Department of Pesticide Regulation
Environmental Monitoring Branch
1001 I Street
Sacramento, California 95812

Comparison of Use and Sales of Group III Pyrethroid Pesticides

Xuyang Zhang and Frank Spurlock
July 29, 2010

Abstract

Understanding urban use patterns of synthetic pyrethroid pesticides is an important component of their re-evaluation by the California Department of Pesticide Regulation (DPR). Some urban uses are reported in DPR's Pesticide Use Reporting system (PUR), while certain other uses are unreported. This latter category includes residential home and garden uses, and most industrial and institutional uses. Most estimates of unreported urban pesticide use are based on differences between pesticide sales data and PUR reported pesticide use. Here we examine the accuracy of this estimation procedure by comparing pesticide use and sales data from 2006 and 2007. Annual use and sales data retrieved from DPR's PUR and the Sales Database were compared side by side on an (a) individual product basis, (b) primary EPA registration number basis, and (c) total pounds of active ingredient (AI) basis. There were four types of disagreements between reported annual use and sales. Among the 1,127 group III pyrethroid individual products reported used and/or sold in 2006 and 2007, 73% were of type 2 and type 4 disagreements where reported use was greater than reported sales, while 27% were of type 1 and type 3 disagreements with reported use less than reported sales. Possible reasons for each type of disagreement were identified. We conclude that although unreported urban pesticide use can be estimated as the difference between sales and use *in theory*, the large uncertainties in PUR, sales data, and associated errors severely undermine the accuracy of those estimates. Consequently it is impossible to derive meaningful estimates of unreported urban use at any of the levels of data aggregation studied (product, EPA primary registration number or total pounds active ingredient).

Introduction

Recent monitoring studies have shown widespread detections of synthetic pyrethroid (SP) insecticides in California's urban and agricultural waterways (Weston et al., 2004, 2005, 2010). Observed sediment toxicity associated with those detections of SPs triggered re-evaluation of 608 pesticide products containing SPs (Sanders, 2005). Among the various SPs, the group III SPs are of particular concern due to their environmental persistence, high toxicity, high use and known presence in California sediments.

Although the Pesticide Use Reporting (PUR) database provides useful pesticide use information in California, it only includes a portion of urban pesticide use. Some urban uses are exempt from reporting requirements according to the California Code of Regulations and thus not included in the PUR. These uses include residents applying pesticides to their own homes and landscapes,

pet groomers and kennels (unless they apply a restricted pesticide material), employees applying incidental treatments to commercial businesses/buildings, employees applying incidental treatments to institutional facilities, employees applying incidental treatments at industrial facilities (factories and warehouses) and the Department of Defense (Kreidich et al., 2005). Among the unreported user groups, we assume that residents applying pesticides to their own homes and landscapes comprise the majority of unreported use. Unreported urban uses are generally considered to consist primarily of residential home and garden use.

The California Department of Pesticide Regulation (DPR) also maintains a database on the sales of the pesticides in the State of California. The sales database contains records of the amount of all pesticide products reported sold. Quarterly reports are filed by the sellers of pesticide products. The reports are mostly hardcopy with hand-written data. Recorded information includes total sales (dollars) and total amount sold for each specific product. DPR compiles these data on statewide pesticide sales into an internal digital database.

The assumed relationship between total use and total sales is

$$\text{product\_sales} + \varepsilon_{sales} = \text{product\_use} + \varepsilon_{use} + \text{unreported\_use} \qquad (1)$$

The ε are the errors in the sales and use data. The ε_{sales} contains contributions from under- or over-reporting of annual sales, inventory carryover from year to year, actual database errors such as might occur during data entry, and non-reporting, if any. Similarly, the ε_{use} includes under- or over- reporting of use or actual database errors.

The assumed unreported urban use is then

$$\text{unreported\_urban\_use} \approx \text{unreported\_use} = \text{reported\_sales} - \text{reported\_use} + \varepsilon_{total} \qquad (2)$$

where ε_{total} includes contributions from both ε_{sales} and ε_{use}. Evaluation of unreported use estimates relies on understanding and quantifying these error terms.

Although PUR is the best available pesticide use reporting database and generally considered reliable, errors from the following sources are present.

(1) There is an unknown rate of reporting noncompliance. For example, it has been reported that many maintenance gardeners who apply pesticides were not licensed and did not report pesticide use (Kreidich et al., 2005).

