NEW JERSEY FOOD MONITORING & EVALUATION PROGRAM
2013-2015

New Jersey Department of Environmental Protection
Compliance & Enforcement
Pesticide Evaluation & Monitoring Section

TO THE READER

The New Jersey Food Monitoring & Evaluation Program (NJFMEP) is conducted every year to collect data on pesticide residues in fresh produce being grown and sold in New Jersey. This report shows that overall pesticide residues found in fresh produce from roadside markets in New Jersey are at levels below the standards (Tolerances) set by the US Environmental Protection Agency (EPA).

NJFMEP tests a wide variety of fresh produce using the most current laboratory methods. The data collected provides information regarding dietary exposure to pesticide residues from fresh produce, a critical step in evaluating overall pesticide exposure. While the NJFMEP is not designed for the enforcement of EPA Tolerances, if a Tolerance is exceeded, the Bureau of Pesticide Compliance is immediately notified and follow-up is initiated.

Introduction

The NJFMEP was initiated in 2000. The program was designed to identify pesticide residues on fresh produce being grown and sold in New Jersey. While this program was initially created to examine New Jersey grown produce exclusively, the scope has expanded to include fresh produce that is being sold in New Jersey, regardless of where it is grown. These non-New Jersey grown items make up a large percentage of the fresh produce available to New Jersey consumers (Figure 1). The program examines fresh produce from roadside markets. While expanding into other sampling venues throughout the last decade, roadside markets continue to be the focus because they are unique to New Jersey.

NJFMEP was created as a result of the 1996 Food Quality Protection Act (FQPA). The US Environmental Protection Agency (EPA) has determined allowable levels for pesticide residues on raw and processed produce. These EPA Tolerance Levels determine the amount of pesticide residues that can be present with "a reasonable certainty of no harm". The FQPA required that all Tolerance Levels be reassessed over a 10-year period, also incorporating an additional safety factory for children and considering an aggregate exposure. Our laboratory methods detect the smallest possible residues present on various New Jersey grown crops and allow us to determine if the Tolerance Levels are being met.

The information gathered through NJFMEP is critical for maintaining the quality of New Jersey's produce. It also helps to assure that EPA Tolerance Levels are not exceeded and allows the New Jersey Department of Environmental Protection (DEP) to accurately determine pesticide exposure levels. Additionally, data collected by the program helps to assess the validity of future proposed revisions to EPA Tolerance Levels.

Methods

Samples were collected during New Jersey's growing season (approximately May through September) from locations throughout the State's 21 counties. Pesticide applications occur throughout the growing season both while the crops are in the fields and after they are harvested. To capture both pre and post-

harvest applications, samples were collected at the point of purchase after all applications had already occurred.

NJFMEP currently includes 22 types of produce likely to be found at roadside markets. "Staple" produce routinely found at roadside markets include apples, cucumbers, peppers, peaches, squash and tomatoes. Asian vegetables have also become popular. All of the 22 produce types may not be represented in the sample pool every season. Produce selected for analysis are based on national trends and/or current issues being faced by New Jersey's growers.

The composite samples were processed and analyzed by the DEP's Pesticide Evaluation and Monitoring Section (PEMS). Produce was homogenized into composite samples by blending, and pesticide residues were extracted from the homogenized samples for analysis in accordance with the PEMS SOP entitled "Preparation of Pesticide Residue Extracts from Fruits and Vegetable Samples Using Dispersive Solid-Phase Extraction, QuEChERS." Samples are not washed or rinsed to remove dirt or debris before the pesticide residues were extracted. In addition, only the edible portion of the produce is blended into the composite sample. For example, pits are removed from peaches and corn is peeled and removed from the cob. This differs from the national USDA Pesticide Data Program (PDP) in which the entire fruit or vegetable is blended. The multi-residue extracts are analyzed by a gas chromatograph/mass spectrometer (GC/MS) and a triple quad liquid chromatograph/mass spectrometer (LC/MS) for a large list of targeted pesticide compounds consisting of fungicides, herbicides, and insecticides. The current GC/MS and triple quad LC/MS scans consists of over 300 different pesticide compounds, and the list of compounds incorporated into each scan increases each year. For instance, the LC/MS scan consisted of 19 compounds in 2011. At the end of the 2015 season, the LC/MS scan contained over 47 compounds. Furthermore, the limit of detection for many compounds was reduced significantly for many of the target pesticides. For example, when the monitoring program was initiated, most of the GC/MS compounds had limits of detection that were 0.2 ug/g. The limits of detection have been significantly reduced due to advancements in technology. The current limit of detection levels for most LC/MS compounds are now 0.004 ug/g. These improvements in analytical capability also increased the number of compounds detected. In addition to the targeted compounds, unknown compounds can be found in the analytical results. These were examined using mass spectral library searches to identify additional pesticide compounds.

