2010

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

MEMORANDUM

SUBJECT: Chlorpyrifos Aerial Application Information

FROM: Arthur Grube, Economist
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Biological and Economic Analysis Division (7503P)

THRU: Timothy Kiely, Chief
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Biological and Economic Analysis Division (7503P)

TO: Jeff Dawson, Chemist/Risk Assessor
Registration Action Branch 7
Health Effects Division (7509P)

Product Review Panel: March 6, 2012

Summary

This memorandum is a correction to the memorandum of March 14, 2012. The only change is the addition of aerial application information for soybeans which was omitted from the previous memorandum.

This memorandum provides estimates of percent crop treated, application rates and maximum observed application rates for aerial applications for agricultural crops with chlorpyrifos usage. This information covers the use of chlorpyrifos on all crops for which data are available. There may be other agricultural crops with aerial applications of chlorpyrifos.

Introduction

As part of the risk assessment for chlorpyrifos, OPP/HED and EFED are conducting an assessment of possible human exposure via spray drift. In order to refine estimates of possible chlorpyrifos exposure, and to develop risk mitigation options, the risk assessment and pesticide re-evaluation divisions require information on the use of chlorpyrifos: for all application methods including percent of the crop treated, average application rates, average number of applications, maximum application rates and equivalent information for aerial applications. For the chlorpyrifos analysis it was determined by HED that residues of concern from spray drift would be most likely from aerial and airblast applications. This memo covers only applications made by air. Information for all chlorpyrifos applications has been provided in earlier memos.

Data and Methodology

The numbers presented in Table 1 are based upon information obtained from a private marketing research database that stores results of annual market surveys that cover the continental United States and the majority of crops produced in the United States and collects detailed information on pesticide usage including: the amount used, the number of acres treated, and the application method. The surveys utilize sampling procedures that result in statistically valid results. However, the precision of the estimates depends on the sample size, which may be low for some crops and for crops with limited use of chlorpyrifos. Data from 2006 to 2010 was used in this analysis, and the results presented are an average of the five years of data. The percent of each crop treated with chlorpyrifos was obtained from a spreadsheet provided by the proprietary data source. The rate range information for each crop was obtained by querying the proprietary source database.

The application method rate range data was summed over the five years for each rate range in which applications were reported and the percentage of applications in each rate range was calculated for all application methods grouped together and for aerial applications separately. The approximate 90^{th} percentile observed rate for aerial applications was retained and is reported the last column in the table below. For most crops the 90^{th} percentile and the maximum observed rate are the same. For those crops in which the maximum observed rate was higher than the 90^{th} percentile rate the 90^{th} percentile rate is reported in parentheses. The maximum label rates may be higher than these maximum observed rates and in that case it is possible that higher rates might have been used. However the rates reported in Table 1 were the highest rates observed over a five year period so a significant number of applications at higher rates are unlikely.

The percentage of aerial applications as a percentage of all applications and the approximate percentage of the crop treated by air was calculated. This calculation assumes that the average number of applications was the same for aerial applications as for all applications. Since the average number of applications for most crops for all application methods is either one application or just above one application this is probably not an unrealistic assumption.

Results

Results are shown in Table 1. For most crops only a small percentage of chlorpyrifos applications are made by air and there are no crops for which more than 10 percent of the crop receives aerial applications of chlorpyrifos. Nine percent of asparagus acres were estimated to have been treated by air. An estimated five percent of sunflowers and sweet corn was treated with aerial applications of chlorpyrifos and for all other crops less than five percent of planted acres received aerial applications of chlorpyrifos.

Table 1: Aerial Applications of Chlorpyrifos to Agricultural Crops 2006-2010

Crop	% of Total Applications Applied by Air	% of Total Crop Acreage Treated by Air	Average Lbs AI Year Applied by Air	Average Application Rate for Aerial Applications	Maximum Rate Observed for Aerial Applications (rounded up) When 90th percentile is lower it is shown in parentheses
Alfalfa	31	1	130,000	0.5	1.0
Almonds	14	3	60,000	1.9	2.0
Apples	5	3	15,000	1.0	2.0
Asparagus	24	9	4,000	1.0	1.0
Beans (Snap	<1	<1	<100	0.8	0.8
Broccoli	<1	<1	<100	1.0	1.0
Cabbage	<1	<1	<100	1.0	1.0
Cauliflower	1	1	200	0.9	1.0
Cherries	2	1	700	0.9	1.0
Corn	2	<1	20,000	0.8	2.0
Cotton	8	<1	40,000	0.8	1.0
Cucumbers	.	None			
Dry Beans	17	<1	2,000	0.5	1.0
Grapefruit	2	<1	700	1.5	1.5
Grapes, Raisin	.	None			
Grapes, Table	<1	<1	150	1.0	1.0
Grapes, Wine	.	None			
Hazelnuts	32	4	1,000	1.0	2.0
Lemons	4	2	3,000	2.7	5.7
Onions	<1	<1	<100	1.0	1.0
Oranges	7	2	30,000	1.8	(2.5) 6.0
Peaches	5	1	2,000	1.1	3.0
Peanuts	2	<1	2,500	1.4	1.8
Pears	3	1	800	2.0	2.0
Peas (Fresh)	.	None			
Pecans	15	4	40,000	0.9	(1.5) 2.0
Peppers	7	<1	<100	0.3	0.3
Plums/Prunes	.	None			
Potatoes	8	<1	200	1.0	1.0
Pumpkins	.	None			
Sorghum	18	<1	2,000	0.5	0.8
Soybeans	16	1	600,000	0.4	(0.8) 1.0
Squash	1	<1	<100	3.0	3.0
Strawberries	.	None			
Sugar Beets	13	1	10,000	0.6	1.2
Sunflowers	80	5	50,000	0.5	(0.7) 1.0

Sweet Corn	43	5	30,000	0.6	2.0
Tobacco	.	None			
Walnuts	6	3	25,000	1.9	(2.0) 3.0
Wheat, Spring	38	1	50,000	0.4	(0.5) 1.0
Wheat, Winter	30	1	110,000	0.4	(0.5) 1.0

Apricots, cantaloupes, lettuce, pistachios and watermelons are excluded from this table because there was very little use of chlorpyrifos on those crops and none of that was applied by air. For beans (snap), broccoli, cabbage cauliflower, cherries, dry beans, grapefruit, lemons, onions, peaches, peanuts, pears, peppers, potatoes, sorghum, and squash, there were very few observations for aerial applications so for those crops the numbers cannot be considered robust.