(2) Errors occur during data entering and processing. PUR records are classified as errors when the application rate exceeds one of the following limits: (i) 200 pounds of AI per acre treated; (ii) the median pounds of product per acre for all uses of that product on a site or commodity, and (iii) a value determined by a neural network (Wilhoit, 2002). DPR's error handling procedure then corrects the errors which were identified by the first two criteria and flag those identified by the third criterion. This error handling procedure identifies approximately 2% of PUR records as errors every year, although the true error rate is unknown (Wilhoit, 2002; Zhang et al., 2005). It's also worth noting that the error identification criteria based on

application rate are not applicable to those uses where "per area" application data are not reported. This includes certain uses that are dominant in urban settings, such as commercial structural applications. While other error identification criteria have been devised for uses such as commercial structural, these are relatively ineffective and only identify the most extreme errors (L. Wilhoit, personal communication). It should also be noted that the error handling procedure focuses on overestimating records rather than underestimating ones. Therefore, the data may underestimate some of the uses because use records with extremely low use amounts are not effectively screened.

The Sales database is calculated to determine mill assessment fees. Errors in the database are present for a variety of reasons.

(1) Incorrect reporting units. For example, a retailer may report their amount of product sales in ounces rather than pounds or vice versa.

(2) Misplaced decimal points. Since many sales report forms were filled out by hand by reporting manufactures/retailers, errors often occur when transferring the hand-written forms into the digital database. For example, a product might be reported with a sold amount of 216.05 gallons in the hardcopy of report forms, and recorded as 21605 in the Sales Database by mistake.

(3) Unreported sales. According to DPR Product Compliance staff, some pesticide sales, especially the newly emerged internet sales, were not reported. A previous audit of the DPR sales data program suggested that sales data may understate actual sales of urban products (DPR, 2004). In contrast with the PUR database, there is no established error and outlier identification mechanism for the sales data.

Objectives

The objectives of this study are:

1. Investigate the differences between reported pesticide use and sales in California for group III SPs;
2. Evaluate potential sources of error and uncertainty in estimating unreported pesticide use from comparisons between sales and use data.
3. Investigate the veracity unreported use estimates obtained using different levels of data aggregation.

Pyrethroid pesticides evaluated here

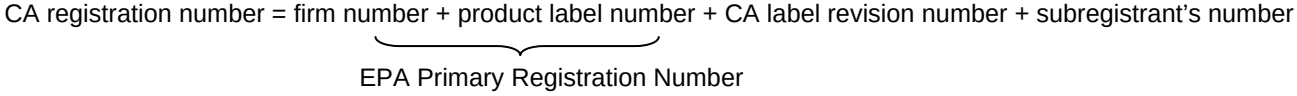
Sales and use data for eleven pyrethroid active ingredients were evaluated here: bifenthrin, cyfluthrin, β-cyfluthrin, λ-cyhalothrin, γ-cyhalothrin, cypermethrin, *S*-cypermethrin, deltamethrin, esfenvalerate, fenpropathrin and permethrin. These were designated as the "group III" pyrethroids in DPR's reevaluation. Among all registered synthetic pyrethroids these are distinguished as having been detected in California aquatic sediments (DPR Notice.2006-13; http://www.cdpr.ca.gov/docs/registration/canot/2006/ca2006-13.pdf), and by possessing generally high persistence, a relative lack of photosensitivity, and generally high toxicity.

Data aggregation for estimating unreported urban use

Sales and Use data for 2006 and 2007 were downloaded directly from Oracle tables on DPR's internal servers. There was no effort to screen the several thousand individual PUR or Sales database records to identify errors. Data in both databases had already been subjected to the standard data screening/outlier identification procedures that DPR uses for the two databases. The purpose of the comparison was to compare these sales and use data that had already been vetted to evaluate the consistency between the two databases. Three levels of sales and use data aggregation were evaluated:

1. Product-by-product level: aggregate yearly total use and sales for individual products.
2. Primary EPA registration number level: aggregate yearly total use and sales for products with the same primary EPA registration number. Each pesticide product registered in California is identified by its California registration number composed of 4 components: the firm number, product label number, California label revision code and the subregistrant's / distributor number (Fig.1). The primary EPA registration number is composed of only 2 of the 4 components: the firm number and the product label number (Fig. 1), and one EPA registration number often represents many different products. Products with the same primary EPA registration number are considered to be essentially of the same chemical composition, usually differing only by labeled uses, minor formulation differences, or are essentially identical products but marketed by subregistrants in California. The primary EPA registration number level of aggregation was used to eliminate a relatively common type of error present in both the PUR and sales databases. This error occurs when use and sales of products with unique California registration numbers are mistakenly assigned to other products with the same EPA registration number (Fig. 1). This type of error has been found in the PUR database when growers or data entry workers arbitrarily assign the California label revision number or omit the subregistrant firm number (Fig. 1) to a product when it was unknown.

