Pesticide Residue Monitoring Program Fiscal Year 2016 Pesticide Report

U.S. Food and Drug Administration

http://www.fda.gov/food/foodborneillnesscontaminants/pesticides/default.htm

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Acknowledgments

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FDA Pesticide Residue Monitoring Program

For more information about FDA pesticide residue monitoring program reports, see http://www.fda.gov/Food/FoodborneIllnessContaminants/Pesticides/ucm2006797.htm. Since 1987, annual pesticide reports have been prepared to summarize results of the Food and Drug Administration's (FDA or the Agency) pesticide residue monitoring program. Reports from Fiscal Year (FY) 1987 to FY 1993 were published in the Journal of the Association of Official Analytical Chemists/Journal of AOAC International. FY 1993 and FY 1994 reports were published in the journal and also made available on the public FDA website (www.fda.gov). Subsequent reports are only available on the FDA website. Each report is available in the format(s) used at the time they were written.

In addition to the annual reports, specific pesticide monitoring data and statistical analyses of human foods for each year are also available in text format on the FDA website as "database" files. The database files include statistical analysis of findings by multiple country/commodity/pesticide combinations, along with data for individual samples from which the summary information was compiled. Instructions and explanations of the data and statistical analyses are provided for each database file. The database files are available from FY 1996 on.

Executive Summary

Growers often use pesticides to protect their products from insects, weeds, fungi, and other pests. U.S. regulators help ensure that food produced with the use of pesticides is safe to eat by setting allowable levels called tolerances for pesticide chemical residues and by monitoring foods in the market to determine if those levels are being met.

The role of the Environmental Protection Agency (EPA) is to establish pesticide tolerances on the amount of a pesticide chemical residue a food can contain. The Food and Drug Administration (FDA) is responsible for enforcing those tolerances for domestic foods shipped in interstate commerce and foods imported into the United States (U.S.)[1]

This report summarizes the results of FDA's pesticide monitoring program for FY 2016. The findings show that the levels of pesticide chemical residues measured by FDA in the U.S. food supply are generally in compliance with EPA pesticide tolerances.

FDA employs a three-fold strategy to enforce EPA's pesticide tolerances in human and animal foods. In its regulatory pesticide residue monitoring program, FDA selectively monitors a broad range of import and domestic commodities for residues of over 700 different pesticides and selected industrial compounds. FDA may also carry out focused sampling surveys for specific commodities or selected pesticides of special interest. In addition, FDA monitors the levels of pesticide chemical residues in foods prepared for consumption in its Total Diet Study (TDS), an ongoing program that monitors contaminants and nutrients in the average U.S. diet.

In FY 2016 (October 1, 2015 through September 30, 2016), FDA analyzed 7,413 samples in its regulatory monitoring program: 6,946 human foods and 467 animal foods. Because the violation rates of import human food samples are generally higher than for domestic samples, FDA tests more import than domestic commodities (4,276 import and 2,670 domestic samples). We collected import human food samples from 98 countries and domestic human food samples from 46 states and U.S. territories.

FDA found that over 99 % of domestic and 90 % of import human foods were compliant with federal standards. Further, no pesticide chemical residues were found in 52.9 % of the domestic and 50.7 % of the import samples that we analyzed.

In FY 2016, FDA also analyzed 467 animal food samples (242 domestic and 225 import) for pesticides. The Agency found that over 98 % of the animal food samples were compliant with federal standards. No pesticide chemical residues were found in 43.0 % of the domestic and 54.7 % of the import animal food samples. Most of the animal food samples were for livestock or poultry; 53 of the samples were pet food.

In some human food commodity groups, the violation rate was higher for import samples. The higher violation rate affirms the validity of the sampling design in targeting import

[1] With the exception of meat, poultry, and certain egg products regulated by the Food Safety Inspection Service (FSIS) of the U.S. Department of Agriculture (USDA).

commodities more likely to contain violative pesticide chemical residues, and the countries more likely to export them. Factors considered in targeting import commodities include past problem areas, findings from state and federal monitoring, and foreign pesticide usage data.

In addition to samples collected for routine regulatory monitoring, in FY 2016, FDA conducted pesticide analyses for two field assignments. In the first assignment, 527 domestic milk, shell eggs, honey, and game meat samples were analyzed for "Domestically Produced Animal-Derived Foods." Only one of the 527 samples analyzed was found to be violative. No residues were found in any of the game meat samples, 98.0 % of the milk, 83.8 % of the egg, and 72.9 % of the honey samples.

The second assignment conducted in FY 2016 was the "Collection of Selected Domestic and Imported Foods for Herbicides Analysis" (Herbicides) assignment, using two new selective residue methods (SRMs) for the analysis of (1) the herbicides glyphosate and glufosinate (glyphosate SRM) and (2) 30 selected acid herbicides (acid herbicides SRM). We analyzed for glyphosate and glufosinate residue levels in 274 grain corn, 267 soybean, 113 milk, and 106 egg samples. No samples contained violative levels of glyphosate or glufosinate; and no residues were found in the milk and egg samples. Non-violative levels of glyphosate were found in 173 (63.1%) of the corn samples and 178 (67.0%) of the soybean samples and non-violative levels of glufosinate were found in 4 (1.4%) of the corn samples and 3 (1.1%) soybean samples.

We determined acid herbicide residue levels in 891 samples, including six grain crops (corn, soybeans, barley, rice, wheat, and oats) and eight root crops (potatoes, turnips, sugar beets, peanuts, carrots, radishes, beets, and sweet potatoes). No residues were found in 88.0 % (784) of the samples. Two soybean samples (0.7 %) contained violative residues.

FDA analyzed 1,062 total samples in the TDS program in FY 2016. No foods contained violative pesticide levels. The most frequently observed pesticide chemical residues are consistent with those reported in FY 2015. Residues of 155 different pesticides were found in the TDS foods, most frequently at trace levels. Of all the residues found in TDS foods, 87 % percent were at levels below 0.01 parts per million (ppm), and 2 % were above 0.1 ppm.

Glossary and Abbreviations

Term	Definition
Action level	Food or feed may contain a pesticide chemical residue from sources of contamination that cannot be avoided by good agricultural or manufacturing practices, such as contamination by a pesticide that persists in the environment. In the absence of an EPA tolerance, or tolerance exemption, FDA may establish an "action level" for such unavoidable pesticide chemical residues. An action level is a recommended level of a contaminant not to exceed. An action level is not legally binding and FDA may take enforcement action on a case-by-case basis whether a contaminant is below, at, or above an action level. (http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/ucm077969.htm)
Agency	U.S. Food and Drug Administration
APEC	Asia Pacific Economic Cooperation
CFR	U.S. Code of Federal Regulations
CFSAN	FDA Center for Food Safety and Applied Nutrition
Codex	Codex Alimentarius Commission
CVM	FDA Center for Veterinary Medicine
Domestic sample	Sample of a commodity produced and held for sale in the U.S.
DWPE	Detention Without Physical Examination
EPA	U.S. Environmental Protection Agency
FFDCA	Federal Food, Drug, and Cosmetic Act
FDA	U.S. Food and Drug Administration
FSCF	Food Safety Cooperation Forum
FSIS	USDA Food Safety and Inspection Service
FY	Fiscal Year
Import sample	Sample of products, which originate from another country, collected while the goods are in import status.
JIFSAN	Joint Institute for Food Safety and Applied Nutrition

Term	Definition
LOD	Limit of Detection – The minimum concentration of a pesticide chemical residue that can be reliably distinguished from zero.[1]
LOQ	Limit of Quantitation – The minimum concentration of a pesticide chemical residue that can be quantified with acceptable precision.[1]
MOU	Memorandum of Understanding
MRL	Maximum Residue Level
MRM	Multiresidue Method – FDA pesticide method designed to analyze multiple pesticide chemical residues during a single analysis
No-tolerance violation	Pesticide chemical residue found at, or above, a quantifiable level for pesticides in a commodity in which EPA has not established a tolerance for that particular pesticide/commodity combination or a tolerance exemption
Over-tolerance violation	Pesticide chemical residue found at a level above an EPA tolerance.
ORA	FDA Office of Regulatory Affairs
PDP	USDA Pesticide Data Program
PPB	Parts per billion – residue concentration equivalent to microgram/kilogram
PPM	Parts per million – residue concentration equivalent to milligram/kilogram
SPS	Sanitary and Phytosanitary
SRM	Selective Residue Method – FDA pesticide method designed to analyze selected pesticide chemicals or a single pesticide chemical
TDS	Total Diet Study
Tolerance	The EPA established maximum residue level of a specific pesticide chemical that is permitted in or on a human or animal food in the United States. The tolerances are listed in 40 CFR Part 180 – Tolerances and Exemptions for Pesticide Chemical Residues in Food
Trace level	Residue level less than the LOQ but greater than, or equal to, the LOD
USDA	U.S. Department of Agriculture
WTO	World Trade Organization

FDA Pesticide Residue Monitoring Program

Three federal government agencies share responsibility for the regulation and oversight of pesticide chemical residues in or on food. The U.S. Environmental Protection Agency (EPA) registers (i.e., approves) the use of pesticides and establishes tolerances for pesticide chemical residues in or on food resulting from the use of the pesticides. Tolerances are the EPA established maximum residue levels (MRLs) of a specific pesticide chemical that is permitted in or on a human or animal food in the United States.[2] EPA also provides a strong U.S. preventive controls program by licensing pesticide applicators, conducting pesticide use inspections, and establishing and enforcing pesticide labelling provisions. FDA enforces tolerances in both import foods and domestic foods shipped in interstate commerce, except for meat, poultry, and certain egg products for which the Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture (USDA) is responsible. FDA also monitors pesticide chemical residue levels in commodities representative of the U.S. diet by carrying out market basket surveys under the TDS.

Regulatory Monitoring and Enforcement

FDA samples individual lots of domestically produced and import foods and analyzes them to determine whether they contain pesticide chemical residues that are "unsafe" within the meaning of the FFDCA. This activity is carried out pursuant to the enforcement of tolerances established by EPA and includes the monitoring of food for residues of cancelled pesticides used in the past that persist in the environment, which may be addressed by FDA action levels. Domestic samples of foods produced and held for sale in the U.S. are typically collected close to the point of production in the distribution system, e.g., growers, packers, and distributors. Import samples are collected when products are offered for entry into U.S. commerce. Because the EPA tolerances are established primarily for raw agricultural commodities, the emphasis of FDA's sampling is on the unwashed, whole (unpeeled) raw commodity; some processed foods are also sampled.

FDA may take regulatory action against food commodities containing pesticide chemical residues when they are found:

- at a level above an EPA tolerance for the pesticide/commodity combination and
- when present in a commodity for which EPA has not established a tolerance or a tolerance exemption for that particular pesticide/commodity combination ("no tolerance" violations)

Food or feed may contain a pesticide chemical residue from sources of contamination that cannot be avoided by good agricultural or manufacturing practices, such as contamination by a pesticide that persists in the environment. FDA may establish an "action level" for unavoidable residues that do not have a tolerance or tolerance exemption. The action level is not legally binding, but FDA monitors unavoidable residues and may take enforcement action on a case-by-case basis, considering the action level and other factors.

For domestic foods, FDA may issue Warning Letters to the responsible growers and invoke other sanctions such as seizure to remove the food from commerce, or injunction to correct the cause of the violation. Shipments of import food commodities shipments may be refused entry into U.S. commerce. Firms may be placed under an import alert

(http://www.accessdata.fda.gov/cms_ia/ialist.html) and "Detention Without Physical Examination," or DWPE, may be invoked for future shipments of that firm's commodity based on the finding of a single violative shipment. Congress has authorized FDA to refuse admission of regulated articles based on information that causes an article to appear to violate the FFDCA. Typically, the information is obtained by physical examination of the entry, although physical examination is not required. For example, entries of imported foods with a violative history would likely create an appearance of adulteration under the FFDCA for future shipments, based on the results obtained from previous examinations of the same foods that were found to contain "unsafe" pesticide residues. DWPE can be applied to a product or products from specific growers, manufacturers, or shippers, and may extend to a geographic area or country if the problem is demonstrated to be sufficiently broad-based.

FDA's import alerts describe current DWPEs for pesticide chemical residues and other food issues. There are currently four import alerts that address food products that are under DWPE for pesticides:

- Import Alert 99-05, "Detention Without Physical Examination Of Raw Agricultural Products for Pesticides"
- Import Alert 99-08, "Detention Without Physical Examination of Processed ***Human and Animal*** Foods for Pesticides"
- Import Alert 99-14, "Countrywide Detention Without Physical Examination Of Raw Agricultural Products for Pesticides"
- Import Alert 99-15, "Countrywide Detention Without Physical Examination Of Processed Foods for Pesticides"

Growers, manufacturers, and shippers that have products under import alert must provide evidence of compliance for each lot of product exported to the United States. This procedure places the burden of demonstrating product compliance with U.S. tolerances for pesticide chemical residues on the importer before the entry can be released into domestic commerce. Firms can have their product(s) removed from DWPE under an FDA import alert by providing evidence establishing that the conditions that gave rise to the appearance of a violation have been resolved and that there is sufficient evidence for the Agency to have confidence that future entries will be in compliance with the FFDCA. Additionally, a minimum of five consecutive non-violative commercial shipments, as demonstrated by providing FDA with acceptable reports of private laboratory analyses, is expected in order to remove a grower's, manufacturer's, or shipper's product from an import alert. Removal of a countrywide or geographic area import alert would typically require submission to FDA of an effective, detailed approach to correcting the problem, along with acceptable laboratory reports demonstrating compliance of the commodity in question.

