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SUBJECT: RESULTS FOR THE ENVIRONMENTAL MONITORING OF IMIDACLOPRID AND β-CYFLUTHRIN USED IN THE ASIAN CITRUS PSYLLID ERADICATION PROGRAM

INTRODUCTION

In August 2008, the California Department of Food and Agriculture's (CDFA) Pest Detection/Emergency Projects Branch detected *Diaphorina citri*, or Asian or Asian Citrus Psyllid (ACP) in San Diego and Imperial Counties. ACP is a small bug, part of the order of Hemiptera and the suborder sternorrhyncha which includes aphids, scales, and white flies. These insects may cause direct damage to a citrus tree by feeding on phloem sap and excreting a honeydew that promotes mold growth (Brar, 2015). However, the most extensive damage originates from three species of bacteria in the genus Candidatus that are carried and transmitted by the ACP. These bacteria cause huanglongbing (HLB), also known as citrus greening disease (Boina and Bloomquist, 2015). Initial symptoms of citrus greening are observed as yellowing and blotchy leaves, followed by decreased fruit production and fruit characteristics that include lopsided shape, bitter taste, and premature drop (University of Florida, 2018). There is no known treatment after infection except tree removal.

ACP is native to Southeast Asia and India and has since been found in numerous areas including Iran, Saudi Arabia, Brazil, the Caribbean, and Central America (Qureshi et al., 2009). The first sighting of ACP in the United States occurred in Palm Beach County, Florida in June of 1998 (CDFA, 2018), but it wasn't until 2005 that citrus greening was detected (Qureshi et al., 2009). The Florida Department of Citrus has determined that the economic impact of HLB from 2006 to 2016 was a $4.643 billion net loss (average of $464 million per year) and at least 34,124 lost jobs (average of 3,412 per year) (Court et al., 2017).

In anticipation of the potential economic impact of citrus greening on the citrus industry, California implemented a statewide pest prevention and management program. One of the strategies of this program is to implement quarantines in counties where HLB is present (Cal. Code Regs. tit. 3, § 3439, 2012). In areas where ACP is detected, CDFA may authorize pesticide treatments of imidacloprid and β-cyfluthrin (Horizon Water and Environment, 2014). Imidacloprid is a chloronicotinyl insecticide that blocks nicotinic acetylcholine receptors in the central nervous system (Fossen, 2006). β-cyfluthrin is a synthetic pyrethroid insecticide that interferes with voltage gated sodium channels in the nervous system (Soderlund, 2012).

At the request of CDFA, the Environmental Monitoring Branch of the Department of Pesticide Regulation (DPR) developed a protocol for monitoring imidacloprid and β-cyfluthrin treatments (see Appendix), and DPR staff oversaw the pesticide monitoring. The monitoring results summarized in this document include imidacloprid and β-cyfluthrin treatments from March 17, 2009 to April 3, 2019 in the following counties: Alameda, Contra Costa, Fresno, Imperial, Kern, Kings, Los Angeles, Marin, Merced, Monterey, Orange, Placer, Riverside, Sacramento, San Benito, San Bernardino, San Diego, San Francisco, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Solano, Stanislaus, Tulare, Ventura, and Yolo. Air, vegetation (fruit and leaf), soil, and tank mixture monitoring results are presented.

Description of Application
Since 2009 CDFA has treated properties in California under the ACP eradication program. Treatment consisted of a soil drench of imidacloprid around citrus tree trunks followed by a foliar application of β-cyfluthrin to all citrus trees on each property. For the soil drench applications, Merit® 2F, active ingredient (A.I.) imidacloprid, was mixed with water to 0.027% A.I. Two gallons of mixed product per inch of trunk growth (maximum 7 gallons) was applied through a chemical applicator spray gun attached to a hose connected to the application truck tank. For the foliar applications, Tempo® SC Ultra (Bayer), A.I. β-cyfluthrin, was mixed with water to 0.0020% A.I. The mixed product was delivered through a chemical applicator spray gun attached to a hose connected to the application truck tank. All applications were supervised by CDFA staff and performed by CDFA staff or licensed contractors.

MATERIALS AND METHODS

The protocol used for monitoring imidacloprid and β-cyfluthrin treatments for the ACP eradication program is described below. Air, vegetation, and soil were sampled at various pesticide application intervals: pre-treatment (background), treatment, and post-treatment. The pesticide application tank was also sampled to establish pesticide concentrations at the time of treatment. Appendix I: Table 7 identifies the analytical methods used for each sampling medium. All samples were analyzed by CDFA's Center for Analytical Chemistry. For the general sampling protocol that was used as a starting point for this study, see *Guide to Sampling Air, Water, Soil and Vegetation for Chemical Analysis* (Sava, 1994). For DPR's specific protocol for this study, see *Protocol for Monitoring Imidacloprid and Cyfluthrin in the Asian Citrus Psyllid Eradication Program* (Kim, 2009; Appendix II).

Sampling Sites
The initial discovery of ACP in a county prompted the emergency control treatment program and site selection for environmental monitoring. At least one site was selected for monitoring in that new county. Each site was assigned a county abbreviation (Caltrans) and sequential number. Site selection was based on the following criteria: sites must be (1) located in the treatment area and contain ACP host plants; (2) accessible the day before, during, and after the application; and (3) located in a secure area where any disturbance of the air sampling equipment would be unlikely. Residents authorized permission for DPR staff to access the area.

Air Sampling
All air samples were collected using XAD-2 tubes (SKC# 226-30-02) and SKC air samplers (SKC# 224-PCXR8) calibrated at approximately 3 liters-per-minute. Air sampling equipment was located outdoors in an open area. Samples were collected at the following treatment intervals: 1) pre-treatment was 12-24 hours prior to pesticide application; 2) treatment was the duration of the application plus at least 2 hours; and 3) post-treatment was the interval immediately following the application period sample (sample #2), plus 12 to 24 hours. Samples were stored on dry ice until delivered to the laboratory for analysis.

Leaf Sampling
Leaf samples were collected from one or two species of host plant in close proximity to air monitoring sites. Samples were collected prior to foliar application and after the spray had dried (at least one hour after treatment). Pre-treatment and post-treatment samples were collected from the same trees. Whole leaf samples were placed in a glass Mason® jar with an aluminum foil lined lid. Leaf punch samples were collected into a 4 oz glass jar then sealed with a Teflon®-lined cap. Dislodgeable foliar residue (DFR) samples were stored on wet ice and delivered to the laboratory within 24 hours. Total residue samples were stored on dry or wet ice and delivered to lab at completion of sampling, within 3 days.

DFR samples collected through January 2011 were collected with a leaf punch, to quantify the leaf surface area, and were reported in $\mu g/cm^2$. The fluids from the citrus leaves interfered with the chemical analysis and the laboratory had problems reducing the detection limit which required a method change. Additional whole leaf samples were then collected to undergo DFR and total residue tests, reported in $\mu g/cm^2$ and ppm ($\mu g/g$), respectively.

The new DFR method, using whole leaves and a different solvent, decreased the detection limit but also increased the residue extraction to near 100%, effectively making it a total residue sample for the freshly applied pesticide. Both dislodgeable and total residue results are reported, with higher than real-world concentrations for DFR samples.

Fruit Sampling
Fruit samples were collected at the time of pesticide treatment if the fruit was ready to harvest. This was done to confirm that United States Environmental Protection Agency (U.S. EPA) tolerances were not exceeded. The U.S EPA tolerances are the maximum amount of a pesticide allowed to remain in or on a food to ensure it is safe at the time it is marketed. Each sample was a composite of multiple fruit

samples collected from a single property or tree. Samples were collected at various intervals when mature fruit was available; pre-treatment samples were collected prior to pesticide application and post-treatment samples were collected after spray residue had dried. All samples were collected in paper bags, sealed in plastic bags, and stored on wet ice until delivered to the laboratory.

Soil Sampling
Soil was sampled at treatment sites to measure the concentration of imidacloprid in the soil before and after treatment. The initial sample was collected prior to pesticide treatment. The post-treatment sample was collected at least one hour after treatment. Each sample consisted of three randomly selected soil cores taken to a depth of 1 inch. Cores were collected using a 2-1/2 inch (28.56 square centimeter [cm^2]) diameter stainless steel tube and composited into one wide mouth glass Mason® jar with an aluminum foil lined lid. All samples were stored on wet ice until delivered to the laboratory.

Tank Mixture Sampling
Tank mixtures were sampled to establish the concentration of imidacloprid and β-cyfluthrin in the spray material. Samples were collected from treatment spray guns immediately after treatment. Samples were collected in 500 mL Nalgene® wide mouth bottles; each bottle was triple bagged and kept on wet ice or refrigerated until delivered to the laboratory.

Quality Control
The CDFA Center for Analytical Chemistry analyzed all samples collected for this monitoring study. Standard operating procedures for continuing quality control (QC) measures are specified in QAQC001.01 (Peoples, 2019). Continuing QC samples were evaluated by laboratory chemists and adjustments were made to the analytical equipment on an as-needed basis to ensure analytical integrity.

RESULTS AND DISCUSSION

Air Samples
A total of 299 air samples were collected. Of this total, 149 were for β-cyfluthrin and 150 were for imidacloprid. Typically, three samples were collected for each pesticide corresponding to pre-treatment, treatment, and post-treatment intervals. Some samples did not yield accurate results due to sample pump malfunction. These samples were not delivered to the CDFA Center for Analytical Chemistry laboratory and are not included in this report. None of the samples contained detectable residues of either imidacloprid or β-cyfluthrin. However, there was one application interval sample with a trace detection, below the detection limit, for imidacloprid of less than 0.022 $\mu g/m^3$, (see Table 1 for the data analysis, Appendix I: Table 8 for individual sample results of β-cyfluthrin, and Table 9 for individual results of imidacloprid).

Acute inhalation screening levels have been developed by DPR, in consultation with the Office of Environmental Health Hazard Assessment, for imidacloprid and β-cyfluthrin at 150 micrograms per cubic meter ($\mu g/m^3$) and 1.04 $\mu g/m^3$, respectively. Imidacloprid reporting limits were low enough to ensure air concentrations did not exceed acute screening levels. Due to a short sampling period during

β-cyfluthrin treatment (under three hours), six samples had reporting limits over 1.04 µg/m^3 at 1.10 to 1.19 µg/m^3. These samples were collected during the early stages of the study. As a result, the sample volume was increased to lower the reporting limit.

Table 1: Reporting limits and data analysis of air sampling for imidacloprid and β-cyfluthrin treatments from March 17, 2009 to April 3, 2019. These values represent the highest concentration that may have gone undetected.

Tested A.I.	**Interval**	**MDL/LOQ** µg/sample	**Minimum Reporting Limit** µg/m^3	**Maximum Reporting Limit** µg/m^3	**Average Reporting Limit** µg/m^3	**Count**
β-Cyfluthrin	Pre-treatment	0.05	0.016	0.023	0.019	17
		0.5	0.115	0.266	0.173	31
	Treatment	0.05	0.030	0.041	0.035	20
		0.5	0.326	1.190	0.692	31
	Post-treatment	0.05	0.014	0.019	0.016	19
		0.5	0.115	0.195	0.144	31
Imidacloprid	Pre-treatment	0.01	0.003	0.004	0.004	8
		0.05	0.012	0.027	0.018	37
		0.5	0.143	0.217	0.186	4
	Treatment	0.01	0.007	0.020	0.009	10
		0.05	0.029	0.123	0.062	37
		0.5	0.329	0.580	0.450	4
	Post-treatment	0.01	0.003	0.004	0.003	9
		0.05	0.011	0.090	0.017	37
		0.5	0.130	0.374	0.199	4

Leaf Samples
For the 27 leaf samples analyzed for pre-treatment total residue, 3 had detectable residues of 0.24, 0.28, and 0.5 ppm, yielding an average of 0.34 ppm of β-cyfluthrin. The other 24 samples were below the detection limit (ND). The ND samples are not given a numeric value and therefore not used in any statistical calculations.

For the 36 leaf samples analyzed for post-treatment total residue the average was 2.66 ppm of β-cyfluthrin with a maximum of 9.57 ppm, Table 2.