Fig 1. Product registration number



3. Active ingredient (AI) level: aggregate yearly total use and sales for all the products for each active ingredient.

Among the three approaches, the product-by-product basis (approach 1) is the most straight-forward for data analysis and interpretation. It is also the basic way that the PUR/Sales data are structured. However, access to product specific sales data is also limited by confidentiality requirements; these data are not publicly available. Aggregating data based on EPA registration number (approach 2) has the potential benefit of eliminating known sources of error in reported product registration numbers previously described. Finally, the active ingredient aggregation level (approach 3) provides estimates for active ingredient totals, ignoring the sales and use differences among products. This approach does not require any confidential sales data since it is not product specific. It has been used by previous studies to estimate urban use (Spurlock and

Lee, 2008; TDC Environmental, 2005, 2007). Approach 2 and 3 are essentially increasing levels of aggregation based on approach 1 because the underlying use and sales data are reported at the product level. Therefore, we initially focus on use and sales data using approach 1 to understand the basic data structure, patterns and reliability.

Comparison of reported use and sales

In comparing annual use and sales for the pyrethroid products here, four types of disagreement were found (Table 1):

(1) Products were reported used but were not reported as sold;

(2) Products were reported as sold but were not reported as used;

(3) Reported use for products was higher than reported sales;

(4) Reported use was lower than reported sales.

Among the 1,127 group III pyrethroid products found in either or both of the PUR and sales databases during 2006 and 2007, the frequencies of occurrence were 21%, 54%, 6% and 19% of products for type 1, type 2, type 3 and type 4 disagreements, respectively (Fig 2).

Type 1: products that were reported as used but not reported as sold in California

Approximately 21% of products had type 1 disagreements. Some of the most common are shown in Table 2. Significant amounts of those products were used in 2006 and 2007, but there were no reported sales (Table 2). Products such as Dragnet Ft Termiticide® (279-3062-AA) and Torpedo Insecticide® (10182-95-AA) were inactive since 2001 and 1994, respectively, but were still reported used. In addition, the discrepancy between sales and use cannot be explained by accidental entry of their label revision or subregistered product in the databases. For example, there exists one label revised product for the "AA" Torpedo Insecticide product, but that product also had no reported sales.

In general, this situation may arise for several possible reasons. First, there could be unreported sales of these products even though some were no longer actively registered in California. Second, purchasers may stockpile products and continue to use them until existing stocks are exhausted. This is probably unlikely when there is a long period between non-renewal of the product registration and the queried sales year. Third, pesticide products can be brought into California and used so that sales are not reported. Finally, inaccurate product identification or other data in the PUR or sales databases may be the cause for the discrepancies. As discussed earlier, this type of error is known to occur in pesticide use reporting. However, even with lengthy and detailed investigation, it may not be possible to identify the cause of the disagreements between sales and PUR "after the fact" with certainty.

Several of the products in Table 2 have labels allowing applications to institutional, structural and residential uses. At least some of these probably represent unreported urban use. Two of the products are agricultural products.

For products with this type of disagreement between sales and use, Eqn. 2 dictates that $\varepsilon_{total} \geq$ reported_use. Therefore products with type 1 disagreements cannot be used to estimate unreported urban use using Eqn. 2.

Type 2: products that were reported sold but not reported as used in CA

A little over half of the pyrethroid products were reported as sold while they had no use records. The most intuitive reason for this is that the uses were not reported to the PUR database (Table 3). This implies the product's usage are likely unreported urban use, generally considered to represent consumer home and garden use. It is also possible that the sales database over-states sales due to database errors. A list of top ranked products with type 2 disagreement is given in Table 3. The first product is "Spectracide terminate termite & carpenter ant killer concentrate®" (9688-149-AA-8845), originally registered in early 2006. This product is a concentrate (as opposed to ready-to-use, RTU), but sold in 1 quart quantities, so much of the use is likely consumer use. Nearly all of the remaining products in Table 3 are obviously consumer products, explaining their lack of reported use. The interesting exception is Hot Shot Pest Control Concentrate (73049-154-AA-8845). The product is labeled "For industrial/institutional/ commercial use only" so is not a general consumer use product. Consequently, although an urban use product, it is likely not used by homeowners.

Unreported urban use may be estimated using Eqn. 2 by assuming that unreported_use >> ε_{total}.