Regulatory Monitoring Program Sampling Design

The goal of FDA's pesticide residue monitoring program is to carry out selective monitoring to achieve an adequate level of consumer protection. FDA samples are primarily of the surveillance type; meaning there is no specific prior knowledge or evidence that a particular food shipment contains illegal residues. However, FDA's monitoring is not random or statistically designed; rather, emphasis is given to the sampling of commodities based upon multiple factors, including:

- most frequently consumed or imported
- commodities and places of origin with a history of violations
- size of shipments
- analysis of past problem areas
- commodity/pesticide findings from state, USDA, and FDA monitoring
- foreign pesticide usage data and regional intelligence on pesticide use
- dietary significance of the food
- volume and product value of individual commodities of domestic food produced and entered into interstate commerce and of import food offered for entry into the United States
- origin of imported food, and
- chemical characteristics and toxicity of the pesticide(s) used

One important consideration when designing the FDA pesticide residue monitoring program for human foods is the distinction between domestic and import commodities. Historically, the violation rate of import samples is 3-5 times higher than the rate for domestic samples. For example, in FY 2012-2015 the violation rate for domestic samples ranged from 1.4-2.8 %, whereas the rate for import samples ranged from 9.4-12.6 %. Because the violation rate of import samples is higher than for domestic samples, FDA allocates more of its resources towards testing import compared with domestic commodities. Typically, import commodities comprise more than 60 % of all samples analyzed each year.

In addition to increased sampling of import commodities, FDA targets specific commodities and countries that might warrant special attention based upon historically high violation rates and trends. FDA also utilizes available foreign pesticide usage data and data from the USDA's Pesticide Data Program (PDP), a statistically representative survey of pesticide residues in selected food commodities, to develop sampling guidance (https://www.ams.usda.gov/datasets/pdp).

Other federal agencies and several states have their own monitoring programs for pesticides. Through collaboration and agreements, they provide FDA information and data on violative samples found in domestic commerce (see Cooperative Arrangements and International Activities section). FDA leverages that data to focus its resources where they are most efficiently and effectively used.

Sampling levels and bias for particular import or domestic commodities can vary significantly from year to year. Pesticide applications are modified in response to changing weather patterns, new or re-emergent pests, or developed resistance to pesticides. Targeted commodities may not be the largest imports by volume from a particular country. A high violation rate for a targeted commodity does not mean that a country's overall violation rate for all commodities is high; rather, it affirms FDA's sampling design to select commodities and production sources that are likely to be higher risk.

Considering the above and available Agency resources, FDA has not attempted to develop a monitoring program that would be statistically based. The current pesticide sampling program, coupled with broad-based enforcement strategies for imports, allows FDA to achieve the program's main objective of consumer protection.

Focused Sampling

In addition to samples collected for routine regulatory monitoring, FDA may conduct special "focused sampling" assignments to target specific food commodities for analysis. Focused sampling is generally used to follow up on suspected problem areas or to acquire residue data on selected commodities, and/or pesticides, not usually or previously covered during regulatory monitoring. Typically, samples collected for a focused sampling assignment are analyzed using routine pesticide procedures; but in some cases, targeted residues of interest are analyzed.

In the early 1990s, FDA conducted statistically-based, comprehensive incidence and level monitoring studies of four major foods and published the results.[3,4] However, due to resource constraints, incidence and level monitoring was replaced by regulatory-based "focused sampling." Incidence and level monitoring data are provided by FDA's TDS program and the USDA PDP.

Animal Food

In addition to monitoring food for human consumption, FDA samples and analyzes domestic and imported animal foods for pesticide chemical residues. FDA's Center for Veterinary Medicine (CVM) directs this portion of the Agency's surveillance program via its Animal Food Contaminants Program. CVM's program focuses on animal food that is consumed by livestock and poultry animals that ultimately become or produce food for human consumption, although some pet food samples are also included.

Analytical Methods and Pesticide Coverage

To analyze large numbers of samples with unknown pesticide treatment history, FDA uses both multi-residue methods (MRMs) capable of simultaneously determining many different pesticide chemical residues and SRMs that target specific pesticide(s). The complete list of pesticides analyzed in FY 2016 is provided in Appendix A.

The FDA MRMs can detect the majority of the approximately 400 pesticides with EPA tolerances in Title 40 of the U.S. Code of Federal Regulations (CFR) part 180, and many others that have no EPA tolerances. These MRMs are also able to detect many metabolites, impurities, and alteration products of pesticides, as well as selected industrial chemicals. FDA pesticide SRMs are optimized to determine one or several specific pesticide chemical residues in foods. They are more resource intensive and therefore employed more judiciously. SRMs are sometimes needed to analyze pesticides that are not adequately extracted or detected using standard MRMs or to target specific pesticide/commodity combinations.

The lower limit of residue measurement in FDA's determination of a specific pesticide is well below typical tolerance levels, which range from 0.1 to 50 parts per million (ppm). Most pesticides analyzed are easily quantified at FDA's default limit of quantitation (LOQ) of 0.01 ppm[5]. Residue levels detected above the limit of detection (LOD) but below the LOQ are designated as "trace" values.

FDA conducts ongoing research to update its pesticide residue monitoring program. This research includes testing the behavior of new or previously untested pesticides through existing analytical methods, as well as developing new methods to improve efficiencies

and detection capabilities. Newer extraction procedures and more sensitive detection techniques have increasingly replaced older methods, allowing for a greater breadth of pesticide coverage.

FDA Total Diet Study

An important complement to FDA's regulatory pesticide residue monitoring program is the FDA TDS program. The TDS is distinct from FDA's regulatory pesticide residue monitoring program. The TDS monitors levels of pesticide chemicals in foods representing the totality of the American diet. Data from the TDS are used to calculate exposures to pesticides from the U.S. diet.

Regulatory monitoring determines pesticide chemical residues primarily in raw commodities, but the TDS monitors foods prepared table-ready for consumption. Therefore, depending on the TDS food, the sample may be washed, peeled, and/or cooked before analysis, simulating typical consumer handling. In addition to being analyzed for pesticide chemical residues, TDS foods also are selectively analyzed for toxic and nutrient elements, industrial chemicals, and other chemical contaminants.

Another distinction from FDA's pesticide residue monitoring program is that TDS foods are analyzed at levels 10-100 times lower than the regulatory monitoring program. TDS residue levels as low as 0.1 parts per billion (ppb) are reported routinely.

TDS foods are collected for sampling as "market baskets," with each market basket comprising samples of about 266 different foods that represent the average U.S. consumer's diet, bought from the same retail venues from which consumers buy them. Each year, the market baskets are collected from four different regions of the country, from three different cities in each of those regions. For each region, samples from the three cities are combined to form a single composite prior to analysis.

Analytical results and additional information about the history and design of the TDS can be found on FDA's TDS website.[6] The Agency is in the process of updating the website with additional TDS data.

Cooperative Agreements and International Activities

FDA collaborates with local, state, federal, and international authorities, leveraging their programs and capacities to maximize the effectiveness of its pesticide program. For example, the FDA and USDA have a Memorandum of Understanding (MOU) in which USDA alerts FDA monthly of presumptive tolerance violations they find in the PDP. FDA uses this information when designing the annual pesticide residue monitoring program, and for directing immediate sample collection efforts, as appropriate.

FDA-State Cooperation

FDA field offices interact with their counterparts in many states to enhance the effectiveness of the Agency's pesticide residue monitoring program. Partnership agreements and MOUs have been established between FDA and many state agencies. These agreements provide for more efficient residue monitoring by both parties by coordinating efforts, broadening coverage, and eliminating duplication of effort. These agreements are specific to each state and take into account available resources. The

agreements stipulate how FDA and the state will jointly plan work for collecting and analyzing samples, sharing data, and enforcing compliance follow-up responsibilities for individual commodities of import and domestic products.

International Activities

FDA is subject to the obligations placed on countries by the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement). Pesticide residue tolerances and monitoring activities are included as sanitary measures under the SPS Agreement. FDA's obligations under this agreement include the requirement that standards are based on an assessment, as appropriate to the circumstances, of the risk to human and animal life or health, and on international standards except when a more stringent standard can be scientifically supported. The standards must also be applied equally to domestic and import products unless there is scientifically based justification for doing otherwise.

Similarly, FDA is subject to obligations arising from several bilateral and multilateral free trade agreements with U.S. trading partners that contain provisions on sanitary measures consistent with the provisions of the SPS Agreement. The sanitary provisions of these agreements can also include provisions relating to pesticide residues.

FDA pesticide residue monitoring activities, for domestic and imported products, are a part of the Agency's overall food safety programs and are in keeping with these international obligations. Additionally, arrangements FDA makes with other countries with respect to food safety programs, and the activities that FDA carries out internationally with respect to food safety, can also affect how our monitoring is conducted.

FDA maintains a number of cooperative arrangements with counterpart agencies in foreign governments including MOUs and Confidentiality Commitments. These arrangements most often contain information-sharing provisions that include the ability to share analytical findings about pesticide residues. Several of the MOUs have specific provisions relating to pesticide residue information sharing or cooperative efforts relating to pesticide residues.

FDA participates regularly in meetings with food safety regulatory agencies of foreign governments, in a variety of settings including bilateral and multilateral fora, and in formal and informal technical and policy meetings. FDA carries out bilateral discussions on food safety with our regulatory partners from around the world; pesticide control programs and pesticide residue issues can be subjects for discussion at these meetings. Multilateral fora in which FDA participates include the Food Safety Cooperation Forum (FSCF) of the Asia Pacific Economic Cooperation (APEC), which promotes regulatory cooperation in food safety including pesticide MRLs.

FDA also participates in the work of international standards-setting organizations, including that of the Codex Alimentarius Commission (Codex). Within Codex, FDA is an active participant in the work of the Codex Committee on Pesticide Residues. In addition, FDA supports the Joint Institute for Food Safety and Applied Nutrition (JIFSAN), which implements several training programs on pesticide risk assessment and the use of pesticide residue analytical methods.

Results and Discussion

This report discusses results of the FY 2016 FDA pesticide residue monitoring program in accordance with the threefold design of the program, i.e., the regulatory pesticide monitoring program, focused sampling surveys, and the TDS program. Additionally, the report examines data to evaluate import products that may warrant special attention.

In FY 2016, FDA analyzed 7,413 samples under the regulatory monitoring program, of which 6,946 were human foods and 467 were animal foods. Results for the testing of human and animal foods are reviewed under separate headings, "Regulatory Monitoring of Human Foods" and "Regulatory Monitoring of Animal Foods." Sampling and analytical data were obtained from the FDA Field Accomplishment and Compliance Tracking System (FACTS) database.

Regulatory Monitoring of Human Foods

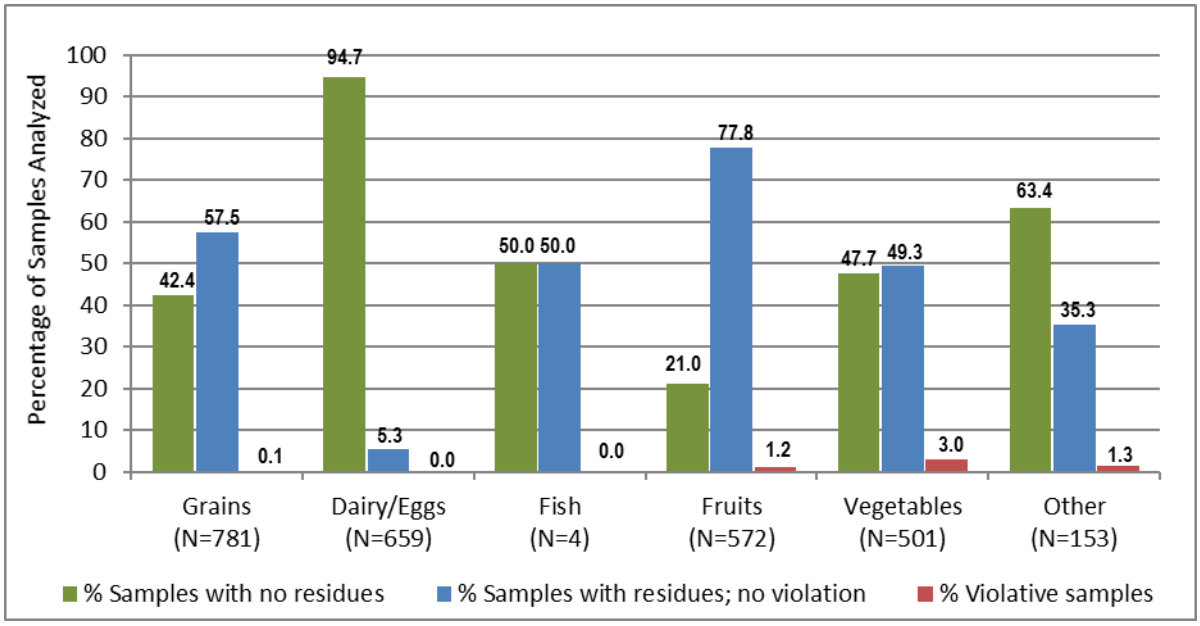
The 6,946 human foods analyzed in FY 2016 include results from two focused sampling assignments: 527 samples were analyzed for "Domestically Produced Animal-Derived Foods" assignment and 1,134 samples were analyzed for the "Collection of Selected Domestic and Imported Foods for Herbicides Analysis" (Herbicides) assignment. Results of each assignment are discussed separately in the section "Focused Sampling"; however, the findings are included in the sample summaries and statistics for human foods.