As mentioned in the methods section, early DFR samples had detection issues and were all non-detects; the results are included in this report but are not used in the statistics. The new method extracted all recently applied surface residues, and is not a realistic representation of dislodgeable residues with the freshly (~1hr) applied samples, but instead is a maximum that can be used as a worst case scenario.

For the 36 leaf pre-treatment dislodgeable samples taken, one sample had detectable residues of β-cyfluthrin at 0.000028 $\mu g/cm^2$ (0.015 ppm). Eight of the 44 post-treatment dislodgeable leaf samples were below the detection limit (ND). The ND samples are not given a numerical value or used in the statistical calculations. The average of the post-treatment dislodgeable leaf samples is 1.01 $\mu g/cm^2$ with a maximum of 6.77 $\mu g/cm^2$, Table 3.

Table 2: Data analysis of total residue vegetation (leaf) sample results for β-cyfluthrin treatments from March 17, 2009 to April 3, 2019 with results in parts per million.

Sample Type	Average	Median	Min	Max	Standard Deviation	Count*
Leaf-T Pre-treatment	0.34	ND	ND	0.5	0.14	3
Leaf-T Post-treatment	2.66	1.61	ND	9.57	2.63	34

*Count of non ND samples used for Average and Standard Deviation.

Table 3: Data analysis of leaf dislodgeable sampling for β-cyfluthrin treatments from March 17, 2009 to April 3, 2019 with results in $\mu g/cm^2$. Measuring β-cyfluthrin for leaf samples.

Sample Type	Average	Median	Min	Max	Standard Deviation	Count*
Leaf-D Pre-treatment	0.00003	ND	ND	0.00003		1
Leaf-D Post-treatment	1.01	1.05	ND	6.77	1.4	36

*Count of non ND samples used for Average and Standard Deviation.

Fruit Samples
A total of 34 fruit samples (rind and pulp) were collected prior to treatment and none of them had detectable residues of β-cyfluthrin. For the 36 samples collected a few hours after treatment or later when the fruit was ripe, 12 samples had detections with an average of 0.066 ppm of β-cyfluthrin and a maximum of 0.14 ppm. One of the analytical methods used had a detection limit of 0.1 ppm (higher than the 0.066 ppm average); those samples should be considered to have similar levels. No fruit samples

exceeded U.S. EPA tolerances for citrus (0.20 ppm). See Table 4 for data analysis of β-cyfluthrin results in ppm and Appendix I: Table 12 for individual sample results and detection limits.

Table 4: Data analysis of vegetation (fruit) sample results for β-cyfluthrin treatments from March 17, 2009 to April 3, 2019 with results in parts per million.

Sample Type	Average	Median	Min	Max	Standard Deviation	Count
Fruit Pre-treatment	ND	ND	ND	ND		34
Fruit Post-treatment	0.066	ND	ND	0.14	0.04	12*

*Count of non ND samples used for Average and Standard Deviation.

Soil Samples

A total of 56 pre-treatment samples were collected, four of which had detectable residues of imidacloprid (0.01 to 0.48 ppm) with an average of 0.14 ppm. All 54 post-treatment samples had detectable residues. At one site the applicator mixed the wrong concentration of Merit® 2F (0.13% instead of 0.027%) resulting in high soil concentrations, 199 and 737 ppm. These sites were treated from the same treatment tank mixture and the values were not used in the following calculations. The average for the other 52 post-treatment soil samples was 39.93 ppm of imidacloprid. The results were between 0.24 ppm and 178 ppm of imidacloprid. See Table 5 for data analysis for imidacloprid results for soil samples and Appendix I: Table 13 for individual sample results.

Table 5: Data analysis of soil sample results for imidacloprid treatments from March 17, 2009 to April 3, 2019 with results in parts per million.

Sample Type	Average	Median	Min	Max	Standard Deviation	Count*
Soil Pre-treatment	0.14	ND	ND	0.483	0.23	4
Soil Post-treatment	39.93	30.85	0.24	178.3	38.03	52

*Count of non ND samples used for Average and Standard Deviation.

Tank mix

Tank samples had average concentrations of 0.0014 and 0.034% A.I. of β-cyfluthrin and imidacloprid, respectively. The range of the 46 samples taken from the Tempo® tank was from 0.000094 and 0.00596 percent A.I. of β-cyfluthrin. The range of the 44 samples taken from the Merit® tank was from 0.0059 to 0.134 percent A.I. of imidacloprid. As described in the Soil Samples section, the values from the tank with the wrong concentration (0.126% and 0.134%) are not included in the following calculations, Table 6. The target application rate was 0.0020% A.I. of β-cyfluthrin 0.027% A.I. of imidacloprid. See Appendix I: Table 14 for individual sample results of Tempo® tanks and Table 15 for individual sample results of Merit® tanks.

Table 6: Data analysis of tank sampling for imidacloprid and β-cyfluthrin treatments from March 17, 2009 to April 3, 2019 with results in percentage of active ingredient.

Sample	Average	Median	Min	Max	Standard Deviation	Count
Tank β-Cyfluthrin	0.0014	0.0011	0.000094	0.00596	0.0013	46
Tank Imidacloprid	0.0309	0.0280	0.0059	0.057	0.0097	42

The two incorrectly mixed imidacloprid samples are not included

CONCLUSIONS

Imidacloprid and β-cyfluthrin monitoring for treatments on 60 sites in 26 counties from March 17, 2009 to April 3, 2019, yielded the following results:

- Pre-treatment, treatment, and post-treatment air samples contained no detected residues of β-cyfluthrin. Pre-treatment and post-treatment air samples contained no detected residues of imidacloprid, one treatment sample had a trace detection of <0.022 $\mu g/m^3$ of imidacloprid.

- Pre-treatment samples testing surface of leaf (dislodgeable) found one detectable amount of β-cyfluthrin, 0.00003 $\mu g/cm^2$. Post-treatment samples testing surface of leaf found 1.01 $\mu g/cm^2$ of β-cyfluthrin on average.

- Pre-treatment samples testing whole leaf (total) found three samples (0.34 ppm average) with β-cyfluthrin. Post-treatment samples contained an average of 2.66 ppm of β-cyfluthrin.

- No whole fruit samples (rind and pulp) exceeded U.S. EPA tolerances for citrus. Pre-treatment fruit samples had no detectable residues of β-cyfluthrin. Post-treatment fruit samples had less than 0.14 ppm of β-cyfluthrin.

- Four pre-treatment soil samples had detectable imidacloprid residues (average of 0.14 ppm). Post-treatment samples had an average of 39.93 ppm of imidacloprid (excluding the errant application) with a large standard deviation due to the various soil types and moisture levels.

- Tank sample average concentrations were 0.0014 and 0.032% A.I. of β-cyfluthrin and imidacloprid, respectively.

- One imidacloprid tank (two samples) was mixed incorrectly (0.13% instead of 0.027%) resulting in high soil concentrations at two sample sites.

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APPENDIX I

ADDITIONAL TABLES

Table 7. Analytical methods used for imidacloprid and β-cyfluthrin in all sampling media. Reporting limits presented in micrograms per cubic meter (µg/m^3), parts per million (ppm), parts per billion (ppb) and percent active ingredient (% A.I.).

Sample Medium	β-Cyfluthrin		Imidacloprid	
	Analytical Method	**Reporting Limit**	**Analytical Method**	**Reporting Limit**
Air	EMON 16.0 Modified EMON 12.3 Modified	0.02 - 1.19 µg/m^3	EMON 12.3 Modified	0.003 - 0.552 µg/m^3
Leaf-D	WHS-SM-1 Modified	0.02 - 0.53 ppm	N/A	N/A
Leaf-T	EMON 12.5 Modified	0.002 - 1.0 ppm	N/A	N/A
Fruit	QuEChERS	0.001 - 0.1 ppm	N/A	N/A
Soil	N/A	N/A	EMON 12.6 Modified	0.01 ppm
Tank Mixture	HPLC	percent	HPLC	percent

‡ Analytical methods protocols available at: http://www.cdpr.ca.gov/docs/emon/pubs/em_methd_main.htm or available upon request

† The reporting limit for air samples varies from 0.003 - 0.552 µg/m^3 for imidacloprid and from 0.02 - 1.19 µg/m^3 for β-cyfluthrin due to the variation in sample collection duration (sample volume)

‡‡ List of all analytical methods used for analysis in each respective sampling medium during 2009-2017 monitoring

†† Reporting limits vary depending on sample and analytical method used

Table 8: Results of air sampling for β-cyfluthrin treatments from March 17, 2009 to April 3, 2019. Results are presented in micrograms per cubic meter (µg/m^3).

Sample #	Site #	Date On	Interval	Amount Detected (µg/m^3)	MDL/LOQ Results (µg/sample)	Reporting Limit (µg/m^3)	Method
120	IMP3	3/16/2009	Pre-treatment	ND	0.5	0.166	EMON 12.3 Modified
123	IMP3	3/17/2009	Treatment	ND	0.5	1.019	EMON 12.3 Modified
124	IMP3	3/17/2009	Post-treatment	ND	0.5	0.115	EMON 12.3 Modified
180	SD1	3/25/2009	Pre-treatment	ND	0.5	0.126	EMON 12.3 Modified
181	SD2	3/25/2009	Pre-treatment	ND	0.5	0.135	EMON 12.3 Modified
173	SD1	3/26/2009	Treatment	ND	0.5	0.569	EMON 12.3 Modified
176	SD2	3/26/2009	Treatment	ND	0.5	0.597	EMON 12.3 Modified
172	SD1	3/26/2009	Post-treatment	ND	0.5	0.121	EMON 12.3 Modified
178	SD2	3/26/2009	Post-treatment	ND	0.5	0.148	EMON 12.3 Modified
210	IMP3	5/11/2009	Pre-treatment	ND	0.5	0.165	EMON 12.3 Modified
215	IMP3	5/12/2009	Treatment	ND	0.5	1.113	EMON 12.3 Modified
209	IMP3	5/12/2009	Post-treatment	ND	0.5	0.134	EMON 12.3 Modified
334	LA1	9/23/2009	Pre-treatment	ND	0.5	0.122	EMON 12.3 Modified
327	LA1	9/24/2009	Treatment	ND	0.5	0.921	EMON 12.3 Modified
333	LA1	9/24/2009	Post-treatment	ND	0.5	0.120	EMON 12.3 Modified
355	LA3	10/5/2009	Pre-treatment	ND	0.5	0.148	EMON 12.3 Modified
358	LA3	10/6/2009	Treatment	ND	0.5	0.922	EMON 12.3 Modified
356	LA3	10/6/2009	Post-treatment	ND	0.5	0.116	EMON 12.3 Modified
958	SBD1	12/7/2010	Pre-treatment	ND	0.5	0.134	EMON 12.3 Modified
960	SBD2	12/7/2010	Pre-treatment	ND	0.5	0.188	EMON 12.3 Modified
360	SBD1	12/8/2010	Treatment	ND	0.5	1.127	EMON 12.3 Modified
963	SBD2	12/8/2010	Treatment	ND	0.5	0.799	EMON 12.3 Modified
957	SBD1	12/8/2010	Post-treatment	ND	0.5	0.144	EMON 12.3 Modified
962	SBD2	12/8/2010	Post-treatment	ND	0.5	0.148	EMON 12.3 Modified
1041	VEN2	1/17/2011	Pre-treatment	ND	0.5	0.124	EMON 12.3 Modified
1047	VEN2	1/18/2011	Treatment	ND	0.5	1.103	EMON 12.3 Modified
1053	VEN2	1/18/2011	Post-treatment	ND	0.5	0.115	EMON 12.3 Modified
349	ORA2	2/14/2011	Pre-treatment	ND	0.5	0.115	EMON 12.3 Modified
362	ORA2	2/15/2011	Treatment	ND	0.5	0.840	EMON 12.3 Modified
351	ORA2	2/15/2011	Post-treatment	ND	0.5	0.122	EMON 12.3 Modified
1101	RIV1	2/28/2011	Pre-treatment	ND	0.5	0.133	EMON 12.3 Modified
1097	RIV1	3/1/2011	Treatment	ND	0.5	1.162	EMON 12.3 Modified
1102	RIV1	3/1/2011	Post-treatment	ND	0.5	0.122	EMON 12.3 Modified
1096	RIV2	6/20/2011	Pre-treatment	ND	0.5	0.121	EMON 12.3 Modified
1049	RIV2	6/21/2011	Treatment	ND	0.5	1.190	EMON 12.3 Modified