Type 3: reported use was higher than reported sale

A small proportion (6%) of the pyrethroid products had greater reported use than reported sales Table 4). The four reasons given for type 1 disagreement also apply here. It is not possible to discount database errors, even when large discrepancies are observed. For example, the reported use of AI for "Tengard sfr one shot termiticide/insecticide®" (70506-6-AA) was 90,000 lbs more than that reported as sold (Table 4). The product label for this structural permethrin concentrate states "For use by commercial applicators as an insecticide ...." and "For control of subterranean termites: For use by individuals/firms licensed or registered by the state to apply termiticide products." Although PUR records with extremely high use rates are often captured and corrected by DPR's error and outlier procedures (Wilhoit, 2002), the error identification criteria for commercial structural applications are much less effective than those for production agriculture applications (Larry Wilhoit, personal communication). Consequently database error cannot be discounted for structural products, even when there are very large deviations between use and sales. Most of the products in Table 4 are for structural or institutional applications with the exception of Perm-Up 3.2 Ec Insecticide (70506-9-AA), an agricultural insecticide.

Similar to the type 1 disagreements, Eqn. 2 implies that $\varepsilon_{total} \geq$ reported_use. Products with substantial type 3 disagreements cannot be used to estimate unreported urban use from Eqn. 2.

Type 4: reported use was lower than reported sale

When both sales and use values were nonzero, reported sales were sometimes higher than reported use. This occurred with 19% of products. Possible reasons are similar to those for type 2 disagreements: unreported use and/or over-stated sales. Unreported urban use of a dual ag-urban use product is one possible reason. However, as many of the products were labeled only for agricultural use, unreported urban use would not occur. In addition, the error/outlier procedure for the PUR database does not capture records with extremely low values, so it is also possible that the PUR under-states the use amount. Finally, part of the sold products may be saved in stock for future use. Table 5 shows the top 10 products with type 4 disagreement as ranked by difference in pounds of AI between reported use and sales (Table 5). Similar to the case of type 2 disagreements, unreported urban use may be estimated for dual ag/urban use products using Eqn. 2 by assuming that unreported_use >> ε_{total}. If the product is strictly for use in production agriculture, then it's assumed unreported use will inflate unreported use estimates derived using the highest level of data aggregation (i.e. comparison of total AI sales and use).

Out of a total of 1127 group III pyrethroid products reported either sold, used or both, 43 products had an average absolute deviation (years 2006 and 2007) between AI sold and AI used of 5,000 pounds or more (Table 6). Of these, 22 products had deviations (sold - used) ranging from -5,100 to -112,000 lbs. These are referred to here as "unexplainable Type 1 + Type 3 deviations" because there is no obvious way to determine if the inordinately high use relative to sales is a result of contributions of ε_{sales}, ε_{use}, or both to ε_{total}. For the 22 products, the total amount by which use exceeded sales was more than 490,000 lbs AI. By way of comparison, total annual group III pyrethroid sales was 940,000 lbs AI (mean of 2006, 2007). Among the products are 3 ag-use products and 19 termiticide/commercial structural products. Six different AIs are in these products (Table 6).

Twenty-one other products had mean sales that were at least 5,000 lbs AI greater than reported use (range 5,300 - 53,000 lbs). However, 10 of these 21 products are agricuultural-use only products, so their putative unreported use is likely not urban use (Table 6).

Effect of data aggregation

It was our initial assumption that aggregating the data to the level of the primary EPA registration number level would improve our ability to make sense of the combined sales and use data. We anticipated that the fraction of EPA primary registration numbers with greater use than sales (Type 1 and Type 3 disagreements) would be much lower than that observed with the individual product data. This was clearly not the case. In the aggregated data 26% of registration numbers had Type 1 or Type 3 errors. This is in contrast to the 27% of products with those same types of errors. The total pounds by which the aggregated Type 1+Type 3 category annual use exceeded sales was 500,000 pounds AI, slightly more than the corresponding number for the product level comparison above. Thus, the amount by which use exceeds sales for those Type 1+Type 3 registration numbers is comparable to more than half of all reported sales.

Finally, aggregation to the AI level reduces the overall magnitude of disagreement between sales and use across the dataset, where reported use across all 11 pyrethroids was 108% of sales (Table 7). However, it was evident from our inspection of the data that this occurs because positive and

negative differences between use and sales tend to cancel out as the level of aggregation increases.

Four of eleven group III pyrethroids had two-year mean use greater than two-year mean sales: beta-cyfluthrin, cypermethrin, deltamethrin and permethrin (Table 7). Among the remainder, fenpropathrin, (S)-cypermethrin and gamma-cyhalothrin are essentially agricultural-use only products, and their sales exceeded use by 24% to 68%. The remaining four AIs are used in both agricultural and urban environments.

