Quantitative Usage Analysis for Malathion

Case Number: 0248 PC Code: 57701
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The attached Tables 1-4 divide the estimated malathion usage into four categories: agricultural crops, postharvest grain treatment, other agricultural sites, and non-agricultural sites. Table 5 summarizes usage in all four categories. There are two total rows listed for the agricultural crops table and for the final summary table. This is because usage on cotton is estimated twice; once without the usage on cotton as part of the USDA's Boll Weevil Eradication Program (Program), and once including usage on cotton as part of the Program (see attached tables). As a result of the relatively large amounts of malathion applied as part of the Program, the difference in the two estimates is substantial.

Based on available pesticide survey usage information for the years of 1988 through 1999, an average annual estimate of malathion's total domestic usage is approximately 6.4 million pounds active ingredient (a.i.) without the cotton usage as part of the Program, and 16.7 million pounds a.i. including the cotton usage as part of the Program (see Table 5 below).

Agricultural Crops

Malathion is registered for use on more than 100 agricultural crops. Estimates of malathion usage on agricultural crops is provided in Table 1 below. There are two estimates provided for cotton and for the total in Table 1; one for cotton usage not including usage as part of the United States Department of Agriculture's Boll Weevil Eradication Program (Program) (listed in parentheses), and one including cotton usage as part of the Program. The majority of the malathion usage on cotton is for the control of the boll weevil as part of Program, however, it is estimated that malathion usage on cotton will decline over the next 5-8 years as the boll weevil is eradicated from the remaining major cotton growing regions of the U.S. (including Texas, Mississippi, and Louisiana). The usage estimate provided for cotton not including the usage in the Program is an estimate of what malathion usage may be when the boll weevil eradication is complete.

Including cotton usage as part of the Program, approximately 74% or 12.5 million pounds (33% or 2.1 million pounds without the cotton usage as part of the Program) of the estimated average total amount of malathion applied per year to all sites, is applied to agricultural crops. On average, approximately 3.1 million acres (1.2 million acres) of agricultural crops are treated per year with malathion. Most of the acreage is treated with 1 pound of active ingredient (a.i.) or less per application and 5 pounds a.i. or less per year.

Cotton represents malathion's largest agricultural crop market in terms of total pounds a.i. applied, followed by alfalfa. Nearly 90% (40%) of the total pounds of malathion applied to agricultural crops is applied to cotton, and 3% (16%) is applied to alfalfa. No other crop accounts for more than 1% (4%) (wheat) of the estimated pounds of malathion applied. Crops with a high percentage of their total U.S. planted acres treated with malathion include blueberries (29%), raspberries (36%), sweet cherries (30%), and dates (29%). The application of malathion to cotton acreage accounts for more than 70% (25%) of the total agricultural crop acreage treated with malathion. On average, an estimated 17% (3%) of the U.S. cotton acreage is treated with

malathion.

Post Harvest Grain Treatment

Malathion is applied as a post harvest grain treatment to corn, wheat and oats. Post harvest applications to these grains accounted for, on average, 2% (5%) (or 344,000 pounds) of the total pounds of malathion applied to all sites. Wheat receives the majority of the post harvest usage of malathion. On average, more than 30% of the bushels of wheat are treated with malathion. (Please see Table 2 below.)

Other Agricultural Sites

Other agricultural sites, such as cattle and agricultural buildings, account for approximately 3% (8%) (or 534,000 pounds) of the total malathion pounds applied to all sites. Applications to beef cattle, grain storage facilities, and roads, ditches and miscellaneous farm use account for more than 85% of malathion usage on other agricultural sites. (Please see Table 3 below.)

Non-Agricultural Sites

Approximately 3.4 million pounds of malathion are applied to non-agricultural sites, such as medfly quarantine, mosquito abatement districts, and homeowner use for outdoor insect control. This usage represents approximately 20% (53%) of the total malathion applied to all sites. Outdoor application by homeowners (1.5 million pounds) and application for mosquito control (800,000 pounds) accounts for nearly 60% of the malathion usage on non-agricultural sites. The majority of the non-agricultural site acre treatments are for the control of mosquitos (an estimated 12 million acre treatments or approximately 80% of the total). (Please see Table 4 below.)

This quantitative usage analysis updates estimates provided in an earlier BEAD usage profile (D. Herzi, 9/98).