Sample #	Site #	Date On	Interval	Amount Detected (µg/m^3)	MDL/LOQ Results (µg/sample)	Reporting Limit (µg/m^3)	Method
361	RIV2	6/21/2011	Post-treatment	ND	0.5	0.134	EMON 12.3 Modified
1372	VEN1	7/11/2011	Pre-treatment	ND	0.5	0.117	EMON 12.3 Modified
1371	VEN1	7/12/2011	Treatment	ND	0.5	0.919	EMON 12.3 Modified
1376	VEN1	7/12/2011	Post-treatment	ND	0.5	0.137	EMON 12.3 Modified
2136	LA4	4/9/2012	Pre-treatment	ND	0.5	0.175	EMON 12.3 Modified
2138	LA5	4/9/2012	Pre-treatment	ND	0.5	0.146	EMON 12.3 Modified
2140	LA4	4/10/2012	Treatment	ND	0.5	0.581	EMON 12.3 Modified
2145	LA5	4/10/2012	Treatment	ND	0.5	0.607	EMON 12.3 Modified
2143	LA5	4/10/2012	Post-treatment	ND	0.5	0.146	EMON 12.3 Modified
2146	LA4	4/10/2012	Post-treatment	ND	0.5	0.135	EMON 12.3 Modified
2148	ORA3	8/28/2012	Pre-treatment	ND	0.5	0.266	EMON 16.0 Modified
2510	ORA3	8/29/2012	Treatment	ND	0.5	1.115	EMON 16.0 Modified
2515	ORA3	8/29/2012	Post-treatment	ND	0.5	0.140	EMON 16.0 Modified
2621	TUL2	12/5/2012	Pre-treatment	ND	0.5	0.145	EMON 16.0 Modified
2623	TUL1	12/5/2012	Pre-treatment	ND	0.5	0.167	EMON 16.0 Modified
2625	TUL1	12/6/2012	Treatment	ND	0.5	0.573	EMON 16.0 Modified
2627	TUL2	12/6/2012	Treatment	ND	0.5	0.574	EMON 16.0 Modified
2629	TUL1	12/6/2012	Post-treatment	ND	0.5	0.139	EMON 16.0 Modified
2631	TUL2	12/6/2012	Post-treatment	ND	0.5	0.126	EMON 16.0 Modified
2844	SB1	3/4/2013	Pre-treatment	ND	0.5	0.154	EMON 16.0 Modified
2845	SB2	3/4/2013	Pre-treatment	ND	0.5	0.154	EMON 16.0 Modified
2848	SB1	3/5/2013	Treatment	ND	0.5	0.522	EMON 16.0 Modified
2850	SB2	3/5/2013	Treatment	ND	0.5	0.404	EMON 16.0 Modified
2852	SB1	3/5/2013	Post-treatment	ND	0.5	0.126	EMON 16.0 Modified
2853	SB2	3/20/2013	Post-treatment	ND	0.5	0.133	EMON 16.0 Modified
3308	SLO1	4/14/2014	Pre-treatment	ND	0.5	0.223	EMON 16.0 Modified
3310	SLO2	4/14/2014	Pre-treatment	ND	0.5	0.225	EMON 16.0 Modified
3311	SLO1	4/15/2014	Treatment	ND	0.5	0.358	EMON 16.0 Modified
3313	SLO2	4/15/2014	Treatment	ND	0.5	0.897	EMON 16.0 Modified
3316	SLO2	4/15/2014	Post-treatment	ND	0.5	0.157	EMON 16.0 Modified
3317	SLO1	4/15/2014	Post-treatment	ND	0.5	0.195	EMON 16.0 Modified
3625	KER1	9/21/2014	Pre-treatment	ND	0.5	0.226	EMON 12.3 Modified
3627	KER2	9/21/2014	Pre-treatment	ND	0.5	0.226	EMON 12.3 Modified
3630	KER1	9/22/2014	Treatment	ND	0.5	0.342	EMON 12.3 Modified
3631	KER2	9/22/2014	Treatment	ND	0.5	0.388	EMON 12.3 Modified
3633	KER1	9/22/2014	Post-treatment	ND	0.5	0.159	EMON 12.3 Modified
3636	KER2	9/22/2014	Post-treatment	ND	0.5	0.159	EMON 12.3 Modified

Sample #	Site #	Date On	Interval	Amount Detected (µg/m^3)	MDL/LOQ Results (µg/sample)	Reporting Limit (µg/m^3)	Method
3899	SBT1	4/29/2015	Pre-treatment	ND	0.05	0.018	EMON 12.3 Modified
3901	SBT2	4/29/2015	Pre-treatment	ND	0.05	0.019	EMON 12.3 Modified
3903	SBT2	4/30/2015	Treatment	ND	0.05	0.038	EMON 12.3 Modified
3905	SBT1	4/30/2015	Treatment	ND	0.05	0.038	EMON 12.3 Modified
3907	SBT2	4/30/2015	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified
3909	SBT1	4/30/2015	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified
4108	STA2	11/11/2015	Pre-treatment	ND	0.05	0.017	EMON 12.3 Modified
4110	STA1	11/11/2015	Pre-treatment	ND	0.05	0.017	EMON 12.3 Modified
4112	STA2	11/12/2015	Treatment	ND	0.05	0.035	EMON 12.3 Modified
4114	STA1	11/12/2015	Treatment	ND	0.05	0.032	EMON 12.3 Modified
4116	STA2	11/12/2015	Post-treatment	ND	0.05	0.016	EMON 12.3 Modified
4118	STA1	11/12/2015	Post-treatment	ND	0.05	0.016	EMON 12.3 Modified
4138	SM1	11/18/2015	Pre-treatment	ND	0.5	0.190	EMON 12.3 Modified
4140	SM2	11/18/2015	Pre-treatment	ND	0.05	0.019	EMON 12.3 Modified
4142	SM1	11/19/2015	Treatment	ND	0.05	0.035	EMON 12.3 Modified
4144	SM2	11/19/2015	Treatment	ND	0.05	0.033	EMON 12.3 Modified
4146	SM1	11/19/2015	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
4148	SM2	11/19/2015	Post-treatment	ND	0.05	0.016	EMON 12.3 Modified
4202	FRE1	1/20/2016	Pre-treatment	ND	0.5	0.190	EMON 12.3 Modified
4204	FRE2	1/20/2016	Pre-treatment	ND	0.5	0.175	EMON 12.3 Modified
4206	FRE1	1/21/2016	Treatment	ND	0.5	0.361	EMON 12.3 Modified
4208	FRE2	1/21/2016	Treatment	ND	0.5	0.369	EMON 12.3 Modified
4210	FRE2	1/21/2016	Post-treatment	ND	0.5	0.186	EMON 12.3 Modified
4212	FRE1	1/21/2016	Post-treatment	ND	0.5	0.181	EMON 12.3 Modified
4378	KIN1	5/23/2016	Pre-treatment	ND	0.5	0.220	EMON 12.3 Modified
4380	KIN2	5/23/2016	Pre-treatment	ND	0.5	0.214	EMON 12.3 Modified
4382	KIN1	5/24/2016	Treatment	ND	0.5	0.326	EMON 12.3 Modified
4384	KIN2	5/24/2016	Treatment	ND	0.5	0.337	EMON 12.3 Modified
4386	KIN1	5/24/2016	Post-treatment	ND	0.5	0.166	EMON 12.3 Modified
4388	KIN2	5/24/2016	Post-treatment	ND	0.5	0.166	EMON 12.3 Modified
4412	MON1	6/28/2016	Pre-treatment	ND	0.05	0.021	EMON 12.3 Modified
4414	MON2	6/28/2016	Pre-treatment	ND	0.05	0.020	EMON 12.3 Modified
4416	MON1	6/29/2016	Treatment	ND	0.05	0.037	EMON 12.3 Modified
4418	MON2	6/29/2016	Treatment	ND	0.05	0.037	EMON 12.3 Modified
4420	MON1	6/29/2016	Post-treatment	ND	0.05	0.016	EMON 12.3 Modified
4422	MON2	6/29/2016	Post-treatment	ND	0.05	0.017	EMON 12.3 Modified
4486	PLA1	9/25/2016	Pre-treatment	ND	0.05	0.020	EMON 12.3 Modified

Sample #	Site #	Date On	Interval	Amount Detected (µg/m^3)	MDL/LOQ Results (µg/sample)	Reporting Limit (µg/m^3)	Method
4492	PLA2	9/26/2016	Pre-treatment	ND	0.05	0.019	EMON 12.3 Modified
4489	PLA1	9/26/2016	Treatment	ND	0.05	0.037	EMON 12.3 Modified
4490	PLA1	9/26/2016	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
4494	PLA2	9/27/2016	Treatment	ND	0.05	0.038	EMON 12.3 Modified
4496	PLA2	9/27/2016	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified
4558	MER1	11/21/2016	Pre-treatment	ND	0.05	0.020	EMON 12.3 Modified
4560	MER2	11/21/2016	Pre-treatment	ND	0.05	0.020	EMON 12.3 Modified
4562	MER1	11/22/2016	Treatment	ND	0.05	0.032	EMON 12.3 Modified
4564	MER2	11/22/2016	Treatment	ND	0.05	0.033	EMON 12.3 Modified
4566	MER1	11/22/2016	Post-treatment	ND	0.05	0.018	EMON 12.3 Modified
4568	MER2	11/22/2016	Post-treatment	ND	0.05	0.019	EMON 12.3 Modified
4588	SOL1	1/25/2017	Pre-treatment	ND	0.05	0.017	EMON 12.3 Modified
4594	SOL2	1/25/2017	Pre-treatment	ND	0.05	0.017	EMON 12.3 Modified
4590	SOL1	1/26/2017	Treatment	ND	0.05	0.036	EMON 12.3 Modified
4596	SOL2	1/26/2017	Treatment	ND	0.05	0.032	EMON 12.3 Modified
4592	SOL1	1/26/2017	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified
4598	SOL2	1/26/2017	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
4634	YOL1	3/6/2017	Pre-treatment	ND	0.05	0.016	EMON 12.3 Modified
4628	ALA1	3/7/2017	Pre-treatment	ND	0.05	0.016	EMON 12.3 Modified
4636	YOL1	3/7/2017	Treatment	ND	0.05	0.039	EMON 12.3 Modified
4638	YOL1	3/7/2017	Post-treatment	ND	0.05	0.018	EMON 12.3 Modified
4630	ALA1	3/8/2017	Treatment	ND	0.05	0.041	EMON 12.3 Modified
4633	ALA1	3/8/2017	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
4692	CC1	4/9/2017	Pre-treatment	ND	0.05	0.018	EMON 12.3 Modified
4694	CC1	4/10/2017	Treatment	ND	0.05	0.034	EMON 12.3 Modified
4696	CC1	4/10/2017	Post-treatment	ND	0.05	0.017	EMON 12.3 Modified
4904	MRN1	12/26/2018	Pre-treatment	ND	0.5	0.228	EMON 12.3 Modified
4909	MRN2	12/26/2018	Pre-treatment	ND	0.5	0.231	EMON 12.3 Modified
4906	MRN1	12/27/2018	Treatment	ND	0.5	0.421	EMON 12.3 Modified
4912	MRN2	12/27/2018	Treatment	ND	0.5	0.394	EMON 12.3 Modified
4907	MRN1	12/27/2018	Post-treatment	ND	0.5	0.151	EMON 12.3 Modified
4914	MRN2	12/27/2018	Post-treatment	ND	0.5	0.161	EMON 12.3 Modified
4966	SF1	2/6/2019	Treatment	ND	0.5	0.609	EMON 12.3 Modified
4968	SF1	2/6/2019	Post-treatment	ND	0.5	0.157	EMON 12.3 Modified
5036	SAC1	4/2/2019	Pre-treatment	ND	0.05	0.023	EMON 12.3 Modified
5038	SAC1	4/3/2019	Treatment	ND	0.05	0.030	EMON 12.3 Modified
5042	SAC2	4/3/2019	Treatment	ND	0.05	0.030	EMON 12.3 Modified

Sample #	Site #	Date On	Interval	Amount Detected (µg/m^3)	MDL/LOQ Results (µg/sample)	Reporting Limit (µg/m^3)	Method
5044	SAC2	4/3/2019	Treatment	ND	0.05	0.033	EMON 12.3 Modified
5040	SAC1	4/3/2019	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified
5046	SAC2	4/3/2019	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified

Table 9: Results of air sampling for imidacloprid treatments from March 17, 2009 to April 3, 2019. Results are presented in micrograms per cubic meter (µg/m^3).