Results

A total of 144 fresh produce samples were collected and analyzed during the 2013 through 2015 sampling seasons (Table 1).

Because both pre and post-harvest applications are captured and the samples are not washed or peeled, the analytical results represent the maximum exposure risk to pesticide residues from each individual sample. Of the 144 samples analyzed, 32% contained no detectable pesticides, 24% contained one pesticide and 44% contained more than one pesticide. While the USDA Pesticide Data Program (PDP) had a much larger sample pool (10,104 samples), its 2013 data similarly show 40.5% contained no detectable pesticides, 28.5% contained one pesticide and 36% contained more than one pesticide. Examination of multiple residues from the same produce type is critical because pesticides with common mechanisms of toxicity can lead to cumulative exposures.

Since the program began in 2000, only 1% of the samples collected have contained residues exceeding EPA Tolerance Levels. Only 5% have had residues with no associated EPA Tolerance Levels (Table 2). These results are comparable to the 2013 USDA PDP program results in which 0.23% contained residues exceeding EPA Tolerance Levels and 3.0% contained residues with no associated EPA Tolerance Levels.

During the 2013 through 2015 growing seasons, 84% of the samples collected were from produce grown in New Jersey. The remaining 16% were not grown in New Jersey or had an unknown origin (Figure 1.) The national PDP statistics for 2013 indicate that 70.8% of the samples were grown in the United

States. Imported fresh produce accounted for 26.6%. The remaining 2.6% were of mixed or unknown origin.

Apples were collected during all three growing seasons addressed in this report. A total of 12 samples were collected; 7 samples were from NJ grown produce and 5 were not. When comparing the average number of residues per sample, the results are strikingly similar. NJ grown apples averaged 4 residues per sample, where as non-NJ grown apples averaged 3.8 residues per sample.