Of the human foods analyzed for pesticides in FY 2016, 2,670 were domestic samples and 4,276 were import samples. Results for the domestic samples are tabulated in Appendix B, "Analysis of Domestic Samples by Commodity Group in FY 2016," and results for the import samples are tabulated in Appendix C, "Analysis of Import Samples by Commodity Group in FY 2016." Each appendix includes information on the total number of samples analyzed, the number and percentage of samples with no residues detected, and the number and percentage of violative samples including the nature of the violation (over-tolerance vs. no-tolerance). Results are summarized for all samples analyzed, by commodity groups and by subgroups.

Results

Of the 2,670 domestic samples analyzed in FY 2016, 99.1 % were in compliance and 52.9 % had no detectable residues (Appendix B). Samples collected under the domestic commodity groups "Grains and Grain Products" and "Milk/Dairy Products/Eggs" accounted for the majority (53.9 %) of domestic samples.

Figure 1 - Results of Domestic Samples by Commodity Group

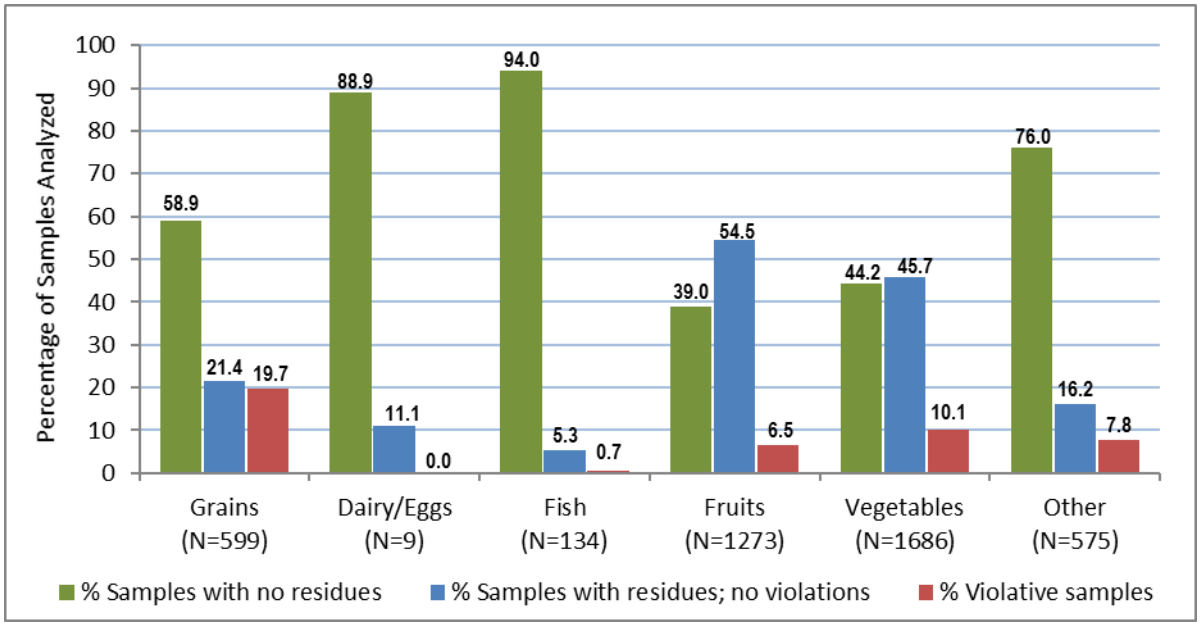


N = Number of samples analyzed for commodity group

Figure 1 summarizes the number of samples analyzed and the residue findings in domestic samples by commodity groups. For the grains and grain commodity group, no residues were detected in 42.4 % of the 781 samples analyzed and only 1 sample (0.1 %) was found to contain violative residues. In the milk/dairy products/eggs commodity group, 94.7 % of the 659 samples analyzed contained no pesticide residues and none were violative. In the fish/shellfish/other aquatic products commodity group, no pesticide residues were found in 50.0 % of the four samples analyzed and none were violative. In the fruits commodity group, 572 samples were analyzed; 21.0 % contained no residues and 7 samples (1.2 %) contained violative residues. For the vegetables commodity group, no residues were found in 47.7 % of the 501 samples analyzed and 15 (3.0 %) contained violative residues. In the commodity group of other food products, no residues were found in 63.4 % of the 153 samples analyzed and only (1.3 %) samples contained violative residues.

Of the 4,276 import samples analyzed in FY 2016, 90.2 % were in compliance and 50.7 % had no detectable residues (Appendix C). Fruits and vegetables accounted for the majority (69.2 %) of import samples.

Figure 2 - Results of Import Samples by Commodity Group



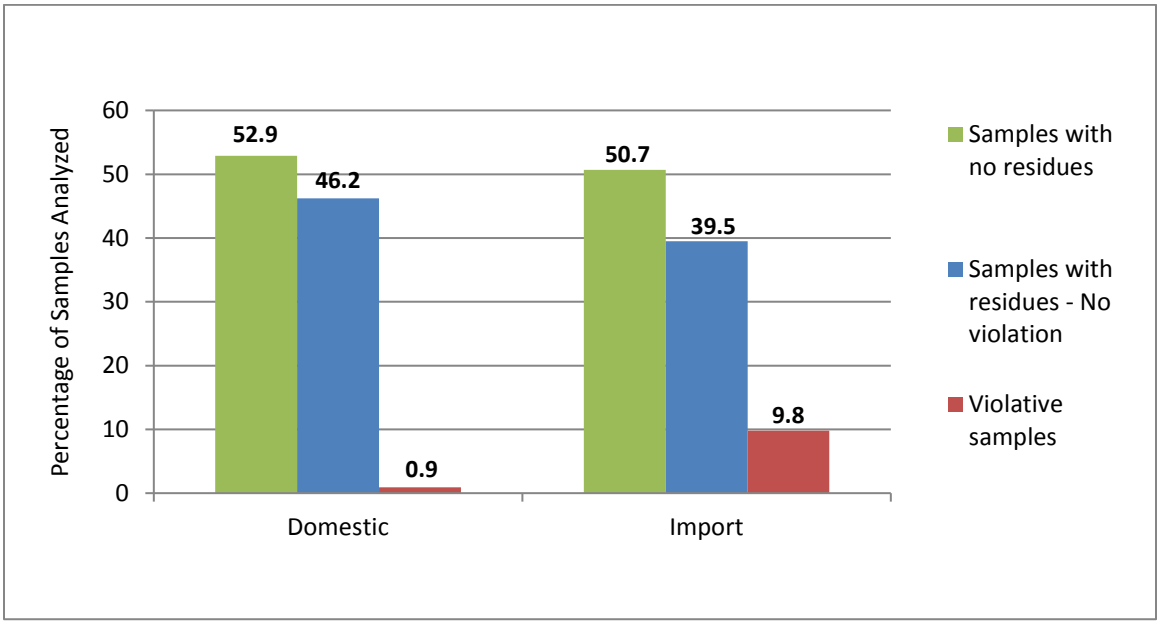
N = Number of samples analyzed for commodity group

Figure 2 summarizes the number of samples analyzed and the residue findings in import samples by commodity groups. In the import grains and grain products commodity group, 58.9 % of the 599 samples analyzed had no detectable residues, and 118 (19.7 %) contained violative residues. Import rice comprises most of the violations in this commodity group; 107 of the 118 violations were rice and rice products. For the import milk/dairy products/eggs commodity group, no residues were found in 88.9 % of the 9 samples and none had violative residues. For the fish/shellfish/other aquatic products commodity group, no residues were found in 94.0 % of the 134 samples analyzed, and one sample (0.7 %) was found to contain violative residues. For the import fruit commodity group, no residues were detected in 39.0 % of 1,273 samples analyzed and 83 (6.5 %) had violative residues. Of the 1,686 import vegetable commodity group samples analyzed, 44.2 % had no residues detected and 171 (10.1 %) had violative residues. In the commodity group of other food products, consisting largely of nuts, seeds, oils, honey, candy, beverages, spices, multi-ingredient products, and dietary supplements, 76.0 % of the 575 samples analyzed had no residues detected, while 45 (7.8 %) of the samples had violative residues.

Overall Results for Domestic and Import Samples

In total, 2,670 domestically produced and 4,276 import human food samples were collected and analyzed for the pesticides listed in Appendix A. No residues were found in 52.9 % of domestic samples and 50.7 % of import samples (Figure 3). Violative residues were found in 0.9 % of the domestic samples and 9.8 % of the import samples. The violation rates for FY 2016 are consistent with those from FY 2012-2015, i.e., 1.4-2.8 % for domestic samples and 9.4-12.6 % for import samples.

Figure 3. Summary of Results of Domestic vs. Import Food Samples



For several commodity groups, the violation rate was higher for import samples. For example, 19.7 % of import grain samples were violative; however, only one (0.1 %) of the domestic grain samples was violative. Similarly, 6.5 % of the import fruit samples were violative compared with 1.2 % of the domestic fruit samples; and 10.1 % of import vegetables were violative, whereas 3.0 % of domestic vegetable samples were violative. In the commodity group of other food products, the violation rate was 7.8 % for import samples compared with 1.3 % for domestic samples.

Of the 25 domestic violative samples, 21 contained pesticide chemical residues that have no EPA tolerance, i.e., “no-tolerance” violations and 4 contained pesticide chemical residues that exceeded an EPA tolerance, i.e., “over-tolerance” violations.

Of the 418 import violative samples, 389 had no-tolerance violations and 64 had over-tolerance violations; 35 samples had both no-tolerance and over-tolerance violations.

Geographic Coverage

Domestic: A total of 2,670 domestic samples were collected from 46 states and Puerto Rico. Table 1 lists the number of domestic samples from each state and territory, in descending order.

Table 1. Domestic Samples Collected and Analyzed per State/Territory

State/Territory	Samples (N)	State/Territory	Samples (N)
California	270	Indiana	21
Minnesota	198	Virginia	20
Washington	175	North Carolina	18
Texas	174	Nebraska	17
Illinois	173	Louisiana	17
Kansas	163	South Dakota	16
New York	163	Alabama	16
Missouri	159	Vermont	16
Florida	122	Idaho	15
Wisconsin	108	Connecticut	13
Ohio	83	Maine	13
Tennessee	75	Mississippi	13
Oregon	74	South Carolina	13
Michigan	66	Utah	12
Colorado	66	Arizona	11
Pennsylvania	58	Arkansas	7
Georgia	56	New Mexico	6
Massachusetts	46	Delaware	5
Iowa	40	New Hampshire	4
New Jersey	40	Wyoming	3
Kentucky	31	Rhode Island	3
Puerto Rico	23	Montana	3
North Dakota	22	Alaska	1
Maryland	22		

No domestic samples were collected from the states of Hawaii, Nevada, Oklahoma, and West Virginia, or the District of Columbia.

Imports: A total of 4,276 import samples were collected representing food shipments from 98 countries/economies. Table 2 lists the number of samples and names of countries/economies from which ten or more samples were collected. Table 2a lists the countries/economies of origin that had fewer than ten samples collected.