Sample #	Site #	Date	Interval	Amount Detected (µg/m^3)	MDL/LOQ Results (µg/sample)	Reporting Limit (µg/m^3)	Method
121	IMP3	3/16/2009	Pre-treatment	ND	0.05	0.017	EMON 12.3 Modified
122	IMP3	3/17/2009	Treatment	ND	0.05	0.105	EMON 12.3 Modified
125	IMP3	3/17/2009	Post-treatment	ND	0.05	0.012	EMON 12.3 Modified
175	SD1	3/25/2009	Pre-treatment	ND	0.05	0.013	EMON 12.3 Modified
183	SD2	3/25/2009	Pre-treatment	ND	0.05	0.013	EMON 12.3 Modified
177	SD2	3/26/2009	Treatment	ND	0.05	0.062	EMON 12.3 Modified
179	SD1	3/26/2009	Treatment	ND	0.05	0.059	EMON 12.3 Modified
174	SD1	3/26/2009	Post-treatment	ND	0.05	0.012	EMON 12.3 Modified
182	SD2	3/26/2009	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
206	IMP3	5/11/2009	Pre-treatment	ND	0.05	0.017	EMON 12.3 Modified
220	IMP3	5/12/2009	Treatment	ND	0.05	0.112	EMON 12.3 Modified
208	IMP3	5/12/2009	Post-treatment	ND	0.05	0.090	EMON 12.3 Modified
330	LA1	9/23/2009	Pre-treatment	ND	0.05	0.012	EMON 12.3 Modified
201	LA1	9/24/2009	Treatment	ND	0.05	0.092	EMON 12.3 Modified
326	LA1	9/24/2009	Post-treatment	ND	0.05	0.012	EMON 12.3 Modified
354	LA3	10/5/2009	Pre-treatment	ND	0.05	0.027	EMON 12.3 Modified
359	LA3	10/6/2009	Treatment	ND	0.05	0.092	EMON 12.3 Modified
357	LA3	10/6/2009	Post-treatment	ND	0.05	0.012	EMON 12.3 Modified
329	SBD2	12/7/2010	Pre-treatment	ND	0.05	0.018	EMON 12.3 Modified
956	SBD1	12/7/2010	Pre-treatment	ND	0.05	0.014	EMON 12.3 Modified
331	SBD1	12/8/2010	Treatment	0.02	0.05	0.108	EMON 12.3 Modified
965	SBD2	12/8/2010	Treatment	ND	0.05	0.083	EMON 12.3 Modified
328	SBD1	12/8/2010	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
332	SBD2	12/8/2010	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
363	ORA2	2/14/2011	Pre-treatment	ND	0.05	0.013	EMON 12.3 Modified
353	ORA2	2/15/2011	Treatment	ND	0.05	0.089	EMON 12.3 Modified
350	ORA2	2/15/2011	Post-treatment	ND	0.05	0.012	EMON 12.3 Modified

Sample #	Site #	Date	Interval	Amount Detected (µg/m^3)	MDL/LOQ Results (µg/sample)	Reporting Limit (µg/m^3)	Method
1098	RIV1	2/28/2011	Pre-treatment	ND	0.05	0.023	EMON 12.3 Modified
1105	RIV2	6/20/2011	Pre-treatment	ND	0.05	0.012	EMON 12.3 Modified
1099	RIV2	6/21/2011	Treatment	ND	0.05	0.123	EMON 12.3 Modified
1052	RIV2	6/21/2011	Post-treatment	ND	0.05	0.013	EMON 12.3 Modified
1380	VEN1	7/11/2011	Pre-treatment	ND	0.05	0.012	EMON 12.3 Modified
1373	VEN1	7/12/2011	Treatment	ND	0.05	0.088	EMON 12.3 Modified
1379	VEN1	7/12/2011	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified
2137	LA4	4/9/2012	Pre-treatment	ND	0.05	0.012	EMON 12.3 Modified
2139	LA5	4/9/2012	Pre-treatment	ND	0.05	0.015	EMON 12.3 Modified
2141	LA4	4/10/2012	Treatment	ND	0.05	0.057	EMON 12.3 Modified
2144	LA5	4/10/2012	Treatment	ND	0.05	0.061	EMON 12.3 Modified
2142	LA5	4/10/2012	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified
2147	LA4	4/10/2012	Post-treatment	ND	0.05	0.013	EMON 12.3 Modified
2624	TUL1	12/5/2012	Pre-treatment	ND	0.5	0.169	EMON 12.3 Modified
2622	TUL2	12/5/2012	Pre-treatment	ND	0.5	0.143	EMON 12.3 Modified
2626	TUL1	12/6/2012	Treatment	ND	0.5	0.580	EMON 12.3 Modified
2628	TUL2	12/6/2012	Treatment	ND	0.5	0.558	EMON 12.3 Modified
2630	TUL1	12/6/2012	Post-treatment	ND	0.5	0.130	EMON 12.3 Modified
2632	TUL2	12/6/2012	Post-treatment	ND	0.5	0.131	EMON 12.3 Modified
2843	SB1	3/4/2013	Pre-treatment	ND	0.05	0.015	EMON 12.3 Modified
2847	SB1	3/5/2013	Treatment	ND	0.05	0.052	EMON 12.3 Modified
2851	SB1	3/5/2013	Post-treatment	ND	0.05	0.012	EMON 12.3 Modified
2854	SB3	4/17/2013	Pre-treatment	ND	0.05	0.018	EMON 12.3 Modified
2979	SB4	4/17/2013	Pre-treatment	ND	0.05	0.018	EMON 12.3 Modified
2980	SB3	4/18/2013	Treatment	ND	0.05	0.091	EMON 12.3 Modified
2982	SB4	4/18/2013	Treatment	ND	0.05	0.114	EMON 12.3 Modified
2983	SB3	4/18/2013	Post-treatment	ND	0.05	0.012	EMON 12.3 Modified
2986	SB4	4/18/2013	Post-treatment	ND	0.05	0.012	EMON 12.3 Modified
2987	SB5	3/17/2014	Pre-treatment	ND	0.05	0.016	EMON 12.3 Modified
3261	SB6	3/17/2014	Pre-treatment	ND	0.05	0.022	EMON 12.3 Modified
3262	SB5	3/18/2014	Treatment	ND	0.05	0.080	EMON 12.3 Modified
3265	SB6	3/18/2014	Treatment	ND	0.05	0.094	EMON 12.3 Modified
3264	SB5	3/18/2014	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified
3266	SB6	3/18/2014	Post-treatment	ND	0.05	0.013	EMON 12.3 Modified
3309	SLO2	4/14/2014	Pre-treatment	ND	0.05	0.022	EMON 12.3 Modified
3314	SLO2	4/15/2014	Treatment	ND	0.05	0.088	EMON 12.3 Modified
3315	SLO2	4/15/2014	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified

Sample #	Site #	Date	Interval	Amount Detected (µg/m^3)	MDL/LOQ Results (µg/sample)	Reporting Limit (µg/m^3)	Method
3626	KER1	9/21/2014	Pre-treatment	ND	0.05	0.022	EMON 12.3 Modified
3628	KER2	9/21/2014	Pre-treatment	ND	0.05	0.023	EMON 12.3 Modified
3629	KER1	9/22/2014	Treatment	ND	0.05	0.036	EMON 12.3 Modified
3632	KER2	9/22/2014	Treatment	ND	0.05	0.037	EMON 12.3 Modified
3634	KER1	9/22/2014	Post-treatment	ND	0.05	0.016	EMON 12.3 Modified
3635	KER2	9/22/2014	Post-treatment	ND	0.05	0.017	EMON 12.3 Modified
3743	MAD1	12/29/2014	Pre-treatment	ND	0.05	0.020	EMON 12.3 Modified
3747	MAD1	12/30/2014	Treatment	ND	0.05	0.038	EMON 12.3 Modified
3749	MAD2	12/30/2014	Treatment	ND	0.05	0.041	EMON 12.3 Modified
3751	MAD1	12/30/2014	Post-treatment	ND	0.05	0.018	EMON 12.3 Modified
3753	MAD2	12/30/2014	Post-treatment	ND	0.05	0.018	EMON 12.3 Modified
3900	SBT1	4/29/2015	Pre-treatment	ND	0.05	0.018	EMON 12.3 Modified
3902	SBT2	4/29/2015	Pre-treatment	ND	0.05	0.018	EMON 12.3 Modified
3904	SBT2	4/30/2015	Treatment	ND	0.05	0.038	EMON 12.3 Modified
3906	SBT1	4/30/2015	Treatment	ND	0.05	0.039	EMON 12.3 Modified
3908	SBT2	4/30/2015	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified
3910	SBT1	4/30/2015	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
4109	STA2	11/11/2015	Pre-treatment	ND	0.05	0.017	EMON 12.3 Modified
4111	STA1	11/11/2015	Pre-treatment	ND	0.05	0.016	EMON 12.3 Modified
4113	STA2	11/12/2015	Treatment	ND	0.05	0.034	EMON 12.3 Modified
4115	STA1	11/12/2015	Treatment	ND	0.05	0.029	EMON 12.3 Modified
4117	STA2	11/12/2015	Post-treatment	ND	0.05	0.016	EMON 12.3 Modified
4119	STA1	11/12/2015	Post-treatment	ND	0.05	0.017	EMON 12.3 Modified
4139	SM1	11/18/2015	Pre-treatment	ND	0.05	0.020	EMON 12.3 Modified
4141	SM2	11/18/2015	Pre-treatment	ND	0.05	0.020	EMON 12.3 Modified
4143	SM1	11/19/2015	Treatment	ND	0.05	0.034	EMON 12.3 Modified
4145	SM2	11/19/2015	Treatment	ND	0.05	0.034	EMON 12.3 Modified
4147	SM1	11/19/2015	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
4149	SM2	11/19/2015	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
4203	FRE1	1/20/2016	Pre-treatment	ND	0.05	0.018	EMON 12.3 Modified
4205	FRE2	1/20/2016	Pre-treatment	ND	0.05	0.018	EMON 12.3 Modified
4207	FRE1	1/21/2016	Treatment	ND	0.05	0.034	EMON 12.3 Modified
4209	FRE2	1/21/2016	Treatment	ND	0.05	0.038	EMON 12.3 Modified
4211	FRE2	1/21/2016	Post-treatment	ND	0.05	0.019	EMON 12.3 Modified
4213	FRE1	1/21/2016	Post-treatment	ND	0.05	0.019	EMON 12.3 Modified
4377	KIN1	5/23/2016	Pre-treatment	ND	0.5	0.215	EMON 12.3 Modified
4379	KIN2	5/23/2016	Pre-treatment	ND	0.5	0.217	EMON 12.3 Modified