We conclude that it is impossible to use sales and use data to derive meaningful estimates of unreported urban use because

- at the product level, deviations between use and sales show no consistent pattern to type of use: situations where reported sales > reported use occur with agricultural, urban and mixed used products,
- more than half of group III pyrethroid sales *and* use is comprised of products with unexplainable Type 1 + Type 3 deviations (use > sales) that average 5,000 lbs AI per product or greater during 2006 and 2007,
- data aggregation to the EPA primary registration number provides essentially no improvement in the unexplainable Type 1 + Type 3 deviations between sale and use,
- further data aggregation to the AI level results in obfuscation because positive and negative deviations between use and sales cancel,
- agricultural-use only AIs demonstrate both negative and positive deviations between use and sales, so that cases where sales > use cannot be arbitrarily assumed to represent unreported urban use.

In summary, both combined sales and use database error ε_{total} and unreported use are unknown quantities. There is no information to support a general assumption that ε_{total} is negligible relative to unreported use. Consequently any reliable method for estimating unreported urban use (or unreported ag use) at any level of data aggregation requires additional information well beyond simple sales and use data.

References

California Department of Pesticide Regulation (DPR). 2004. DPR reports mill compliance results. Press release.

Kreidich, N., M.L. Flint, C.A. Wilen, M. Zhang. 2005. Tracking non-residential pesticide use in urban areas of California. UC IPM

Sanders, J. November 15, 2005. Memorandum to B. Cortez, Request to place pyrethroids products into reevaluation.

Spurlock, F., and M. Lee. 2008. Synthetic Pyrethroid Use Patterns, Properties, and Environmental Effects. *In:* Gan, J., F. Spurlock, P. Hendley, and D. Weston (ed.). Synthetic Pyrethroids: Occurrence and Behavior in Aquatic Environments. Amer. Chem. Soc. Symp. Ser. 991. Amer. Chem. Soc., Washington, DC.

TDC Environmental, 2005. Pesticides in urban surface water: urban pesticides use trends annual report 2005. Prepared for the San Francisco Estuary project. March.

TDC Environmental, 2007. Pesticides in urban surface water: urban pesticides use trends annual report 2007. Prepared for the San Francisco Estuary project. June.

Weston, D.P., J.C. You and M.J. Lydy. 2004. Distribution and toxicity of sediment-associated pesticides in agriculture-dominated water bodies of California's Central Valley. Environmental Science and Technology. 38:2752-2759

Weston, D.P., R.W. Holmes, J.You and M.J. Lydy. 2005. Aquatic toxicity due to residential sue of pyrethroids insecticides. Environmental Science and Technology 39: 9778-9784

Weston, D.P. and M.J. Lydy. 2010. Urban and agricultural sources of pyrethroid insecticides to the Sacramento-San Joaquin Delta of California. Environmental Science and Technology. In press.

Wilhoit, L. 2002. Pesticide use report loading and error-handling processes. California Department of Pesticide Regulation report PM 02-01. January.

Zhang, M., L.Wilhoit, C. Geiger. 2005. Assessing dormant season organophosphate use in California almonds. Agriculture, Ecosystems and Environment. 105: 41-58

Table 1. Selected bifenthrin use and sale records, 2006-2007 (2-year average)

Registration Number	Product Name	AI Used (lbs)	AI Sold (lbs)	Note
279-3160-AA	Talstar 13% Mup Insecticide/Miticide	26	0	(1) Product were reported used but were not reported as sold (actively registered)
279- 3190-AA	Talstar Sfr Mup Insecticide/Miticide	57	0	
279- 3130-AA	Talstar T&O Granular Insecticide	1,687	0	(registration inactive)
279- 3162-AA	Talstar Lawn & Tree Flowable Insecticide/Miticide Prescription Treatment Brand	869	0	
279- 3155-AA- 499	Talstar Ca Greenhouse & Nursery Flowable Insecticide/Miticide	97	0	
228-458-AA	Menace Gc 7.9% Flowable	0	1,068	(2) Products were reported as sold but were not reported as used
239-2663-ZC	Ortho Home Defense Max Perimeter & Indoor Insect Killer	0	4,029	
279-3206-AA	Talstar Termiticide/Insecticide	19,234	2,209	(3) Reported use for products was higher than reported sale
279-3206-AA-72113	Speckoz Bifenthrin Termiticide/Insecticide	8,152	1,351	
279-3206-AA-73748	Valueline Bifenthrin Tc	7,243	4,464	
279-3206-ZA	Talstarone Multi-Insecticide	16,287	402	
279-3218-AA-239	Ortho Ortho-Klor Termite & Carpenter Ant Killer	1	2,091	(4) Reported use was lower than reported sale
279-3240-AA-239	Ortho Bug-B-Gon Max Insect Killer For Lawns	1	1,864	
66222-99-AA	Fanfare 2Ec Insecticide-Miticide	14,315	63,625	
70506-58-AA	Bifenture	4,945	7,162	

Table 2. Top products with type 1 disagreement ranked by pounds of AI used (2-year average)