EPA's QUANTITATIVE USAGE ANALYSIS

Table 1. Estimated Usage of Malathion on Agricultural Crops

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Blackberries	5	0	1	6%	13%	1	1	2.0	1.1	1.8	OR 100%
Blueberries	59	17	34	29%	57%	50	99	2.9	2.5	1.2	MI NJ 87%
Cranberries	30	0	0	0%	1%	0	0	1.7	1.0	1.7	WA 100%
Raspberries	12	4	5	36%	46%	5	7	1.3	1.0	1.3	WA OR 81%
Strawberries	50	10	14	20%	28%	52	73	5.2	3.5	1.5	CA 95%
Berries, Other /1	2	0	0	0%	0%	0	0	--	--	--	
Citrus, Other /2	55	0	0	0%	0%	0	0	1.0	1.0	1.0	FL 87%
Grapefruit	167	1	3	1%	2%	2	4	2.0	3.7	0.5	FL AZ CA 94%
Lemons	62	0	1	1%	1%	0	2	1.2	1.0	1.2	AZ 96%
Oranges	838	6	10	1%	1%	10	21	1.8	1.5	1.2	CA FL 84%
Apples	508	45	64	9%	13%	63	85	1.4	1.3	1.1	WA VA MO TN TX CO 78%
Pears	75	0	0	0%	1%	0	1	1.7	2.0	0.8	MS OH WA UT AL 81%
Figs	16	0	0	0%	1%	0	0	2.0	1.0	2.0	CA 100%
Cherries, Sweet	46	14	17	30%	35%	50	72	3.5	3.2	1.1	OR WA 100%

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Cherries, Tart	39	0	0	0%	1%	0	0	1.0	1.0	1.0	OR PA 100%
Peaches	269	5	11	2%	4%	7	18	1.5	1.7	0.9	TX MS CA GA AL NM 73%
Apricots	19	0	0	0%	0%	0	0	1.4	1.0	1.4	CA 100%
Plums & Prunes	140	0	0	0%	0%	1	1	1.7	2.0	0.9	CA 90%
Nectarines	27	0	0	0%	0%	0	0	1.3	1.0	1.3	CA 100%
Dates	5	2	3	29%	58%	8	16	3.0	1.5	2.0	CA 100%
Avocados	82	1	3	1%	4%	2	5	1.5	2.0	0.7	CA FL 100%
Fruits, Passion	--	--	--	--	--	--	--	--	--	--	
Guavas	--	--	--	--	--	--	--	--	--	--	
Mangoes	--	--	--	--	--	--	--	--	--	--	
Papayas	--	--	--	--	--	--	--	--	--	--	
Quinces	--	--	--	--	--	--	--	--	--	--	
Pineapples	--	--	--	--	--	--	--	--	--	--	
Grapes	831	4	10	0%	1%	12	23	3.2	2.5	1.3	CA MO TN TX WA 82%
Almonds	434	1	3	0%	1%	1	2	0.7	1.0	0.7	CA 100%
Pecans	473	19	30	4%	6%	51	70	2.7	1.9	1.4	TX LA NM GA OK 83%
Walnuts	204	10	18	5%	9%	26	50	2.8	1.3	2.1	CA 100%
Macadamia Nuts	22	1	1	5%	5%	0	1	1.0	1.0	1.0	

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Filberts	33	0*	0*	0*	0*	0*	0*	--	--	--	
Chestnuts	--	--	--	--	--	--	--	--	--	--	
Vegetables, Bulb /3	201	10	19	5%	9%	12	23	1.2	1.0	1.2	CA UT 81%
Garlic	34	0	0	0%	0%	0	0	1.1	1.0	1.1	CA 100%
Onions	165	8	16	5%	10%	16	32	2.0	1.5	1.4	WA CA OR MI ID GA 85%
Eggplant	3	0	0	2%	4%	0	0	1.6	1.0	1.6	CA 100%
Peppers, Bell	61	1	2	1%	3%	2	4	2.3	1.0	2.3	TX 90%
Peppers, Hot	34	0	0	0%	0%	0	0	0.4	1.0	0.4	CA 100%
Celery	34	1	2	4%	7%	2	3	1.4	1.3	1.1	MI CA 100%
Lettuce	265	5	10	2%	4%	9	18	1.8	1.1	1.6	CA FL 90%
Spinach	36	1	2	2%	4%	2	4	2.0	1.2	1.6	CA 100%
Kale	--	--	--	--	--	--	--	--	--	--	
Parsley	--	--	--	--	--	--	--	--	--	--	
Broccoli	115	1	1	1%	1%	1	2	1.7	1.6	1.1	CA 99%
Brussels Sprouts	4	0	0	2%	4%	0	0	1.4	1.0	1.4	CA 100%
Cabbage	84	1	2	1%	2%	2	3	1.6	1.3	1.2	CA WI 98%
Cauliflower	57	0	0	0%	1%	0	1	1.7	1.0	1.7	CA 100%