Sample #	Site #	Date	Interval	Amount Detected (µg/m^3)	MDL/LOQ Results (µg/sample)	Reporting Limit (µg/m^3)	Method
4381	KIN1	5/24/2016	Treatment	ND	0.5	0.336	EMON 12.3 Modified
4383	KIN2	5/24/2016	Treatment	ND	0.5	0.329	EMON 12.3 Modified
4385	KIN1	5/24/2016	Post-treatment	ND	0.5	0.374	EMON 12.3 Modified
4387	KIN2	5/24/2016	Post-treatment	ND	0.5	0.160	EMON 12.3 Modified
4413	MON1	6/28/2016	Pre-treatment	ND	0.05	0.021	EMON 12.3 Modified
4415	MON2	6/28/2016	Pre-treatment	ND	0.05	0.020	EMON 12.3 Modified
4417	MON1	6/29/2016	Treatment	ND	0.05	0.036	EMON 12.3 Modified
4419	MON2	6/29/2016	Treatment	ND	0.05	0.036	EMON 12.3 Modified
4421	MON1	6/29/2016	Post-treatment	ND	0.05	0.016	EMON 12.3 Modified
4423	MON2	6/29/2016	Post-treatment	ND	0.05	0.011	EMON 12.3 Modified
4487	PLA1	9/25/2016	Pre-treatment	ND	0.05	0.021	EMON 12.3 Modified
4493	PLA2	9/26/2016	Pre-treatment	ND	0.05	0.019	EMON 12.3 Modified
4488	PLA1	9/26/2016	Treatment	ND	0.05	0.037	EMON 12.3 Modified
4491	PLA1	9/26/2016	Post-treatment	ND	0.05	0.015	EMON 12.3 Modified
4495	PLA2	9/27/2016	Treatment	ND	0.05	0.037	EMON 12.3 Modified
4497	PLA2	9/27/2016	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified
4559	MER1	11/21/2016	Pre-treatment	ND	0.01	0.004	EMON 12.3 Modified
4561	MER2	11/21/2016	Pre-treatment	ND	0.01	0.004	EMON 12.3 Modified
4563	MER1	11/22/2016	Treatment	ND	0.01	0.007	EMON 12.3 Modified
4565	MER2	11/22/2016	Treatment	ND	0.01	0.007	EMON 12.3 Modified
4567	MER1	11/22/2016	Post-treatment	ND	0.01	0.004	EMON 12.3 Modified
4569	MER2	11/22/2016	Post-treatment	ND	0.01	0.004	EMON 12.3 Modified
4589	SOL1	1/25/2017	Pre-treatment	ND	0.01	0.003	EMON 12.3 Modified
4595	SOL2	1/25/2017	Pre-treatment	ND	0.01	0.003	EMON 12.3 Modified
4591	SOL1	1/26/2017	Treatment	ND	0.01	0.007	EMON 12.3 Modified
4597	SOL2	1/26/2017	Treatment	ND	0.01	0.007	EMON 12.3 Modified
4593	SOL1	1/26/2017	Post-treatment	ND	0.01	0.003	EMON 12.3 Modified
4599	SOL2	1/26/2017	Post-treatment	ND	0.01	0.003	EMON 12.3 Modified
4635	YOL1	3/6/2017	Pre-treatment	ND	0.01	0.003	EMON 12.3 Modified
4629	ALA1	3/7/2017	Pre-treatment	ND	0.01	0.003	EMON 12.3 Modified
4637	YOL1	3/7/2017	Treatment	ND	0.01	0.008	EMON 12.3 Modified
4639	YOL1	3/7/2017	Post-treatment	ND	0.01	0.004	EMON 12.3 Modified
4631	ALA1	3/8/2017	Treatment	ND	0.01	0.008	EMON 12.3 Modified
4632	ALA1	3/8/2017	Post-treatment	ND	0.01	0.003	EMON 12.3 Modified
4693	CC1	4/9/2017	Pre-treatment	ND	0.01	0.003	EMON 12.3 Modified
4695	CC1	4/10/2017	Treatment	ND	0.01	0.007	EMON 12.3 Modified
4697	CC1	4/10/2017	Post-treatment	ND	0.01	0.003	EMON 12.3 Modified

Sample #	Site #	Date	Interval	Amount Detected (µg/m^3)	MDL/LOQ Results (µg/sample)	Reporting Limit (µg/m^3)	Method
4910	MRN2	12/26/2018	Pre-treatment	ND	0.01	0.004	EMON 12.3 Modified
4905	MRN1	12/27/2018	Treatment	ND	0.01	0.008	EMON 12.3 Modified
4911	MRN2	12/27/2018	Treatment	ND	0.01	0.020	EMON 12.3 Modified
4908	MRN1	12/27/2018	Post-treatment	ND	0.01	0.003	EMON 12.3 Modified
4967	SF1	2/6/2019	Treatment	ND	0.01	0.013	EMON 12.3 Modified
4969	SF1	2/6/2019	Post-treatment	ND	0.01	0.003	EMON 12.3 Modified
5035	SAC1	4/2/2019	Pre-treatment	ND	0.05	0.023	EMON 12.3 Modified
5041	SAC2	4/2/2019	Pre-treatment	ND	0.05	0.020	EMON 12.3 Modified
5037	SAC1	4/3/2019	Treatment	ND	0.05	0.030	EMON 12.3 Modified
5043	SAC2	4/3/2019	Treatment	ND	0.05	0.038	EMON 12.3 Modified
5039	SAC1	4/3/2019	Post-treatment	ND	0.05	0.017	EMON 12.3 Modified
5045	SAC2	4/3/2019	Post-treatment	ND	0.05	0.014	EMON 12.3 Modified

Table 10: Results of leaf samples (surface only – dislodgeable) for β-cyfluthrin treatments from March 17, 2009 to April 3, 2019. Results are presented in parts per million wet weight (ppm) and microgram per centimeter squared (µg/cm^2).

Sample #	Site #	Date On	Interval	Amount detected (ppm)	Amount detected (µg/cm^2)	MDL/LOQ	MDL/LOQ units	Reporting Limit (ppm)
0165	SD2	3/26/2009	Pre-treatment	ND	ND	10	µg/sample	
0167	SD1	3/26/2009	Pre-treatment	ND	ND	10	µg/sample	
0168	SD2	3/26/2009	Post-treatment	ND	ND	10	µg/sample	
0169	SD1	3/26/2009	Post-treatment	ND	ND	10	µg/sample	
0262	ORA1	9/9/2009	Post-treatment	ND	ND	10	µg/sample	
0263	ORA1	9/9/2009	Pre-treatment	ND	ND	10	µg/sample	
0364	SBD2	12/8/2010	Post-treatment	ND	ND	5	µg/sample	
0365	SBD1	12/8/2010	Post-treatment	ND	ND	5	µg/sample	
0367	SBD2	12/8/2010	Pre-treatment	ND	ND	5	µg/sample	
0369	SBD1	12/8/2010	Pre-treatment	ND	ND	5	µg/sample	
1062	VEN2	1/18/2011	Post-treatment	ND	ND	5	µg/sample	
1070	VEN2	1/18/2011	Pre-treatment	ND	ND	5	µg/sample	
0164	ORA2	2/15/2011	Post-treatment	ND	ND	0.5	µg/sample	
1063	ORA2	2/15/2011	Pre-treatment	ND	ND	0.5	µg/sample	
1066	VEN1	7/12/2011	Pre-treatment	ND	ND	1	µg/sample	0.043
1381	VEN1	7/14/2011	Post-treatment	0.63	0.03	1	µg/sample	0.033
1892	IMP6	1/21/2012	Pre-treatment	ND	ND	0.5	µg/sample	0.016

Sample #	Site #	Date On	Interval	Amount detected (ppm)	Amount detected (µg/cm^2)	MDL/LOQ	MDL/LOQ units	Reporting Limit (ppm)
1893	IMP7	1/21/2012	Post-treatment	0.10	0.004	2.5	µg/sample	0.066
1897	IMP6	1/21/2012	Post-treatment	0.10	0.004	2.5	µg/sample	0.078
1898	IMP7	1/21/2012	Pre-treatment	ND	ND	0.5	µg/sample	
0368	LA4	4/10/2012	Post-treatment	0.50	0.02	0.5	µg/sample	0.019
1068	LA5	4/10/2012	Pre-treatment	ND	ND	0.5	µg/sample	0.024
1868	LA4	4/10/2012	Pre-treatment	ND	ND	0.5	µg/sample	0.017
1887	LA5	4/10/2012	Post-treatment	ND	ND	0.5	µg/sample	0.021
2637	TUL1	12/6/2012	Pre-treatment	ND	ND	0.5	µg/sample	0.038
2638	TUL2	12/6/2012	Pre-treatment	ND	ND	0.5	µg/sample	0.038
2639	TUL1	12/6/2012	Post-treatment	3.35	0.10	0.5	µg/sample	0.050
2640	TUL2	12/6/2012	Post-treatment	3.74	0.15	0.5	µg/sample	0.036
2861	SB1	3/5/2013	Pre-treatment	ND	ND	0.5	µg/sample	0.042
2862	SB2	3/5/2013	Pre-treatment	ND	ND	0.5	µg/sample	0.071
2863	SB1	3/5/2013	Post-treatment	3.62	0.11	0.5	µg/sample	0.050
2864	SB2	3/5/2013	Post-treatment	6.99	0.21	0.5	µg/sample	0.042
3257	SLO1	4/14/2014	Pre-treatment	ND	ND	0.5	µg/sample	0.038
3258	SLO2	4/14/2014	Pre-treatment	ND	ND	0.5	µg/sample	0.042
3259	SLO2	4/15/2014	Post-treatment	2.20	0.07	0.5	µg/sample	0.083
3260	SLO1	4/15/2014	Post-treatment	1.63	0.05	0.5	µg/sample	0.050
3664	SCL1	10/28/2014	Pre-treatment	0.02	0.000028	10	ppb	0.010
3666	SCL2	10/28/2014	Pre-treatment	ND	ND	10	ppb	0.010
3668	SCL1	10/28/2014	Post-treatment	0.24	0.35	10	ppb	0.010
3669	SCL2	10/28/2014	Post-treatment	0.91	0.95	10	ppb	0.010
3700	SJ1	11/5/2014	Pre-treatment	ND	ND	10	ppb	0.010
3702	SJ2	11/5/2014	Pre-treatment	ND	ND	10	ppb	0.010
3705	SJ2	11/5/2014	Post-treatment	0.69	0.88	10	ppb	0.010
3707	SJ1	11/5/2014	Post-treatment	0.91	1.01	10	ppb	0.010
4390	KIN1	5/24/2016	Post-treatment	0.79	0.00	0.1	ppm	0.100
4392	KIN1	5/24/2016	Post-treatment	1.71	0.00	0.1	ppm	0.100
4398	KIN2	5/24/2016	Post-treatment	3.70	0.01	0.1	ppm	0.100
4400	KIN2	5/24/2016	Post-treatment	2.19	0.01	0.1	ppm	0.100
4429	MON1	6/29/2016	Post-treatment	2.17	2.97	0.5	µg	0.019
4432	MON2	6/29/2016	Post-treatment	4.51	6.77	0.5	µg	0.019
4462	PLA1	9/26/2016	Pre-treatment	ND	ND	5	µg/sample	0.341
4463	PLA1	9/26/2016	Post-treatment	1.75	0.99	5	µg/sample	0.319
4466	PLA2	9/27/2016	Pre-treatment	ND	ND	5	µg/sample	0.531
4467	PLA2	9/27/2016	Post-treatment	0.18	0.04	5	µg/sample	0.592

