
MCPB	HFf	810	P	1300	1.60	10
mecoprop	HFf	1800	CR/P	3420	1.90	230
metiram	FXf	10	PF	1400	14.00	17
metsulfuron	HAf	150	P	50	.33	
oryzalin	HXs	10	PF	60	6.00	1
picloram	HOf	450	P	140	.32	20
prochloraz	HAF	430	CR	160	.38	3
propiconazole	FXf	430	CR	45	.11	100
simazine	HAf	10	PF	15	1.50	100
terbuthylazine	HAf	2000	P	1520	.76	4.6
triallate	HCs	430	CR	340	.08	1.2
triclopyr	HXf	1540	P	3270	2.12	2.2
trifluralin	HXs	360	P	290	.81	.1

PESTICIDE LOADS : MANIOTOTO

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4,5-T	HFf	160	F/P	500	3.13	20
amitrole	HAf	40	P	40	1.00	50
ammonium thiocyanate	XXf	40	P	10	.25	10
bentazone	HXf	70	CR	15	.21	
chlormequat	HXf	1450	CR	160	.11	
chlorsulfuron	HXf	1450	CR	10	.01	250
clopyralid	HXf	2050	CR/P	35	.02	104
copper	FXf	80	CR/F	50	.63	9.6
dicamba	HOf	1450	CR	30	.02	135
diclofop-methyl	HXf	70	CR	15	.21	.35
difenzoquat	HAf	1450	CR	70	.05	694
dinoseb	HXf	70	CR	50	.72	.14
glyphosate	HXf	100	P	90	.90	86
MCPA	HFf	1450	CR	880	.61	10
MCPB	HFf	670	CR/P	170	.25	10
mecoprop	HFf	1450	CR	910	.63	230
metsulfuron	HAf	80	P	10	.13	
picloram	HOf	290	P	220	.76	20
prochloraz	HAF	1450	CR	560	.38	3
propiconazole	FXf	1450	CR	150	.11	100
terbuthylazine	HAf	40	P	70	1.75	4.6
triallate	HCs	1450	CR	120	.08	1.2
triclopyr	HXf	100	P	600	6.00	2.2
trifluralin	HXs	70	CR	10	.14	.1

PESTICIDE LOADS : SILVERPEAKS (incl. DUNEDIN CITY)

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	10	F	25	2.50	2
2,4,5-T	HFf	23000	P/F	9300	.40	20
amitrole	HAf	35	PF	126	3.60	50
azinphos methyl	IPf	35	B/PF	130	3.71	.014
azocyclotin	IAf	35	PF	50	1.43	.018
benomyl	FCf	25	V	10	.40	.17
bitertanol	FAf	35	PF	40	1.14	2.5
captan	FXf	35	PF	105	3.00	.3
carbaryl	ICf	45	B/PF	370	8.22	4.34
chlormequat	HXf	680	CR	80	.12	
chlorothalonil	FOf	300	V	490	1.63	.02
chlorpropham	HCs	25	V	30	1.20	>5
chlorpyrifos	IPf	35	PF	30	.86	.003
clopyralid	HXf	680	CR	15	.02	104
copper	FXf	70	F/PF	200	2.86	9.6
demeton-S-methyl	IPf	130	V	16	.12	4.3
diazinon	IPf	165	V	70	.42	.09
dicamba	HOf	680	CR	15	.02	135
dichlofluanid	FXf	10	B	20	2.00	5
difenzoquat	HAf	680	CR	30	.04	694
diquat	HXf	35	PF	25	.72	10
dodine	FXf	35	PF	30	.86	.6
endosulfan	IOf	270	V	65	.24	.0012
EPTC	HCs	130	V	560	4.31	19
fluazifop-butyl	HXf	130	V	16	.12	1.37
glyphosate	HXf	2000	P/PF	4000	2.00	86
hexazinone	HAf	10	F	25	2.50	300
linuron	HXs	25	V	20	.40	16
mancozeb	FXf	200	B/V	420	2.10	4
MCPA	HFf	4300	CR/P	3300	.77	10
mecoprop	HFf	680	CR	430	.63	230
methabenzthiazuron	HXf	130	V	230	1.77	15.9
metiram	FXf	35	PF	490	14.00	17
metribuzin	HAf	130	V	70	.54	76
metsulfuron	HAf	6000	P	200	.03	
oryzalin	HXs	35	PF	200	5.71	1
paraquat	HXf	35	PF	50	1.44	32
parathion methyl	IPf	40	B	45	1.13	2.7
phorate	IPs	130	V	290	2.23	.01
picloram	HOf	23000	P/F	2300	.10	20
pirimiphos-methyl	IPf	140	V	30	.21	.02
prochloraz	HAF	680	CR	260	.38	3
prometryne	HAf	25	V	10	.40	2.5
propiconazole	FXf	680	CR	70	.10	100
simazine	HAf/s	35	PF	45	1.29	100
triadimefon	FAf	50	PF	20	.40	25
triallate	HCs	680	CR	55	.08	1.2
zineb	FCf	150	V	70	.47	24