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Collards	15	0	0	1%	2%	0	1	2.0	1.0	2.0	FL 98%
Cabbage, Chinese	--	--	--	--	--	--	--	--	--	--	
Broccoli raab	--	--	--	--	--	--	--	--	--	--	
Broccoli, Chinese	--	--	--	--	--	--	--	--	--	--	
Cucumbers	151	2	4	1%	3%	2	6	1.1	1.4	0.8	OH CA 90%
Pumpkins	41	4	4	9%	11%	11	14	2.8	1.0	2.8	CA OH 88%
Squash	58	2	4	3%	6%	2	4	1.2	1.0	1.2	MI CA 96%
Mushrooms	--	--	--	--	--	--	--	--	--	--	
Kohlrabi	--	--	--	--	--	--	--	--	--	--	
Swiss Chard	--	--	--	--	--	--	--	--	--	--	
Melons, Other /4	26	1	2	3%	6%	1	3	0.9	1.0	0.9	AZ FL MS TX MO 82%
Cantaloupes	110	2	3	2%	3%	2	4	1.1	1.3	0.8	CA 95%
Watermelons	180	2	5	1%	3%	3	8	1.5	1.4	1.0	CA TX GA 86%
Asparagus	90	3	6	3%	7%	6	11	1.8	1.6	1.1	WA CA 87%
Okra	3	1	2	21%	45%	1	2	1.0	1.0	1.0	

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Beets	7	0	0	1%	2%	0	0	2.1	1.0	2.1	CA 99%
Carrots	112	3	5	2%	4%	6	11	2.5	1.6	1.6	MI CA 82%
Potatoes	1,433	5	15	0%	1%	5	14	0.9	1.2	0.8	OR MI MN WI ID 84%
Radishes	46	0	0	0%	0%	0	0	1.3	1.0	1.3	CA 100%
Rutabagas	--	--	--	--	--	--	--	--	--	--	
Sweet Potatoes	--	--	--	--	--	--	--	--	--	--	
Turnips	--	--	--	--	--	--	--	--	--	--	
Sweet Corn	777	3	8	0%	1%	4	13	1.4	1.4	1.0	CA PA VA MN 82%
Tomatoes	496	6	10	1%	2%	14	31	2.2	2.0	1.1	AL CA MI NC MS OH 83%
Beans, Dry	1,809	2	3	0%	0%	1	2	1.0	1.0	1.0	
Beans, Snap	280	0	0	0%	0%	0	1	1.6	1.3	1.2	OR CA 100%
Peas, Dry	249	8	16	3%	6%	7	14	0.9	1.0	0.9	WA ID CA 80%
Peas, Green	321	3	6	1%	2%	3	6	1.0	1.0	1.0	CA FL 88%
Sorghum	11,140	11	23	0%	0%	11	23	1.0	1.0	1.0	KS TX MO 84%
Corn	72,425	28	84	0%	0%	37	128	1.3	1.2	1.1	GA CO TX AZ KY 82%

