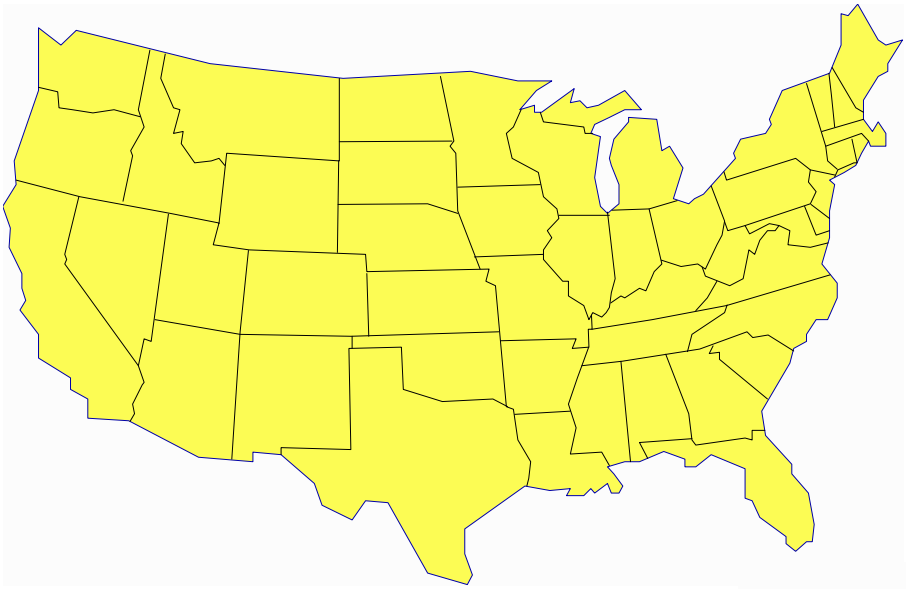
Food and Drug Administration

Pesticide Program

Residue Monitoring 1995



Residue Monitoring - 1995

This is the ninth annual report summarizing the results of the Food and Drug Administration's (FDA) pesticide residue monitoring program. The 8 previous reports, which were published in the Journal of the Association of Official Analytical Chemists/Journal of AOAC International, presented results from Fiscal Years (FY) 1987 through 1994. This current report includes findings obtained during FY95 (October 1, 1994 through September 30, 1995) under regulatory and incidence/level monitoring. Selected Total Diet Study findings for 1995 are also presented. Results in this and earlier reports continue to demonstrate that levels of pesticide residues in the U.S. food supply are well below established safety standards.

FDA Monitoring Program

Three federal government agencies share responsibility for the regulation of pesticides (1). The Environmental Protection Agency (EPA) registers (i.e., approves) the use of pesticides and sets tolerances (the maximum amount of a residue that is permitted in or on a food) if use of that particular pesticide may result in residues in or on food (2). 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 is charged with enforcing tolerances in imported foods and in domestically produced foods shipped in interstate commerce. FDA also acquires incidence/level data on particular commodity/pesticide combinations and carries out its market basket survey, the Total Diet Study. For 5 years, USDA's Agricultural Marketing Service (AMS), through contracts with participating states, has carried out a residue testing program directed primarily at raw agricultural products. FSIS and AMS report their pesticide residue data independently.

Regulatory Monitoring

Under this approach to pesticide residue monitoring, FDA samples individual lots of domestically produced and imported foods and analyzes them for pesticide residues to enforce the tolerances set by EPA. Domestic samples are collected as close as possible to the point of production in the distribution system; import samples are collected at the point of entry into U.S. commerce. Emphasis is on the raw agricultural product, which is analyzed as the unwashed, whole (unpeeled), raw commodity. Processed foods are also included. If illegal residues (above EPA tolerance or no tolerance for that particular food/pesticide combination) are found in domestic samples, FDA can invoke various sanctions, such as a seizure or injunction. For imports, shipments may be stopped at the port of entry when illegal residues are found. "Automatic detention" may be invoked for imports based on the finding of 1 violative shipment if there is reason to believe that the same situation will exist in future lots during the same shipping season for a specific shipper, grower, geographic area, or country.

Domestic and import food samples collected are classified as either "surveillance" or "compliance". Most samples collected by FDA are the surveillance type; that is, there is no prior knowledge or evidence that a specific food shipment contains illegal pesticide residues. Compliance samples are taken as follow-up to the finding of an illegal residue or when other evidence indicates that a pesticide residue problem may exist.