Data Limitations

Sample sizes for many of these chlorpyrifos crop aerial application combinations are quite small and therefore the confidence limits for acre treatments, acres treated and pounds of active ingredient may be quite large. For chemicals used on only a small percentage of the crop the sampling procedure may lead to no use being reported. In other cases use may be overestimated. There are also some crops for which pesticide use data is not available and these crops are therefore not included in this analysis. These crops include; brussels sprouts, collards, cranberries, figs, kale, kohlrabi, kumquats, limes, nectarines, radishes, rutabagas, sweet potatoes, tangelos, tangerines, and turnips.

References

Proprietary data, 2006-2010.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

APR 13 2012

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

MEMORANDUM

SUBJECT: Information on Ground Applications of Chlorpyrifos

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TO: Jeff Dawson, Chemist/Risk Assessor
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Health Effects Division (7509P)

Product Review Panel: April 4, 2012

Summary

This memorandum provides estimates of percent crop treated, application rates and maximum observed application rates for ground applications for agricultural crops with chlorpyrifos usage. Where possible, seed treatments are excluded from the data and at-plant incorporated ground applications are reported in a separate table since spray drift from incorporated applications is likely to be minimal. This information covers the use of chlorpyrifos on all crops for which data are available in the proprietary market survey database that is used by BEAD. There may be other agricultural crops with ground applications of chlorpyrifos, which are not covered by this survey database.

Introduction

As part of the risk assessment for chlorpyrifos, OPP/HED and EFED are conducting an assessment of possible human exposure via spray drift. In order to refine estimates of possible chlorpyrifos exposure and to develop risk mitigation options, OPP requires information on the use of chlorpyrifos for certain application methods including percent of the crop treated, average application rates, maximum application rates, and average number of applications. For the chlorpyrifos analysis it was determined by HED that residues of concern from spray drift would be most likely from aerial and airblast applications. This memo covers only applications made by ground which would include airblast and any other ground applications. Information for total chlorpyrifos applications (combined across all application methods), as well as for aerial applications alone, has been provided in separate memoranda.

Data and Methodology

Information for this analysis is obtained from results of annual market surveys of growers conducted by a private marketing research firm. The surveys cover the continental United States and the majority of crops produced in the United States and collect detailed information on pesticide usage including the amount used, the number of acres treated, and the application method. The surveys utilize sampling procedures that result in statistically valid results. However, the precision of the estimates depends on the sample size, which may be low for some crops and for crops with limited use of chlorpyrifos. Data from 2006 to 2010 was used in this analysis, and the results presented are an average of the five years of data.

The percent of each crop treated with chlorpyrifos was obtained from a spreadsheet provided by the proprietary data source. The percentage of ground applications as a percentage of all applications and the approximate percentage of the crop treated by ground was calculated. This calculation assumes that the average number of applications was the same for ground applications as for all applications. Since the average number of applications of chlorpyrifos for most crops for all application methods is either one application or just above one application this is probably not an unreasonable assumption.

The rate range information for each crop was obtained by querying the proprietary source database. The application method rate range data were summed over the five years for each rate range in which applications were reported and the percentage of applications in each rate range was calculated for all application methods grouped together and for ground applications separately. The approximate 90th percentile observed rate for ground applications was retained and is reported in the last column in the tables below. For some crops the 90th percentile and the maximum observed rate are the same. For those crops in which the maximum observed rate was higher than the 90th percentile rate, the 90th percentile rate is reported in parentheses. The maximum label rates may be higher than these maximum observed rates and in that case it is possible that higher rates might have been used. However, the rates reported in Table 1 were the highest rates observed over a five year period so a significant number of applications at higher rates are unlikely.

Results

The results are summarized in Tables 1 and 2. For most crops, most chlorpyrifos applications are made by ground equipment. Some of these applications are incorporated at the time of application. Table 1 includes all ground applications that were not specifically indicated to have been incorporated. Most of these applications were probably not incorporated but it is possible that some could have been incorporated. Table 2 includes those applications which were known to have been incorporated. Information in Table 2 is not included in Table 1. The crop with the highest percentage of acres treated with ground applications of chlorpyrifos is apples (59% treated) (Table 1). Significant percentages of some other tree crops and vegetables are also treated. Only small percentages of field crops are treated with chlorpyrifos.

Table 1: Ground Applications of Chlorpyrifos to Agricultural Crops 2006-2010 excluding Seed Treatments and Incorporated Applications

Crop	% of Total Applications Applied by Ground	% of Total Crop Acreage Treated by Ground	Average Lbs AI Year Applied by Ground	Average Application Rate for Ground Applications	Maximum Rate Observed for Ground Applications (rounded up) When 90th percentile is lower it is shown in parentheses
Alfalfa	69	2	320,000	0.6	1.0
Almonds	86	20	380,000	1.9	(2.0) 4.0
Apples	95	59	370,000	1.5	(2.0) 2.8
Asparagus	76	29	10,000	1	(1.0) 1.5
Beans (Snap)	99	1	2,000	0.5	1.0
Broccoli	100	53	100,000	1.4	(2.1) 2.3
Cabbage	100	14	10,000	1.1	(1.5) 2.3
Cauliflower	99	40	15,000	1.1	(1.5) 2.3
Cherries	98	36	80,000	1.5	(2.0) 3.0
Corn	19	0	200,000	0.9	(1.5) 3.0
Cotton	32	1	150,000	0.8	1.0
Dry Beans/Peas	37	0	5,000	0.5	(0.5) 0.8
Grapefruit	98	22	50,000	1.9	3
Grapes, Raisin	100	8	50,000	1.9	(2.0) 2.2
Grapes, Table	100	51	140,000	2.7	4
Grapes, Wine	100	9	120,000	2	(2.0) 4.0
Hazelnuts	68	8	4,000	1.4	2
Lemons	96	37	90,000	3.6	6
Onions	100	45	70,000	0.9	(1.1) 2.8
Oranges	93	22	600,000	2.6	6
Peaches	95	26	50,000	1.3	(2.0) 3.0
Peanuts	13	1	20,000	1.6	2
Pears	97	17	20,000	1.8	2
Peas (Fresh)	100	1	1,000	1	(1.0) 1.4
Pecans	85	24	200,000	0.9	(1.0) 3.4
Peppers	93	2	2,000	0.8	1.5
Plums/Prunes	100	11	25,000	1.8	2
Potatoes	82	0	1,000	0.8	1
Pumpkins	100	1	2,000	1	(1.1) 1.2
Sorghum	47	0	6,000	0.5	0.8
Soybeans	82	5	3,000,000	0.4	(0.8) 1.1
Squash	99	2	800	1	(1.5) 2.0
Strawberries	100	28	15,000	1	(1.0) 2.0
Sugar Beets	38	4	40,000	0.7	(1.0) 2.0
Sunflowers	20	1	15,000	0.5	(0.5) 0.6
Sweet Corn	57	7	70,000	1.1	(2.0) 4.0

Tobacco	83	11	80,000	2.1	(2.1) 5.0
Walnuts	94	43	320,000	1.8	(2.0) 4.0
Wheat, Spring	56	1	70,000	0.3	(0.5) 1.0
Wheat, Winter	69	2	290,000	0.4	(0.8) 1.0

Apricots, cantaloupes, lettuce, pistachios and watermelons are excluded from this table because there was very little use of chlorpyrifos on those crops. For dry beans, peanuts, peppers, potatoes, sorghum, and squash, there were very few observations for ground applications so for those crops the numbers cannot be considered robust. Source: Private market research data, 2006-2010.