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Barley	7,326	6	14	0%	0%	5	10	0.8	1.0	0.8	VA MN NC ND CA WA 79%
Oats/Rye	6,184	5	14	0%	0%	5	14	1.1	1.0	1.0	CA MD TX MN OH NY 76%
Rice	2,992	43	119	1%	4%	44	120	1.0	1.1	0.9	TX AR LA MS 86%
Wheat	66,219	92	159	0%	0%	91	210	1.0	1.0	1.0	VA NC KY TN 88%
Wheat, Spring	21,311	9	18	0%	0%	8	16	0.9	1.1	0.8	MN SD ND MT 88%
Wheat, Winter	44,907	83	141	0%	0%	83	194	1.0	1.0	1.0	TN OK VA MS TX IN 61%
Wild Rice	31	7	14	21%	45%	3	6	0.4	1.0	0.4	MN 100%
Hay, Other	33,881	24	55	0%	0%	37	76	1.5	1.3	1.1	CA AZ TX MO SD KY 81%
Alfalfa	23,701	240	400	1%	2%	330	560	1.4	1.2	1.2	CA OK ID AZ MT KS 68%
Pasture	75,719	12	29	0%	0%	12	40	1.0	1.2	0.9	LA MO GA TX FL 81%
Canola	170	0	0	0%	0%	0	0	0.1	1.0	0.1	MT 100%
Peanuts	1,582	3	7	0%	0%	3	5	0.8	1.0	0.8	GA OK NC VA FL 90%
Soybeans	63,141	54	185	0%	0%	34	78	0.6	1.0	0.6	TN MN IN LA AL MO 76%
Sunflower	2,789	15	49	1%	2%	24	65	1.6	1.1	1.5	SD MN ND 90%
Cotton (less the usage in the USDA Boll Weevil Eradication Program) /5	13,100	332	500	3%	4%	824	1,250	2.5	3.2	0.8	TX MS AR LA OK 90%

Site	Acres Grown (000)	Acres Treated (000)		% of Crop Treated		LB AI Applied (000)		Average Application Rate			States of Most Usage
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl	(% of total lb ai used on this site)
Cotton (including the usage in the USDA Boll Weevil Eradication Program)/5	13,100	2,250	5,900	17%	45%	11,200	35,000	5.0	5.9	0.8	TX MS LA TN 90%
Flax	175	0	0	0%	0%	0	0	1.0	1.0	1.0	ND 100%
Sugarbeets	1,434	19	38	1%	3%	32	64	1.7	1.0	1.7	CA 94%
Mint	170	13	26	8%	15%	6	12	0.5	1	0.5	
Hops	--	--	--	--	--	--	--	--	--	--	
Safflower	--	--	--	--	--	--	--	--	--	--	
Tobacco	716	7	16	1%	2%	14	36	1.9	1.6	1.2	KY OH TN NC 86%
Woodland	62,089	9	16	0%	0%	46	99	5.3	4.1	1.3	AL LA TN 83%
Total (less the usage in the USDA Boll Weevil Eradication Program)/6		1,228	2,281			2,104	3,792				
Total (including the usage in the USDA Boll Weevil Eradication Program)/6		3,146	7,681			12,480	37,542				

Table 2. Estimated Usage of Malathion on Post Harvest Treatments

Site	Volume Handled (000 bushels)	Bushels Treated (000)		% of Bushels Treated		LB AI Applied (000)		Average Application Rate		
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ 1000 bushel/ yr	#appl / yr	lb ai/ 1000 bushel/ appl
Post Harvest, Corn	9,400,158	42,301	84,601	0%	1%	13	25	0.3	1.0	0.3
Post Harvest, Wheat	2,436,412	828,380	1,193,842	34%	49%	331	487	0.4	1.0	0.4
Post Harvest, Oats	162,538	423	845	0%	1%	0.2	0.4	0.3	1.0	0.3
Total		871,103	1,279,288			344	513			

Table 3. Estimated Usage of Malathion on Other Agricultural Sites

Site	Number of Animals (000 Head)	Animals Treated (000)		% of Animals Treated		LB AI Applied (000)		Average Application Rate		
		Wtd Avg	Est Max	Wtd Avg	Est Max	Wtd Avg	Est Max	lb ai/ acre/yr	#appl / yr	lb ai/ A/appl
Beef Cattle	84,000	839	1,677	1%	2%	141	282	0.17	3.8	0.04
Dairy Cattle	16,000	49	98	0%	1%	2	5	0.05	4.9	0.01
Other Livestock /7	74,500	154	309	0%	0%	27	54	0.2	35.0	0.01
Grain Storage Facilities, empty	--	--	--	--	--	164	329	--	--	--
Agriculture Building and Structures	--	--	--	--	--	42	83	--	--	--
Roads, Ditches and Misc. General Farm Use	--	--	--	--	--	157	315	--	--	--
Total		1,042	2,084			534	1,068			