Factors considered by FDA in planning the types and numbers of samples to collect include review of recently generated state and FDA residue data, regional intelligence on pesticide use, dietary importance of the food, information on the amount of domestic food that enters interstate commerce and of imported food, chemical characteristics and toxicity of the pesticide, and production volume/pesticide usage patterns.

Analytical Methods

To analyze the large numbers of samples whose pesticide treatment history is usually unknown, FDA uses analytical methods capable of simultaneously determining a number of pesticide residues. These multiresidue methods (MRMs)

can determine about half of the approximately 400 pesticides with EPA tolerances, and many others that have no tolerances. The most commonly used MRMs can also detect many metabolites, impurities, and alteration products of pesticides (3).

Single residue methods (SRMs) or selective MRMs are used to determine some pesticide residues in foods (3). An SRM usually determines 1 pesticide; a selective MRM measures a relatively small number of chemically related pesticides. These types of methods are usually more resource-intensive per residue. Therefore, they are much less cost effective than MRMs.

The lower limit of residue measurement in FDA's determination of a specific pesticide is usually well below tolerance levels, which generally range from 0.1 to 50 parts per million (ppm). Residues present at 0.01 ppm and above are usually measurable; however, for individual pesticides, this limit may range from 0.005 to 1 ppm. In this report, the term "trace" is used to indicate residues detected, but at levels below the limit of quantitation (LQ).

FDA/State Cooperation

Personnel in FDA field offices interact with their counterparts in many states to increase FDA's effectiveness in pesticide residue monitoring. In most cases, work-sharing agreements (Memoranda of Understanding) have been established between FDA and various state agencies.

FDA also acquires and uses state-generated pesticide residue data to complement its own and other federally sponsored residue programs. For many years, FDA has supported, through a contract with Mississippi State University (MSU), the "Foodcontam" database, which is a compilation of state-collected residue data.

Animal Feeds

In addition to monitoring foods for human consumption, FDA also samples and analyzes domestic and imported feeds for pesticide residues. FDA's Center for Veterinary Medicine (CVM) directs this portion of the Agency's monitoring via its Feed Contaminants Compliance Program. Although animal feeds containing violative pesticide residues may present a potential hazard to a number of different categories of animals (e.g., laboratory animals, pets, wildlife, etc.), the major focus of CVM's monitoring is on feeds for livestock and poultry, animals that ultimately become, or produce, foods for human consumption.

CVM also reviews pesticide residue data supplied by various states under "Feedcon", a database operated by MSU under the auspices of the Association of American Feed Control Officials. These data are reviewed periodically by CVM so that potential problems arising from pesticide residues in foods of animal origin may be identified.

International Activities

FDA obtains information on foreign pesticide usage via contract with Landell Mills (Bath, England). Each year, FDA receives pesticide usage data for about 40 countries that export food to the United States. These data can be used by FDA to target its pesticide residue monitoring toward specific pesticide/commodity/country combinations.

In addition to the foreign pesticide usage data obtained through the commercial contract, under provisions of the Pesticide Monitoring Improvements Act, FDA receives information from foreign governments on pesticides used on their food exports to the United States. FDA makes this information available to FDA Districts for use in their planning of monitoring of imported foods.

As part of the exchange of information on pesticides, FDA provides foreign countries with updates on U.S. pesticide usage. FDA also supplies foreign countries annually with reports on FDA's regulatory monitoring coverage and the findings in foods imported from their respective countries, as well as a personal computer database in which coverage and findings are summarized by country/commodity/pesticide combination.

Under the auspices of the North American Free Trade Agreement (NAFTA), the United States, Mexico, and Canada

have established a NAFTA Technical Working Group on Pesticides (TWG). The NAFTA Pesticide TWG now serves as the focal point for all pesticide issues that arise among the 3 NAFTA countries. The TWG reports directly to the NAFTA Sanitary and Phytosanitary Committee.

One of the major goals of the TWG is to ensure that pesticide registrations and tolerances/maximum residue limits in the 3 countries are harmonized to the extent practical, while strengthening protection of public health and the environment. A number of projects have been undertaken by the TWG to identify differing residue limits in the NAFTA countries and to determine what steps might be taken to harmonize the limits. While this is a difficult process, the TWG envisions eventual movement toward a "North America" pesticide registration and tolerance system so that citizens of all 3 countries can be assured of the safety and legality of foods produced in any 1 of the NAFTA countries.