Product name	Registration number	Chemical name	AI used	AI sold
Dragnet Ft Termiticide	279- 3062-AA	Permethrin	111,857	0
Speckoz Permethrin Tc	51036-287-AA-72113	Permethrin	7,324	0
Prelude Termiticide/Insecticide	10182-95-ZA	Permethrin	5,972	0
Torpedo Insecticide	10182-95-AA	Permethrin	5,803	0
Permethrin 3.2 Ag	279-3014-AA-51036	Permethrin	4,666	0
Whitmire Optem Pt 600	499-304-AA	Cyfluthrin	4,239	0
Demand Cs Insecticide	10182-361-AA	Lambda-Cyhalothrin	3,079	0
Tempo Sc Ultra Premise Spray	11556-124-AA	Beta-Cyfluthrin	2,206	0
Talstar T&O Granular Insecticide	279-3130-AA	Bifenthrin	1,687	0
Dragnet Tc Termiticide	279- 3014-ZB	Permethrin	1,552	0

Table 3. Top products with type 2 disagreement ranked by pounds of AI sold (2-year average)

Product name	Registration number	Chemical name	AI used	AI sold
Spectracide Terminate Termite & Carpenter Ant Killer Concentrate	9688-149-AA-8845	Permethrin	0	52,555
Zodiac Spot On Flea & Tick Control For Puppies, Toys & Miniatures Under 15 Lbs.	2724-497-ZA	Permethrin	0	43,902
Zodiac Spot On Flea & Tick Control For Large Dogs Over 60 Lbs.	2724-497-ZD	Permethrin	0	17,655
Bio Spot Flea & Tick Control For Dogs	270-278-AA	Permethrin	0	10,476
Real-Kill Home Insect Control Indoor & Outdoor Insect Killer	9688-201-AA-478	Cyfluthrin	0	10,385
Cutter Bug Free Backyard Brand Spray Concentrate	9688-136-AA-121	Permethrin	0	8,727
Hot Shot Fogger3	478-126-AA-8845	Permethrin	0	8,431
Raid Ant & Roach Killer 17	4822-447-AA	Cypermethrin	0	8,343
Hot Shot Pest Control Concentrate	73049-154-AA-8845	Cypermethrin	0	6,539
Real-Kill Indoor Fogger 3	8845-123-ZB-478	Permethrin	0	6,509

Table 4. Top products with type 3 disagreement ranked by pounds of difference between AI sold and AI used (2-year average)

Product name	**Registration number**	**Chemical name**	**AI used (lbs)**	**AI sold (lbs)**	**Difference** (lbs)
Tengard Sfr One Shot Termiticide/Insecticide	70506-6-AA	Permethrin	121,428	30,528	90,899
Perm-Up 3.2 Ec Insecticide	70506-9-AA	Permethrin	81,861	44,881	36,980
Prelude Termiticide/Insecticide	100-997-AA	Permethrin	38,645	3,627	35,018
Demon Tc Insecticide	100-1006-AA	Cypermethrin	24,532	33	24,499
Demon Max	100-1218-AA	Cypermethrin	37,755	13,801	23,954
Demon Tc Insecticide	10182-107-AA	Cypermethrin	22,473	10	22,462
Dragnet Sfr Termiticide/Insecticide	279-3062-ZC	Permethrin	48,238	30,803	17,435
Talstar Termiticide/Insecticide	279-3206-AA	Bifenthrin	19,234	2,209	17,025
Talstarone Multi-Insecticide	279-3206-ZA	Bifenthrin	16,287	402	15,885
Probuild Tc Termiticide	100-1006-ZA	Cypermethrin	29,387	15,360	14,027

Table 5. Top products with type 4 disagreement ranked by pounds of difference between AI sold and AI used (2-year average)

Product name	**Registration number**	**Chemical name**	**AI used (lbs)**	**AI sold (lbs)**	**Difference** (lbs)
Fanfare 2Ec Insecticide-Miticide	66222-99-AA	Bifenthrin	14,315	63,625	49,310
Adjourn Insecticide	352-515-AA-66222	Esfenvalerate	6,066	26,334	20,268
Tenkoz Permethrin 3.2Ec Insecticide	279-3014-AA-55467	Permethrin	9,693	25,711	16,018
Warrior Insecticide With Zeon Technology	100-1112-AA	Lambda-Cyhalothrin	17,605	31,094	13,489
Mustang 1.5 Ew Insecticide	279-3126-ZA	S-Cypermethrin	19,602	32,587	12,984
Real-Kill Home Insect Control Indoor & Outdoor Insect Killer	9688-201-AA-478	Cyfluthrin	0.1	10,385	10,385
Pounce 3.2 Ec	279-3014-AA	Permethrin	7,235	16,651	9,416
Hot Shot Fogger3	478-126-AA-8845	Permethrin	0.1	8,431	8,431
Demand Cs Insecticide	100-1066-AA	Lambda-Cyhalothrin	9,518	17,886	8,368
Raid Ant & Roach Killer 17	4822-447-AA	Cypermethrin	0.1	8,343	8,343

Table 6. Products with more than 5,000 lbs difference in annual reported AI sales and use (based on average of 2006, 2007 data).