PESTICIDE LOADS : SOUTHLAND

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	210	F/P	550	2.62	2
2,4,5-T	HFf	15000	F/P	5600	.37	20
amitrole	HAf	130	P	520	4.00	50
azinphos methyl	IPf	140	B/SF	270	1.93	.014
azocyclotin	IAf	11	SF	10	.91	.018
benomyl	FCf	14320	CR/SF	3590	.25	.17
bitertanol	FAf	10	SF	15	1.50	2.5
bromacil	HXf	130	P/V	390	3.00	75
carbaryl	ICf	10	SF	50	5.00	4.34
chlormequat	HXf	14310	CR	4840	.34	
chlorothalonil	FXf	420	B/SF/V	250	.60	.02
chlorpyrifos	IPf	130	B	10	.08	.003
chlorsulfuron	HXf	14300	CR	130	.01	250
clopyralid	HXf	320	P	100	.31	104
copper	FXf	740	B/PF/SF	620	.84	9.6
cyanazine	HAs	600	PF	900	1.50	10
demeton-S-methyl	IPf	320	SF/V	45	.14	4.3
diazinon	IPf	220	V	80	.05	.09
dichlorvos	IPf	130	B	20	.15	.5
diquat	HXf	200	P	60	.30	10
diuron	HXs	130	P/V	780	6.00	20
endosulfan	IOf	410	B/V	100	.24	.002
EPTC	HCs	240	V	1030	4.29	19
fluazifop-butyl	HXf	240	V	30	.13	1.37
glyphosate	HXf	2600	P/F	2900	1.12	86
hexazinone	HAf	10	F	40	4.00	300
iprodione	FXf	140	B/SF	45	.32	
linuron	HXs	30	V	20	.67	16
mancozeb	FXf	400	B/V	1140	2.85	4
MCPA	HFf	21310	CR/P	10640	.50	10
MCPB	HFf	1400	P	2240	1.60	10
metalaxyl	FXf	240	V	14	.06	100
methabenzthiazuron	HXf	240	V	420	1.75	15.9
metribuzin	HAf	870	PF/V	340	.39	76
paraquat	HXf	5000	P	2500	.50	32
parathion methyl	IPf	200	B/V	190	.95	2.7
phorate	IPS	390	P/V	670	1.72	.01
picloram	HOf	8900	F/P	650	.07	20
pirimicarb	ICf	370	B/V	50	.14	29
pirimiphos-methyl	IPf	50	SF/V	40	.80	.02
prometryne	HAf	30	V	15	.50	2.5
propiconazole	FXf	14300	CR	2990	.21	100
terbuthylazine	HAf	3700	P	2050	.76	4.6
triadimenol	FAf	14300	CR	430	.03	23.5
triclopyr	HOf	8700	P	4870	.56	120
trifluralin	HXs	40	V	20	.50	.1
triforine	FXf	10	SF	20	2.00	1000
vinclozolin	FXf	13	SF/V	20	1.54	52.5
zineb	FCf	240	V	90	.38	24