The NAFTA TWG is cochaired by EPA, Health Canada, and Mexico's Ministry of Health (representing the Comision Intersecretarial para el Control del Proceso y Uso de Plaguicidas, Fertilizantes y Sustancias Toxicas). FDA is an active participant on the TWG and is assisting by providing expertise on enforcement monitoring programs and residue data to support harmonization activities. FDA's activities on the TWG complement its ongoing bilateral cooperation with its counterparts in Mexico and Canada.

Incidence/Level Monitoring

A complementary approach to regulatory monitoring, incidence/level monitoring is used to increase FDA's knowledge about particular pesticide/commodity combinations by analyzing certain foods to determine the presence and levels of selected pesticides. In 1995, a survey of triazine herbicides in various commodities was carried out and a statistically based monitoring survey that had been initiated in 1994 was completed.

The latter focused on domestic and imported fresh apples and processed rice. This is the second FDA survey of this type; the first covered domestic and imported pears and tomatoes (4). These statistically based surveys were initiated to determine whether FDA data acquired under regulatory monitoring are statistically representative of the overall residue situation for a particular pesticide, commodity, or place of origin. In FDA's surveillance sampling for pesticide residues, sampling bias may be incurred by weighting sampling toward such factors as commodity or place of origin with a past history of violations or large volume of import shipments. In addition, the total number of samples of a given commodity analyzed for a particular pesticide each year may not be sufficient to draw specific conclusions about the residue situation for the whole volume of that commodity in commerce. Therefore, the objective of these statistically based surveys is to determine whether violation rates, frequency of occurrence of residues, and residue levels obtained from such a sampling regimen differ from those obtained through FDA's traditional surveillance approach.

Apples and rice were chosen as the second set of test commodities because they are widely consumed year round and have significant domestic and import components. Fresh apples and all types of processed rice (white, brown, glutinous, fragrant, parboiled, converted, etc., but not wild or brewer's rice) were included in the study. The same general procedures were followed in the apples/rice study as in the pears/tomatoes study (4). Samples were collected throughout the United States by FDA inspectors, except for domestic rice. These samples were collected by USDA Federal Grain Inspection Service personnel, who are routinely present at the mills that process domestic rice. Most of the mills are located in those few states in which rice growing is a major agricultural industry.

Analyses were performed by the Buffalo (apples) and Minneapolis (rice) District Laboratories. The goal was to collect and analyze about 800 domestic and 800 import apple samples and about 575 domestic and 800 import rice samples.

Total Diet Study

The Total Diet Study is another major element of FDA's pesticide residue monitoring program (5). In its previous annual pesticide reports, FDA provided Total Diet Study findings for 1987-1994 (6). In addition, more detailed information, including estimated dietary intakes of pesticide residues covering June 1984-April 1986 (7) and July 1986-April 1991 (8), has been published. In September 1991, FDA implemented revisions to the Total Diet Study that were formulated in 1990 (9). These revisions primarily consisted of collection and analysis of an updated and expanded

number (to 261) of food items, addition of 6 age/sex groups (for a total of 14), and revised analytical coverage. Details of the recent revision are presented elsewhere (10,11).

In conducting the Total Diet Study, FDA personnel purchase foods from supermarkets or grocery stores 4 times per year, once from each of 4 geographic regions of the country. The 261 foods that comprise each market basket represent over 3500 different foods reported in USDA food consumption surveys; for example, apple pie represents all fruit pies and fruit pastries. Each collection is a composite of like foods purchased in 3 cities in a given region. The foods are prepared table-ready and then analyzed for pesticide residues (as well as radionuclides, industrial chemicals, toxic elements, trace and macro elements, vitamin B_6, and folic acid). The levels of pesticides found are used in conjunction with USDA food consumption data to estimate the dietary intakes of the pesticide residues.