Table 2. Incorporated Ground Applications of Chlorpyrifos 2006-2010

Crop	% of Total Applications Incorporated	% of Total Crop Acreage With Incorporated Treatments	Average Lbs AI Year Applied by Incorporated Applications	Average Application Rate for Incorporated Applications	Maximum Rate Observed for Incorporated Applications (rounded up)When 90th percentile is lower it is shown in parentheses
Corn	65	1	800,000	1.0	(1.4) 2.0
Cotton	5	0	15,000	0.4	1.0
Dry Beans/Peas	45	0	5,000	0.5	0.5
Peanuts	85	6	140,000	1.7	2.0
Potatoes	10	0	<500	1.1	1.5
Sorghum	13	0	3,000	0.8	0.8
Soybeans	1	0	40,000	0.6	1.2
Sugar Beets	50	5	80,000	1.0	(1.0) 2.0
Tobacco	17	2	13,000	1.6	(2.1) 5.0

The applications reported in this table were those for which the application method clearly indicated incorporation. This level of detail about application method was not available for fruits and vegetables so some of the ground applications for those crops may have incorporated as well as some of the ground applications for field crops not listed here. Source: Private market research data, 2006-2010.

Data Limitations

The sample sizes for some of the chlorpyrifos crop ground application combinations are quite small and therefore the confidence limits for acre treatments, acres treated and pounds of active ingredient may be quite large. For chemicals used on only a small percentage of the crop the

sampling procedure may lead to no use being reported. In other cases use may be overestimated. There are also some crops for which pesticide use data is not available and these crops are therefore not included in this analysis. These crops include Brussels sprouts, collards, cranberries, figs, kale, kohlrabi, kumquats, limes, nectarines, radishes, rutabagas, sweet potatoes, tangelos, tangerines, and turnips.

References

Private Marketing Research Data, 2006-2010.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

MEMORANDUM

SUBJECT: Information on Application Rates and Acres Treated per Application per Day for Selected Chlorpyrifos Formulations

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Product Review Panel: November 7, 2012

Summary

This memorandum provides information on the usage of different formulations of chlorpyrifos, a broad-spectrum organophosphate insecticide, to support the assessment and mitigation of risks associated with volatilized chlorpyrifos. The Agency is currently conducting a human health risk assessment of exposures from volatilization of chlorpyrifos treated fields. The usage information contained in the memo includes, by crop and chlorpyrifos formulation, the range of application rates of chlorpyrifos and the range of field treatment sizes per application per day for chlorpyrifos. The estimates of average and 90th percentile application rates for agricultural crops with chlorpyrifos usage are based on a private pesticide market research database. The estimates of acres treated per application are derived from the public database maintained by the California Department of Pesticide Regulation (CDPR). These data will also be included in the larger risk assessment memo being developed for chlorpyrifos volatilization. In general, the usage data show that the highest application rates of chlorpyrifos were in citrus crops and table grapes (regardless of formulation type). Most crops had average application rates of 1 pound of chlorpyrifos per acre or less. The chlorpyrifos acres treated per application data show wide variability across crop and chlorpyrifos formulation type.

Introduction

As part of the risk assessment for chlorpyrifos, EPA is conducting an assessment of possible human exposure through volatilization of this pesticide from treated fields. One of the flux studies being utilized in this effort looked at volatilization of a "low VOC" liquid formulation of chlorpyrifos (Lorsban Advanced™), while the other used an older liquid formulation (Dursban 4EC™). "Low VOC" formulations were developed by registrants in response to California's concerns over air pollution risks from volatile organic compounds (VOCs); chlorpyrifos is one such compound. There are still several chlorpyrifos formulations (some liquid, some dry flowable, and some granular products) on the market that are not formulated to control VOC emissions.

In this document, BEAD refers to these non-"low VOC" products as "regular" formulations for brevity. The volatilization risk assessment which this memo supports does not consider volatilization of granular chlorpyrifos formulations separately, nor does it consider different application methods (e.g. aerial vs. ground) to be different. Therefore, in this memo, BEAD focused on usage of all liquid "low VOC" formulations (combined), *vs* all "regular" liquid formulations (combined), regardless of application methods.

In order to refine estimates of possible chlorpyrifos exposure, and to develop risk mitigation options, the risk assessors and risk managers require information on the use of chlorpyrifos application rates by formulation and crop for all application methods. Earlier BEAD memoranda provided information about aerial and ground applications of chlorpyrifos (data in those papers were not separated based on formulation type).

Chlorpyrifos Application Rate Information

Data

Information on chlorpyrifos application rates is obtained from results of annual private pesticide market surveys covering the majority of crops produced in the continental United States. The surveys collect detailed information on agricultural pesticide usage including the amount of pesticide applied by active ingredient and product, the number of acres treated, application rates, number of observations etc. The surveys utilize sampling procedures that result in statistically valid results, however the sample sizes are sometimes small and therefore have large confidence limits. Data from 2007 to 2011 were used in this analysis, and the results presented are an average of the five years of data. Statistical software (SAS, Inc.) was used to compile the data reported in Tables 1 and 2 below. The tables provide, by crop and chlorpyrifos formulation, average application rates and the 90th percentile application rate.

BEAD also calculated the ratio of the number of "low VOC" product applications to the number of "regular" chlorpyrifos product applications in each crop for which data were available. The number of applications of each type of product was summed across the five year period before the ratios were computed. A ratio of one means equal numbers of grower observations for both formulation types; a ratio of less than one indicates higher use of "regular" formulations, while a ratio greater than one indicates higher use of "low VOC" products.