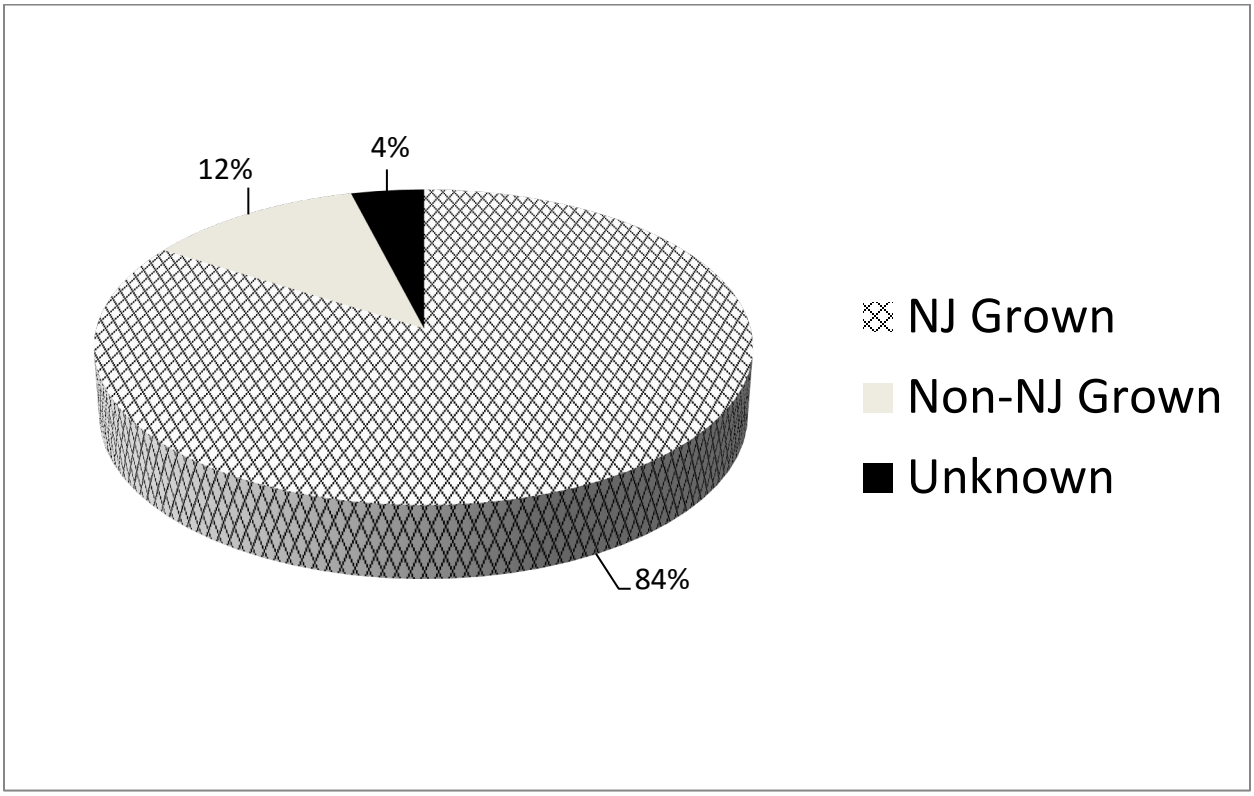

Figure 1. Source of produce samples collected from 2013 to 2015.

Table 1. Residues found on fresh produce samples from 2013-2015.

Commodity	Samples With Residues	Pesticide	Number of Times Detected	Residue Range (ppm)	EPA Tolerance (ppm)
Apples					
(12 composite samples)	12	Phosmet	2	0.29-0.4	10
		Carbendazim	7	<0.004-0.14	2.0
		Pyrimethalin	4	<0.004-1.9	14
		Thiabendazole	5	<0.004-0.010	5.0
		Thiophanate-methyl	6	<0.01-0.092	2.0
		Difenoconazole	2	<0.010-<0.02	5.0
		Fludioxinil	2	<0.004	5.0
		Pyraclostrobin	4	<0.004-0.022	1.5
		Clothianidin	1	<0.01	1.0
		Indoxacarb	1	0.019	1.0
		Thiamethoxam	1	<0.004	0.2
		Trifloxystrobin	1	<0.004	0.5
		Carbaryl	1	<0.004	12
		Methoxyfenozide	1	0.013	2.0
		Imidacloprid	3	<0.004-0.022	0.6
		Chlorantranilipole	2	<0.008-0.095	1.2
		Acetamiprid	2	0.033-0.093	1.0
		Cyprodinil	1	0.022	1.7
		Fenpropathrin	1	<0.004	5.0
Cherries					
(11 composite samples)	10	Acetamiprid	1	0.073	1.2
		Fenpropathrin	6	<0.004-0.47	5.0
		Pyraclostrobin	7	<0.004-0.31	2.5
		Imidacloprid	4	<0.004-0.049	3.0
		Quinoxyfen	5	0.0054-0.11	0.70
		Carbaryl	1	<0.004	10
		Carbendazim	3	<0.004-0.14	20
		Thiophanate-methyl	3	<0.01-0.01	20
		Clothianidin	2	<0.01	0.5
		Cyprodinil	2	<0.004	2.0
		Fenbuconazole	2	0.033-0.22	1.0
		Indoxacarb	2	0.01-0.11	0.90
		Thiamethoxam	3	0.0059-0.034	0.5
		Trifloxystrobin	3	0.014-0.12	2.0
		Etoxazole	1	<0.004	1.0
		Fludioxinil	1	Identified*	5.0
		Chlorothalonil	***1***	***0.68***	***0.5***
		Difenconazole	1	<0.01	2.5
Cucumbers					
(10 composite samples)	5	Phenmedipham	1	0.005	**
		Thiamethoxam	5	<0.004-0.0052	0.2
		Acetamiprid	1	0.019	0.5
		Dinotefuran	1	0.0051	0.5
		Famoxadone	1	<0.02	0.3
Lettuce					
(10 composite samples)	8	Imidacloprid	8	<0.004-0.094	3.5
		Thiamethoxam	2	<0.004	4.0
		Cyazofamid	1	0.029	10
		Cyprodinil	3	<0.004-0.13	50
		Fludioxinil	1	0.049	30
		Bensulide	1	<0.01	0.15
		Linuron	1	<0.01	**
		Trifloxystrobin	2	<0.004	**
		Dimethoate	2	<0.004-0.017	2.0
		Difenoconazole	1	<0.004	**
		Dimethenamid	1	<0.004	**