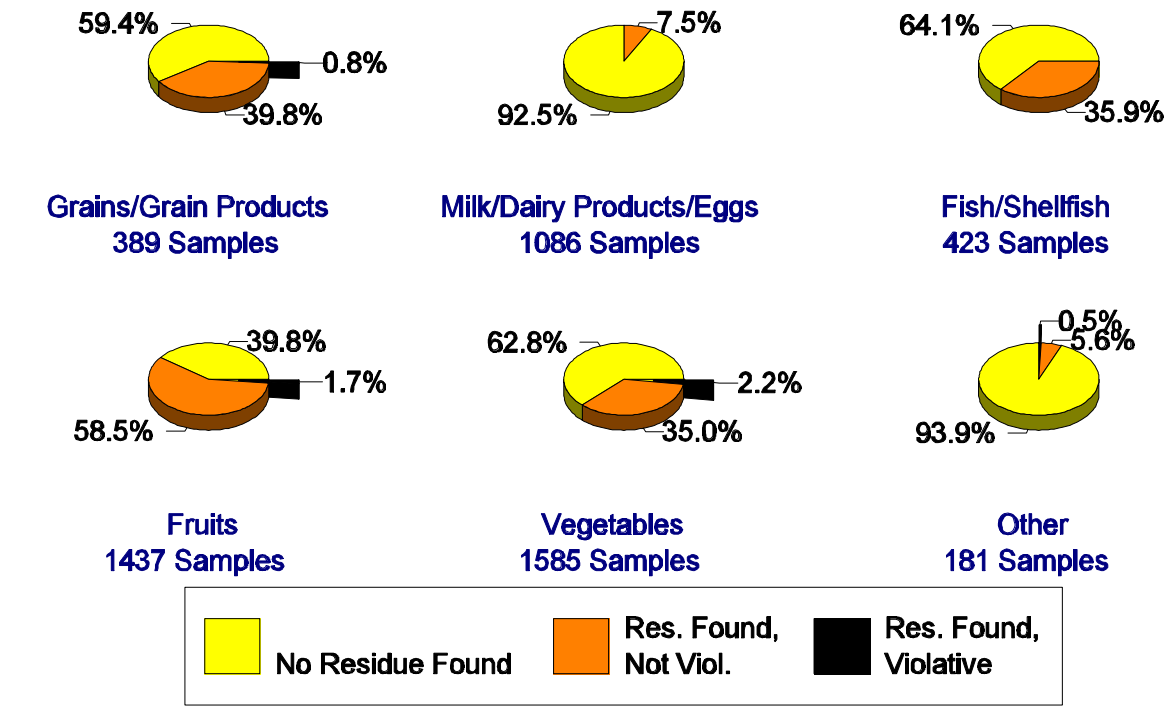
Results and Discussion

Regulatory Monitoring

In 1995, 10,615 samples (10,133 surveillance and 482 compliance) were analyzed under regulatory monitoring. Of these, 5198 were domestic and 5417 were imports.

Figure 1 shows the percentage of the 5101 domestic surveillance samples by commodity group with no residues found,

FIGURE 1. Summary of Results (Domestic) by Commodity Group of 1995 Sample Analyses for Pesticide Residues (Surveillance Samples Only)



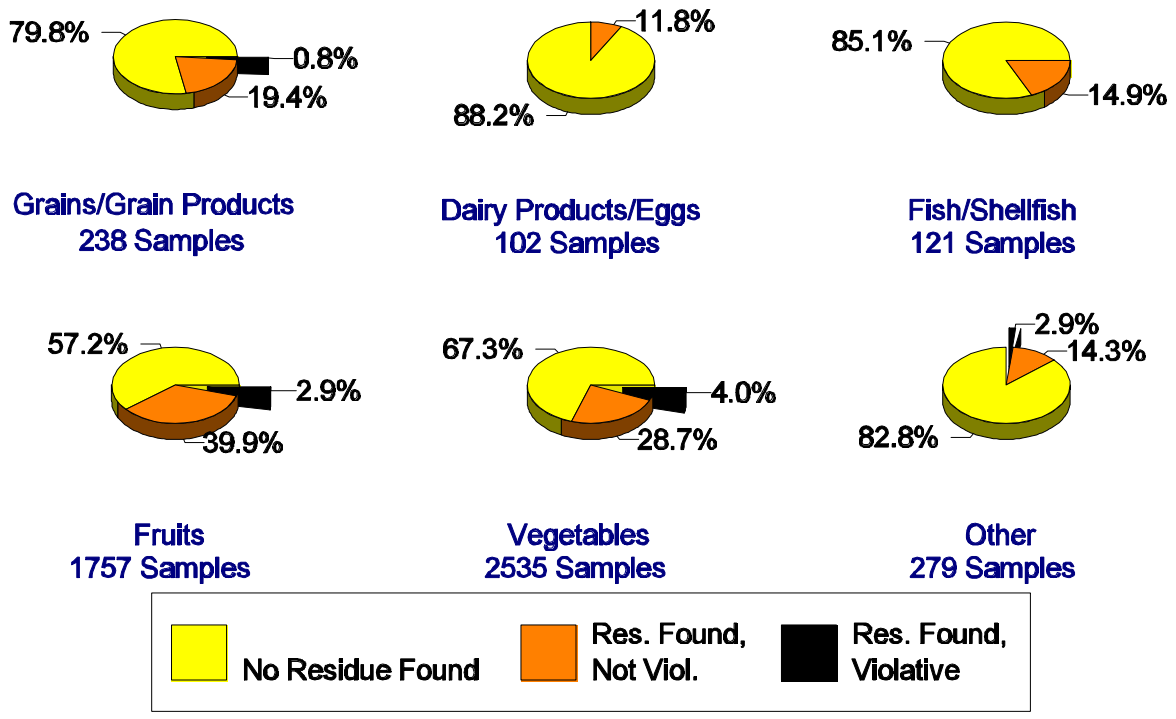
nonviolative residues found, and violative residues found. (A violative residue is defined in this report as a residue

