Methods

Indicator

E9. Percentage of apples, carrots, grapes, and tomatoes with detectable residues of organophosphate pesticides, 1998-2016.

Summary

The U.S. Department of Agriculture (USDA) has been conducting the Pesticide Data Program (PDP) since 1991. Since 1998 the PDP has measured pesticide residues on fresh fruits and vegetables, canned and frozen fruits and vegetables, fruit juices, whole milk, wheat, soybeans, oats, corn syrup, peanut butter, poultry, beef, pork, drinking water, bottled water, and groundwater. In order to maintain comparability across the years 1998 to 2016, the organophosphate detection rates reported in this indicator include only detections of the 42 organophosphate pesticides and metabolites that were included in the PDP for each and every year from 1998 to 2016 and were above the minimum of the limits of detection available in 1998. Indicator E9 is the percentage of apples, carrots, grapes, and tomatoes with detectable residues of organophosphate pesticides. For each of these commodities, this indicator is calculated as the number of food samples with a detectable residue divided by the total number of food samples analyzed for one or more of the 42 pesticides.

Data Summary

Indicator	E9. Percentage of apples, carrots, grapes, and tomatoes with detectable residues of organophosphate pesticides, 1998-2016.												
Time Period	**1998-2016**												
Years (1998-2010)	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
	Number of samples												
Apples		379	184	736	556		744	743				744	744
Carrots			184	739	554				744	744			
Grapes			741	705			738	739				744	745
Tomatoes	717	364				742	744			741	740		
Years (2011-2016)	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**							
	Number of samples												

Apples				177	708	531							
Carrots			712	708									
Grapes					708	708							
Tomatoes				177	708	528							

Overview of Data Files

The following files are needed to calculate this indicator. They were all obtained from the Pesticide Data Program website:

https://www.ams.usda.gov/datasets/pdp/pdpdata

This webpage contains downloadable, zipped, database files in the MDB (MS ACCESS 2000) format with pre-written macros and instructions to assemble the various component text files into a single database for each calendar year. In each assembled year's database file are two data files describing the sample data and testing results and translations for all fields used in the database.

Two files are used to perform the analysis here:

- PDP Reference Tables 1998.xls: Excel file with Pesticide Data Program summary information for 1998 including pesticide names and codes for 1998 (Pest Code worksheet). The three-digit pesticide codes are used to extract the data for the 43 pesticides from the Analytical Results data files.

- Current Year Database Tables (XXResultsData and XXSampleData within the database, PdpXXSamples.txt and PdpXXResults.txt as text files outside of the database): Pesticide Data Program Analytical Results data for calendar year (XX). Each record is for a single sample and pesticide. The sample is identified by the combination of the following codes: STATE, YEAR, MONTH, DAY, SITE, COMMOD (commodity), LAB (laboratory), and SOURCE_ID (Code to make sample ID unique). The pesticide analyzed is given by the pesticide code (PESTCODE). For these analyses we also needed the level of detection (LOD) and the measured concentration (CONCEN); the concentration value is missing if it is at or below the level of detection.

Pesticide Data Program

Pesticide residue data for the years 1998 to 2016 were obtained from the Pesticide Data Program website:

https://www.ams.usda.gov/datasets/pdp/pdpdata

For each year, the analytical results data are reported in the ASCII files PdpXXResults.txt and PdpXXSamples.txt, where "XX" denotes the last two digits of the calendar year. A single sample is defined by the combination of the variables STATE, YEAR, MONTH, DAY, SITE, COMMOD (commodity), LAB (laboratory), SOURCE_ID (Sample Source ID). The same

sample can be measured for pesticide residues of one or more pesticides or metabolites, as defined by the three digit pesticide code (PESTCODE). The pesticide codes and names are reported in the table PesticideRef inside the assembled database. For these analyses we extracted only those sample/pesticide combinations where the pesticide compound was one of the 42 organophosphate (OP) compounds in the following list of compounds analyzed each year from 1998 to 2016:

42 OP Compounds Analyzed in 1998 to 2016

OP Compound	Limit of Detection (ppm)	OP Compound	Limit of Detection (ppm)
Acephate	0.001	Malathion oxygen analog	0.001
Azinphos methyl	0.003	Methamidophos	0.001
Carbophenothion	0.001	Methidathion	0.001
Chlorpyrifos	0.001	Mevinphos Total	0.003
Coumaphos	0.002	Omethoate	0.001
Coumaphos oxygen analog	0.003	Oxydemeton methyl sulfone	0.001
DEF (Tribufos)	0.001	Parathion ethyl	0.001
Diazinon	0.001	Parathion methyl	0.001
Dichlorvos (DDVP)	0.001	Phorate	0.001
Dimethoate	0.001	Phorate oxygen analog	0.001
Disulfoton	0.001	Phorate sulfone	0.001
Disulfoton sulfone	0.001	Phorate sulfoxide	0.002
Ethion	0.001	Phosalone	0.003
Ethoprop	0.003	Phosmet	0.002
Fenamiphos	0.001	Phosphamidon	0.001
Fenamiphos sulfone	0.002	Pirimiphos methyl	0.001
Fenamiphos sulfoxide	0.002	Profenofos	0.001
Fenitrothion	0.001	Sulprofos	0.001
Fenthion	0.001	Terbufos	0.001
Fonofos	0.001	Terbufos sulfone	0.001
Malathion	0.001	Tetrachlorvinphos	0.001

For all years, we compared the measured values with the 1998 minimum detection limit. For each pesticide, the 1998 minimum detection limit is defined as the minimum of all the detection levels (LOD) for that pesticide in the 1998 analytical results file, across all samples, laboratories, and commodities. This minimum detection limit was calculated across all 30 commodities sampled in 1998.

In addition to the 42 OPs measured by the PDP every year from 1998-2016, an additional 81 OPs were measured in one or more of these years. Between 14 and 59 of these additional OPs were measured in any one year during the 1998-2016 period.

This analysis excluded the data for the year 2017 since all four commodities of interest were not measured that year.

Calculation of Indicator

Indicator E9 is calculated as follows.

The following steps were applied separately to the samples from each of the four commodities of interest: apples (commodity code COMMOD = AP), carrots (code CR), grapes (code GR), and tomatoes (code TO).

1. The number of unique samples is calculated for each year: Each sample is defined by the combination of the variables STATE, YEAR, MONTH, DAY, SITE, COMMOD (commodity), LAB (laboratory), and SOURCE_ID (Sample Source ID). The same sample can appear multiple times in the database. For each sample, we only count the first of the records where one of the 42 pesticide compounds listed above was measured. Samples where none of the 42 pesticide compounds listed above were measured are not included.

2. The number of unique samples with a detectable residue is calculated for each year: For this step, we first list the subset of records where the measured pesticide compound was among the 42 compounds tabulated above, the concentration was above the detection limit for that laboratory measurement (i.e., the concentration field is not blank), and the concentration is greater than and not equal to the 1998 minimum detection limit for the same pesticide. Note that a measured value might exceed the detection limit for that pesticide compound, measurement year, laboratory, and commodity, but not exceed the 1998 minimum detection limit for the compound. Note also that to compare to 1998 thresholds, all reported concentrations are converted to ppm before comparison. The number of unique samples with a detectable residue is the number of distinct samples in this subset.

3. The percentage of a commodity with detectable residues is calculated by dividing the total number of food samples of that commodity with detectable residues (step 2) by the total number of samples of that commodity analyzed (step 1):

> Percentage of commodity C (apples, carrots, grapes, or tomatoes) with detectable residues =
>
> [Number of unique samples of commodity C with a detectable residue / Number of unique samples of commodity C] × 100 %

Questions and Comments

Questions regarding these methods, and suggestions to improve the description of the methods, are welcome. Please use the “Contact Us” link at the bottom of any page in the America’s Children and the Environment website.