PESTICIDE LOADS : TUAPEKA

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	10	F/P	40	4.00	2
2,4,5-T	HFf	30000	P/F	3800	.13	20
amitrole	HAf	360	PF	1300	3.60	50
azinphos methyl	IPf	730	PF/SF/V	2460	3.37	.014
azocyclotin	IAf	710	PF/SF	720	1.01	.018
benomyl	FCf	350	SF	310	.89	.17
bentazone	HXf	70	CR	15	.21	
bitertanol	FAf	560	PF/SF	700	1.25	2.5
captan	FXf	360	PF	1080	3.00	.3
carbaryl	ICf	720	PF/SF/V	5240	7.28	4.34
chlormequat	HXf	1400	CR	160	.11	
chlorothalonil	FOf	350	SF	1560	4.46	.02
chlorpyrifos	IPf	510	PF/SF	790	1.55	.003
chlorsulfuron	HXf	1400	CR	10	.01	250
clopyralid	HXf	1400	CR	30	.02	104
copper	FXf	780	CR/PF/SF	13600	17.43	9.6
demeton-S-methyl	IPf	200	SF	1130	5.65	4.3
dicamba	HOf	1400	CR	30	.02	135
dichlofluanid	FXf	20	B	20	1.00	5
diclofop-methyl	HXf	70	CR	15	.21	.35
difenzoquat	HAf	1400	CR	70	.05	694
dinoseb	HXf	70	CR	50	.72	.14
diquat	HXf	360	PF	260	.72	10
dodine	FXf	360	PF	290	.80	.6
EPTC	HCs	10	V	20	2.00	19
fenarimol	FXf	360	PF	30	.08	.91
flusilazol	FAf	360	PF	80	.23	
glyphosate	HXf	1360	F/P/PF	2660	1.96	86
iprodione	FXf	370	SF/V	740	2.00	
lindane	IOf	150	SF	225	1.50	.025
mancozeb	FXf	20	B	80	4.00	4
MCPA	HFf	11400	CR/P	2000	.18	10
MCPB	HFf	70	CR	20	.28	10
mecoprop	HFf	1400	CR	880	.63	230
methabenzthiazuron	HXf	10	V	20	2.00	15.9
metiram	FXf	360	PF	5040	14.00	17
metsulfuron	HAf	600	P	50	.08	
oryzalin	HXs	360	PF	2030	5.64	1
paraquat	HXf	360	PF	520	1.44	32
permethrin	IXf	200	SF	30	.15	.009
phorate	IPs	20	V	20	2.00	.01
picloram	HOf	20000	P/F	500	.03	20
pirimiphos-methyl	IPf	200	SF	570	2.85	.02
prochloraz	HAF	1400	CR	540	.38	3
propiconazole	FXf	1400	CR	160	.11	100
simazine	HAf/s	360	PF	450	1.25	100
triallate	HCs	1400	CR	100	.07	1.2
triadimefon	FAf	360	PF	150	.42	25
triclopyr	HXf	10000	P	1500	.15	2.2
trifluralin	HXs	70	CR	10	.16	.1
triforine	FXf	350	SF	430	1.23	1000
vinclozolin	FXf	200	SF	390	1.95	52.5