which exceeds a tolerance or a residue at a level of regulatory significance for which no tolerance has been established in the sampled food.) As in earlier years, fruits and vegetables accounted for the largest proportion of the commodities analyzed in 1995; those 2 commodity groups comprised 59% of the total number of domestic surveillance samples. In 1995, no violative residues were found in nearly 99% of all domestic surveillance samples (the same percentage as in the past several years).

Appendix A contains more detailed data on domestic surveillance monitoring findings by commodity, including the total number of samples analyzed, the percent samples with no residues found, and the percent violative samples. Of the 5101 domestic surveillance samples, 64% had no detectable residues, less than 1% had over-tolerance residues, and less than 1% had residues of pesticides for which there was no tolerance for that particular pesticide/commodity combination. In the largest commodity groups, fruits and vegetables, 40 and 63% of the samples, respectively, had no residues detected. Less than 2% of the fruit samples and about 2% of the vegetable samples contained violative residues (Figure 1). In the milk/dairy products/eggs group, 93% of the samples had no residues detected and no violative residues were found. Within the category Other were 61 samples of baby foods/formula, nearly 3 times the number of samples of baby foods/formula collected and analyzed in 1994. This included 29 vegetable, 13 cereal, 13 fruit/fruit juice, 4 formula, 1 custard/fruit pudding, and 1 teething biscuit samples. None of the samples had violative residues.

The findings by commodity group for the 5032 import surveillance samples are shown in Figure 2. Fruits and vegetables accounted for 85% of these samples. Overall, no violative residues were found in nearly 97% of the import surveillance samples (97% in 1993 and 96% in 1994).

FIGURE 2. Summary of Results (Import) by Commodity Group of 1995 Sample Analyses for Pesticide Residues (Surveillance Samples Only)



Appendix B contains detailed data on the import surveillance samples. Of the 5032 samples analyzed, 66% had no residues detected, less than 1% had over-tolerance residues, and 3% had residues for which there was no tolerance for that particular pesticide/commodity combination. Fruits and vegetables had 57 and 67%, respectively, with no residues detected. The fruit group had less than 1% with over-tolerance residues and the vegetable group had 1% with over-tolerance residues; each group had 3% no-tolerance residues. No residues were found in 88% of the dairy products/eggs group and 85% of the fish/shellfish group, and no violative residues were found in either of those groups.

Pesticide monitoring data collected under FDA's regulatory monitoring approach in 1995 are available to the public as a computer database. This database summarizes FDA 1995 regulatory monitoring coverage and findings by country/commodity/pesticide combination. The database also includes the monitoring data by individual sample from which the summary information was compiled. Information on purchase of this database as well as those for 1992, 1993, and 1994 is provided at the end of this report.

Geographic Coverage

Domestic. - In 1995, domestic surveillance samples were collected from all 50 states and Puerto Rico. The largest numbers of samples were collected from the states in which agriculture is a major industry. Import. - Samples representing food shipments from 94 countries were collected. Table 1 lists the numbers of samples collected and the countries from which they originated. Mexico, as usual, was the source of the largest number of samples. This large number reflects the volume and diversity of commodities imported from that country, especially during the winter months.

Pesticide Coverage

Table 2 lists the 345 pesticides that were detectable by the methods used; the 92 pesticides that were actually found are indicated.

FDA conducts ongoing research to expand the pesticide coverage of its monitoring program. This research includes testing the behavior of new or previously untested pesticides through existing analytical methods, and development of new methods to cover pesticides that cannot be determined by methods currently used by FDA. The research encompasses both U.S.-registered pesticides and foreign-use pesticides that are not registered in the United States. The list of pesticides detectable for 1995 (Table 2) reflects the addition of a number of pesticides for which new methods had been developed and pesticides whose recovery through the analytical methods used was demonstrated as a result of ongoing research.

