



**New Jersey Department of  
Environmental Protection  
Pesticide Control Program**

**FARM FRESH PRODUCE IN THE  
GARDEN STATE:  
A LOOK AT DIRECT MARKET  
FRUITS & VEGETABLES**

**New Jersey Food Monitoring  
& Evaluation Program**

**2004-2006**



## **Introduction**

The New Jersey Food Monitoring & Evaluation Program (NJFMEP) was initiated in 2000. The project was designed to identify and catalog pesticide residues on fresh produce being grown and sold in New Jersey. While the project was initially envisioned 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. This project examines fresh produce from roadside markets; the first time such commodities have ever been monitored in New Jersey. And while expanding into other sampling venues throughout the six years of the project, roadside markets continue to be the focus.

NJFMEP is intimately related to the 1996 Food Quality Protection Act (FQPA). Accurate measurement of the pesticide residues present on various New Jersey grown crops will provide insight into actual pesticide residue levels as opposed to theoretical or calculated levels. The US Environmental Protection Agency (EPA) has determined allowable levels for pesticide residues on raw and processed agricultural commodities. These EPA Tolerance Levels are the only legal means to control the amount of pesticide residues on commodities consumed by the public.

The information gathered through NJFMEP is critical in maintaining the quality of the food supply while also assuring risk estimates (EPA Tolerance Levels) are not exceeded, and allows the New Jersey Department of Environmental Protection (NJDEP), Pesticide Control Program (PCP) to accurately determine pesticide exposure levels. Realistic assessments of proposed Tolerance revisions would also be achieved utilizing the data collected through NJFMEP.

This report covers the 2004 through 2006 sampling seasons. For more information regarding the first four years of the project, a report entitled "2000-2003 Food Monitoring Comprehensive Report" can be found under the Publications link on the Pesticide Control Program's website ([www.pcpnj.org](http://www.pcpnj.org)).

## **Methods**

Sample collection occurs during the peak of the growing season in New Jersey (approximately April through November) from locations throughout the State's 21 counties. NJFMEP currently includes 22 commodities likely to be found at roadside markets. "Staple" commodities routinely found at roadside markets include apples, cucumbers, peppers, peaches, squash and tomatoes, while items such as Asian vegetables have also become popular as added value products. All of the 22 commodities may not be represented in the sample pool every year; commodities selected for sampling are based on national trends or current issues being faced by New Jersey's growers.

The samples are processed and analyzed by the NJDEP's PCP Laboratory. The samples are chopped and placed in a blender in accordance with the PCP Laboratory SOP entitled "Preparation of Pesticide Residue Extracts from Fruit and Vegetable Samples Using Liquid Solid Phase Extraction". Samples are not washed or rinsed to remove any possible dirt or debris before they are extracted. The multi-residue extracts are analyzed by a gas chromatograph/mass spectrometer (GC/MS) for a large list of targeted pesticide compounds consisting of fungicides, herbicides, and insecticides from various chemical families. The current GC/MS scan consists of approximately 300 different pesticide residues. In addition to the targeted compounds, unknowns will be examined with the intention of identifying potential pesticides using mass spectral library searching and interpretation. Table 1 shows all of the results for the 2004 through 2006 season samples.

## **Results**

A total of 101 fresh produce samples were collected and analyzed during the three growing seasons (Table 2). Since the project began in 2000, over half of the samples (56%) showed no detectable pesticide residues. Of the remaining samples, 35% had residues below EPA Tolerance Levels and 6 samples (2%) had a residue detection above the EPA Tolerance Level. These statistics are comparable to the US Food and Drug Administration's (FDA) 2003 Residue

Monitoring Results, which found 63% of samples with no detectable residue, 35% with residues below EPA Tolerance Levels, and 2% with a violative detection (above the EPA Tolerance).

It has been noted that there are several “staple” commodities routinely found at roadside markets in New Jersey, regardless of the actual harvest period for these crops. Items such as apples, cucumbers, peaches, peppers, squash, and tomatoes tend to appear at roadside markets throughout the entire growing season. The availability of these items is reflected in the number of each of these samples collected during a growing season. Tomatoes and squash account for 28% of the total number of samples collected between 2004 and 2006.

While more than half of the samples collected did not show any detectable residues, it is not uncommon to find pesticide residues on fresh produce. What is notable, however, is the concentration of these detections as compared to the associated Tolerance Level. In most cases, there is typically an order of magnitude difference between the range of detections and the Tolerance Level. For example, phosmet is a commonly used insecticide and the Tolerance Level for phosmet on apples is 10.0 ppm. The range of detections for phosmet on apples from 2004-2006 was 0.009-0.028 ppm (Chart 2), which is just above the Reporting Level for the analytical instrument.