PRODUCT_NAME	EPA reg	Chemical	AI use	AI sold	status	(sold-use)	primary use
SPECTRACIDE TERMINATE TERMITE & CARPENTER ANT KILLER CONCENTRATE	9688-149-AA-8845	PERMETHRIN	0	52581	No_Use	52581	structural
FANFARE 2EC INSECTICIDE-MITICIDE	66222-99-AA	BIFENTHRIN	14315	63625	Sales>Use	49310	production ag
ADJOURN INSECTICIDE	352-515-AA-66222	ESFENVALERATE	6066	26334	Sales>Use	20268	production ag
ZODIAC SPOT ON FLEA & TICK CONTROL FOR LARGE DOGS OVER 60 LBS.	2724-497-ZD	PERMETHRIN	0	17655	No_Use	17655	home/garden
TENKOZ PERMETHRIN 3.2EC INSECTICIDE	279-3014-AA-55467	PERMETHRIN	9693	25711	Sales>Use	16017	production ag
WARRIOR INSECTICIDE WITH ZEON TECHNOLOGY	100-1112-AA	LAMBDA CYHALOTHRIN	17606	31094	Sales>Use	13488	production ag
MUSTANG 1.5 EW INSECTICIDE	279-3126-ZA	(S)-CYPERMETHRIN	19604	32587	Sales>Use	12983	production ag
DANITOL 2.4 EC SPRAY	59639-35-AA	FENPROPATHRIN	35401	47802	Sales>Use	12401	production ag
BIO SPOT FLEA & TICK CONTROL FOR DOGS	270-278-AA	PERMETHRIN	0	10476	No_Use	10476	home/garden
REAL-KILL HOME INSECT CONTROL INDOOR & OUTDOOR INSECT KILLER	9688-201-AA-478	CYFLUTHRIN	0	10385	Sales>Use	10385	home/garden
POUNCE 3.2 EC	279-3014-AA	PERMETHRIN	7235	16651	Sales>Use	9416	production ag
CUTTER BUG FREE BACKYARD BRAND SPRAY CONCENTRATE	9688-136-AA-121	PERMETHRIN	0	8727	No_Use	8727	home/garden
HOT SHOT FOGGER3	478-126-AA-8845	PERMETHRIN	0	8431	Sales>Use	8431	home/garden
DEMAND CS INSECTICIDE	100-1066-AA	LAMBDA CYHALOTHRIN	9518	17886	Sales>Use	8368	structural
RAID ANT & ROACH KILLER 17	4822-447-AA	CYPERMETHRIN	0	8343	Sales>Use	8343	home/garden
DU PONT ASANA XL INSECTICIDE	352-515-AA	ESFENVALERATE	34733	42661	Sales>Use	7928	production ag
PERMETHRIN 3.2 EC INSECTICIDE	279-3014-ZA-34704	PERMETHRIN	177	7211	Sales>Use	7034	production ag
HOT SHOT PEST CONTROL CONCENTRATE	73049-154-AA-8845	CYPERMETHRIN	0	6539	Sales>Use	6539	structural
REAL-KILL INDOOR FOGGER 3	8845-123-ZB-478	PERMETHRIN	0	6509	No_Use	6509	home/garden
KATTLEGUARD II	1021-1739-AA-73103	PERMETHRIN	0	5466	No_Use	5466	production ag
SPECTRACIDE TRIAZICIDE BRAND SOIL & TURF INSECT KILLER CONCENTRATE	9688-183-AA-8845	LAMBDA CYHALOTHRIN	1	5282	Sales>Use	5281	home/garden
CYNOFF WP INSECTICIDE	279-3070-AA	CYPERMETHRIN	9043	3900	Use>Sales	-5144	structural
TEMPO SC ULTRA	3125-498-AA	BETA-CYFLUTHRIN	5236	13	Use>Sales	-5224	structural
TORPEDO INSECTICIDE	10182-95-AA	PERMETHRIN	5803	0	No_Sales	-5803	structural
PRELUDE TERMITICIDE/INSECTICIDE	10182-95-ZA	PERMETHRIN	5972	0	No_Sales	-5972	structural
MUSTANG INSECTICIDE	279-3126-ZB	(S)-CYPERMETHRIN	6905	335	Use>Sales	-6570	production ag
SPECKOZ BIFENTHRIN TERMITICIDE/INSECTICIDE	279-3206-AA-72113	BIFENTHRIN	8152	1351	Use>Sales	-6801	structural
SPECKOZ PERMETHRIN TC	51036-287-AA-72113	PERMETHRIN	7324	0	No_Sales	-7324	structural
UP-STAR GOLD INSECTICIDE	70506-24-AA	BIFENTHRIN	8868	1163	Use>Sales	-7704	structural
TIMES UP T/C	55431-3-AA	PERMETHRIN	8603	125	Use>Sales	-8478	structural
SUSPEND SC INSECTICIDE	432-763-ZA	DELTAMETHRIN	10401	0	Use>Sales	-10401	structural
PERMETHRIN PRO TERMITE TURF ORNAMENTAL	51036-287-AA	PERMETHRIN	12365	476	Use>Sales	-11889	structural
PROBUILD TC TERMITICIDE	100-1006-ZA	CYPERMETHRIN	29387	15360	Use>Sales	-14027	production ag
TALSTARONE MULTI-INSECTICIDE	279-3206-ZA	BIFENTHRIN	16287	402	Use>Sales	-15885	structural
TALSTAR TERMITICIDE/INSECTICIDE	279-3206-AA	BIFENTHRIN	19234	2209	Use>Sales	-17025	structural
DRAGNET SFR TERMITICIDE/INSECTICIDE	279-3062-ZC	PERMETHRIN	48238	30803	Use>Sales	-17435	structural
DEMON TC INSECTICIDE	10182-107-AA	CYPERMETHRIN	22473	10	Use>Sales	-22462	structural
DEMON MAX	100-1218-AA	CYPERMETHRIN	37755	13801	Use>Sales	-23954	structural
DEMON TC INSECTICIDE	100-1006-AA	CYPERMETHRIN	24532	33	Use>Sales	-24499	structural
PRELUDE TERMITICIDE/INSECTICIDE	100-997-AA	PERMETHRIN	38645	3627	Use>Sales	-35018	structural
PERM-UP 3.2 EC INSECTICIDE	70506-9-AA	PERMETHRIN	81861	44881	Use>Sales	-36980	production ag
TENGARD SFR ONE SHOT TERMITICIDE/INSECTICIDE	70506-6-AA	PERMETHRIN	121428	30528	Use>Sales	-90899	structural
DRAGNET FT TERMITICIDE	279-3062-AA	PERMETHRIN	111862	0	No_Sales	-111862	structural