PESTICIDE LOADS : VINCENT

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	340	P	100	.29	2
2,4,5-T	HFf	600	P	640	1.07	20
amitrole	HAf	270	P/PF	1000	3.70	50
azinphos methyl	IPf	830	PF/SF	2310	2.78	.014
azocyclotin	IAf	830	PF/SF	605	.73	.018
benomyl	FCf	640	SF	480	.75	.17
bentazone	HXf	50	CR	10	.20	
bitertanol	FAf	450	PF/SF	605	1.34	2.5
bromacil	HXf	80	P	240	3.00	75
captan	FXf	190	PF	570	3.00	.3
carbaryl	ICf	830	PF/SF	4890	5.89	4.34
chlormequat	HXf	1600	CR	130	.08	
chlorothalonil	FOf	380	SF	3930	10.34	.02
chlorpyrifos	IPf	570	PF/SF	1430	2.51	.003
chlorsulfuron	HXf	1600	CR	15	.01	250
clopyralid	HXf	1800	CR/P	90	.05	104
copper	FXf	880	CR/PF/SF	25100	28.52	9.6
demeton-S-methyl	IPf	260	SF	150	.58	4.3
dicamba	HOf	1600	CR	30	.02	135
diclofop-methyl	HXf	50	CR	10	.20	.35
difenzoquat	HAf	1600	CR	80	.05	694
dinoseb	HXf	50	CR	36	.72	.14
diquat	HXf	220	P/PF	180	.82	10
diuron	HXs	80	P	480	6.00	20
dodine	FXf	190	PF	150	.79	.6
fenarimol	FXf	190	PF	15	.08	.91
flusilazol	FAf	190	PF	40	.21	
fluvalinate	IXf	640	SF	220	.34	.014
glyphosate	HXf	3190	P/PF	2980	.93	86
iprodione	FXf	640	SF	1380	2.16	
lindane	IOf	380	SF	570	1.50	.025
MCPA	HFf	2900	CR/P	2470	.85	10
MCPB	HFf	800	CR/P	1210	1.51	10
mecoprop	HFf	1600	CR	1000	.63	230
metiram	FXf	190	PF	2660	14.00	17
metsulfuron	HAf	360	P	150	.42	
oryzalin	HXs	190	PF	1070	5.63	1
paraquat	HXf	3400	P/PF	1900	.56	32
permethrin	IXf	260	SF	40	.15	.009
phorate	IPs	80	P	80	1.00	.01
picloram	HOf	175	P	670	.26	20
pirimiphos-methyl	IPf	260	SF	740	2.85	.02
prochloraz	HAF	1600	CR	610	.38	3
propiconazole	FXf	1600	CR	170	.11	100
simazine	HAf/s	190	PF	240	1.26	100
terbuthylazine	HAf	2300	P	1750	.76	4.6
triallate	HCs	1600	CR	130	.08	1.2
triadimefon	FAf	190	PF	80	.42	25
triforine	FXf	380	SF	220	.58	1000
vinclozolin	FXf	260	SF	510	1.96	52.5

PESTICIDE LOADS : WAIHEMO

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4,5-T	HFf	25	P	80	3.20	20
amitrole	HAf	10	P	10	1.00	50
chlormequat	HXf	470	CR	50	.11	
clopyralid	HXf	470	CR	10	.02	104
dicamba	HOf	470	CR	10	.02	135
difenzoquat	HAf	470	CR	25	.05	694
EPTC	HCs	12	V	50	4.17	19
glyphosate	HXf	150	P	140	1.27	86
MCPA	HFf	1800	CR/P	400	.22	10
mecoprop	HFf	470	CR	300	.63	230
methabenzthiazuron	HXf	12	V	20	1.67	15.9
metsulfuron	HAf	165	P	10	.06	
phorate	IPs	12	V	25	2.08	.009
picloram	HOf	610	P	170	.28	20
prochloraz	HAF	470	CR	180	.38	3
propiconazole	FXf	470	CR	50	.11	100
terbuthylazine	HAf	10	P	20	2.00	4.6
triallate	HCs	470	CR	40	.09	1.2
triclopyr	HXf	15	P	100	6.67	2.2