Eighteen out of the 35 pesticides detected from 2000-2006 were insecticides (Chart 1). A total of 255 residues have been identified. Insecticides accounted for 60% of the total number of detections. Of the eight fungicides identified, chlorothalonil accounted for nearly half of all the fungicide detections and 17% of the overall total number of detections. Herbicide detections only accounted for 5% of the total number of detections. The synergist PBO was only detected once.

Historical contaminants are pesticides that have been banned in the United States for over 30 years, including dieldrin and DDT and its metabolites. These historical contaminants account for 13% of the total number of detections. This figure is comparable to the 18% occurrence of DDT and dieldrin in the 2003 FDA Residue Monitoring.

During the three growing seasons, 8 organic samples were collected. One sample each of the following commodities were collected: broccoli, Chinese cabbage, cucumbers, onions, peppers, squash, sweet potatoes, and white potatoes. There were no detections on any of the organic samples collected.

NJFMEP also has a compliance and enforcement component that requires non-compliant sample results to be turned over to the Bureau of Pesticide Compliance (BPC) for further investigation. During the 2004 through 2006 sampling seasons, seven samples were turned over to BPC for further investigation.

The most common source of non-compliant results is a misapplication (drift, etc.) that results in a residue on a commodity when the pesticide is not labeled for use on that commodity. While residue concentrations resulting from a misapplication are typically just above the GC/MS reporting level, these results are turned over to BPC for further investigation. Although not nearly as common as a misapplication, Tolerance violations do occur. These samples are also turned over to BPC for further investigation.

The draw of fresh produce has made roadside markets increasingly popular in the past few years. This popularity puts “staple” commodities in demand on a daily basis, in addition to any other specialty crops being harvested at that time. We have found that roadside markets in New Jersey will go so far as to sell non-NJ grown items to ensure that these staples are available throughout the growing season. The trend toward continued demand for fresh produce and new specialty commodities will determine the focus of NJFMEP in the future.

**Table 1. Residues found on fresh produce samples in 2004-2006.**

<b>Commodity</b>	<b>Samples With Residues</b>	<b>Pesticide</b>	<b>Number of Times Detected</b>	<b>Residue Range (ppm)</b>	<b>EPA Tolerance (ppm)</b>
Apples (8 samples)	6	Phosmet	6	0.009-0.028	10.0
		Bifenthrin	1	0.048	**
		Esfenvalerate	1	0.11	2.0
Asparagus (7 samples)	2	Metribuzin	1	0.009	0.10
		Napropamide	2	0.007-0.009	0.1
Blueberries (3 samples)	2	Phosmet	2	0.009-0.024	10
		Captan	1	Identified	25
Broccoli (3 samples)	0	None Detected	--	--	--
Cauliflower (1 sample)	0	None Detected	--	--	--
Cherries (3 samples)	3	<b>Chlorothalonil</b>	2	<b>0.016-0.91^</b>	<b>0.5</b>
		Bifenthrin	1	0.008	**
		Methiocarb	1	Identified	**
		Captan	2	Identified	100
		Esfenvalerate	1	0.33	10
		Endosulfan II	1	0.024	2
		Endosulfan Sulfate	1	0.085	2
		None Detected	--	--	--
Chinese Cabbage (1 sample)	0	None Detected	--	--	--
Cucumbers (4 samples)	2	Dieldrin	2	0.015-0.091	0.1*
		Endosulfan II	1	0.012	2.0
		Endosulfan sulfate	1	0.074	2.0
Eggplant (4 samples)	0	None Detected	--	--	--
Lettuce (5 samples)	2	Pendimethalin	1	0.018	**
		Permethrin	1	4.8	20
		Azoxystrobin	1	1.2	30
Onions (1 sample)	0	None Detected	--	--	--
Peaches (6 samples)	5	Propiconazole	3	0.012-0.074	1.0
		Phosmet	4	0.24-1.9	5.0
		Carbaryl	1	Identified	10.0
		Captan	1	Identified	50.0
		Azinphos-methyl	1	0.03	2.0
		Chlorothalonil	1	0.010	0.5
		PBO	1	0.021	8
		None Detected	--	--	--
Peas (2 samples)	0	None Detected	--	--	--