Surveillance/Compliance Violation Rate Comparison

In 1995, 97 domestic and 385 import compliance samples were collected and analyzed (Table 3). Because compliance samples are collected when a pesticide residue problem is known or suspected, violation rates are expectedly higher than those for surveillance samples: 12% for domestic (10% in 1994) and 11% for imports (18% in 1994). The corresponding violation rates for surveillance samples were 1.3% for domestic and 3.2% for imports (Figure 3).

Most of the 1995 compliance samples were collected as follow-up to violative surveillance samples. These included follow-up samples from the same shipment as the violative surveillance sample, follow-up samples of the same commodity from the same grower or shipper, and audit samples from shipments presented for entry into the United States with a certificate of analysis (i.e., shipments subject to automatic detention).

Table 1

Foreign Countries and Number of Samples[a] Collected and Analyzed in 1995

Country	No. of Samples	Country	No. of Samples	Country	No. of Samples
Mexico	1723	Greece	81	Hong Kong	23
Chile	467	Turkey	79	Philippines	23
The Netherlands	370	Ecuador	72	United Kingdom	21
Canada	253	Taiwan	55	Germany	17
Italy	218	Argentina	51	Denmark	16
Thailand	198	New Zealand	48	Pakistan	16
China, People's Rep. of	184	Jamaica	47	Poland	16
		Japan	47	South Africa	16
Guatemala	174	Belgium	46	Lebanon	15
Costa Rica	139	Panama	43	Australia	14
India	137	Colombia	42	Czech Republic	14
Spain	126	France	40	Egypt	13
Peru	85	Indonesia	31	Haiti	12
Isreal	83	Brazil	30	Morocco	12
Dominican Republic	91	Honduras	29	Venezuela	12
		Korea, Rep. of	25	Unspecified	15

Ten or fewer samples collected from the following:

Austria	Hungary	Slovakia
Bahamas	Iceland	Slovenia
Belize	Ivory Coast	Sri Lanka
Bermuda	Kenya	St. Vincent
Bolivia	Macedonia	Surinam
Bosnia-Hercegovina	Malaysia	Sweden
Bulgaria	Martinique	Switzerland
Croatia	Moldavia	Syria
Cyprus	Netherlands Antilles	Tanzania
Dominica	Nicaragua	Trinidad & Tobago
El Salvador	Nigeria	Tunisia
Estonia	Norway	Turks & Caicos Islands
Ethiopia	Papua New Guinea	United Arab Emirates
Faeroe Islands	Portugal	Uruguay
Fiji	Russia	Vietnam, Rep. of
Ghana	Singapore	Zambia

[a]Surveillance plus compliance samples.

Table 2

Pesticides Detectable by the Methods Used and Pesticides Found (*) in 1995 Regulatory Monitoring[a,b]