Sample #	Site #	Date On	Interval	Amount detected (ppm)	Amount detected (µg/cm^2)	MDL/LOQ	MDL/LOQ units	Reporting Limit (ppm)
4574	MER1	11/22/2016	Pre-treatment	ND	ND	0.5	µg/sample	0.037
4575	MER2	11/22/2016	Pre-treatment	ND	ND	0.5	µg/sample	0.016
4577	MER1	11/22/2016	Post-treatment	0.96	0.31	0.5	µg/sample	0.046
4578	MER2	11/22/2016	Post-treatment	0.47	0.34	0.5	µg/sample	0.024
4600	SOL2	1/26/2017	Pre-treatment	ND	ND	5	µg/sample	0.326
4601	SOL2	1/26/2017	Post-treatment	1.32	0.48	5	µg/sample	0.415
4602	SOL2	1/26/2017	Post-treatment	7.09	1.69	5	µg/sample	0.416
4603	SOL1	1/26/2017	Pre-treatment	ND	ND	5	µg/sample	0.215
4604	SOL1	1/26/2017	Post-treatment	3.61	1.59	5	µg/sample	0.334
4605	SOL1	1/26/2017	Post-treatment	2.25	1.06	5	µg/sample	0.325
4640	YOL1	3/7/2017	Pre-treatment	ND	ND	5	µg/sample	0.407
4641	YOL1	3/7/2017	Post-treatment	6.87	2.08	5	µg/sample	0.449
4643	ALA1	3/8/2017	Pre-treatment	ND	ND	5	µg/sample	0.363
4644	ALA1	3/8/2017	Post-treatment	5.45	2.60	5	µg/sample	0.391
4698	CC1	4/10/2017	Pre-treatment	ND	ND	0.5	µg/sample	0.026
4699	CC1	4/10/2017	Post-treatment	4.31	3.59	0.5	µg/sample	0.025
4915	MRN1	12/27/2018	Pre-treatment	ND	ND	0.05	µg/sample	0.004
4917	MRN1	12/27/2018	Post-treatment	7.07	2.87	0.05	µg/sample	0.004
4919	MRN2	12/27/2018	Pre-treatment	ND	ND	0.05	µg/sample	0.004
4921	MRN2	12/27/2018	Post-treatment	6.89	3.46	0.05	µg/sample	0.003
4972	SF1	2/6/2019	Pre-treatment	ND	ND	0.5	µg/sample	0.039
4974	SF1	2/6/2019	Post-treatment	4.78	1.58	0.5	µg/sample	0.048
5047	SAC1	4/3/2019	Pre-treatment	ND	ND	0.05	µg/sample	0.004
5049	SAC1	4/3/2019	Post-treatment	0.31	0.08	0.05	µg/sample	0.006
5051	SAC2	4/3/2019	Pre-treatment	ND	ND	0.05	µg/sample	0.008
5053	SAC2	4/3/2019	Post-treatment	0.19	0.04	0.05	µg/sample	0.007

Table 11: Results of leaf samples (whole leaf – total) for β-cyfluthrin treatments from March 17, 2009 to April 3, 2019. Results are presented in parts per million wet weight (ppm).

Sample #	Site #	Date On	Interval	Amount detected (ppm)	MDL/LOQ (ppm)
0133	IMP3	3/17/2009	Post-treatment	0.06	0.05
0161	SD1	3/25/2009	Pre-treatment	ND	0.05
0163	SD2	3/25/2009	Pre-treatment	ND	0.05
0189	SD1	3/26/2009	Post-treatment	0.06	0.05
0191	SD2	3/26/2009	Post-treatment	ND	0.05
1093	RIV2	6/21/2011	Pre-treatment	ND	0.1
1095	RIV2	6/21/2011	Post-treatment	2.31	0.1
3637	KER1	9/22/2014	Pre-treatment	ND	0.1
3639	KER1	9/22/2014	Post-treatment	1.51	1.0
3638	KER2	9/22/2014	Pre-treatment	ND	0.1
3640	KER2	9/22/2014	Post-treatment	0.443	0.2
3756	MAD1	12/30/2014	Post-treatment	3.6	0.01
3757	MAD2	12/30/2014	Pre-treatment	ND	0.01
3761	MAD2	12/30/2014	Post-treatment	9.1	0.01
3921	SBT1	4/30/2015	Pre-treatment	ND	0.1
3923	SBT1	4/30/2015	Post-treatment	9.57	0.1
3922	SBT2	4/30/2015	Pre-treatment	ND	0.1
3924	SBT2	4/30/2015	Post-treatment	1.59	0.1
4120	STA1	11/12/2015	Pre-treatment	ND	0.2
4121	STA1	11/12/2015	Pre-treatment	ND	0.2
4126	STA1	11/12/2015	Post-treatment	9.42	0.2
4127	STA1	11/12/2015	Post-treatment	2.38	0.2
4124	STA2	11/12/2015	Pre-treatment	0.498	0.2
4125	STA2	11/12/2015	Pre-treatment	ND	0.2
4129	STA2	11/12/2015	Post-treatment	5.02	0.2
4130	STA2	11/12/2015	Post-treatment	4.43	0.2
4152	SM1	11/19/2015	Pre-treatment	0.636	0.2
4154	SM1	11/19/2015	Post-treatment	ND	0.2
4150	SM2	11/19/2015	Pre-treatment	ND	0.2
4156	SM2	11/19/2015	Post-treatment	0.275	0.2
4215	FRE1	1/21/2016	Pre-treatment	0.282	0.1
4217	FRE1	1/21/2016	Post-treatment	1.62	0.1
4216	FRE2	1/21/2016	Post-treatment	1.8	0.1
4222	FRE2	1/21/2016	Pre-treatment	0.242	0.1
4403	KIN1	5/23/2016	Pre-treatment	ND	0.1
4402	KIN2	5/23/2016	Pre-treatment	ND	0.1

Sample #	Site #	Date On	Interval	Amount detected (ppm)	MDL/LOQ (ppm)
4389	KIN1	5/24/2016	Post-treatment	1.47	0.1
4391	KIN1	5/24/2016	Post-treatment	2.21	0.1
4397	KIN2	5/24/2016	Post-treatment	2.87	0.1
4399	KIN2	5/24/2016	Post-treatment	2.71	0.1
4424	MON1	6/29/2016	Pre-treatment	ND	0.1
4428	MON1	6/29/2016	Post-treatment	4.06	0.1
4426	MON2	6/29/2016	Pre-treatment	ND	0.1
4431	MON2	6/29/2016	Post-treatment	1.78	0.1
4461	PLA1	9/26/2016	Pre-treatment	ND	0.1
4464	PLA1	9/26/2016	Post-treatment	3.49	0.1
4465	PLA2	9/27/2016	Pre-treatment	ND	0.1
4468	PLA2	9/27/2016	Post-treatment	1.2	0.1
4576	MER1	11/22/2016	Post-treatment	1.05	0.1
4579	MER2	11/22/2016	Post-treatment	0.583	0.1
4642	YOL1	3/7/2017	Post-treatment	0.494	0.1
4645	ALA1	3/8/2017	Post-treatment	5.62	0.1
4700	CC1	4/10/2017	Post-treatment	5.85	0.1
4916	MRN1	12/27/2018	Pre-treatment	1.10	
4918	MRN1	12/27/2018	Post-treatment	1.16	
4920	MRN2	12/27/2018	Pre-treatment	ND	0.1
4922	MRN2	12/27/2018	Post-treatment	1.27	
4973	SF1	2/6/2019	Pre-treatment	ND	0.1
4975	SF1	2/6/2019	Post-treatment	0.678	0.1
5048	SAC1	4/3/2019	Pre-treatment	ND	0.1
5050	SAC1	4/3/2019	Post-treatment	0.178	0.1
5052	SAC2	4/3/2019	Pre-treatment	ND	0.1
5054	SAC2	4/3/2019	Post-treatment	ND	0.1

Table 12: Results of fruit samples (whole fruit – pulp and rind) for β-cyfluthrin treatments from March 17, 2009 to April 3, 2019. Results are presented in parts per million wet weight (ppm).

Sample #	Site #	Date On	Interval	Amount detected (ppm)	MDL/LOQ (ppm)
0143	IMP3	3/17/2009	Pre-treatment	ND	0.05
0142	IMP3	3/17/2009	Post-treatment	0.08	0.05
0137	IMP2	3/17/2009	Pre-treatment	ND	0.05
0138	IMP2	3/17/2009	Post-treatment	ND	0.05
0184	SD1	3/25/2009	Pre-treatment	ND	0.05
0185	SD2	3/25/2009	Pre-treatment	ND	0.05
0186	SD1	3/26/2009	Post-treatment	ND	0.05
0187	SD1	3/26/2009	Post-treatment	0.11	0.05
0192	SD2	3/26/2009	Post-treatment	0.11	0.05
0193	SD2	3/26/2009	Post-treatment	ND	0.05
0729	SBD1	12/7/2010	Pre-treatment	ND	0.01
0735	SBD2	12/7/2010	Pre-treatment	ND	0.01
0730	SBD1	12/8/2010	Post-treatment	ND	0.01
0974	VEN2	1/10/2011	Post-treatment	ND	0.01
0973	VEN2	1/17/2011	Pre-treatment	ND	0.01
0975	VEN2	1/18/2011	Post-treatment	0.02	0.01
0966	VEN1	7/12/2011	Pre-treatment	ND	0.01
0967	VEN1	7/12/2011	Post-treatment	0.027	0.01
2634	TUL1	12/5/2012	Pre-treatment	ND	0.01
2633	TUL2	12/5/2012	Pre-treatment	ND	0.01
2635	TUL1	12/6/2012	Post-treatment	0.113	0.01
2636	TUL2	12/6/2012	Post-treatment	0.079	0.01
2855	SB1	3/5/2013	Pre-treatment	ND	0.1
2856	SB1	3/5/2013	Pre-treatment	ND	0.1
2858	SB1	3/5/2013	Post-treatment	ND	0.1
2859	SB1	3/5/2013	Post-treatment	ND	0.1
2857	SB2	3/5/2013	Pre-treatment	ND	0.1
2860	SB2	3/5/2013	Post-treatment	ND	0.1
3289	SLO1	4/14/2014	Pre-treatment	ND	0.01
3290	SLO2	4/14/2014	Pre-treatment	ND	0.01
3291	SLO2	4/15/2014	Post-treatment	0.021	0.01
3712	SJ1	11/5/2014	Pre-treatment	ND	0.01
3715	SJ1	11/5/2014	Post-treatment	ND	0.01
3713	SJ2	11/5/2014	Pre-treatment	ND	0.01
3714	SJ2	11/5/2014	Post-treatment	ND	0.01
3762	MAD1	12/30/2014	Pre-treatment	ND	0.01

Sample #	Site #	Date On	Interval	Amount detected (ppm)	MDL/LOQ (ppm)
3772	MAD1	12/30/2014	Post-treatment	0.04	0.01
3763	MAD2	12/30/2014	Pre-treatment	ND	0.01
3773	MAD2	12/30/2014	Post-treatment	0.14	0.01
4232	FRE1	1/21/2016	Pre-treatment	ND	0.01
4234	FRE1	1/21/2016	Post-treatment	0.04	0.01
4233	FRE2	1/21/2016	Pre-treatment	ND	0.01
4235	FRE2	1/21/2016	Post-treatment	0.012	0.01
4437	MON1	6/29/2016	Pre-treatment	ND	0.1
4438	MON1	6/29/2016	Post-treatment	ND	0.1
4439	MON1	6/29/2016	Post-treatment	ND	0.1
4436	MON2	6/29/2016	Pre-treatment	ND	0.1
4435	MON2	6/29/2016	Post-treatment	ND	0.1
4584	MER1	11/22/2016	Pre-treatment	ND	0.1
4586	MER1	11/22/2016	Post-treatment	ND	0.1
4608	SOL1	1/26/2017	Pre-treatment	ND	0.1
4609	SOL1	1/26/2017	Pre-treatment	ND	0.1
4618	SOL1	1/26/2017	Post-treatment	ND	0.1
4619	SOL1	1/26/2017	Post-treatment	ND	0.1
4610	SOL2	1/26/2017	Pre-treatment	ND	0.1
4611	SOL2	1/26/2017	Pre-treatment	ND	0.1
4612	SOL2	1/26/2017	Post-treatment	ND	0.1
4613	SOL2	1/26/2017	Post-treatment	ND	0.1
4650	YOL1	3/7/2017	Pre-treatment	ND	0.1
4651	YOL1	3/7/2017	Post-treatment	ND	0.1
4652	ALA1	3/8/2017	Pre-treatment	ND	0.1
4653	ALA1	3/8/2017	Post-treatment	ND	0.1
4703	CC1	4/10/2017	Pre-treatment	ND	0.1
4704	CC1	4/10/2017	Post-treatment	ND	0.1
4931	MRN1	12/27/2018	Pre-treatment	ND	0.1
4932	MRN1	12/27/2018	Post-treatment	ND	0.1
4933	MRN2	12/27/2018	Pre-treatment	ND	0.1
4934	MRN2	12/27/2018	Post-treatment	ND	0.1
5061	SAC2	4/3/2019	Pre-treatment	ND	0.1
5062	SAC2	4/3/2019	Post-treatment	ND	0.1

Table 13: Results of soil samples for imidacloprid treatments from March 17, 2009 to April 3, 2019. Results are presented in parts per million wet weight (ppm).