**Table 1. Continued.**

<b>Commodity</b>	<b>Samples With Residues</b>	<b>Pesticide</b>	<b>Number of Times Detected</b>	<b>Residue Range (ppm)</b>	<b>EPA Tolerance (ppm)</b>
Peppers (7 samples)	4	Esfenvalerate	1	0.05	1.0
		Metalaxyl	2	0.013-0.054	1.0
		Lambda-cyhalothrin	1	0.20	0.20
White Potatoes (3 samples)	0	None Detected	--	--	--
Spinach (1 sample)	0	None Detected	--	--	--
Squash (9 samples)	3	Endosulfan sulfate	2	0.033-0.063	2.0
		4,4'-DDT	1	0.009	0.1*
		4,4'-DDE	1	<0.004	0.1*
		4,4'-DDD	1	<0.004	0.1*
		Dieldrin	2	0.014-0.020	0.1*
Strawberries (6 samples)	3	Phosmet	1	0.02	**
		Captan	1	Identified	25.0
		Bifenthrin	1	0.018	3
		Napropamide	1	0.019	0.1
Sweet Corn (4 samples)	0	None Detected	--	--	--
Sweet Potatoes (3 samples)	0	None Detected	--	--	--
Tomatoes (20 samples)	7	<b>Chlorothalonil</b>	3	0.015-5.6 <sup>^</sup>	<b>5.0</b>
		<b>Myclobutanil</b>	1	<b>0.09<sup>^</sup></b>	<b>0.03</b>
		<b>Azoxystrobin</b>	3	0.051-0.67 <sup>^</sup>	<b>0.2</b>
		Esfenvalerate	2	0.14-0.35	1.0
		Carbaryl	1	Identified	10
		Endosulfan I	1	0.046	2.0
		Endosulfan II	1	0.058	2.0

\*FDA Action Level.

\*\* This compound is currently not labeled for use with this commodity.

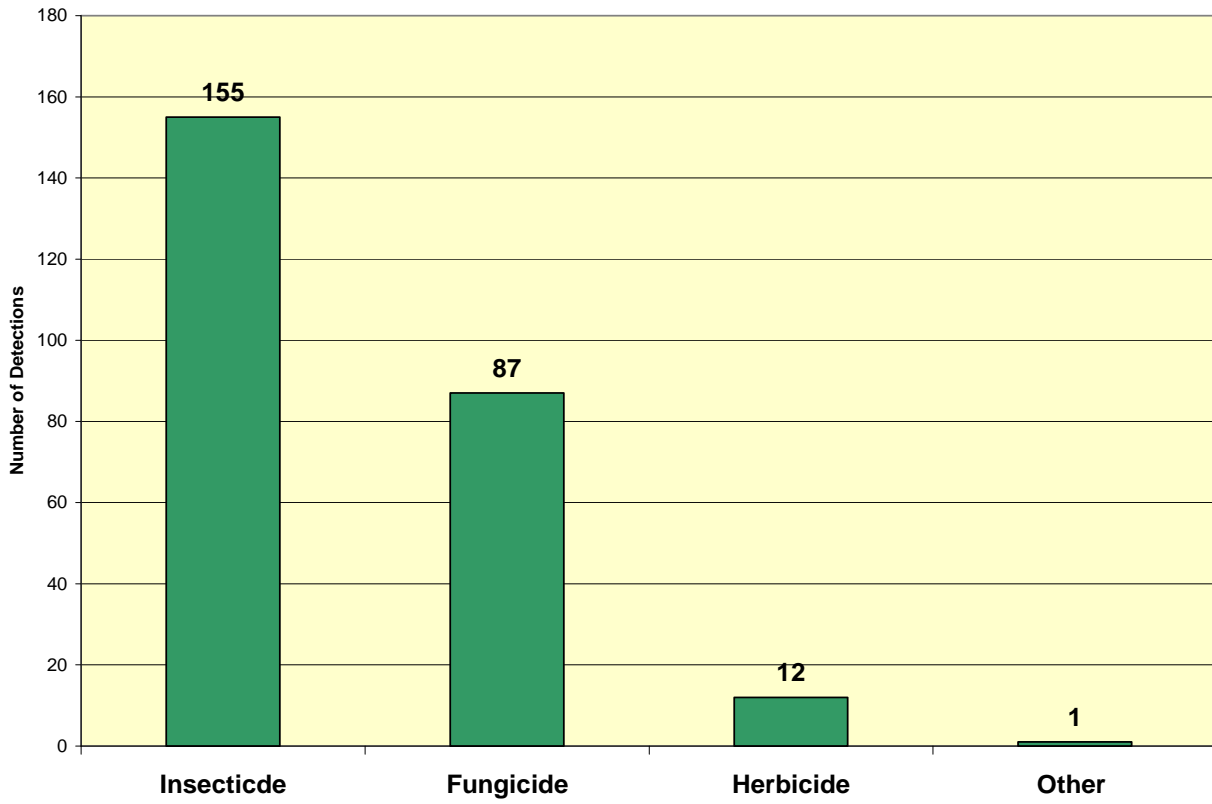
<sup>^</sup> Concentration is above the EPA Tolerance.

**Table 2. Summary of New Jersey sample results for 2000 through 2005.**

<b>Year</b>	<b>Total Samples Tested</b>	<b>Samples With No Residues</b>	<b>Samples With Residues Within EPA Tolerances</b>	<b>Samples With Residues Over EPA Tolerances</b>	<b>Samples With Residues With No EPA Tolerances</b>
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
	357	200	124	6	26
		56%	35%	2%	7%

\*FDA Action Level.

**Chart 1. Occurrence of the pesticides found from 2000-2006.**



**Chart 2. Phosmet on Apples 2004-2006.**