Acephate*
Acetochlor
Acrinathrin
Alachlor*
Aldicarb*
Aldrin
Allethrin
Allidochlor
Alpha-cypermethrin
Ametryn
Aminocarb
Amitraz*
Anilazine
Aramite
Atrazine
Azinphos-ethyl
Azinphos-methyl*
Bendiocarb
Benfluralin
Benodanil
Benomyl/carbendazim*[c]
Benoxacor
Bensulide
Benzoylprop-ethyl
BHC*
Bifenox
Bifenthrin*
Binapacryl
S-Bioallethrin
Biphenyl
Bitertanol*
Bromacil
Bromophos
Bromophos-ethyl
Bromopropylate*
Bromoxynil
Bufencarb
Bulan
Bupirimate
Butachlor
Butocarboxim
Butralin
Cadusafos
Captafol
Captan*
Carbaryl*
Carbofuran*
Carbon tetrachloride
Carbophenothion*
Carbosulfan
Carboxin
Chlorbenside
Chlorbromuron
Chlorbufam
Chlordane*
Chlordecone
Chlordimeform*
Chlorethoxyfos
Chlorfenvinphos
Chlorflurecol methyl ester
Chlorimuron ethyl ester
Chlornitrofen
Chlorobenzilate
Chloroform
3-Chloro-5-methyl-4-nitro-1H-pyrazole
Chloroneb
Chloropropylate
Chlorothalonil*
Chloroxuron
Chlorpropham*
Chlorpyrifos*
Chlorpyrifos-methyl*
Chlorthiophos
Clomazone
Coumaphos
Crotoxyphos
Crufomate
Cyanazine
Cyanofenphos
Cyanophos
Cycloate
Cyfluthrin
Cyhexatin*
Cypermethrin*
Cyprazine
Cyproconazole
Daminozide
DCPA*
DDT*
Deltamethrin
Deltamethrin, trans
Demeton*
Desmetryn
Dialifor
Di-allate
N,N-Diallyl dichloroacetamide
Diazinon*
Dichlobenil
Dichlofenthion
Dichlofluanid
Dichlone*
4-(Dichloroacetyl)-1-oxa-4-azapiro[4.5]decane
Dichlorvos*
Diclobutrazol
Diclofop-methyl
Dicloran*
Dicofol*
Dicrotophos
Dieldrin*
Diethatyl-ethyl
Dilan
Dimethachlor
Dimethametryn
Dimethipin
Dimethoate*
Dinitramine
Dinobuton
Dinocap
Dioxabenzofos
Dioxacarb
Dioxathion
Diphenamid
Diphenylamine*
Dipropetryn
Disulfoton
Diuron
Edifenphos
Endosulfan*
Endrin*
EPN
EPTC
Esfenvalerate*
Etaconazole
Ethalfluralin
Ethephon*
Ethiofencarb
Ethion*
Ethofumesate
Ethoprop
Ethoxyquin*
Ethylenebisdithio-carbamates*[d]
Ethylene dibromide
Ethylene dichloride
Etridiazole
Etrimfos
Famphur
Fenamiphos*
Fenarimol*
Fenbuconazole
Fenfuram
Fenitrothion*
Fenobucarb
Fenoxaprop ethyl ester
Fenoxycarb
Fenpropathrin
Fenpropimorph
Fenson
Fensulfothion
Fenthion
Fenuron
Fenvalerate*
Fipronil

Flamprop-M-isopropyl
Flamprop-methyl
Fluazifop butyl ester
Fluchloralin
Flucythrinate
Flusilazole
Fluvalinate
Folpet*
Fonofos*
Formetanate hydrochloride*
Formothion
Fuberidazole
Furilazole
Gardona*
Heptachlor*
Heptenophos
Hexachlorobenzene*
Hexaconazole
Hexazinone
Imazalil*
Imazamethabenz methyl ester
Iprobenfos
Iprodione*
Isazofos
Isocarbamid
Isofenphos
Isoprocarb
Isopropalin
Isoprothiolane
Lactofen
Lambda-cyhalothrin
Leptophos
Lindane*
Linuron*
Malathion*
Mecarbam
Mephosfolan
Merphos*
Metalaxyl*
Metasystox thiol
Metazachlor
Methabenzthiazuron
Methamidophos*
Methidathion*
Methiocarb*
Methomyl*
Methoprotryne
Methoxychlor*
Methylene chloride
Metobromuron
Metolachlor
Metolcarb
Metoxuron
Metribuzin
Mevinphos*
Mirex*
Monocrotophos*
Monolinuron
Monuron
Myclobutanil*
Naled
Napropamide
Neburon
Nitralin
Nitrapyrin
Nitrofen
Nitrofluorfen
Nitrothal-isopropyl
Norflurazon
Nuarimol
Octhilinone
Ofurace
Omethoate*
Ovex
Oxadiazon
Oxadixyl
Oxamyl*
Oxydemeton-methyl*
Oxyfluorfen
Oxythioquinox
Paclobutrazol
Paraquat
Parathion*
Parathion-methyl*
Pebulate
Penconazole
Pendimethalin
Permethrin*
Perthane
Phenothrin
Phenthoate
Phenylphenol, ortho-*
Phorate*
Phosalone*
Phosmet*
Phosphamidon*
Phosphine
Piperonyl butoxide
Piperophos
Pirimicarb
Pirimiphos-ethyl
Pirimiphos-methyl*
Pretilachlor
Probenazole
Prochloraz
Procyazine
Procymidone*
Prodiamine
Profenofos*
Profluralin
Prolan
Promecarb
Prometryn
Pronamide
Propachlor
Propanil
Propargite*
Propazine
Propetamphos
Propham
Propiconazole
Propoxur
Prothiofos*
Prothoate
Pyrazon
Pyrazophos
Pyrethrins
Pyridaphenthion
Quinalphos
Quintozene*
Quizalofop ethyl ester
Ronnel
Schradan
Secbumeton
Simazine*
Simetryn
Strobane
Sulfallate
Sulfotep*
Sulfur dioxide*
Sulphenone
Sulprofos
TCMTB
Tebuconazole
Tebupirimfos
Tecnazene
TEPP
Terbacil
Terbufos
Terbumeton
Terbuthylazine
Terbutryn
Tetradifon*
Tetraiodoethylene
Tetrasul
Thiabendazole*
Thiobencarb
Thiodicarb
Thiometon
Thionazin
Thiophanate-methyl
Tolylfluanid
Toxaphene
Tralomethrin
Traloxydim
Triadimefon*
Triadimenol*
Tri-allate
Triazamate
Triazophos
Tribufos
Trichlorfon
Tricyclazole
Tridiphane
Trietazine
Triflumizole
Trifluralin*
Triflusulfuron methyl ester
Trimethacarb
Vamidothion sulfone