Scope and Data Limitations

For many crops and formulations there were only a limited number of observations so the confidence limits for average and 90^{th} percentile rates may be quite large. For chlorpyrifos used on only a small percentage of the crop, the sampling procedure may lead to no use being reported, simply because none of these users happened to be among those surveyed.

Crop/formulation combinations with very low numbers of observations (less than a total of 10 observations over the five year period) were excluded. Crops where data on some formulations were excluded due to low sample size (= number of observations) include: alfalfa, almonds, apples, apricots, asparagus, green beans, cabbage cantaloupes, cauliflower celery, cherries, corn, cotton, grapefruit, lemons, lettuce, onions, oranges, peaches, peanuts, green peas, pecans, peppers, pistachios, potatoes, sorghum, soybeans, squash, strawberries, sunflowers sweet corn, tobacco, tomatoes and walnuts. For some of these crops some formulations are included while others are excluded. For some crops all formulations were excluded.

There are also some labeled crops for which pesticide use data are not available in the pesticide usage database, and these crops are therefore not included in this analysis. These crops include Brussels sprouts, collards, cranberries, figs, kale, kohlrabi, kumquats, limes, nectarines, radishes, rutabagas, sweet potatoes, tangelos, tangerines, and turnips.

Results

Based on private pesticide marketing survey data, over the five year period from 2007 to 2011 twenty nine different chlorpyrifos products were used on agricultural sites. For individual crop/year combinations, anywhere from one to eight different products were reported as having been used. Liquid formulations accounted for about 90% of total national use. One "regular" product, Lorsban 4E™, accounted for more than one-half (approximately 4,000,000 pounds) of all chlorpyrifos use on agricultural crops. Lorsban products also accounted for most granular use of chlorpyrifos. Application rates for chlorpyrifos varied significantly among crops. Rates for the citrus crops and grapes were higher than for any other crops. Field crops tended to have the lowest average application and 90th percentile application rates.

According to the available usage data, two "low VOC" products show substantial use in the agricultural crops surveyed. These products are Lorsban Advanced™ (approximately 400,000 pounds of this product applied across all crops) and Chlorpyrifos "4E AG"(approximately 200,000 pounds of this product applied across all crops). Together, these products accounted for about 10% of the liquid formulation pounds of chlorpyrifos applied and about 9% of the total pounds of chlorpyrifos applied nationally, as described in the proprietary database. Note, however, that this estimate of total usage presumes that all products with the "4E AG" designation are "low VOC" products. BEAD is unsure as to whether or not this is the case. Therefore, detailed data on application rates is presented in two slightly different tables. This is discussed further in the paragraph below.

Due to uncertainty over which registrants' products have been designated as manufacturers of "low VOC" Chlorpyrifos 4E AG products, the information provided on application rates is in two tables. In Table 1, only Lorsban Advanced™ is considered "low VOC". In Table 2, both Lorsban Advanced™ and all Chlorpyrifos 4E AG™ products are considered "low VOC". Both tables present chlorpyrifos application rates with information for "low VOC" formulations broken out separately from other formulations. For about one-half of the "regular" formulations the number of observations was large enough that the rate information should be quite reliable. For most of the "low VOC" formulations the number of observations was much lower, but it should be noted that the average and 90th percentile application rates for the regular and "low VOC" formulations are usually quite close. Although not noted in the tables, for some crops and formulations the 90th percentile was equal to the 100th percentile (maximum).

For most crops, the "low VOC" formulations account for a relatively small percentage of the liquid chlorpyrifos applications. This would be expected since the "low VOC" formulations account for about ten percent of all liquid chlorpyrifos formulations when measured in pounds of chlorpyrifos applied. The exception is green beans, where more than half the applications were with the "low VOC" formulations. About 30% of the applications to wine grapes, broccoli, lemons and grapefruit were made with the "low VOC" formulations. The ratio of "low VOC" to all other applications in Table 2 is equal to or larger than the ratio in Table 1 because both "low VOC" products are included in the numerator of the ratio in Table 2.

Since the “low VOC” formulations are relatively recent, EPA examined the 2010 and 2011 usage data separately to see if the relative use of “low VOC” formulations was increasing (these specific years’ data are not shown in detail in this memo); this does not appear to be the case.

Table 1. Chlorpyrifos application rate data (lb a.i./acre), with the "4E AG" formulation included in the "Regular" group. Data are for the years 2007 to 2011 (EPA, 2012) and the table is sorted by the 90th percentile application rate (in descending order).

		Application rate (lb a.i./acre)				
Crop	**Formulation**	**Average - "Regular" products**	**90th percentile rate - "regular" products**	**Average - "low VOC" products**	**90th percentile - "low VOC" products**	**Ratio of "low VOC" to "regular" products applications**
Oranges	Liquid	2.5	6.0	3.0	5.7	0.22
Lemons	Liquid	3.4	5.0	3.4	5.7	0.28
Grapes, Table	Liquid	2.9	4.0	1.6	2.2	0.14
Grapefruit	Liquid	1.9	3.0	2.2	2.4	0.20
Broccoli	Liquid	1.5	2.3	2.0	2.2	0.26
Broccoli	Granular	1.5	2.1	.	.	.
Cabbage	Granular	1.2	2.1	.	.	.
Almonds	Liquid	1.9	2.0	1.8	1.9	0.18
Apples	Liquid	1.6	2.0	1.2	1.9	0.06
Cherries	Liquid	1.8	2.0	1.6	1.9	0.04
Grapes, Raisin	Liquid	2.0	2.0	1.6	2.2	0.18
Grapes, Wine	Liquid	2.0	2.0	1.8	1.9	0.38
Peaches	Liquid	1.3	2.0	1.1	1.9	0.01
Peanuts	Granular	1.8	2.0	.		.
Pears	Liquid	1.8	2.0	1.9	1.9	0.05
Plums/Prunes	Liquid	1.9	2.0	1.0	1.9	0.06
Sugar Beets	Granular	1.3	2.0	.	.	.
Tobacco	Liquid	1.9	2.0	.	.	.
Walnuts	Liquid	1.9	2.0	1.8	1.9	0.12
Apples	Dry Flowable	1.0	1.6	.		.
Apples	Wettable Powder	1.0	1.5	.		.
Hazelnuts	Liquid	1.1	1.5	1.9	1.9	0.07
Cauliflower	Granular	1.2	1.4	.	.	.
Corn	Granular	1.1	1.4	.	.	.
Sweet Corn	Granular	1.2	1.4	.	.	.
Cherries	Dry Flowable	0.9	1.2	.	.	.
Onions	Granular	0.9	1.1	.		.
Pumpkins	Granular	0.7	1.1	.	.	.
Alfalfa	Liquid	0.5	1	0.5	0.5	0.01
Asparagus	Liquid	0.9	1	0.9	1	0.21