Table 1. Residues found on fresh produce samples from 2013-2015 (cont.).

Commodity	Samples With Residues	Pesticide	Number of Times Detected	Residue Range (ppm)	EPA Tolerance (ppm)
Peaches					
(18 composite samples)	17	Cyprodinil	3	<0.004-0.092	2
		Chlorothalonil	***1***	***1.1***	***0.5***
		Thiophanate-methyl	8	<0.01-0.37	3.0
		Methomyl	2	0.012	5.0
		Captan	1	Identified*	15
		Acetamiprid	11	<0.004-0.21	1.2
		Carbaryl	3	<0.004-0.28	10
		Chlorantranilipole	3	<0.004-0.022	4.0
		Clothianidin	3	<0.01-0.011	0.8
		Etoxazole	1	<0.004	1.0
		Indoxacarb	4	<0.02-0.024	0.9
		Pyraclostrobin	4	<0.004-0.053	2.5
		Phosmet	3	<0.2-0.39	10
		Thiamethoxam	1	<0.004	0.5
		Carbendazim	10	<0.004-0.31	3.0
		Febuconazole	3	<0.004-0.059	1.0
		Fenpropathrin	3	<0.002-0.023	1.4
		Imidacloprid	8	<0.008-0.022	3
		Trifloxystrobin	5	<0.004-0.01	2
		Bifenthrin	1	<0.2	0.5
		Difenconazole	3	<0.02-0.029	2.5
		Carbaryl	1	0.120	10
Peppers					
(18 composite samples)	7	Methomyl	1	<0.01	2.0
		Quinoxyfen	3	00069-0.012	1.7
		Thiamethoxam	1	0.004	0.25
		Imidacloprid	1	0.0055	1.0
		Acetamiprid	1	0.058	0.2
		Bifenthrin	1	<0.2	0.5
		Cyazofamid	1	0.014	0.9
		Pyraclostrobin	2	0.005-0.015	1.4
Potatoes					
(10 composite samples)	6	Clothianidin	4	<0.01	0.3
		Thiamethoxam	5	0.0044-0.025	0.3
		Oxamyl	1	0.0066	0.1
		Pyraclostrobin	1	<0.004	0.04
		Thiophanate-methyl	1	<0.01	1.0
		Linuron	1	<0.01	0.20
Squash					
(28 composite samples)	24	Thiamethoxam	11	<0.004	0.2
		Imidacloprid	12	<0.004-0.048	0.5
		Quinoxyfen	3	<0.004-0.013	1.7
		Pyraclostrobin	3	<0.004-0.014	0.5
		Thiabendazole	1	<0.004	0.02
		Carbaryl	1	<0.004	3
		Chlorothalonil	1	0.99	5.0
		Cyprodinil	1	<0.004	0.07
		Acetamiprid	1	<0.004	0.5
		Fenpropathrin	1	<0.004	0.5
		Carbendazim	1	<0.004	1
		Thiophanate-methyl	1	<0.01	1
		Methomyl	1	0.023	0.2
		Clothianidin	1	<0.01	0.06

Table 1. Residues found on fresh produce samples from 2013-2015 (cont.).