PESTICIDE LOADS : WAITAKI

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	400	P	1060	2.65	2
2,4,5-T	HFf	335	P/F	550	1.64	20
acephate	IPf	65	V	10	.15	1000
amitrole	HAf	75	P/PF	175	2.33	50
ammonium thiocyanate	XXf	40	P	10	.25	10
azinphos methyl	IPf	120	B/PF/SF	315	2.62	.014
azocyclotin	IAf	70	PF/SF	50	.71	.018
benomyl	FCf	120	SF/V	80	.67	.17
bentazone	HXf	1100	CR	210	.19	
bitertanol	FAf	45	PF	60	1.33	2.5
captan	FXf	15	PF	45	3.00	.3
carbaryl	ICf	100	B/PF/SF	425	4.25	4.34
chlormequat	HXf	10300	CR	1100	.11	
chlorothalonil	FOf	285	SF/V	400	1.40	.02
chlorpropham	HCs	65	V	70	1.08	>5
chlorpyrifos	IPf	25	SF	85	3.40	.003
chlorsulfuron	HXf	10300	CR	90	.01	250
clopyralid	HXf	10700	CR/P	240	.02	104
copper	FXf	1200	CR/F/PF/SF	2640	2.20	9.6
demeton-S-methyl	IPf	180	SF/V	40	.22	4.3
diazinon	IPf	75	V	90	1.20	.09
dicamba	HOf	10300	CR	200	.02	135
dichlofluanid	FXf	10	B	20	2.00	5
diclofop-methyl	HXf	1100	CR	210	.19	.35
difenzoquat	HAf	10300	CR	520	.05	694
dinoseb	HXf	1100	CR	790	.72	.14
diquat	HXf	1100	CR/PF	100	.09	10
endosulfan	IOf	200	V	80	.40	.0012
EPTC	HCs	150	V	650	4.33	19
fluazifop-butyl	HXf	150	V	20	.13	1.37
glyphosate	HXf	600	F/P/PF	540	.90	86
iprodione	FXf	100	B/SF	140	1.40	
lindane	IOf	25	SF	40	1.60	.025
linuron	HXs	30	V	20	.67	16
mancozeb	FXf	230	B/V	480	2.09	4
MCPA	HFf	11800	CR/P	8000	.68	10
MCPB	HFf	1800	CR/P	750	.42	10
mecoprop	HFf	10300	CR	6500	.63	230
methabenzthiazuron	HXf	200	V	300	1.50	15.9
metiram	FXf	15	PF	210	14.00	17
metribuzin	HAf	150	V	80	.53	76
metsulfuron	HAf	180	P	40	.22	
oryzalin	HXs	15	PF	80	5.33	1
paraquat	HXf	270	P/PF	110	.36	32
parathion methyl	IPf	50	B	50	1.00	2.7
phorate	IPs	240	P/V	420	1.75	.01
picloram	HOf	480	P/F	220	.46	20
prochloraz	HAF	10300	CR	3940	.38	3
prometryne	HAF	30	V	10	.33	2.5
propiconazole	FXf	10300	CR	1100	.11	100
propyzamide	HXs	65	V	25	.38	
simazine	HAf/s	15	PF	20	1.33	100
triallate	HCs	10300	CR	820	.05	1.2
triclopyr	HXf	100	P	450	4.50	2.2
trifluralin	HXs	1300	CR/V	400	.31	.1
triforine	FXf	60	SF	70	1.17	1000
vinclozolin	FXf	100	SF/V	80	.80	52.5
zineb	FCf	215	V	100	.47	24

PESTICIDE LOADS : WALLACE

Active ingredient	Code	Area (ha)	Land use code	Mass (kg)	Rate (kg/ha.yr)	LC50 (mg/l)
2,4-D(all forms)	HFf	40	F/P	110	2.75	2
2,4,5-T	HFf	60	F/P	220	3.67	20
bentazone	HXf	280	CR	50	.18	
chlormequat	HXf	5940	CR	670	.11	
chlorothalonil	FXf	10	V	30	3.00	.02
chlorsulfuron	HXf	5940	CR	50	.01	250
clopyralid	HXf	5940	CR	120	.02	104
copper	FXf	330	CR/F	250	.76	9.6
dicamba	HOf	7000	CR/P	200	.03	135
diclofop-methyl	HXf	280	CR	50	.18	.35
difenzoquat	HAf	5940	CR	300	.05	694
dinoseb	HXf	280	CR	200	.72	.14
diquat	HXf	280	CR	20	.07	10
EPTC	HCs	40	V	170	4.25	19
glyphosate	HXf	1000	P/F	1850	1.85	86
hexazinone	HAf	10	F	40	4.00	300
MCPA	HFf	9540	CR/P	7000	.73	10
MCPB	HFf	1150	CR/P	1480	1.29	10
mecoprop	HFf	7000	CR/P	6400	.91	230
methabenzthiazuron	HXf	40	V	70	1.75	15.9
metribuzin	HAf	40	V	20	.50	76
phorate	IPS	40	V	90	2.25	.01
picloram	HOf	320	F/P	140	.44	20
prochloraz	HAf	5940	CR	2260	.38	3
propiconazole	FXf	5940	CR	670	.11	100
triallate	HCs	5940	CR	475	.08	1.2
triclopyr	HOf	1300	P	2760	2.12	120
trifluralin	HXs	580	CR/P	280	.48	.1

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