Sample #	Site #	Date On	Interval	Amount detected (ppm)	MDL/LOQ (ppm)
0126	IMP3	3/17/2009	Pre-treatment	ND	0.01
0132	IMP3	3/17/2009	Post-treatment	26.89	0.01
0131	IMP2	3/17/2009	Pre-treatment	ND	0.01
0134	IMP2	3/17/2009	Post-treatment	46.57	0.01
0160	SD1	3/25/2009	Pre-treatment	ND	0.01
0162	SD2	3/25/2009	Pre-treatment	ND	0.01
0190	SD1	3/26/2009	Post-treatment	12.2	0.01
0188	SD2	3/26/2009	Post-treatment	22.4	0.01
0336	LA1	9/24/2009	Pre-treatment	ND	0.01
0340	LA1	9/24/2009	Post-treatment	119	0.01
0346	LA3	10/6/2009	Pre-treatment	ND	0.01
0343	LA3	10/6/2009	Post-treatment	20.67	0.01
0200	SBD1	12/7/2010	Pre-treatment	ND	0.01
0205	SBD2	12/7/2010	Pre-treatment	0.0193	0.01
0203	SBD1	12/8/2010	Post-treatment	1.32	0.01
0199	SBD2	12/8/2010	Post-treatment	178.3	0.01
1074	ORA2	2/14/2011	Pre-treatment	ND	0.01
1071	ORA2	2/15/2011	Post-treatment	18.4	0.01
1072	RIV1	2/28/2011	Pre-treatment	ND	0.01
1067	RIV1	3/1/2011	Post-treatment	31.7	0.01
1073	RIV2	6/20/2011	Pre-treatment	ND	0.01
0198	RIV1	6/21/2011	Post-treatment	17.2	0.01
1092	VEN1	7/11/2011	Pre-treatment	ND	0.01
1094	VEN1	7/12/2011	Post-treatment	35.4	0.01
1896	IMP6	1/21/2012	Post-treatment	7.25	0.01
1895	IMP7	1/21/2012	Pre-treatment	ND	0.01
1899	IMP7	1/21/2012	Pre-treatment	ND	0.01
1894	IMP7	1/21/2012	Post-treatment	18.4	0.01
1867	LA4	4/10/2012	Pre-treatment	0.034	0.01
1064	LA5	4/10/2012	Pre-treatment	ND	0.01
2512	ORA3	8/28/2012	Pre-treatment	ND	0.01
2514	ORA3	8/28/2012	Pre-treatment	ND	0.01
2517	ORA3	8/29/2012	Post-treatment	16.4	0.01
2518	ORA3	8/29/2012	Post-treatment	59.8	0.01
2616	TUL1	12/5/2012	Pre-treatment	0.01	0.01
2618	TUL2	12/5/2012	Pre-treatment	ND	0.01

Sample #	Site #	Date On	Interval	Amount detected (ppm)	MDL/LOQ (ppm)
2617	TUL1	12/6/2012	Post-treatment	62.6	0.01
2619	TUL2	12/6/2012	Post-treatment	14.5	0.01
2865	SB1	3/5/2013	Pre-treatment	ND	0.01
2866	SB2	3/5/2013	Pre-treatment	ND	0.01
2867	SB2	3/5/2013	Post-treatment	90.4	0.01
2868	SB2	3/5/2013	Post-treatment	17.9	0.01
2975	SB3	4/18/2013	Pre-treatment	ND	0.01
2977	SB3	4/18/2013	Post-treatment	48.6	0.01
2976	SB4	4/18/2013	Pre-treatment	ND	0.01
2978	SB4	4/18/2013	Post-treatment	32.9	0.01
3273	SB5	3/18/2014	Pre-treatment	ND	0.01
3283	SB5	3/18/2014	Post-treatment	37.5	0.01
3276	SB6	3/18/2014	Pre-treatment	ND	0.01
3284	SB6	3/18/2014	Post-treatment	24.3	0.01
3293	SLO1	4/14/2014	Pre-treatment	ND	0.01
3294	SLO2	4/14/2014	Pre-treatment	ND	0.01
3296	SLO1	4/15/2014	Post-treatment	77.2	0.01
3295	SLO2	4/15/2014	Post-treatment	484	0.01
3641	KER1	9/22/2014	Pre-treatment	ND	0.01
3643	KER1	9/22/2014	Post-treatment	81.5	0.01
3642	KER2	9/22/2014	Pre-treatment	ND	0.01
3644	KER2	9/22/2014	Post-treatment	39.9	0.01
3754	MAD1	12/30/2014	Pre-treatment	0.483	0.01
3758	MAD1	12/30/2014	Post-treatment	64.4	0.01
3759	MAD2	12/30/2014	Pre-treatment	ND	0.01
3760	MAD2	12/30/2014	Post-treatment	112	0.01
3917	SBT1	4/30/2015	Pre-treatment	ND	0.01
3919	SBT1	4/30/2015	Post-treatment	42.1	0.01
3918	SBT2	4/30/2015	Pre-treatment	ND	0.01
3920	SBT2	4/30/2015	Post-treatment	64.5	0.01
4122	STA1	11/12/2015	Pre-treatment	ND	0.01
4128	STA1	11/12/2015	Post-treatment	199	0.01
4123	STA2	11/12/2015	Pre-treatment	ND	0.01
4131	STA2	11/12/2015	Post-treatment	737	0.01
4153	SM1	11/19/2015	Pre-treatment	ND	0.01
4155	SM1	11/19/2015	Post-treatment	7.98	0.01
4151	SM2	11/19/2015	Pre-treatment	ND	0.01
4157	SM2	11/19/2015	Post-treatment	1.56	0.01

Sample #	Site #	Date On	Interval	Amount detected (ppm)	MDL/LOQ (ppm)
4214	FRE1	1/21/2016	Pre-treatment	ND	0.01
4225	FRE1	1/21/2016	Post-treatment	0.802	0.01
4223	FRE2	1/21/2016	Pre-treatment	ND	0.01
4224	FRE2	1/21/2016	Post-treatment	2.99	0.01
4394	KIN1	5/23/2016	Pre-treatment	ND	0.01
4393	KIN2	5/23/2016	Pre-treatment	ND	0.01
4395	KIN1	5/24/2016	Post-treatment	20.3	0.01
4396	KIN2	5/24/2016	Post-treatment	33.5	0.01
4425	MON1	6/29/2016	Pre-treatment	ND	0.01
4430	MON1	6/29/2016	Post-treatment	70.2	0.01
4427	MON2	6/29/2016	Pre-treatment	ND	0.01
4433	MON2	6/29/2016	Post-treatment	29.9	0.01
4471	PLA1	9/26/2016	Pre-treatment	ND	0.01
4472	PLA1	9/26/2016	Post-treatment	37	0.01
4473	PLA2	9/27/2016	Pre-treatment	ND	0.01
4474	PLA2	9/27/2016	Post-treatment	27.9	0.01
4570	MER1	11/22/2016	Pre-treatment	ND	0.01
4572	MER1	11/22/2016	Post-treatment	30	0.01
4571	MER2	11/22/2016	Pre-treatment	ND	0.01
4573	MER2	11/22/2016	Post-treatment	4.09	0.01
4606	SOL2	1/26/2017	Pre-treatment	ND	0.01
4607	SOL2	1/26/2017	Post-treatment	40.6	0.01
4646	YOL1	3/7/2017	Pre-treatment	ND	0.01
4647	YOL1	3/7/2017	Post-treatment	90	0.01
4648	ALA1	3/8/2017	Pre-treatment	ND	0.01
4649	ALA1	3/8/2017	Post-treatment	145	0.01
4701	CC1	4/10/2017	Pre-treatment	ND	0.01
4702	CC1	4/10/2017	Post-treatment	0.239241593	0.01
4923	MRN1	12/27/2018	Pre-treatment	ND	0.01
4924	MRN1	12/27/2018	Post-treatment	1.48	0.01
4925	MRN2	12/27/2018	Pre-treatment	ND	0.01
4926	MRN2	12/27/2018	Post-treatment	0.328	0.01
4976	SF1	2/6/2019	Pre-treatment	ND	0.01
4977	SF1	2/7/2019	Post-treatment	9.71	0.01
5055	SAC1	4/3/2019	Pre-treatment	ND	0.01
5056	SAC1	4/3/2019	Post-treatment	32.2	0.01

Table 14: Results of tank sampling for Tempo® SC Ultra (β-cyfluthrin A.I.) treatments from March 17, 2009 to April 3, 2019.

Sample #	Site #	Date On	Amount Detected (%)
0170	SD1	3/26/2009	0.0026
0214	LA1	9/24/2009	0.0014
0371	LA3	10/6/2009	0.0011
0374	LA3	10/6/2009	0.0016
0383	SBD1	12/8/2010	0.00069
0467	SBD2	12/8/2010	0.00064
1056	RIV2	6/21/2011	0.0013
1058	VEN2	1/18/2011	0.00063
1059	RIV1	3/1/2011	0.0025
1060	VEN2	1/18/2011	0.00085
1091	ORA2	2/15/2011	0.0008
1359	VEN1	7/12/2011	0.00097
1901	LA4	4/10/2012	0.00032
2641	TUL1	12/6/2012	0.002
3288	SLO2	4/15/2014	0.00143
3298	SLO1	4/15/2014	0.00099
3645	KER1	9/22/2014	0.00071
3647	KER2	9/22/2014	0.0052
3708	SJ2	11/5/2014	0.00044
3710	SJ1	11/5/2014	0.0001
3716	SJ2	11/5/2014	0.00042
3718	SJ1	11/5/2014	0.000094
3765	MAD1	12/30/2014	0.00123
3767	MAD1	12/30/2014	0.00236
3769	MAD1	12/30/2014	0.00092
3770	MAD1	12/30/2014	0.00123
4105	STA1	11/12/2015	0.00596
4106	STA2	11/12/2015	0.00515
4135	SM1	11/19/2015	0.00111
4229	FRE1	1/21/2016	0.0011
4230	FRE2	1/21/2016	0.0013
4434	MON2	6/29/2016	0.00094
4480	PLA1	9/26/2016	0.00072
4483	PLA1	9/26/2016	0.001
4484	PLA2	9/27/2016	0.00062
4581	MER1	11/22/2016	0.00058
4583	MER2	11/22/2016	0.00033

Sample #	Site #	Date On	Amount Detected (%)
4615	SOL2	1/26/2017	0.0018
4617	SOL1	1/26/2017	0.0015
4655	YOL1	3/7/2017	0.0014
4656	ALA1	3/8/2017	0.0055
4706	CC1	4/10/2017	0.0016
4928	MRN2	12/27/2018	0.001
4980	SF1	2/6/2019	0.00054
5064	SAC1	4/3/2019	0.00074
5066	SAC2	4/3/2019	0.0012

Table 15: Results of tank sampling for Merit® 2F (imidacloprid A.I.) treatments from March 17, 2009 to April 3, 2019.