Table 4. Estimated Usage of Malathion on Non-agricultural sites

Site	Acre Treatments (000) /8		LB AI Applied (000)	
	Wtd Avg	Est Max	Wtd Avg	Est Max
Outdoor insecticides, homeowner	--	--	1,483	1800
Golf Courses	5	10	5	10
Horticultural Nurseries	86	150	218	330
Institutional Turf /9	29	67	60	114
Landscape Contractors	--	--	10	20
Lawn Care Operators	--	--	95	120
Mosquito Abatement Districts /10	12,000	18,000	800	1,200
Pest Control Operators	--	--	200	400
Rangeland	23	33	20	30
Roadways	10	30	15	40
Quarantine Medfly	2,700	4,050	472	709
Total	14,854	22,340	3,378	4,773

Table 5. Estimated Total Pounds of Malathion Applied to All Sites:
Agriculture Crops, Post Harvest Treatments, Other Agricultural Sites, and Non-agricultural Sites

Total Pounds of Malathion Applied	LB AI Applied (000)	
	Wtd Avg	Est Max
Total (less the usage in the USDA Boll Weevil Eradication Program)	6,360	10,145

Total Pounds of Malathion Applied	LB AI Applied (000)	
	Wtd Avg	Est Max
Total (including the usage in the USDA Boll Weevil Eradication Program)	16,736	43,895

COLUMN HEADINGS
Wtd Avg = Weighted average--the most recent years and more reliable data are weighted more heavily.
Est Max = Estimated maximum, which is estimated from available data.
Average application rates are calculated from the weighted averages.

NOTES ON TABLE DATA
Usage data primarily covers 1988 - 1998.
Calculations of the above numbers may not appear to agree because they are displayed as rounded: to the nearest 1000 for acres treated or lb. a.i. (Therefore 0 = < 500) and to the nearest whole percentage point for % of crop treated (therefore 0% = < 0.5%).
0* = Available EPA sources indicate that no usage is observed in the reported data for this site, which implies that there is little or no usage.
A dash (--) indicates that information on this site is NOT available in EPA sources or is insufficient.

/1 Berries, Other includes boysenberries, currants, dewberries, gooseberries, and longanberries.
/2 Citrus, Other includes kumquats, limes, tangelos, and tangerines.
/3 Vegetables, Bulb includes garlic, leeks, and onions.
/4 Melons, Other includes honeydew, muskmelon, and wintermelon.
/5 Malathion is used in the USDA Boll Weevil Eradication Program for cotton.
Estimates of usage are provided for cotton less the usage in the USDA Boll Weevil Eradication Program, and for cotton including usage in the USDA Boll Weevil Eradication Program. Usage is expected to decline as the boll weevil is eradicated from major cotton growing regions in the next 5-8 years.
/6 It is unlikely that the likely maximum amount of usage would occur on all sites in any one year.
/7 Other Livestock includes hogs, sheep, equine, and goats (goats in Texas only). The application rate is for hogs.
/8 Acre treatments = acres treated x number of applications.
/9 Institutional Turf includes cemeteries, educational facilities, and parks.
/10 Mosquito Abatement District estimates for adulticide and larvacide (larvacide accounts for approximately 7,500 acre treatments and 3,500 lbs ai). Based on 1996 usage estimates.

SOURCES:
EPA proprietary data (Doane Marketing Research, Kline Professional and Consumer Markets for Pesticides and Fertilizers, Maritz Marketing Research, Mike Buckley and Associates, etc.); National Center for Food and Agricultural Policy (1992); USDA, National Agricultural Statistics Service, Agricultural Chemical Usage: Field Crops Summary (1990 - 1998); USDA, National Agricultural Statistics Service, Agricultural Chemical Usage: Vegetables Summary (1990, 1992, 1994, 1996, 1998); USDA, National Agricultural Statistics Service, Agricultural Chemical Usage: Fruits Summary (1991, 1993, 1995, 1997); USDA, National Agricultural Statistics Service, Postharvest Applications - Corn and Wheat (1997), oats (1998); USDA, National Agricultural Statistics Service, Livestock and General Farm Summary (1997); USDA, NASS, Agricultural Chemical Usage: Cattle and Cattle Facilities (1999); American Mosquito Control Association Survey (1996), USDA/APHIS (1999); Illinois Agricultural Pest Management Handbook (1999).