Table 2. Import Samples Collected and Analyzed per Country of Origin for Countries with Ten or More Samples Collected

Country/Economy	Samples (N)	Country/Economy	Samples (N)
Mexico	1447	Serbia	23
China	471	Belgium	22
Chile	311	Philippines	20
India	276	Indonesia	17
Canada	166	Poland	17
Vietnam	150	France	16
Pakistan	139	United Arab Emirates	16
Guatemala	133	Australia	15
Peru	92	Bolivia	14
Italy	87	Brazil	14
Thailand	81	Costa Rica	14
Turkey	77	Russia	14
Korea, South	56	Afghanistan	13
Dominican Republic	48	Lebanon	13
Spain	41	Morocco	13
Argentina	40	Taiwan	13
Ecuador	35	Honduras	11
Germany	27	Portugal	11
United States*	27	Romania	11
Greece	26	Bangladesh	10
Egypt	25	Saudi Arabia	10
Netherlands	24		

*Import goods purchased while in U.S. commerce

Table 2a. Countries from Which Fewer Than Ten Samples Were Collected and Analyzed

Countries/Economies		
Albania	Hungary	Norway
Algeria	Iran	Paraguay
Armenia	Iraq	Puerto Rico
Austria	Ireland	Rwanda
Belize	Israel	Singapore
Bosnia-Hercegovina	Ivory Coast	South Africa
Bulgaria	Jamaica	Sri Lanka
Burma	Japan	Sweden
Cambodia	Jordan	Syrian Arab Republic
Cameroon	Kenya	Tonga
Colombia	Lithuania	Trinidad & Tobago
Czech Republic	Macedonia	Tunisia
El Salvador	Madagascar	Uganda
Ethiopia	Malaysia	Ukraine
Georgia	Mozambique	United Kingdom
Ghana	Myanmar	Uzbekistan
Grenada	Nicaragua	Venezuela
Haiti	Nigeria	Zambia
Hong Kong		

Pesticides Found

In FY 2016, FDA pesticide methods could detect the 711 pesticides and industrial chemicals listed in Appendix A. Of these chemicals, residues of 215 different pesticides were actually found in the samples analyzed. They are listed from left to right in Table 3 in order of frequency of detection along with the number of samples in which they were found. Seventeen pesticide chemical residues that had not been previously detected in the FDA regulatory pesticide monitoring program are flagged with an asterisk. Eight of the pesticides listed were found using the new glyphosate and acid herbicides SRMs; they are flagged with †.

Table 3. Pesticides Found in Human Foods in FY 2016 Listed in Order of Frequency Found

Pesticide (No. samples detected)		
Imidacloprid (480)	Boscalid (467)	Acetamiprid (353)
Glyphosate (351)*†	Fludioxonil (334)	Thiophanate-methyl (321)
Pyraclostrobin (290)	Tebuconazole (287)	Azoxystrobin (263)
Chlorantraniliprole (253)	Chlorpyrifos (252)	Thiamethoxam (246)
Pyrimethanil (234)	Cyprodinil (232)	Myclobutanil (204)
Clothianidin (181)	Bifenthrin (176)	Iprodione (156)
Propamocarb (152)	Fenhexamid (150)	Metalaxyl (147)
Cypermethrin (144)	Propiconazole (140)	Difenoconazole (131)
Methoxyfenozide (130)	Thiabendazole (128)	Malathion (123)
Lambda-cyhalothrin (121)	Tricyclazole (120)	Buprofezin (118)
Permethrin (118)	Piperonyl butoxide (114)	Thiacloprid (102)
Flonicamid (100)	Captan (98)	Spinosad (94)
Chlorothalonil (85)	Fenpropathrin (83)	Dimethoate (81)
Bifenazate (74)	Spirodiclofen (72)	Spinetoram (69)
Dinotefuran (66)	Flubendiamide (64)	Isoprothiolane (61)
Methamidophos (61)	Trifloxystrobin (61)	Acephate (60)
Chlorfenapyr (59)	Methomyl (57)	Phosmet (56)
Dimethomorph (54)	Spiromesifen (54)	Carbaryl (52)
Diphenylamine (52)	Indoxacarb (49)	Fenbuconazole (46)
Clopyralid (45)* †	Pyriproxyfen (43)	Fluopyram (42)
Fluxapyroxad (42)	Mandipropamid (42)	Novaluron (39)
Ethoxyquin (38)	Fenpyroximate, e- (37)	Cyfluthrin (35)
Cyromazine (35)	Fluopicolide (34)	Quinoxyfen (33)
Hexythiazox (32)	Endosulfan (31)	2,4-D (30)
Diflubenzuron (30)	Spirotetramat (30)	Fenvalerate (28)
Diazinon (27)	Pirimiphos methyl (25)	Famoxadone (24)
Pymetrozine (24)	Quinclorac (24)* †	BAM (23)
Chlorpropham (23)	Imazalil (23)	Fenamidone (22)
Profenofos (22)	Fenbutatin oxide (21)	Fipronil (21)
Phenylphenol, *o*- (21)	Ametoctradin (20)	Carbofuran (20)
Triazophos (20)	Flupyradifurone (19)*	Triflumizole (19)
DDT (18)	Propargite (18)	Monocrotophos (17)

Pesticide (No. samples detected)		
Procymidone (16)	Cyflumetofen (15)	DCPA (15)
Flutriafol (15)	Hexaconazole (15)	Cyazofamid (14)
Deltamethrin (14)	Oxamyl (14)	Penthiopyrad (14)
Triadimenol (14)	Chlorpyrifos methyl (13)	Fenuron (13)
Sulfoxaflor (13)*	Etoxazole (12)	Linuron (12)
Pyridaben (12)	Dicamba (11)	Dieldrin (11)
Dicloran (10)	Forchlorfenuron (10)	Acibenzolar-S-methyl (9)
Fluoxastrobin (9)	Prochloraz (9)	Quintozene (9)
Diafenthiuron (8)	Glufosinate (8)* †	Metrafenone (8)
Dichlorvos (7)	Esfenvalerate (7)	Flusilazole (7)
Dodine (6)	Ethion (6)	Fenitrothion (6)
Methoprene (6)	Pendimethalin (6)	Trifluralin (6)
Fenobucarb (5)	Metaflumizone (5)	MGK 264 (5)
Phorate (5)	Triadimefon (5)	4-CPA (4)* †
Abamectin (4)	Clofentezine (4)	Cyantraniliprole (4)*
Dicofol (4)	Isofetamid (4)*	Isoprocarb (4)
Phoxim (4)	Azinphos-methyl (3)	Carbosulfan (3)
Cymoxanil (3)	Diuron (3)	Epoxiconazole (3)
Etofenprox (3)	Fluquinconazole (3)	Folpet (3)
Kresoxim-methyl (3)	Lufenuron (3)	Methidathion (3)
Penconazole (3)	Amitraz (2)	Atrazine (2)
Chlorfluazuron (2)	Coumaphos (2)	DEF (2)
Diniconazole (2)	Ethoprop (2)	Flutolanil (2)
Formetanate HCl (2)	Iprovalicarb (2)	Isocarbophos (2)
Metconazole (2)	Methiocarb (2)	Metolachlor (2)
Oxadixyl (2)	Oxyfluorfen (2)	Paclobutrazol (2)
Picloram (2)* †	Pirimicarb (2)	Prometryn (2)
Quinalphos (2)	Rotenone (2)	Simazine (2)
Tebufenpyrad (2)	Tetraconazole (2)	Aldicarb (1)
Benalaxyl (1)	Cadusafos (1)	Chlordane (1)
Chlorpyrifos-d10 (1)	Cyproconazole (1)	Dichlobenil (1)
Diethofencarb (1)	Ethiolate (1)	Ethiprole (1)
Fenarimol (1)	Fenazaquin (1)	Fluvalinate (1)
Fomesafen (1)*	Fuberidazole (1)	Heptachlor (1)

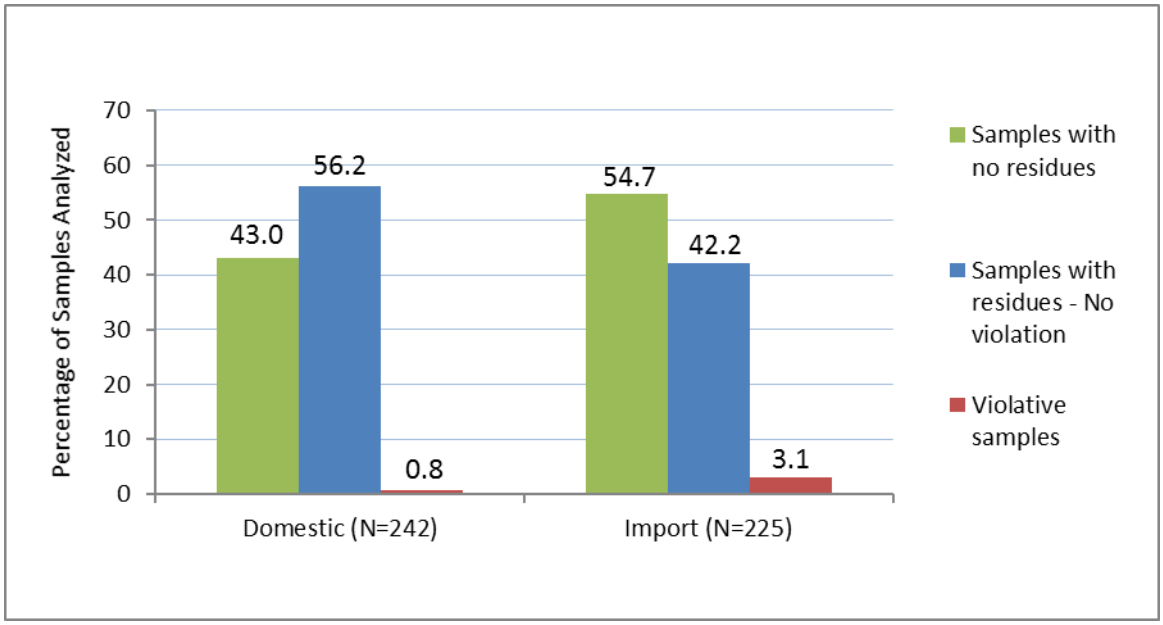
Pesticide (No. samples detected)		
IBP (1)	Imazamox (1)* †	Ivermectin (1)
Metribuzin (1)	Mevinphos (1)	Parathion methyl (1)
Pentachlorophenol (1)* †	Phosalone (1)	Picoxystrobin (1)
Resmethrin (1)	Tebufenozide (1)	Teflubenzuron (1)
Temephos (1)	Tetrasul (1)*	Thiodicarb (1)*
Tolfenpyrad (1)*	Triclopyr (1)* †	

*Pesticide not found previously in FDA regulatory monitoring program.
†Pesticide detected with new glyphosate or acid herbicides SRMs.

Regulatory Monitoring of Animal Foods

In FY 2016, FDA analyzed 467 animal food samples for pesticides. Figure 4 summarizes the number of samples analyzed and residue findings in domestic and import samples.

Figure 4. Summary of Results of Domestic vs. Import Animal Food Samples



Of the 467 animal food samples, 242 samples were domestic and 225 samples were imports. No residues were found in 104 (43.0 %) of the 242 domestic samples, and 0.8 % (2 samples) were violative. Of the 225 import samples, 123 (54.7 %) contained no residues and 3.1 % (7 samples) were violative.

The violation rates of 0.8 % for domestic animal foods and 3.1 % for import animal foods are consistent with those from FYs 2012-2015; i.e., 0.9 - 2.3 % for domestic samples and 1.9 - 4.8 % for import samples. As with human foods, the violation rates of import animal foods are higher than those of domestic animal foods.

Table 4 summarizes residue findings for eight different animal food categories.

Table 4. Summary of Animal Foods Analyzed for Pesticides

Commodity Type	Samples Analyzed N	Without Residues N (%†)	Violative Samples* N (%†)
Totals – All Samples	**467**	**227 (48.6)**	**9 (1.9)**
Whole and Ground Grains/Seeds	177	126 (71.2)	2 (1.1)
Mixed Livestock Food Rations	89	8 (9.0)	0 (0)
Medicated Livestock Food Rations	17	1 (5.9)	0 (0)
Plant Byproducts	84	48 (57.1)	2 (2.4)
Hay and Silage	15	10 (66.7)	0 (0)
Animal Byproducts	7	5 (71.4)	1 (14.3)
Pet Food/Treats	53	11 (20.8)	1 (1.9)
Other Animal Food Ingredients	25	18 (72.0)	3 (12.0)

* Includes two violative domestic samples (milo and rice bran) and 7 import samples (yeast, flax meal, soybeans, fish meal, and three botanical supplements)

†Percentage of the number of samples analyzed per commodity type

Commodities used to feed livestock consumed by humans comprised a minimum of 81.8 % of the samples analyzed, i.e., Whole and Ground Grains/Seeds, Mixed Livestock Food Rations, Medicated Livestock Food Rations, Plant Byproducts, and Hay and Silage. Of the 367 samples analyzed from these five animal food categories, four violations (1.1 %) were found. For categories in which more than 20 samples were analyzed, only Other Animal Food Ingredients had a violation rate over 10 %; i.e., 3 of 25 samples analyzed (12.0 %) were violative. All three violative samples were import botanical herbal supplements for use on horses.

All animal foods were analyzed for 679 different chemicals using the FDA pesticide MRM (Appendix A). Selective residue methods were not used for animal foods. In FY 2016, residues of 74 different pesticides were found in the 467 animal food samples analyzed. They are listed in Table 5 in descending order of frequency of detection along with the number of samples in which they were found.

For all samples, ethoxyquin, malathion and piperonyl butoxide were the most frequently found pesticide chemicals. Ethoxyquin, an approved food additive for specific uses as a preservative in animal foods[2], was found in 28.1 % (131 samples) of the commodities analyzed. The residue levels of all but one sample were well below the food additive approved use level of 150 ppm; one sample of imported fish meal was found violative, containing 240 ppm. Malathion was found in 17.8 % (83 samples) of the samples; none

[2] Code of Federal Regulations, Title 21 Part 573.380

were violative. Piperonyl butoxide was found in 9.9 % (46 samples) of the samples analyzed. Piperonyl butoxide is exempted from tolerances when used as a synergist with pesticides on growing crops.