Commodity	Samples With Residues	Pesticide	Number of Times Detected	Residue Range (ppm)	EPA Tolerance (ppm)
Sweet Corn (15 composite samples)	4	Imidacloprid	1	<0.004	0.05
		Linuron	1	<0.01	0.1
		Methomyl	1	<0.01	0.1
		Chlorantranilipole	1	<0.004	0.02
Tomatoes (12 composite samples)	3	Imidacloprid	1	0.024	1.0
		Thiamethoxam	1	0.0054	0.25
		Clothianidin	1	<0.01	0.2
		Carbendazim	1	<0.008	**

*Analyte was identified using the mass spectral library but was not confirmed by the analysis of a reference standard.
** There is currently no tolerance for this chemical on this commodity.
Bold and italicized results indicate a Tolerance violation.

Table 2. Summary of New Jersey sample results for 2000 through 2015.

Year	Total Samples Collected	Samples With No Residues	Samples With Residues Within EPA Tolerances	Samples With Residues Over EPA Tolerances	Samples With Residues With No EPA Tolerances
2000	24	15	9	0	0
2001	105	59	39	0	8
2002	66	30	24	2	10
2003	61	36	22	1	3
2004	51	32	16	1	3
2005	42	23	12	1	2
2006	8	5	2	1	0
2007	15	7^	6	0	0
2008	15	8	6	0	1
2009**	--	--	--	--	--
2010	38	34	4	0	0
2011	52	23	29	0	0
2012	57	26	31	0	4
2013	42	19	21	1	1
2014	49	20	28	0	1
2015	53	8	40	1	4
	678	345	289	8	37
Percent of total:		51%	43%	1%	5%

^Two samples from 2007 were considered qualified and rejected.
**No samples were collected during this season to accommodate extraction and analytical method development

Summary

With the introduction of new extraction and analytical techniques, a larger library of pesticides at significantly lower levels can be detected. While the number of residue detections has increased over the years, it should be noted that the number of non-compliant samples (Tolerance violations and misapplications) has actually decreased. The most common source of non-compliant results is a misapplication (wind-blown drift and/or cross-contamination during harvest and packaging) that results in a residue on produce when the pesticide is not labeled for use on that produce. While residue concentrations resulting from a misapplication are typically just above the analytical reporting level and usually well

below the EPA Tolerance Level, these results are turned over to the Pesticide Control Program's Enforcement Element for further investigation. Although not nearly as common as misapplication, EPA Tolerance Level violations do occur. These sample results are also turned over for further investigation.

Apples were collected during all three growing seasons addressed in this report. A total of 12 composite samples were collected and all 12 composite samples showed evidence of multiple residue detections. NJ grown apples averaged 4 residues per sample, where as non-NJ grown applies averaged 3.8 residues per sample. Future monitoring may focus on collection of a single produce type targeting both NJ and non-NJ grown products to gain more data.

NJFMEP began including organic produce in sample collections during the 2003 season. Only a small number (20 composite samples) of organics have been collected. The three composite samples collected from 2013 to 2015 did not have any residue detections. However, there have been several cases of NJ growers attempting to transition agricultural lands from traditional to organic.

"Buying local" has become a mainstream trend over the last few years. Demand for fresh, local produce and consumer awareness of pesticides makes residue monitoring at roadside markets critical in New Jersey. Pick-your-own operations can increase the risk of exposure when consumers are in the fields or orchards at the sites of applications. Future monitoring may focus on pick-your-own operations as the popularity of agritourism continues to grow.

More information regarding NJFMEP can be found under the Publications link on the Pesticide Control Program's website (www.pcpnj.org).