		Application rate (lb a.i./acre)				
Crop	**Formulation**	**Average - "Regular" products**	**90th percentile rate - "regular" products**	**Average - "low VOC" products**	**90th percentile - "low VOC" products**	**Ratio of "low VOC" to "regular" products applications**
Beans, Green	Liquid	0.9	1	0.9	1	1.12
Broccoli	Dry Flowable	0.9	1	.	.	.
Broccoli	Wettable Powder	1	1	.	.	.
Cabbage	Liquid	1	1	1.8	2.2	0.2
Cauliflower	Dry Flowable	1	1	.	.	.
Cauliflower	Liquid	1	1	1.1	1.9	0.17
Corn	Liquid	0.6	1	0.2	0.3	0.03
Cotton	Liquid	0.7	1	0.9	1	0.05
Onions	Liquid	0.9	1	0.9	1	0.04
Oranges	Granular	0.8	1	.		.
Pecans	Liquid	0.9	1	0.6	1	0.01
Pumpkins	Liquid	0.9	1	.	.	.
Squash	Liquid	0.8	1	.	.	.
Strawberries	Liquid	1	1	0.9	1	0.1
Sugar Beets	Liquid	0.5	1	0.5	0.6	0.08
Sweet Corn	Liquid	0.9	1	0.9	1	0.22
Soybeans	Dry Flowable	0.4	0.7	.	.	.
Sorghum	Liquid	0.4	0.6	.	.	.
Dry Beans/Peas	Liquid	0.5	0.5	.	.	.
Soybeans	Liquid	0.4	0.5	0.3	0.5	0.04
Sunflowers	Liquid	0.4	0.5	0.5	0.6	0.02
Wheat, Spring	Liquid	0.3	0.5	0.3	0.5	0.07

Notes:

- Crops and formulations with very low numbers of observations (less than a total of 10 observations over the five year period) are not included.
- "." Entry indicates no data for use of any "low VOC" product. Note that "low VOC" products are all **liquid** formulations. Please see the discussion in the *Results* section above for a description of "Regular" *vs* "low VOC" products included.
- The "Ratio" column provides a measure of the number of applications of "low VOC" products *vs* the number of applications of "regular" products. Please see the discussion in the *Data* section above for further description of this ratio.

Table 2. Chlorpyrifos application rate data (lb a.i./acre), with the "4E AG" formulation included in the "Low VOC" group. Data are for the years 2007 to 2011 (EPA, 2012) and the table is sorted by the 90th percentile application rate (in descending order).

		Application rate (lb a.i./acre)				
Crop	**Formulation**	**Average - "Regular" products**	**90th percentile rate - "regular" products**	**Average - "low VOC" products**	**90th percentile - "low VOC" products**	**Ratio of "low VOC" to "regular" products applications**
Oranges	Liquid	2.6	6	2.3	5.7	0.28
Lemons	Liquid	3.4	5	3.4	5.7	0.28
Grapes, Table	Liquid	2.9	4	1.6	2.2	0.14
Grapefruit	Liquid	2.1	3	1.6	2.4	0.37
Broccoli	Liquid	1.5	2.3	1.9	2.2	0.28
Broccoli	Granular	1.5	2.1	.	.	.
Cabbage	Granular	1.2	2.1	.	.	.
Almonds	Liquid	1.9	2	1.8	2	0.22
Apples	Liquid	1.6	2	1.4	2	0.12
Cherries	Liquid	1.8	2	1.7	2	0.11
Grapes, Raisin	Liquid	2	2	1.6	2.2	0.18
Grapes, Wine	Liquid	2	2	1.8	1.9	0.38
Peaches	Liquid	1.3	2	2.1	3	0.04
Peanuts	Granular	1.8	2	.		.
Pears	Liquid	1.8	2	2	2	0.09
Plums/Prunes	Liquid	1.9	2	1.4	2	0.1
Sugar Beets	Granular	1.3	2	.		.
Tobacco	Liquid	1.9	2	2	2	0.01
Walnuts	Liquid	1.9	2	1.8	2	0.15
Apples	Dry Flowable	1	1.6	.	.	.
Apples	Wettable	1	1.5	.	.	.
Hazelnuts	Liquid	1.1	1.5	1.9	1.9	0.07
Cauliflower	Granular	1.2	1.4	.	.	.
Corn	Granular	1.1	1.4	.	.	.
Sweet Corn	Granular	1.2	1.4	.	.	.
Cherries	Dry Flowable	0.9	1.2	.	.	.
Onions	Granular	0.9	1.1	.	.	.
Pumpkins	Granular	0.7	1.1	.	.	.
Alfalfa	Liquid	0.5	1	0.6	0.9	0.03
Asparagus	Liquid	0.9	1	0.9	1	0.26
Beans, Green	Liquid	0.9	1	0.9	1	1.21

		Application rate (lb a.i./acre)				
Crop	**Formulation**	**Average - "Regular" products**	**90th percentile rate - "regular" products**	**Average - "low VOC" products**	**90th percentile - "low VOC" products**	**Ratio of "low VOC" to "regular" products applications**
Broccoli	Dry Flowable	0.9	1	.		.
Broccoli	Wettable	1	1	.		.
Cabbage	Liquid	1	1	1.6	2.2	0.27
Cauliflower	Dry Flowable	1	1	.	.	.
Cauliflower	Liquid	1	1	1.1	1.9	0.17
Corn	Liquid	0.6	1	0.4	0.5	0.09
Cotton	Liquid	0.7	1	0.9	1	0.13
Onions	Liquid	0.9	1	0.9	1	0.13
Oranges	Granular	0.8	1	.	.	.
Pecans	Liquid	0.9	1	0.9	1	0.08
Pumpkins	Liquid	0.9	1	.		.
Squash	Liquid	0.8	1	1	1	0.05
Strawberries	Liquid	1	1	0.9	1	0.1
Sugar Beets	Liquid	0.5	1	0.5	0.6	0.09
Sweet Corn	Liquid	0.9	1	0.9	1	0.22
Soybeans	Dry Flowable	0.4	0.7	.	.	.
Sorghum	Liquid	0.4	0.6	.	.	.
Dry Beans/Peas	Liquid	0.5	0.5	0.8	1	0.17
Soybeans	Liquid	0.4	0.5	0.3	0.5	0.07
Sunflowers	Liquid	0.4	0.5	0.5	0.6	0.05
Wheat, Spring	Liquid	0.3	0.5	0.3	0.5	0.23
Wheat, Winter	Liquid	0.4	0.5	0.3	0.5	0.03

Notes:

- Crops and formulations with Crops and formulations with very low numbers of observations (less than a total of 10 observations over the five year period) are not included.
- "." Entry indicates no data for use of any "low VOC" product. Note that "low VOC" products are all **liquid** formulations.
- Please see the discussion in the *Results* section above for a description of "Regular" vs "low VOC" products included.
- The "Ratio" column provides a measure of the number of applications of "low VOC" products *vs* the number of applications of "regular" products. Please see the discussion in the *Data* section above for further description of this ratio.