Table 5. Pesticides Found in Animal Foods in FY 2016

Pesticide (No. Samples Detected)		
Ethoxyquin (131)	Malathion (83)	Piperonyl butoxide (46)
Deltamethrin (23)	Chlorpyrifos methyl (19)	Methoprene (18)
Azoxystrobin (15)	Chlorpyrifos (13)	Thiabendazole (13)
Diflubenzuron (12)	Tebuconazole (12)	Boscalid (11)
Chlorantraniliprole (11)	Propiconazole (11)	Imidacloprid (10)
Lambda-cyhalothrin (10)	Acetamiprid (9)	Chlorpropham (9)
Difenoconazole (9)	Spinosad (8)	Captan (7)
Fenitrothion (7)	Fenbuconazole (6)	Pirimiphos methyl (6)
Pyraclostrobin (6)	Thiophanate-methyl (6)	DEF (5)
Diuron (5)	Trifloxystrobin (5)	Phenylphenol, o- (4)
Dinotefuran (3)	Diphenylamine (3)	Methomyl (3)
Myclobutanil (3)	Phosmet (3)	Trifluralin (3)
Bifenthrin (2)	Carbaryl (2)	Clothianidin (2)
Cyfluthrin (2)	Cyprodinil (2)	Flubendiamide (2)
Fluopyram (2)	Metalaxyl (2)	MGK 264 (2)
Novaluron (2)	Pyrimethanil (2)	Thiacloprid (2)
Thidiazuron (2)	Triazophos (2)	Azinphos-methyl (1)
Buprofezin (1)	Carboxin (1)	Chlorothalonil (1)
Dimethoate (1)	Emamectin benzoate (1)	Fenpropathrin (1)
Fenuron (1)	Fludioxonil (1)	Flusilazole (1)
Flutriafol (1)	Fluxapyroxad (1)	Mandipropamid (1)
Methoxychlor (1)	Metribuzin (1)	Nicotine (1)
Pendimethalin (1)	Pirimiphos ethyl (1)	Propargite (1)
Pyridaben (1)	Spirodiclofen (1)	Spiromesifen (1)
Tri-allate (1)	Triticonazole (1)	

Focused Sampling

In FY 2016, FDA conducted pesticide analyses for two field assignments. The first assignment conducted in FY 2016 was the "Domestically Produced Animal-Derived Foods"[3] (Animal-Derived Foods) assignment for which selected animal-derived foods were analyzed for pesticides and other chemical contaminants. The second assignment conducted in FY 2016 was the "Collection of Selected Domestic and Imported Foods for Herbicides Analysis" (Herbicides) assignment. This assignment introduced two new SRMs to the FDA regulatory pesticide program, i.e., the analysis of glyphosate and glufosinate (glyphosate SRM) and the analysis of selected acid herbicides (acid herbicides SRM).

Animal-Derived Foods Assignment

In 2016, FDA completed the collection and analysis of 527 samples for the Animal-Derived Foods assignment, consisting of 249 whole milk, 179 shell eggs, 70 honey, and 29 game meat samples. Results are listed in Table 6a.

Table 6a. Pesticides Found in Samples Analyzed for the Animal-Derived Foods Assignment

Commodity	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)
Total	**527**	**474 (89.9)**	**1 (0.2)**
Milk	249	244 (98.0)	0
Eggs	179	150 (83.8)	0
Honey	70	51 (72.9)	1 (1.4)
Bison	1	No residues found in 29 game meat samples	
Elk	12		
Rabbit	7		
Venison	9		

No pesticide chemical residues were found in any of the game meat samples analyzed. The pesticide chemical residues reported in milk (flubendiamide and boscalid) and eggs (cyromazine) were below established tolerances. Ethoxyquin residues in eggs were below the tolerance for residues resulting from use of ethoxyquin as an approved food additive in animal feed.

Residues of seven pesticide chemicals were found in honey. Of those, coumaphos has a tolerance in honey, and piperonyl butoxide is exempted from tolerances when used as a

[3] Previously referred to as the "EU Audit" assignment

synergist with pesticides on growing crops. The remaining five pesticides/degradants are widely used on a variety of fruits and vegetables and were likely detected in honey at trace levels due to inadvertent contamination introduced by bees as they collect nectar from flowers. Of the Animal-Derived Foods assignment samples, only one honey sample was found violative because it contained a degradant common to the pesticides fluopicolide and dichlobenil just above trace level.

Herbicides Assignment

In the first part of the assignment, a new glyphosate SRM was implemented to analyze glyphosate and glufosinate in four commodities: grain corn, soybeans, milk and eggs. Glyphosate and glufosinate are broad-spectrum herbicides used to control weeds, including for crops that have been genetically engineered for glyphosate and glufosinate resistance, e.g., corn and soybeans. Corn and soybeans were analyzed because glyphosate and glufosinate are widely used in the U.S. to treat these crops. Milk and eggs were analyzed because they are consumed by infants and small children; and, they are produced by cows and chickens that may consume corn and soybeans. Assignment results from analyses using the glyphosate SRM are listed in Table 6b.

Table 6b. Results for the Analysis of Selected Foods Using Glyphosate SRM

Commodity	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)	Glyphosate Residues Detected N (%)	Glufosinate Residues Detected N (%)
Totals	**760**	**408 (53.7)**	**0**	**351 (46.2)**	**7 (0.9)**
Corn	274	101 (36.9)	0	173 (63.1)	4 (1.4)
Soybeans	267	88 (33.0)	0	178 (67.0)	3 (1.1)
Milk	113	113 (100)	0	No residues found in milk and eggs	
Eggs	106	106 (100)	0		

A total of 760 different samples were collected and analyzed, consisting of 274 corn, 267 soybeans, 113 milk, and 106 egg samples. None of the 760 samples contained violative levels of glyphosate or glufosinate. Neither glyphosate nor glufosinate was found in 408 (53.7 %) of all samples analyzed; glyphosate was found in 351 (46.2 %) and glufosinate in 7 (0.9 %). No glyphosate or glufosinate residues were found in milk and egg samples, and no residues were found in 36.9 % of the corn samples and 33.0 % of the soybean samples. Glyphosate was found at levels below tolerance in 63.1 % of the corn and 67.0 % of the soybean samples. Glufosinate was found at levels below tolerance in four (1.4 %) of the corn samples and in three (1.1 %) of the soybean samples.

In the second part of the Herbicides assignment, a new acid herbicides SRM was implemented to analyze 30 acid herbicides in specific food commodities; see Appendix A for the complete list of acid herbicides included in the new method.

Six grain commodities (corn, soybean, barley, rice, wheat, and oats) were selected for the assignment because of the use of acid herbicides on grain crops. Eight different root

crops were also chosen for the assignment because acid herbicides are sometimes used to defoliate root crops prior to harvesting. Assignment results from analyses using the acid herbicides SRM are listed in Table 6c.

Table 6c. Results for the Analysis of Selected Foods Using the Acid Herbicides SRM

Commodity	Samples Analyzed N	Without Residues N (%)	Violative Samples N (%)
Totals	**891**	**784 (88.0)**	**2 (0.2)**
Corn	298	292 (98.0)	0
Soybeans	271	251 (92.6)	2 (0.7)
Barley	53	33 (62.3)	0
Rice	31	10 (32.3)	0
Wheat	33	15 (45.5)	0
Oats	17	8 (47.1)	0
Potato	23	20 (87.0)	0
Turnips	16	13 (81.2)	0
Sugar beet	10	6 (60.0)	0
Peanuts	10	7 (70.0)	0
Carrots	56	No residues found	
Radishes	37		
Beets	19		
Sweet potatoes	17		

No acid herbicide residues were found in 88.0 % of the 891 samples collected and analyzed for the assignment in FY 2016. Two of 271 soybean samples (0.7 %) contained violative residues; i.e., one soybean sample contained 2,4-D at a level exceeding the tolerance of 0.02 ppm, and another soybean sample contained 0.023 ppm triclopyr, for which no tolerance is listed for soybeans.

Among the six different grain products analyzed, corn and soybeans contained the lowest percentage of residues; 2.0 % of corn and 7.4 % of the soybean samples. In contrast, over 60 % of the rice samples contained acid herbicide residues; quinclorac constituted the majority of residues found in rice (21 of 22 residues). For the root crops, no residues were found in carrots, radishes, beets, or sweet potatoes. No residues were found in 87.0 % of potato, 81.2 % of turnip, 60.0 % of sugar beet, and 70.0 % of peanut samples.

Of the 30 different acid herbicides included within the scope of the acid herbicide method, nine (clopyralid, 2,4-D, quinclorac, dicamba, 4-CPA, picloram, imazamox, pentachlorophenol, and triclopyr) were found in the commodities tested. Clopyralid was

the most frequently reported acid herbicide, found in 45 samples in six commodities; corn, barley, wheat, oats, turnips and sugar beets. 2,4-D was found in 30 samples in seven commodities, including corn, soybeans, barley, wheat, oats, potatoes and peanuts. Quinclorac residues were found in 21 of 31 rice samples. 4-CPA was found in one barley and three peanut samples. (Although 4-CPA is approved exclusively for use on mung bean sprouts, it is also a product of the degradation of 2,4-D.) Picloram was found in two wheat samples, imazamox in one rice sample, and pentachlorophenol and triclopyr in one soybean sample each. Clopyralid, 2,4-D, quinclorac, dicamba, 4-CPA, and picloram residues were all below established tolerances. Imazamox is exempt from the need for a tolerance. No tolerances are listed for triclopyr and pentachlorophenol (PCP) in soybeans, both found at 0.023 ppm. PCP is not approved as a pesticide for use on foods directly, however there is an indirect food additive tolerance for use of PCP as a preservative on wooden articles used to hold raw agricultural commodities (21 CFR 178.3800).

In summary, in FY2016 FDA conducted special assignments introducing two new SRMs for glyphosate/glufosinate and for acid herbicides. None of the 760 samples analyzed for glyphosate or glufosinate had residues of these herbicides exceeding the tolerances. Two of 891 samples analyzed for 30 acid herbicides contained violative residues.

Total Diet Study

In FY 2016, FDA analyzed four market baskets in the TDS program consisting of 265-266 different food items per market basket: 1062 samples were analyzed altogether. Residues of 155 different pesticides were found in the TDS foods. Most were found at very low levels; the residue levels in 87 % of the samples were below 0.01 ppm, and about 2 % were above 0.1 ppm.

Table 7 lists the most frequently found pesticide residues (i.e., residues found in at least 2 % of the samples) in TDS foods, the total number of findings, and the occurrence as a percentage of all 1062 items analyzed in FY 2016. The most frequently observed pesticide chemical residues are consistent with those reported in FY 2014.

Table 7. Frequency of Occurrence of Pesticide Residues in the Total Diet Study

Pesticide[1]	**Samples N (%)[2]**	**Mean <Max>[3] (ppm)**
Boscalid	337 (31.7)	0.0005 <0.467>
Imidacloprid	309 (29.1)	0.0006 <0.183>
Piperonyl butoxide	204 (19.2)	0.0011 <0.077>
Azoxystrobin	200 (18.8)	0.0003 <0.046>
Bifenthrin	198 (18.6)	0.0005 <0.112>
DDT	179 (16.9)	0.0003 <0.006>
Acetamiprid	143 (13.5)	0.0005 <0.042>
Chlorantraniliprole	143 (13.5)	0.0005 <0.236>
Malathion	140 (13.2)	0.0022 <0.119>
Difenoconazole	138 (13.0)	0.0003 <0.013>
Clothianidin	129 (12.1)	0.0004 <0.027>

Pesticide[1]	Samples N (%)[2]	Mean <Max>[3] (ppm)
Pyraclostrobin	123 (11.6)	0.0003 <0.126>
Thiamethoxam	120 (11.3)	0.0005 <0.051>
Tebuconazole	112 (10.5)	0.0007 <0.074>
Thiabendazole	111 (10.5)	0.0015 <0.648>
Chlorpyrifos methyl	109 (10.3)	0.0006 <0.033>
Carbendazim	108 (10.2)	0.0008 <0.022>
Metalaxyl	101 (9.5)	0.0003 <0.027>
Fluxapyroxad	94 (8.9)	0.0004 <0.048>
Pyrimethanil	86 (8.1)	0.0022 <1.700>
Novaluron	85 (8.0)	0.0004 <0.039>
Fludioxonil	83 (7.8)	0.0010 <0.670>
Propamocarb	70 (6.6)	0.0012 <2.960>
Chlorpropham	68 (6.4)	0.0011 <4.060>
Captan	67 (6.3)	0.0065 <0.699>
Chlorpyrifos	63 (5.9)	0.0005 <0.024>
Myclobutanil	56 (5.3)	0.0008 <0.033>
Cyprodinil	55 (5.2)	0.0016 <1.580>
Penthiopyrad	53 (5.0)	0.0006 <0.256>
Deltamethrin	47 (4.4)	0.0048 <0.087>
Fluopyram	46 (4.3)	0.0003 <0.007>
Carbaryl	44 (4.1)	0.0004 <0.114>
Permethrin	44 (4.1)	0.0047 <1.384>
Bifenazate	44 (4.1)	0.0007 <0.033>
Fluopicolide	43 (4.0)	0.0006 <0.637>
Trifloxystrobin	43 (4.0)	0.0003 <0.031>
Lambda-cyhalothrin	41 (3.9)	0.0022 <0.229>
Buprofezin	41 (3.9)	0.0003 <0.030>
Clopyralid[4]	40 (3.8)	0.0112 <0.081>
Dichlobenil	38 (3.6)	0.0006 <0.011>
Propiconazole	36 (3.4)	0.0017 <0.023>
Methoxyfenozide	36 (3.4)	0.0030 <0.177>
Phenylphenol, *o*-	36 (3.4)	0.0015 <0.348>
Diflubenzuron	35 (3.3)	0.0004 <0.004>
Imazamox[4]	34 (3.2)	0.0003 <0.009>
Imazalil	33 (3.1)	0.0013 <0.253>
Quinoxyfen	31 (2.9)	0.0006 <0.023>
Linuron	31 (2.9)	0.0005 <0.026>