Table 7. 2006-2007 mean sales and use of all group III pyrethroids (lbs AI).

Chemical Name	lbs AI sold	lbs AI used	sold-used	(sold-used) as pct of sales
Bifenthrin	137844	110986	26858	19.5%
Cyfluthrin	32029	31261	768	2.4%
beta-Cyfluthrin	8643	15308	-6665	-77.1%
Cypermethrin	76663	160550	-83886	-109.4%
(S)-Cypermethrin	34993	26611	8382	24.0%
Deltamethrin	4126	14700	-10574	-256.2%
Esfenvalerate	73912	41003	32909	44.5%
Fenpropathrin	51916	35902	16014	30.8%
gamma-Cyhalothrin	2084	656	1428	68.5%
lambda-Cyhalothrin	70251	35925	34326	48.9%
Permethrin	446526	544153	-97627	-21.9%
Total group III	938988	1017055	-78067	-8.3%

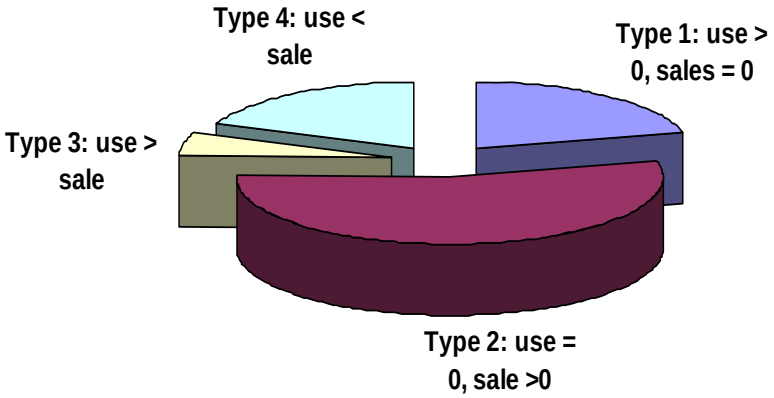


Figure 2. Group-III pyrethroid products with different types of agreements between reported use and reported sales, 2006-2007