Chlorpyrifos Area Treated per Application per Day Information

Data and Scope

Data on the size of fields treated per application of chlorpyrifos would help inform risk managers of the extent to which large buffers would be needed to mitigate volatilization risks. However, with the exception of the detailed pesticide use recording database maintained by the California Department of Pesticide Regulation (CDPR), there do not appear to be sources of this kind of data for chlorpyrifos (or any other pesticide) use. Therefore, BEAD provides in this section a summary of information on acres treated per chlorpyrifos application per day, as derived from the CDPR database for the years 2006-2010.

Since 1990 California has required the full reporting of annual agricultural pesticide use. Under this program, all agricultural pesticide use is reported monthly to county agricultural commissioners, who in turn, report the data to the CDPR. These data are accessible from CDPR's website (CDPR, 2012) and provide the most detailed information available on the use of agricultural pesticides in California. No other state has comparable information on pesticide use.

Data files for 2006 through 2010 were downloaded from CDPR's website (CDPR, 2012). These data were then extracted and imported into a SAS dataset. Supplemental data on crop sites, county, chemical, product, and formulation were added to this dataset.

An analytical chlorpyrifos dataset was created from this comprehensive dataset by keeping only data records that met all of the following criteria: active ingredient is chlorpyrifos, record is not a CDPR identified error, area treated is in units of acres, record is an individual application (i.e., not a monthly summary), application was made to an agricultural site. Using these criteria, a total of 60,910 observations are summarized in Table 3 below. Based on conversations with CDPR, records representing the use of "low VOC" formulations were identified in the data (Lorsban Advanced™, Drexel Chlorpyrifos 4E AG™, Whitmire PT-275 Duro-O-Cap™, or Whitmire PT-275 Duration™). Use of these products is shown in Table 3 as "low VOC"' products applied.

There are some limitations that should be considered when interpreting these data. Caution should be used when extrapolating these results to areas outside of California, as different pest pressures, crop production practices, etc. in these areas will likely alter the relative use of chlorpyrifos. BEAD also notes here that the data are shown as reported by individual county staff. Some counties sometimes enter crop type specifically, while others may use generic crop codes (e.g., the one for "grapes" instead of "grapes, wine"). Furthermore, CDPR does not have crop codes for some types of crops (e.g. there is no specific code for "table grapes").

In addition, some counties may report applications for a particular date when in fact the applications began on that date and continued for multiple days. Since EPA has no way to separate these entries from those that genuinely report applications completed on a single day, the table shows all data as having been applied on a single day. Thus, the data on acres treated per day per application may be overestimates for an unknown number of crops.

Results

Table 3 shows acres treated per application per day with chlorpyrifos, with data separated by crop, application method and product (or "form" as defined by CDPR) applied. Data on acres treated per application per day vary widely across included crops. In general, it appears that ground-based treatments covered larger acres treated per day than aerial treatments at the 90th percentile range. Although maximum area treated in some crops (e.g. walnuts, almonds, asparagus, grapes, alfalfa) can be several hundred acres, these are often single data points (i.e., only one grower/applicator was reporting this amount treated). The 50th and 90th percentile columns depicted in Table 3 are probably more descriptive for typical use than the maximum reported number of acres treated per day. The percentile columns show the amount of acres treated per application per day at or below which 50 or 90 percent of applicator reports occur in the CDPR database (within each crop/product/application method grouping).

Table 3. Acres treated with chlorpyrifos per application per day, with data separated by crop, application method, and product[1] applied.*

				Acres treated per application per day			
Crop[2]	**Application Method[3]**	**Product Applied[4]**	**Sample size**	**Minimum**	**50th percentile**	**90th percentile**	**Maximum**
Corn (human consumption)	Air	Liquid	7	13	30	160	160
Avocado	Ground	Liquid	10	1	6	158	300
Almonds	Air	Liquid	267	4	51	156	640
Grapes (wine)	Ground	Liquid	1117	0	32	146	595
Sorghum (Forage/Fodder)	Air	Liquid	13	36	70	140	160
Sorghum (Milo)	Air	Liquid	11	10	59	130	160
Sugarbeets	Air	Liquid	19	18	70	128	146
Almond	Ground	Liquid	1394	1	36	120	626
Grapes (wine)	Air	Liquid	3	14	27	116	116
Cotton	Air	Liquid	300	4	47	114	316
Asparagus	Air	Liquid	171	1	18	110	235
Wheat (unspecified type)	Air	Liquid	97	5	45	102	216
Lemons	Air	Liquid	15	5	28	100	100
Wheat (forage/fodder)	Air	Liquid	426	4	62	100	185
Alfalfa	Air	Liquid	11735	1	50	96	518
Alfalfa	Other	Liquid	33	2	40	95	101
Tomatoes (processing)	Air	Liquid	3	58	76	93	93
Walnuts	Air	Liquid	745	1	34	93	430
Sugarbeets	G	Liquid	2	59	76	92	92
Corn (forage/fodder)	Air	Liquid	1539	1	39	91	399
Corn (forage/fodder)	Ground	Liquid	582	1	38	85	308