Pesticide[1]	Samples N (%)[2]	Mean <Max>[3] (ppm)
Hexythiazox	30 (2.8)	0.0003 <0.006>
Fenhexamid	29 (2.7)	0.0020 <0.790>
Dimethomorph	29 (2.7)	0.0004 <1.570>
Spinosad	29 (2.7)	0.0008 <0.012>
Flonicamid	28 (2.6)	0.0017 <0.155>
Omethoate	25 (2.4)	0.0004 <0.003>
Spinetoram	24 (2.3)	0.0007 <0.050>
Dinotefuran	24 (2.3)	0.0017 <0.032>
Diphenylamine	24 (2.3)	0.0020 <0.497>
Dimethoate	23 (2.2)	0.0007 <0.008>
Ethion	22 (2.1)	0.0004 <0.002>
Quinclorac[4]	22 (2.1)	0.0015 <0.020>
Indoxacarb	21 (2.0)	0.0007 <0.061>
Thiacloprid	21 (2.0)	0.0009 <0.028>

[1] Isomers, metabolites, and related compounds are included with the 'parent' pesticide.

[2] Based on analysis of 1,062 total items.

[3] Harmonic mean of all positive residue levels; maximum residue level.

[4] Reflects overall incidence; i.e., based on analysis of all samples, though only 64 selected foods per market basket (256 items total) were analyzed for acid herbicides. (Samples not analyzed are counted as negative for the residues of acid herbicides.)

Imported Products That May Warrant Special Attention

The design of the FDA pesticide program focuses on products that have a history of violations or are suspected of violations based on available intelligence. Historically, the violation rate for import foods is much higher than for domestic foods; results from FY 2016 continue that trend. The violation rate for import foods (9.8 %) was over ten times higher than the rate for domestic foods (0.9 %). The majority of the violations for import commodities are no-tolerance violations, and about 80 % of them are < 0.1 ppm. Examination of the FY 2016 pesticide data from the analysis of imported human foods indicates that the commodities listed in Table 8 may warrant targeted sampling in the future.

The following criteria were applied to the FY 2016 data to select import commodities that may warrant special attention:

- Commodities with at least 20 samples analyzed OR with a minimum of 3 violations, and
- A violation rate of 10 % or higher

Table 8 lists the import commodities analyzed in FY 2016 that meet the above criteria. The commodities are sorted alphabetically and include the total number of samples analyzed and violation rate per commodity.

Some of the commodity counts in Table 8 differ from those found in Appendix C because of differences in the way commodities are grouped. To simplify reporting in Appendix C, similar commodities have sometimes been consolidated; however, in Table 8, those same commodities might be extracted and reported separately. For example, Appendix C indicates FDA analyzed 370 import rice and rice products in FY 2016. Of those, 354 samples have been flagged as warranting special attention in Table 8. The other 16 rice product samples have been excluded from Table 8 because they are highly processed products, e.g. rice cakes and snacks.

Table 8. Import Commodities That May Warrant Special Attention

Commodity[†]	**Samples Analyzed**	**Violation Rate (%)**
Blackberries	55	10.9
Cabbage*	50	10.0
Cashews	21	19.1
Mushrooms and fungi*	104	18.3
Onions, leeks, scallions, shallots*	14	35.7
Papaya	17	29.4
Peas*	47	12.8
Pepper, hot*	319	14.4
Pepper, sweet	106	13.2
Prickle pear*	20	40.0
Quinoa*	38	13.2
Rice*	354	29.7
Spinach	81	22.2
String beans	82	13.4
Wheat gluten	30	16.7

[†] Data listed for the commodities in this table are based upon specific product definitions, and may not be directly comparable to product summary subcategories listed in Appendix B.
*Commodity was on the FY 2015 table of import commodities warranting special attention.

References

[1]Guidelines for the Validation of Chemical Methods for the FDA FVM Program, 2nd Edition, 2015
http://www.fda.gov/downloads/ScienceResearch/FieldScience/UCM273418.pdf

[2]Code of Federal Regulations, Title 40, Part 180, http://www.ecfr.gov/cgi-bin/text-idx?SID=186c36f172c2a5f98f740677f73ae152&node=40:24.0.1.1.27&rgn=div5.

[3]Roy, Ronald R., *et al*. (1995) U.S. Food and Drug Administration Pesticide Program: Incidence/Level Monitoring of Domestic and Imported Pears and Tomatoes. *J. AOAC Int.* **78**, 930-940.

[4]Roy, Ronald, R., *et al*. (1997) Monitoring of Domestic and Imported Apples and Rice by the U.S. Food and Drug Administration Pesticide Program, *J. AOAC Int*, **80**, 883-894.

[5]Pesticide Analytical Manual Volume I, 3rd Ed., 1999, Chapter 1, Section 105, http://www.fda.gov/downloads/Food/FoodScienceResearch/ucm111496.pdf

[6]FDA Total Diet Study,
http://www.fda.gov/Food/FoodScienceResearch/TotalDietStudy/default.htm.

Appendices

Appendix A lists the 711 pesticides and industrial chemicals analyzed using FDA methods in 2016, including 32 new pesticides analyzed by the new acid herbicides SRM and glyphosate SRM. In addition to these chemicals, FDA analytical procedures detect other metabolites and isomers associated with the pesticides listed below.

All residue findings are summarized in Appendices B (domestic) and C (import). In FY 2016, 108 different domestic food commodities and 581 different import food commodities were tested. In both appendices, all commodities have been assigned to the same six commodity groups:

Grains and Grain Products
Milk/Dairy Products/Eggs
Fish/Shellfish/Other Aquatic Products
Fruits
Vegetables
Other Food Products

Commodities are further categorized within each commodity group. For example, the subcategories for domestic commodities listed under the "Grains and Grain Products" commodity group in Appendix B include:

Barley and barley products
Corn and corn products
Oats and oat products
Rice and rice products
Soybeans and soybean products
Wheat and wheat products
Other grains and grain products

Except for the "Other grains and grain products" category, each subcategory in Appendix B includes commodities derived from a single agricultural commodity. For example, the subcategory "Wheat and wheat products" includes commodities composed exclusively, or almost exclusively, from wheat, such as whole wheat grain, milled wheat, wheat flour, enriched wheat flour, wheat germ, wheat malt, wheat bran, wheat gluten, etc. The subcategory "Other grains and grain products" includes grains and grain products of grains not listed, e.g. rye, sorghum, etc. It also includes multiple-ingredient, processed-food products derived primarily from grains, like bakery products, pasta, grain snacks, etc.

Although the commodity groups are the same for both the domestic and import appendices, with the exception of the "Milk/Dairy Products/Eggs" group, the subcategories are different in Appendix C because the numbers and kinds of individual commodities are different for domestic and import commodities. For example, the commodity group "Grains and grain products" in Appendix C lists subcategories "Bakery products, doughs, crackers," "Breakfast cereals," and "Macaroni and noodles" separately from "Other grains and grain products.". Similarly, over 39 "Fruit" subcategories are listed for the import samples in Appendix C, but only 16 "Fruit" subcategories are listed for the domestic samples in Appendix B. The additional import "Fruit" subcategories are mostly for fruits not available domestically.

A. Pesticides and Industrial Chemicals Analyzed by FDA Pesticide Methods in FY 2016

Pesticides		
2,3,4,6-tetrachlorophenol	2,4,5-T[1]	2,4-D[1]
2,4-DB[1]	2,6-dimethylaniline	2,6-DIPN
3,4-dichloroaniline[2]	4-CPA[1]	Abamectin
Acephate	Acequinocyl	Acetamiprid
Acetochlor	Acibenzolar-S-methyl	Acifluorfen[1]
Acifluorfen methyl ester	Aclonifen	Acrinathrin
Alachlor	Alanycarb	Aldicarb
Aldrin	Allethrin	Allidochlor
Ametoctradin	Ametryn	Amicarbazone
Amidithion	Aminocarb	Aminopyralid[1]
Amisulbrom	Amitraz	Ancymidol
Anilofos	Aramite	Aspon
Atraton	Atrazine	Azaconazole
Azamethiphos	Azinphos ethyl	Azinphos-methyl
Aziprotryne	Azocyclotin	Azoxystrobin
BAM[3]	Barban	Beflubutamid
Benalaxyl	Bendiocarb	Benfluralin
Benfuracarb	Benfuresate	Benodanil
Benoxacor	Bentazon	Bentazone methyl
Benthiavalicarb-isopropyl	Benzoximate	Benzoylprop ethyl
BHC	Bifenazate	Bifenox
Bifenthrin	Binapacryl	Biphenyl
Bitertanol	Bithionol	Bixafen
Boscalid	Bromacil	Bromfenvinphos ethyl
Bromfenvinphos methyl	Bromobutide	Bromocyclen
Bromophos	Bromophos-ethyl	Bromopropylate
Bromoxynil[1]	Bromoxynil octanoate	Bromuconazole
Bufencarb	Bupirimate	Buprofezin
Butachlor	Butafenacil	Butamifos
Butocarboxim	Butoxycarboxim	Butralin
Butylate	Cadusafos	Cafenstrole
Captafol	Captan	Carbaryl

Pesticides		
Carbetamide	Carbofuran	Carbophenothion
Carbosulfan	Carboxin	Carfentrazone ethyl ester
Carpropamid	Chloramben[1]	Chlorantraniliprole
Chlorbromuron	Chlorbufam	Chlordane
Chlordecone	Chlordimeform	Chlorethoxyfos
Chlorfenapyr	Chlorfenethol	Chlorfenprop-methyl
Chlorfenvinphos	Chlorfenvinphos methyl	Chlorfluazuron
Chlormephos	Chlorobenzilate	Chloroneb
Chloropropylate	Chlorothalonil	Chlorotoluron
Chloroxuron	Chlorpropham	Chlorpyrifos
Chlorpyrifos methyl	Chlorthiamid	Chlorthion
Chlorthiophos	Chlozolinate	Cinidon-ethyl
Clethodim	Clodinafop-propargyl	Cloethocarb
Clofentezine	Clomazone	Clopyralid[1]
Cloquintocet-mexyl	Clothianidin	Coumaphos
Crimidine	Crotoxyphos	Cumyluron
Cyanazine	Cyanofenphos	Cyanophos
Cyantraniliprole	Cyazofamid	Cyclafuramid
Cycloate	Cycloxydime	Cycluron
Cyenopyrafen	Cyflufenamid	Cyflumetofen
Cyfluthrin	Cyhalofop butyl ester	Cymiazole
Cymoxanil	Cypermethrin	Cyphenothrin
Cyprazine	Cyproconazole	Cyprodinil
Cyprofuram	Cyromazine	Cythioate
Daimuron	Dazomet	DCPA
DDT	DEET	DEF
Deltamethrin	Demeton	Desmedipham
Desmetryn	Diafenthiuron	Dialifor
Diallate	Diazinon	Dicamba[1]
Dicapthon	Dichlobenil	Dichlofenthion
Dichlofluanid	Dichlormid	Dichlorobenzene, 1,3-
Dichlorprop[1]	Dichlorvos	Diclobutrazol
Diclocymet	Diclofop[1]	Diclomezine
Dicloran	Dicofol	Dicrotophos
Dicyclanil	Dieldrin	Diethatyl-ethyl