Sample #	Site #	Date On	Amount Detected (%)
0171	SD1	3/26/2009	0.028
0211	LA1	9/24/2009	0.024
0372	LA3	10/6/2009	0.031
0375	LA3	10/6/2009	0.022
0466	SBD1	12/8/2010	0.032
0604	SBD2	12/8/2010	0.032
1086	ORA2	2/15/2011	0.026
1050	RIV1	3/1/2011	0.03
1090	RIV12	6/21/2011	0.028
1355	VEN1	7/12/2011	0.036
1900	LA4	4/10/2012	0.015
2642	TUL1	12/6/2012	0.027
3277	SB6	3/18/2014	0.028
3297	SLO1	4/15/2014	0.031
3287	SLO2	4/15/2014	0.038
3646	KER1	9/22/2014	0.046
3648	KER2	9/22/2014	0.057
3711	SJ1	11/5/2014	0.0274
3719	SJ1	11/5/2014	0.0276
3709	SJ2	11/5/2014	0.0259
3717	SJ2	11/5/2014	0.0259
3764	MAD1	12/30/2014	0.043
3766	MAD1	12/30/2014	0.046
3768	MAD1	12/30/2014	0.032
3771	MAD1	12/30/2014	0.031

4104	STA1	11/12/2015	0.126
4107	STA2	11/12/2015	0.134
4134	SM1	11/19/2015	0.0315
4228	FRE1	1/21/2016	0.028
4231	FRE2	1/21/2016	0.029
4411	MON2	6/29/2016	0.02
4481	PLA1	9/26/2016	0.025
4482	PLA1	9/26/2016	0.028
4485	PLA2	9/27/2016	0.029
4580	MER1	11/22/2016	0.026
4582	MER2	11/22/2016	0.026
4616	SOL1	1/26/2017	0.049
4614	SOL2	1/26/2017	0.046
4654	YOL1	3/7/2017	0.027
4657	ALA1	3/8/2017	0.054
4705	CC1	4/10/2017	0.026
4927	MRN2	12/27/2018	0.027
4981	SF1	2/6/2019	0.0059
5063	SAC1	4/3/2019	0.029

APPENDIX II

PROTOCOL FOR MONITORING IMIDACLOPRID AND CYFLUTHRIN IN THE ASIAN CITRUS PSYLLID ERADICATION PROGRAM

May 15, 2009

I. INTRODUCTION

The Asian citrus psyllid (ACP) is an invasive pest that can vector "Huanglongbing" (HLB), a disease of citrus trees. The California Department of Food and Agriculture (CDFA) Pest Detection/Emergency Projects Branch (PDEP) has detected the ACP in San Diego and Imperial counties (initial find in August 2008), and started an eradication program in September 2008. Extensive ACP detections in Mexico, along the California border, have prompted a similar eradication program in Mexico.

Current treatment includes soil applied systemic, and foliar applied contact insecticide treatments. Imidacloprid is applied as a soil drench around each host plant followed by a foliar application of cyfluthrin.

At the request of CDFA, the Environmental Monitoring Branch (EM) of the Department of Pesticide Regulation (DPR) has developed this protocol to monitor the imidacloprid and cyfluthrin pesticide treatments in San Diego and Imperial counties. Monitoring may be expanded to additional counties if requested by CDFA. Monitoring will provide information about the concentrations of imidacloprid and cyfluthrin in air, fruit and/or foliage, soil, and if obtainable, surface water runoff.

II. PERSONNEL

This study will be conducted by the Environmental Monitoring Branch, under the general direction of Lisa Ross (Environmental Program Manager I). Key personnel are listed below.

Project Leader: David Kim
Field Coordinator: Laura Petro (CDFA)
Senior Scientist: Randy Segawa
Laboratory Liaison: Sue Peoples

Analyzing Laboratory: CDFA, Center for Analytical Chemistry. All questions from the media should be directed to Lea Brooks, (916) 445-3974, e-mail lbrooks@cdpr.ca.gov.

III. OBJECTIVES

The objectives of this monitoring are to: 1) Measure the amount of imidacloprid and cyfluthrin in outdoor ambient air; 2) Characterize the concentrations of imidacloprid and cyfluthrin residue in ripe fruit and/or foliage before and after application; 3) Measure the concentrations of imidacloprid and cyfluthrin in soil; 4) Measure the concentrations of imidacloprid and cyfluthrin in surface runoff water following application and storm events; 5) Measure the amount of imidacloprid and cyfluthrin in the spray material.

IV. MONITORING PLAN

Sampling sites will be located within the ACP treatment area of San Diego and Imperial counties, additional counties may be included if the treatment area expands to additional counties. Air sampling site selection is based on the following criteria: sites must be (1) located in the treatment area and contain ACP host plants; (2) accessible the day before, during, and after the application; and (3) located in a secure area where any disturbance of the air sampling equipment would be unlikely. Soil and foliage sampling sites require access to property only on the day of application. Fruit sampling sites require ripe fruit and access during sampling. Permission from owner or tenant to access private property must be granted before any samples are collected. Soil, foliage and fruit (if ripe) will be collected at all air sampling sites.

OBJECTIVE 1: To measure the amount of imidacloprid and cyfluthrin in outdoor ambient air. DPR uses screening levels to evaluate the possible health effects of exposure to a chemical, based on a chemical's toxicity. A concentration that is below the screening level is not considered to represent a significant health concern and would not generally undergo further evaluation, but also should not automatically be considered “safe.”

Air Samples - Imidacloprid and cyfluthrin are relatively non-volatile pesticides, so little or no material is anticipated in air once the spray settles. Four to six sites located in San Diego and Imperial counties will be sampled to measure outdoor air concentrations of imidacloprid and cyfluthrin. Sites must be accessible at all hours, protected from any direct spray. Based on previous monitoring (Kim 2007, Segawa 2004) a personal air sample pump (SKC#224-PCXR), calibrated to 3 liters/min, mounted with a XAD-2 resin tube as the trapping medium, will be used at each site. The samples will be collected for a period prior to application (background, 12-24 hr), during application (1-4 hr), and for 1 day after application (post application, about 24 hr).

All air samples are stored and transported frozen (dry ice or freezer) until received by CDFA Center for Analytical Chemistry laboratory staff for analysis. DPR and/or CDFA staff will collect the following number of samples.

4 sites x 3 sample periods x 2 chemicals/site = 24 samples

OBJECTIVE 2: To characterize the concentrations of imidacloprid and cyfluthrin residue in ripe fruit and/or foliage before and after application. These results will be used to determine if legal and effective concentrations are achieved. The maximum allowable concentration (tolerance) for imidacloprid in mature citrus fruit is 0.7 ppm and 0.2 ppm for cyfluthrin. This tolerance is based on analysis of the entire fruit, rind included.

Fruit– Fruit samples will be collected from one or two species (e.g., lemon and orange) at multiple sites within the two-county treatment area to confirm that tolerances are not exceeded. Background samples will be collected prior to application, and application samples will be collected after application residue has dried. Post application (interval) samples will be collected from selected sites treated at various intervals prior to citrus fruit harvest. The air sampling sites may be used at a later time as interval sampling if immature fruit is present at time of application. Suggested intervals between treatment and harvest range from 2 to 40 weeks, other intervals may be added depending on the pattern of concentrations observed.

Each sample is a composite of several fruit collected in a paper bag from a single property or tree. Samples are stored and transported refrigerated (wet or blue ice) until received by CDFA Center for Analytical Chemistry laboratory staff for analysis. DPR and/or CDFA staff will collect the following number of samples.

Application Site: 4 sites x 2 periods/site x 2 samples/period = 16 samples
Interval sampling sites: 6 to 24 sites x 1 sample/period = 6 to 24 samples

Foliage – Foliage samples will be collected from one or two species (e.g., lemon and orange) at multiple sites within the two county treatment area to determine efficacy of the spray program. Background samples will be collected prior to application, and post- application samples will be collected after application residue has dried. Leaf Punches will be collected and analyzed for dislodgeable cyfluthryn residues. Whole leaf samples will be collected and analyzed for imidacloprid total residues. CDFA-PDEP is also collecting whole leaf samples to monitor imidacloprid residues over time.

Dislodgeable residue samples consist of 40 one-inch-diameter leaf punches collected into a 4-ounce glass jar and sealed with a Teflon®-lined lid. Samples are stored refrigerated (wet or blue ice) and delivered within 24 hours to CDFA Center for Analytical Chemistry staff. DPR and/or CDFA staff will collect the following number of samples.

4 sites x 2 periods/site = 8 samples

Whole leaf samples consist of a minimum of 25 grams of whole leaves collected into a quart mason jar with a foil lined lid. Samples are stored and transported refrigerated or frozen (wet, blue or dry ice) until received by CDFA Center for Analytical Chemistry laboratory staff for analysis. DPR and/or CDFA staff will collect the following number of samples.

4 sites x 2 periods/site = 8 samples

OBJECTIVE 3: To measure the concentrations of imidacloprid and cyfluthrin in soil before and after treatment. These results will be used to determine if effective concentrations (imidacloprid) are achieved, and measure drift to the ground (cyfluthrin) after treatment.

Soil Samples - Samples will be collected using a 2-1/2 inch stainless steel tube, 28.56cm^2. Each sample will consist of three randomly selected soil cores, 1 inch deep. The background sample will be collected within 24-hours before treatment. The post treatment sample will be collected 1 to 5 hours after treatment.

Soil cores are composited into wide mouth Mason jars with aluminum foil lined lids. Samples are stored and transported refrigerated or frozen (wet, blue or dryice) until received by CDFA Center for Analytical Chemistry laboratory staff for analysis. DPR and/or CDFA staff will collect the following number of samples.

4 sites x 2 sample periods/site = 8 samples

OBJECTIVE 4: To measure the concentrations of imidacloprid and cyfluthrin in surface water and or runoff water following application or storm events. These results will be used to determine if imidacloprid and cyfluthrin may adversely affect sensitive habitat or aquatic organisms.

Surface Water Samples – Surface water may be monitored during storm or irrigation runoff events to determine imidacloprid and cyfluthrin concentrations due to wash off from exposed surfaces. Surface water samples will be collected at sensitive sites and runoff water samples at a common discharge point from treated properties. If rain or irrigation runoff is not present when sampling personnel are available, runoff samples will not be collected.

Water samples are collected and stored in one liter amber glass bottles with Teflon® lined lids. Samples are stored and transported refrigerated (wet or blue ice) until received by CDFA Center for Analytical Chemistry laboratory staff for analysis. DPR and/or CDFA staff will collect the following number of samples.

If runoff present: 4 sites x 2 collections/site = 8 samples

OBJECTIVE 5: To measure the amount of imidacloprid and cyfluthrin in the spray material. The results will be compared to the amount and/or rate specified on the pesticide product label to ensure that the pesticide is mixed properly.

Tank Mixture samples - DPR or CDFA staff will collect tank mixture samples. Samples will be collected, from the treatment spray guns, in plastic bottles.

Samples are stored and transported refrigerated (wet or blue ice) until received by CDFA Center for Analytical Chemistry laboratory staff for analysis. DPR or CDFA staff will collect the following number of samples.

4 sites x 2 chemicals/site = 8 samples

All movement of plant material outside the quarantine area will be transported in accordance with the CDFA issued permit #2618 (see attachment).

This monitoring plan includes current treatment areas of Imperial and San Diego counties. The number of samples and sites may increase if the treatment area expands into other counties or additional pesticides are used to retreat existing areas.

V. CHEMICAL ANALYSIS/QUALITY CONTROL

CDFA's Center for Analytical Chemistry will perform the laboratory analysis for imidacloprid and cyfluthrin in all media. Quality control measures will include analysis of spikes, (samples with known amounts of imidacloprid and cyfluthrin), to verify the accuracy and precision of the methods, and sample blanks, (samples with no imidacloprid or cyfluthrin), to check for contamination, as described in Segawa et al. (1995). The quality control samples will comprise approximately 10% of the field samples.

All plant material will be frozen for at least 24 hours before disposal.

VI. DATA ANALYSIS

Concentrations of imidacloprid and cyfluthrin in air will be reported in micrograms per cubic meter (µg/m3) and parts per trillion (ppt), water concentrations will be reported as both micrograms per liter (µg/L) and parts per billion (ppb), fruit samples will be reported as parts per million (ppm), foliage samples will be reported as micrograms per gram (ug/g) or micrograms per square meter (ug/m^2). When sample size permits, means, percentiles and frequency histograms will be presented. Tank sample results will be reported in percent active ingredient and compared to the target application rate. Air concentrations will be compared to the screening

level. Water concentrations will be compared to aquatic toxicity levels. Foliage samples will be compared to effective levels. Fruit concentrations will be compared to tolerances. Samples used for tolerance purposes must be at the harvest stage, and in its unpeeled, natural form.

IIV. REFERENCES

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