				Acres treated per application per day			
Crop[2]	**Application Method[3]**	**Product Applied[4]**	**Sample size**	**Minimum**	**50th percentile**	**90th percentile**	**Maximum**
Sorghum (Forage/Fodder)	Ground	Liquid	6	10	55	85	85
Strawberries	Ground	Liquid	558	1	28	84	220
Prunes (dried plums)	Ground	Liquid	40	2	34	82	120
Alfalfa	Ground	Liquid	1846	0	37	80	217
Corn (forage/fodder)	Other	Liquid	28	20	47	80	100
Figs	Air	Liquid	1	80	80	80	80
Sunflowers	Air	Liquid	35	2	25	78	170
Corn (grain)	Air	Liquid	2	38	57	77	77
Sunflowers	Other	Liquid	4	14	58	75	75
Wheat (forage/fodder)	Ground	Liquid	11	38	70	75	113
Cotton	Ground	Liquid	82	3	38	74	160
Grapes (unspecified type)	Ground	Liquid	237	1	25	73	322
Asparagus	Ground	Liquid	141	1	30	69	586
Walnuts	Ground	Liquid	3271	1	20	65	517
Citrus (unspecified type)	Ground	Liquid	32	2	7	60	240
Mint	Ground	Liquid	25	2	25	60	160
Beans (dried)	Air	Liquid	2	25	40	55	55
Lemons	Ground	Liquid	1402	0	14	54	145
Almond	Other	Liquid	9	6	20	53	53
Tomatoes	Air	Liquid	2	38	46	53	53
Orchard floor (unspecified crop)	Ground	Liquid	1	46	46	46	46
Figs	Ground	Liquid	1	40	40	40	40
Oranges	Ground	Liquid	3152	0	15	40	240
Oranges	Other	Liquid	28	1	19	40	42
Pecans	Ground	Liquid	33	2	19	40	42
Grapes (wine)	Other	Liquid	14	4	14	39	41
Plums	Ground	Liquid	325	1	10	38	140
Sweetpotatoes	Ground	Liquid	10	8	19	38	38
Beans (dried)	Ground	Liquid	27	5	19	37	43
Brussels sprouts	Ground	Liquid	363	1	12	35	52
Lemons	Other	Liquid	2	15	25	35	35
Turf/Sod	Other	Liquid	6	7	27	35	35
Oranges	Air	Liquid	3	9	10	33	33
Onions (dry)	Ground	Liquid	30	1	15	32	45
Peaches	Air	Liquid	3	8	10	30	30
Pomelo	Ground	Liquid	14	2	5	30	30
Walnuts	Other	Liquid	5	10	18	30	30

				Acres treated per application per day			
Crop[2]	**Application Method[3]**	**Product Applied[4]**	**Sample size**	**Minimum**	**50th percentile**	**90th percentile**	**Maximum**
Turf/Sod	Ground	Liquid	23	5	17	27	60
Grapes (unspecified type)	Other	Liquid	2	10	18	25	25
Sudangrass	Air	Liquid	1	25	25	25	25
Tangelo	Ground	Liquid	87	1	10	25	80
Strawberries	Air	Liquid	1	24	24	24	24
Corn (human consumption)	Ground	Liquid	35	4	10	23	39
Tangerines	Ground	Liquid	166	1	10	23	73
Apples	Ground	Liquid	164	1	5	21	72
Peaches	Ground	Liquid	235	2	8	21	46
Beans (unspecified type)	Ground	Liquid	1	20	20	20	20
Broccoli	Ground	Liquid	3899	0	11	20	162
Nectarines	Ground	Liquid	181	1	9	20	47
Pears	Ground	Liquid	11	1	2	20	35
Turnips	Ground	Liquid	13	8	10	20	25
Broccoli	Other	Liquid	22	5	10	19	36
Sunflowers	Ground	Liquid	3	8	10	18	18
Cauliflower	Ground	Liquid	1125	1	10	16	36
Peas	Ground	Liquid	33	3	10	16	19
Beans (succulent)	Ground	Liquid	12	4	10	15	18
Cherries	Ground	Liquid	34	1	5	15	20
Tangerines	Other	Liquid	1	15	15	15	15
Broccoli	Air	Liquid	6	5	7	14	14
Cabbage	Ground	Liquid	381	1	6	14	27
Cauliflower	Air	Liquid	1	13	13	13	13
Collards	Ground	Liquid	10	5	9	12	13
Grapefruit	Other	Liquid	1	12	12	12	12
Kale	Ground	Liquid	70	0	2	12	15
Pecans	Air	Liquid	2	11	11	11	11
Beans (succulent)	Air	Liquid	1	10	10	10	10
Grapefruit	Ground	Liquid	109	0	5	10	46
Lettuce (leaf)	Ground	Liquid	1	10	10	10	10
Limes	Ground	Liquid	3	1	2	6	6
Rappini	Ground	Liquid	103	1	5	6	9
Bok Choy (cabbage)	Air	Liquid	1	3	3	3	3
Bok Choy	Ground	Liquid	249	0	1	3	5
Cabbage, Chinese (Nappa)	Ground	Liquid	187	1	2	3	5
Kumquats	Ground	Liquid	1	2	2	2	2
Radishes	Ground	Liquid	191	1	1	2	3

				Acres treated per application per day			
Crop[2]	**Application Method[3]**	**Product Applied[4]**	**Sample size**	**Minimum**	**50th percentile**	**90th percentile**	**Maximum**
Grapes (wine)	Ground	Low VOC	367	3	42	212	560
Sorghum (Milo)	Air	Low VOC	9	38	76	115	115
Prunes (dried plums)	Ground	Low VOC	8	7	25	114	114
Corn (forage/fodder)	Ground	Low VOC	33	2	50	110	230
Citrus (unspecified type)	Ground	Low VOC	14	1	10	102	150
Alfalfa	Ground	Low VOC	73	3	40	100	150
Lemons	Air	Low VOC	2	5	53	100	100
Alfalfa	Air	Low VOC	473	1	52	97	319
Almond	Ground	Low VOC	231	3	20	90	470
Corn (forage/fodder)	Air	Low VOC	210	3	38	84	262
Grapes (unspecified type)	Ground	Low VOC	68	3	40	80	301
Cotton	Air	Low VOC	6	10	30	76	76
Walnuts	Air	Low VOC	90	5	21	76	163
Walnuts	Ground	Low VOC	430	2	20	76	200
Wheat (forage/fodder)	Air	Low VOC	3	25	65	66	66
Strawberries	Ground	Low VOC	70	0	28	60	324
Almond	Air	Low VOC	2	8	31	54	54
Asparagus	Air	Low VOC	47	1	21	53	125
Asparagus	Ground	Low VOC	62	4	24	53	471
Sunflowers	Air	Low VOC	3	10	10	50	50
Turf/Sod	Ground	Low VOC	7	10	30	50	50
Lemons	Ground	Low VOC	229	1	10	45	126
Oranges	Air	Low VOC	2	10	28	45	45