Pesticides		
Diethofencarb	Difenoconazole	Difenoxuron
Diflubenzuron	Diflufenican	Diflufenzopyr[1]
Diflumetorim	Dimefluthrin	Dimefox
Dimepiperate	Dimethachlone	Dimethachlor
Dimethametryn	Dimethenamid	Dimethipin
Dimethirimol	Dimethoate	Dimethomorph
Dimetilan	Dimoxystrobin	Diniconazole
Dinitramine	Dinoseb	Dinotefuran
Dinoterb	Diofenolan	Diothyl
Dioxacarb	Dioxathion	Diphacinone
Diphenamid	Diphenylamine	Dipropetryn
Disulfoton	Ditalimfos	Dithianon
Dithiopyr	Diuron	DNOC
Dodemorph	Dodine	Doramectin
Drazoxolon	Edifenphos	Emamectin benzoate
Endosulfan	Endrin	EPN
Epoxiconazole	Eprinomectin	EPTC
Esfenvalerate	Esprocarb	Etaconazole
Ethalfluralin	Ethidimuron	Ethiofencarb
Ethiolate	Ethion	Ethiprole
Ethirimol	Ethofumesate	Ethoprop
Ethoxyquin	Ethychlozate	Etobenzanid
Etofenprox	Etoxazole	Etridiazole
Etrimfos	Famoxadone	Famphur
Fenamidone	Fenamiphos	Fenarimol
Fenazaquin	Fenbuconazole	Fenbutatin oxide
Fenchlorazole-ethyl	Fenclorim	Fenfuram
Fenhexamid	Fenitrothion	Fenobucarb
Fenothiocarb	Fenoxanil	Fenoxaprop-ethyl
Fenoxycarb	Fenpiclonil	Fenpropathrin
Fenpropidin	Fenpropimorph	Fenpyrazamine
Fenpyroximate, e-	Fenson	Fensulfothion
Fenthion	Fenuron	Fenvalerate
Ferimzone	Fipronil	Flamprop-isopropyl
Flamprop-methyl	Flonicamid	Fluacrypyrim

Pesticides		
Fluazifop butyl ester	Fluazifop-p-butyl	Fluazolate
Fluazuron	Flubendiamide	Flubenzimine
Fluchloralin	Flucycloxuron	Flucythrinate
Fludioxonil	Fluensulfone	Flufenacet
Flufenoxuron	Flumetralin	Flumiclorac-pentyl
Flumioxazin	Flumorph	Fluometuron
Fluopicolide	Fluopyram	Fluoranthene
Fluorene	Fluorochloridone	Fluorodifen
Fluoroglycofen	Fluoroimide	Fluotrimazole
Fluoxastrobin	Flupyradifurone	Fluquinconazole
Flurenol n-butyl ester	Flurenol-methyl ester	Fluridone
Fluroxypyr[1]	Flurprimidol	Flurtamone
Flusilazole	Flusulfamide	Fluthiacet-methyl
Flutolanil	Flutriafol	Fluvalinate
Fluxapyroxad	Folpet	Fomesafen
Fonofos	Forchlorfenuron	Formetanate
Formothion	Fosthiazate	Fuberidazole
Furalaxyl	Furametpyr	Furathiocarb
Furilazole	Furmecyclox	Gardona
Glufosinate[4]	Glyphosate[4]	Halfenprox
Halofenozide	Haloxyfop[1]	Heptachlor
Heptenophos	Hexachlorobutadiene	Hexaconazole
Hexaflumuron	Hexazinone	Hexythiazox
Hydramethylnon	Hydroprene	IBP
Imazalil	Imazamethabenz[1]	Imazamethabenz methyl
Imazamox[1]	Imazapic[1]	Imazapyr[1]
Imazaquin[1]	Imazasulfuron	Imazethapyr[1]
Imibenconazole	Imidacloprid	Indaziflam
Indoxacarb	Ioxynil	Ipconazole
Iprodione	Iprovalicarb	Isazofos
Isobenzan	Isocarbamid	Isocarbophos
Isodrin	Isofenphos	Isofetamid
Isomethiozin	Isoprocarb	Isopropalin
Isoprothiolane	Isoproturon	Isopyrazam
Isoxaben	Isoxadifen-ethyl	Isoxaflutole

Pesticides		
Isoxathion	Ivermectin	Jodfenphos
Karbutilate	Kresoxim-methyl	Lactofen
Lambda-cyhalothrin	Lenacil	Leptophos
Lindane	Linuron	Lufenuron
Malathion	Maleic hydrazide	Mandipropamid
MCPA[1]	MCPA-butoxyethyl ester	MCPB[1]
Mecarbam	Mecoprop[1]	Mefenacet
Mefenpyr-diethyl	Mefluidide	Mepanipyrim
Mephosfolan	Mepronil	Mesotrione
Metaflumizone	Metalaxyl	Metaldehyde
Metamitron	Metazachlor	Metconazole
Methabenzthiazuron	Methacrifos	Methamidophos
Methfuroxam	Methidathion	Methiocarb
Methomyl	Methoprene	Methoprotryne
Methoxychlor	Methoxyfenozide	Metobromuron
Metolachlor	Metolcarb	Metominostrobin
Metoxuron	Metrafenone	Metribuzin
Metsulfuron methyl	Mevinphos	Mexacarbate
MGK 264	Mirex	Molinate
Monalide	Monocrotophos	Moxidectin
Myclobutanil	Naftalofos	Naled
Naphthalene	Naphthaleneacetamide	Napropamide
Naptalam	Neburon	Nicotine
Nitenpyram	Nitrapyrin	Nitrofen
Nitrothal-isopropyl	Norflurazon	Novaluron
Noviflumuron	Nuarimol	Octhilinone
Octyldiphenyl PO_4	Ofurace	Orbencarb
Orysastrobin	Oryzalin	Ovex
Oxabetrinil	Oxadiazon	Oxadixyl
Oxamyl	Oxydemeton-methyl	Oxyfluorfen
Oxythioquinox	Paclobutrazol	Parathion
Parathion methyl	Pebulate	Penconazole
Pencycuron	Pendimethalin	Penflufen
Pentachlorophenol[1]	Pentanochlor	Penthiopyrad
Permethrin	Perthane	Phenkapton

Pesticides		
Phenmedipham	Phenothrin	Phenthoate
Phenylphenol, o-	Phorate	Phosalone
Phosfolan	Phosmet	Phosphamidon
Phoxim	Phthalide	Picloram[1]
Picolinafen	Picoxystrobin	Pindone
Pinoxadin	Piperalin	Piperonyl butoxide
Piperophos	Pirimicarb	Pirimiphos ethyl
Pirimiphos methyl	Plifenate	Potasan
Prallethrin	Pretilachlor	Probenazole
Prochloraz	Procymidone	Prodiamine
Profenofos	Profluralin	Prohydrojasmon
Promecarb	Prometon	Prometryn
Pronamide	Propachlor	Propamocarb
Propanil	Propaphos	Propargite
Propazine	Propetamphos	Propham
Propiconazole	Propisochlor	Propoxur
Propoxycarbazone	Proquinazid	Prosulfocarb
Prothioconazole	Prothiofos	Prothoate
Pymetrozine	Pyracarbolid	Pyraclofos
Pyraclostrobin	Pyraflufen ethyl	Pyrazon
Pyrazophos	Pyrazoxyfen	Pyrene
Pyributicarb	Pyridaben	Pyridalyl
Pyridaphenthion	Pyridate	Pyrifenox
Pyrifluquinazon	Pyriftalid	Pyrimethanil
Pyrimidifen	Pyriminobac-methyl	Pyriofenone
Pyriproxyfen	Pyroquilon	Pyroxasulfone
Quinalphos	Quinclorac[1]	Quinoclamine
Quinoxyfen	Quintozene	Quizalofop ethyl[1]
Rabenzazole	Resmethrin	Ronnel
Rotenone	Salithion	Schradan
Sebuthylazine	Secbumeton	Sedaxane
Siduron	Silafluofen	Silthiofam
Silvex[1]	Simazine	Simeconazole
Simetryne	Spinetoram	Spinosad
Spirodiclofen	Spiromesifen	Spirotetramat

Pesticides		
Spiroxamine	Sulfallate	Sulfentrazone
Sulfluramid	Sulfotepp	Sulfoxaflor
Sulprofos	Swep	Tebuconazole
Tebufenozide	Tebufenpyrad	Tebupirimfos
Tebutam	Tebuthiuron	Tecnazene
Teflubenzuron	Tefluthrin	Temephos
TEPP	Tepraloxydim	Terbacil
Terbucarb	Terbufos	Terbumeton
Terbuthylazine	Terbutryn	Tetraconazole
Tetradifon	Tetramethrin	Tetrasul
Thenylchor	Thiabendazole	Thiacloprid
Thiamethoxam	Thiazopyr	Thidiazuron
Thifluzamide	Thiobencarb	Thiocyclam
Thiodicarb	Thiofanox	Thiometon
Thionazin	Thiophanate-methyl	Thioquinox
Tiadinil	Tiocarbazil	Tolclofos methyl
Tolfenpyrad	Tolyfluanid	Transfluthrin
Triadimefon	Triadimenol	Tri-allate
Triamiphos	Triapenthenol	Triazophos
Triazoxide	Tributoxy PO_4	Trichlamide
Trichlorfon	Trichlorobenzene, 1,2,4-	Trichloronat
Trichlorophenol	Triclopyr[1]	Triclopyr butoxyethyl ester
Tricyclazole	Tridemorph	Trietazine
Trifenmorph	Trifloxystrobin	Trifloxysulfuron sodium
Triflumizole	Triflumuron	Trifluralin
Triflusulfuron methyl ester	Triforine	Trimethacarb
Triphenyl PO_4	Tris(1,3-dichloro-2-propyl) PO_4	Tris(beta-chloroethyl) PO_4
Tris(chloropropyl) PO_4	Triticonazole	Tycor
Uniconazole	Vamidothion	Vernolate
Vinclozolin	XMC	Zoxamide

[1]Acid herbicide included within the scope of the acid herbicides SRM
[2]3,4-dichloroanaline is a metabolite of multiple pesticides
[3]BAM is a degradant of both fluopicolide and dichlobenil
[4]Glyphosate and glufosinate are within scope of the glyphosate SRM

B. Analysis of Domestic Human Foods by Commodity Group in FY 2016

Commodity Group	Samples Analyzed (N)	Without Residues (N) (%†)	Violative Samples* (N) (%†)	Over Tolerance Violations (N)	No Tolerance Violations (N)
Totals - All Domestic Samples	**2,670**	**1413 (52.9)**	**25 (0.9)**	**4**	**21**
Grains and Grain Products					
Barley and barley products	45	26 (57.8)	0	0	0
Corn and corn products	314	130 (41.4)	0	0	0
Oats and oat products	21	13 (61.9)	0	0	0
Rice and rice products	25	5 (20.0)	0	0	0
Soybeans and soybean products	288	94 (32.6)	1 (0.3)	1	0
Wheat and wheat products	46	24 (52.2)	0	0	0
Other grains and grain products	42	39 (92.9)	0	0	0
Group Subtotal	**781**	**331 (42.4)**	**1 (0.1)**	**1**	**0**
Milk/Dairy Products/Eggs					
Eggs	293	263 (89.8)	0	0	0
Milk, cream and cheese products	366	361 (98.6)	0	0	0
Group Subtotal	**659**	**624 (94.7)**	**0**	**0**	**0**
Fish/Shellfish/Other Aquatic Products					
Aquaculture seafood	1	0	0	0	0
Fish and fish products	3	2 (66.7)	0	0	0
Group Subtotal	**4**	**2 (50.0)**	**0**	**0**	**0**
Fruits					
Apple fruit/juice	153	14 (9.2)	1 (0.7)	1	0
Avocados	1	0	0	0	0
Blackberry fruit/juice	24	7 (29.2)	1 (4.2)	0	1
Blueberry fruit/juice	30	9 (30.0)	0	0	0
Cantaloupe	61	24 (39.3)	1 (1.6)	0	1
Cherry fruit/juice	49	2 (4.1)	1 (2.0)	0	1
Grape fruit/juice, raisins	32	2 (6.2)	0	0	0
Orange fruit/juice	3	0	0	0	0
Peach fruit/juice	90	40 (44.4)	0	0	0
Pear fruit/juice	6	0	0	0	0
Pineapple fruit/juice	1	0	0	0	0
Plum fruit/juice, prunes	37	5 (13.5)	1 (2.7)	0	1
Raspberry fruit/juice	33	11 (33.3)	1 (3.0)	0	1
Strawberries	40	3 (7.5)	0	0	0
Watermelon	6	2 (33.3)	0	0	0

Commodity Group	Samples Analyzed (N)	Without Residues (N) (%†)	Violative Samples* (N) (%†)	Over Tolerance Violations (N)	No Tolerance Violations (N)
Other fruits/fruit products	6	1 (16.7)	1 (16.7)	1	0
Group Subtotal	**572**	**120 (21.0)**	**7 (1.2)**	**2**	**5**
Vegetables					
Broccoli	17	9 (52.9)	0	0	0
Cabbage	1	0	0	0	0
Carrots	34	32 (94.1)	0	0	0
Celery	22	5 (22.7)	0	0	0
Corn	4	3 (75.0)	0	0	0
Cucumbers	48	19 (39.6)	1 (2.1)	0	1
Eggplant	1	1 (100)	0	0	0
Kale	1	0	1 (100)	0	1
Lettuce, head	3	0	0	0	0
Lettuce, leaf	1	0	0	0	0
Mushrooms and truffles	1	0	0	0	0
Peppers, sweet	49	10 (20.4)	2 (4.1)	0	2
Potatoes	30	22 (73.3)	0	0	0
Radishes	21	21 (100)	0	0	0
Red beets	9	9 (100)	0	0	0
Spinach	44	5 (11.4)	3 (6.8)	0	3
Squash	76	27 (35.5)	6 (7.9)	0	6
String beans (green/snap/pole/long)	35	23 (65.7)	0	0	0
Sweet potatoes	23	18 (78.3)	1 (4.3)	1	0
Tomatoes	45	9 (20.0)	1 (2.2)	0	1
Other bean and pea products	7	6 (85.7)	0	0	0
Other leaf and stem vegetables	2	1 (50.0)	0	0	0
Other root and tuber vegetables	27	19 (70.4)	0	0	0
Group Subtotal	**501**	**239 (47.7)**	**15 (3.0)**	**1**	**14**
Other Food Products					
Edible seeds and seed products	1	1 (100)	0	0	0
Animal products/byproducts	29	29 (100)	0	0	0
Honey	70	51 (72.9)	1 (1.4)	0	1
Peanuts and peanut products	5	3 (60.0)	0	0	0
Miscellaneous foods	44	9 (20.5)	1 (2.3)	0	1
Other products	4	4 (100)	0	0	0
Group Subtotal	**153**	**97 (63.4)**	**2 (1.3)**	**0**	**2**

†Percentage of the number of samples analyzed per commodity group

*Total number of violative samples may not equal sum of samples with "Over Tolerance" and "No Tolerance" violations because one sample can contain pesticide chemical residues of both violation types.