				Acres treated per application per day			
Crop[2]	**Application Method[3]**	**Product Applied[4]**	**Sample size**	**Minimum**	**50th percentile**	**90th percentile**	**Maximum**
Apples	Ground	Low VOC	21	1	18	43	80
Brussels sprouts	Ground	Low VOC	42	2	8	40	52
Corn (human consumption)	Ground	Low VOC	5	2	8	40	40
Oranges	Ground	Low VOC	758	1	17	40	248
Tangerines	Ground	Low VOC	61	2	12	40	157
Peas	Ground	Low VOC	7	7	12	38	38
Cotton	Ground	Low VOC	1	36	36	36	36
Sweetpotatoes	Ground	Low VOC	4	10	20	34	34
Almond	Other	Low VOC	1	32	32	32	32
Beans (succulent)	Ground	Low VOC	56	3	20	31	50
Tangelo	Ground	Low VOC	26	5	10	31	42
Peaches	Ground	Low VOC	16	2	10	24	40
Beans (dried)	Ground	Low VOC	16	10	14	21	25
Broccoli	Other	Low VOC	35	3	15	20	25
Grapes (unspecified type)	Other	Low VOC	1	20	20	20	20
Grapefruit	Ground	Low VOC	27	2	6	20	26
Onions (dry)	Ground	Low VOC	1	20	20	20	20
Pecans	Ground	Low VOC	8	12	19	20	20
Strawberries	Air	Low VOC	3	5	7	18	18
Broccoli	Ground	Low VOC	1061	0	10	17	29
Cauliflower	Ground	Low VOC	145	1	10	17	25
Plums	Ground	Low VOC	13	2	7	17	30
Pomelo	Ground	Low VOC	10	1	6	16	20

				Acres treated per application per day			
Crop[2]	**Application Method[3]**	**Product Applied[4]**	**Sample size**	**Minimum**	**50th percentile**	**90th percentile**	**Maximum**
Broccoli	Air	Low VOC	3	12	12	13	13
Cauliflower	Other	Low VOC	2	5	8	11	11
Nectarines	Ground	Low VOC	9	2	5	11	11
Oranges	Other	Low VOC	2	10	10	10	10
Radishes	Ground	Low VOC	65	3	5	7	9
Cabbage	Ground	Low VOC	94	1	4	5	13
Sunflowers	Ground	Low VOC	1	5	5	5	5
Bok Choy	Ground	Low VOC	38	1	2	3	3
Cabbage, Chinese (Nappa)	Ground	Low VOC	12	1	1	2	2
Kale	Ground	Low VOC	6	1	2	2	2
Kale	Other	Low VOC	1	2	2	2	2
Citrus (unspecified type)	Ground	Granular	35	15	80	240	240
Corn (forage/fodder)	Ground	Granular	121	6	40	89	192
Walnuts	Ground	Granular	10	5	24	82	99
Lemons	Ground	Granular	16	1	5	80	85
Strawberries	Ground	Granular	7	4	14	71	71
Tangerines	Ground	Granular	24	1	14	69	88
Sweetpotatoes	Ground	Granular	93	4	19	60	104
Oranges	Ground	Granular	198	0	19	58	240
Tangerines	Other	Granular	1	48	48	48	48
Broccoli	Other	Granular	15	1	10	40	40
Cauliflower	Other	Granular	18	8	15	40	40
Corn (human consumption)	Ground	Granular	119	2	16	40	48
Onions (dry)	Ground	Granular	39	3	24	40	180
Cauliflower	Air	Granular	6	4	9	35	35
Broccoli	Air	Granular	119	1	11	28	45
Broccoli	Ground	Granular	9847	0	10	19	161
Cabbage	Ground	Granular	1012	1	8	19	53
Cauliflower	Ground	Granular	3542	0	10	16	276
Mustard	Ground	Granular	13	6	14	15	16
Brussels sprouts	Ground	Granular	412	1	8	14	44

				Acres treated per application per day			
Crop[2]	**Application Method[3]**	**Product Applied[4]**	**Sample size**	**Minimum**	**50th percentile**	**90th percentile**	**Maximum**
Collards	Ground	Granular	27	3	9	14	16
Rappini	Ground	Granular	56	1	5	12	20
Grapefruit	Ground	Granular	38	0	3	10	23
Oranges	Other	Granular	1	10	10	10	10
Turf/Sod	Ground	Granular	1	10	10	10	10
Peas	Ground	Granular	3	6	7	9	9
Cabbage	Other	Granular	2	8	8	8	8
Lettuce (leaf)	Ground	Granular	3	3	4	8	8
Cabbage	Air	Granular	3	5	6	7	7
Canola (rapeseed)	Ground	Granular	4	4	6	7	7
Cabbage, Chinese (Nappa)	Ground	Granular	1471	0	4	6	15
Kale	Ground	Granular	137	0	1	4	10
Bok Choy	Ground	Granular	751	0	2	3	8
Alfalfa	Ground	Granular	1	2	2	2	2
Radishes	Ground	Granular	81	0	0	1	24
Turnips	Ground	Granular	85	0	0	1	2

Footnotes

*Data are for use in the years 2006 through 2010 (CDPR, 2012). The table shows data grouped first by "product applied" and within these groups, sorted by the 90th percentile application rate (in descending order) [high to low].

[1] "Product" is referred to as "form" in the CDPR database.

[2] Crop names are shown as reported in the CDPR database (see the "Data and Scope' section above for further discussion).

[3] "Other" application methods may include one or more of the following, as described by CDPR: chemigation, paints, dips, or other non-tractor ground-based methods.

[4] "Liquid" products correspond to the "regular" – non-VOC – products whose application rate data are shown in Tables 1 and 2 above.

Conclusions

Data on application rates of different chlorpyrifos formulations indicate that the majority of growers in all crops use chlorpyrifos at 2 lb a.i./acre or less, regardless of formulation type. These data also indicate that use of "low-VOC" formulations is lower than "regular" formulations for almost all crops. This may be a result of the relative novelty of "low VOC" products [which apparently have been available only for the past 3-5 years], higher product prices for the low VOC products, reduced comparative efficacy, lack of access to products, or some combination of these factors. Data on acres treated per application per day suggest that there is wide variation in the extent of treatment, regardless of formulation or product type, and that ground based applications often cover more acres treated per application per day than aerial application methods. BEAD notes again that these data most accurately describe only chlorpyrifos usage in California, and may not reliably apply to other parts of the U.S.

Citations

CDPR. 2012. California Department of Pesticide Regulation Pesticide Use Database. Online queries available at: http://www.cdpr.ca.gov/docs/pur/purmain.htm . Complete data are available through CA Department of Pesticide Regulation's FTP server at: ftp://pestreg.cdpr.ca.gov/pub/outgoing/pur_archives

EPA Proprietary Data. 2012. Pesticide market research data from GfK Kynetec, 2006-2011.