C. Analysis of Import Human Foods by Commodity Group in FY 2016

Commodity Group	Samples Analyzed (N)	Without Residues (N) (%†)	Violative Samples* (N) (%†)	Over Tolerance Violations (N)	No Tolerance Violations (N)
Totals - All Import Samples	**4276**	**2167 (50.7)**	**418 (9.8)**	**64**	**389**
Grains and Grain Products					
Bakery products, doughs, crackers	14	10 (71.4)	0	0	0
Barley and barley products	23	15 (65.2)	1 (4.3)	0	1
Breakfast cereals	32	13 (40.6)	4 (12.5)	0	4
Corn and corn products	33	26 (78.8)	1 (3.0)	1	0
Macaroni and noodles	18	10 (55.6)	0	0	0
Oats and oat products	2	1 (50.0)	0	0	0
Rice and rice products	370	199 (53.8)	107 (28.9)	14	107
Soybeans and soybean products	26	26 (100)	0	0	0
Wheat and wheat products	58	33 (56.9)	5 (8.6)	0	5
Other grains and grain products	23	20 (87.0)	0	0	0
Group Subtotal	**599**	**353 (58.9)**	**118 (19.7)**	**15**	**117**
Milk/Dairy Products/Eggs					
Eggs	0	0	0	0	0
Milk, cream and cheese products	9	8 (88.9)	0	0	0
Group Subtotal	**9**	**8 (88.9)**	**0**	**0**	**0**
Fish/Shellfish/Other Aquatic Products					
Aquaculture seafood	71	65 (91.5)	0	0	0
Fish and fish products	26	24 (92.3)	1 (3.8)	0	1
Shellfish and crustaceans	31	31 (100)	0	0	0
Other aquatic animals and products	6	6 (100)	0	0	0
Group Subtotal	**134**	**126 (94.0)**	**1 (0.7)**	**0**	**1**
Fruits					
Ackees, lychees, longans	10	6 (60.0)	3 (30.0)	0	3
Apple fruit/juice	36	12 (33.3)	1 (2.8)	0	1
Apricot fruit/juice	16	9 (56.2)	0	0	0
Avocado fruit/juice	12	8 (66.7)	1 (8.3)	0	1
Bananas, plantains	11	8 (72.7)	0	0	0
Blackberry fruit/juice	61	17 (27.9)	8 (13.1)	1	8
Blueberry fruit/juice	71	32 (45.1)	0	0	0

Commodity Group	Samples Analyzed (N)	Without Residues (N) (%†)	Violative Samples* (N) (%†)	Over Tolerance Violations (N)	No Tolerance Violations (N)
Breadfruit, jackfruit	10	10 (100)	0	0	0
Cantaloupe	7	2 (28.6)	0	0	0
Cherry fruit/juice	47	12 (25.5)	3 (6.4)	0	3
Cranberry fruit/juice	11	8 (72.7)	0	0	0
Currant fruit/juice	2	0	1 (50)	0	1
Date fruit/juice	30	26 (86.7)	4 (13.3)	0	4
Fig fruit/juice	9	7 (77.8)	0	0	0
Grapes fruit/juice, raisins	70	7 (10.0)	3 (4.3)	2	1
Guava fruit/juice	10	6 (60.0)	0	0	0
Honeydew melon	4	0	0	0	0
Fruit jams, jellies, preserves, syrups, toppings	18	15 (83.3)	0	0	0
Lemon fruit/juice	6	2 (33.3)	0	0	0
Lime fruit/juice	74	21 (28.4)	3 (4.1)	0	3
Mango fruit/juice	44	40 (90.9)	1 (2.3)	0	1
Nectarine fruit/juice	72	1 (1.4)	1 (1.4)	0	1
Olives	31	30 (96.8)	0	0	0
Orange fruit/juice	11	8 (72.7)	1 (9.1)	0	1
Papaya fruit/juice	17	1 (5.9)	5 (29.4)	1	4
Peach fruit/juice	57	9 (15.8)	5 (8.8)	0	5
Pear fruit/juice	105	39 (37.1)	8 (7.6)	6	2
Pineapple fruit/juice	7	7 (100)	0	0	0
Plum fruit/juice, prunes	65	18 (27.7)	0	0	0
Pomegranate fruit/juice	4	4 (100)	0	0	0
Prickly pear fruit/juice	18	9 (50.0)	8 (44.4)	0	8
Raspberry fruit/juice	75	20 (26.7)	2 (2.7)	0	2
Strawberry fruit/juice	113	23 (20.4)	9 (8.0)	0	9
Watermelon	52	23 (44.2)	3 (5.8)	1	2
Other berry fruit/juice	21	10 (47.6)	5 (23.8)	3	5
Other fruits and fruit products	31	18 (58.1)	6 (19.4)	2	0
Other melons/vine fruit/juice	1	1 (100)	0	0	0
Other pome/core fruit/juice	3	3 (100)	0	0	2
Other sub-tropical fruit/juice	31	25 (80.6)	2 (6.5)	0	1
Group Subtotal	**1273**	**497 (39.0)**	**83 (6.5)**	**16**	**73**
Vegetables					
Artichokes	10	7 (70)	2 (20)	1	0
Asparagus	23	19 (82.6)	0	0	0

Commodity Group	Samples Analyzed (N)	Without Residues (N) (%†)	Violative Samples* (N) (%†)	Over Tolerance Violations (N)	No Tolerance Violations (N)
Bamboo shoots	4	4 (100)	0	0	0
Bean sprouts and seeds	1	1 (100)	0	0	0
Bok choy and Chinese cabbage	4	0	2 (50.0)	2	0
Broccoli	36	26 (72.2)	1 (2.8)	1	0
Brussels sprouts	38	6 (15.8)	0	0	5
Cabbage	50	28 (56.0)	5 (10.0)	4	3
Carrots	59	43 (72.9)	3 (5.1)	0	0
Cassava	6	6 (100)	0	0	0
Cauliflower	10	9 (90.0)	0	0	2
Celery	21	8 (38.1)	2 (9.5)	1	0
Choyote	7	6 (85.7)	0	0	1
Cilantro	6	3 (50.0)	1 (16.7)	0	0
Collards	1	1 (100)	0	0	0
Corn	14	12 (85.7)	0	0	2
Cucumbers	83	23 (27.7)	3 (3.6)	1	1
Eggplant	32	15 (46.9)	1 (3.1)	0	0
Garbanzo beans	7	6 (85.7)	0	0	1
Garlic	3	2 (66.7)	1 (33.3)	0	0
Ginger	7	7 (100)	0	0	0
Kale	7	3 (42.9)	0	0	0
Kidney beans	5	5 (100)	0	0	0
Lettuce, head	6	1 (16.7)	0	0	0
Lettuce, leaf	10	2 (20.0)	0	0	1
Mung beans	5	3 (60.0)	1 (20.0)	0	19
Mushrooms/truffles/fungi	108	80 (74.1)	19 (17.6)	2	0
Mustard greens	1	0	0	0	1
Okra	10	5 (50)	2 (20)	1	5
Onions/leeks/scallions/shallots	15	7 (46.7)	5 (33.3)	0	6
Peas (green/snow/sugar/sweet)	50	23 (46.0)	6 (12.0)	0	46
Peppers, hot	324	48 (14.8)	49 (15.1)	4	0
Peppers, pimiento	7	1 (14.3)	0	0	14
Peppers, sweet	107	29 (27.1)	14 (13.1)	2	0
Potatoes	24	7 (29.2)	0	0	0
Pumpkins	2	0	0	0	1
Radishes	26	20 (76.9)	1 (3.8)	0	0
Red beets	17	14 (82.4)	0	0	0
Soybeans	7	7 (100)	0	0	18

Commodity Group	Samples Analyzed (N)	Without Residues (N) (%†)	Violative Samples* (N) (%†)	Over Tolerance Violations (N)	No Tolerance Violations (N)
Spinach	81	40 (49.4)	18 (22.2)	1	2
Squash	35	13 (37.1)	2 (5.7)	0	9
String beans (green/snap/pole/long)	87	30 (34.5)	12 (13.8)	5	0
Sweet potatoes	9	8 (88.9)	0	0	0
Taro/dasheen	2	1 (50.0)	0	0	4
Tomatoes/tomatillos	157	54 (34.4)	4 (2.5)	0	0
Turnips	3	2 (66.7)	0	0	1
Vegetable juice/drinks	4	1 (25.0)	1 (25.0)	0	0
Vegetables, breaded, or with sauce	9	8 (88.9)	0	0	2
Vegetables, other, or mixed	41	26 (63.4)	3 (7.3)	1	1
Other bean/pea vegetables/products	42	35 (83.3)	1 (2.4)	0	0
Other cucurbit vegetables	4	3 (75.0)	0	0	10
Other leaf and stem vegetables	39	23 (59.0)	10 (25.6)	0	2
Other root and tuber vegetables	20	15 (75.0)	2 (10.0)	0	0
Group Subtotal	**1686**	**746 (44.2)**	**171 (10.1)**	**26**	**158**
Other Food Products					
Animal products and byproducts	1	0	0	0	0
Baby foods/formula	3	1 (33.3)	0	0	0
Beverages and beverage bases	24	21 (87.5)	0	0	0
Candy, confections, chocolate, cocoa products	23	20 (87)	0	0	0
Coconut and coconut products	7	7 (100)	0	0	0
Condiments and dressings	21	21 (100)	0	0	5
Dietary supplement, botanical/herbal	29	22 (75.9)	5 (17.2)	1	3
Dietary supplement, other	18	14 (77.8)	3 (16.7)	0	0
Food additives, colors, flavorings, extracts	3	3 (100)	0	0	0
Food sweeteners, not honey	12	12 (100)	0	0	0
Honey and honey products	49	47 (95.9)	0	0	3
Multi-ingredient foods (dinners, sauces, specialties)	24	10 (41.7)	4 (16.7)	1	0
Nuts, almonds	2	2 (100)	0	0	4
Nuts, cashews	21	13 (61.9)	4 (19)	0	0
Nuts, other nuts and nut products	22	18 (81.8)	0	0	0
Nuts, peanuts and peanut products	18	10 (55.6)	0	0	0
Nuts, pecans	23	19 (82.6)	0	0	3
Oil, olive	65	49 (75.4)	3 (4.6)	0	1
Oil, vegetable	19	15 (78.9)	1 (5.3)	0	0

Commodity Group	Samples Analyzed (N)	Without Residues (N) (%†)	Violative Samples* (N) (%†)	Over Tolerance Violations (N)	No Tolerance Violations (N)
Oil, vegetable, seed stock	6	3 (50.0)	2 (33.3)	2	1
Pepper sauce	13	6 (46.2)	1 (7.7)	0	7
Seeds, edible and seed products	93	77 (82.8)	8 (8.6)	2	0
Spices, basil	2	0	0	0	4
Spices, capsicums	8	3 (37.5)	4 (50.0)	0	4
Spices, other	34	21 (61.8)	5 (14.7)	1	1
Tea	5	3 (60.0)	1 (20.0)	0	4
Tea, botanical/herbal, other	9	3 (33.3)	4 (44.4)	0	0
Water and ice	4	4 (100)	0	0	0
Other food products	16	12 (75.0)	0	0	0
Other nonfood items	1	1 (100)	0	0	0
Group Subtotal	**575**	**437 (76.0)**	**45 (7.8)**	**7**	**40**

†Percentage of the number of samples analyzed per commodity group
*Total number of violative samples may not equal sum of samples with “Over Tolerance” and “No Tolerance” violations because one sample can contain pesticide chemical residues of both violation types.