Vernolate	Vinclozolin*	XMC

[a]The list of pesticides detectable is expressed in terms of the parent pesticide. However, monitoring coverage and findings may have included metabolites, impurities, and alteration products.
[b]Some of these pesticides are no longer manufactured or registered for use in the United States.
[c]The analytical methodology determines carbendazim, which may result from use of benomyl or carbendazim.
[d]Such as maneb.

Table 3

Compliance Samples by Commodity Group in 1995

Commodity Group	Total No. of Samples	Samples with No Residues Found, %	Samples Violative, %
Domestic			
Grains and grain products	3	33	0
Milk/Eggs	5	100	0
Fish	5	80	0
Fruits	23	48	0
Vegetables	56	48	21
Other	5	80	0

Total	97	54	12
Import			
Grains and grain products	49	63	0
Cheese	3	100	0
Fish/shellfish	17	41	0
Fruits	71	68	18
Vegetables	196	52	14
Other	49	86	6

Total	385	61	11

FIGURE 3. DOMESTIC AND IMPORT SURVEILLANCE SAMPLE VIOLATION RATES FOR 1995

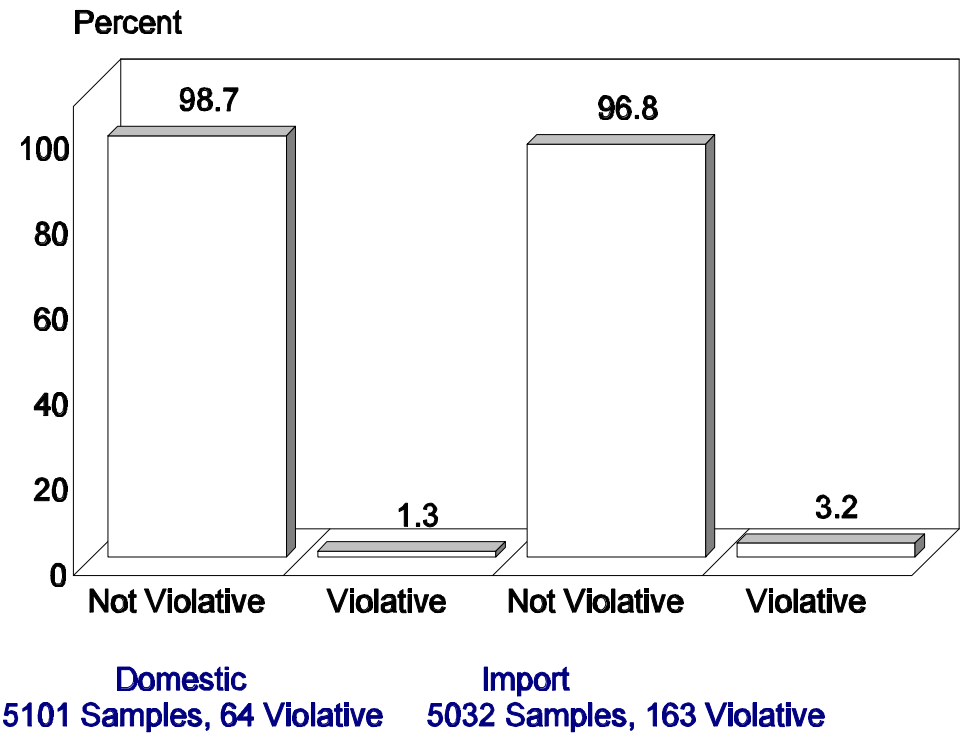
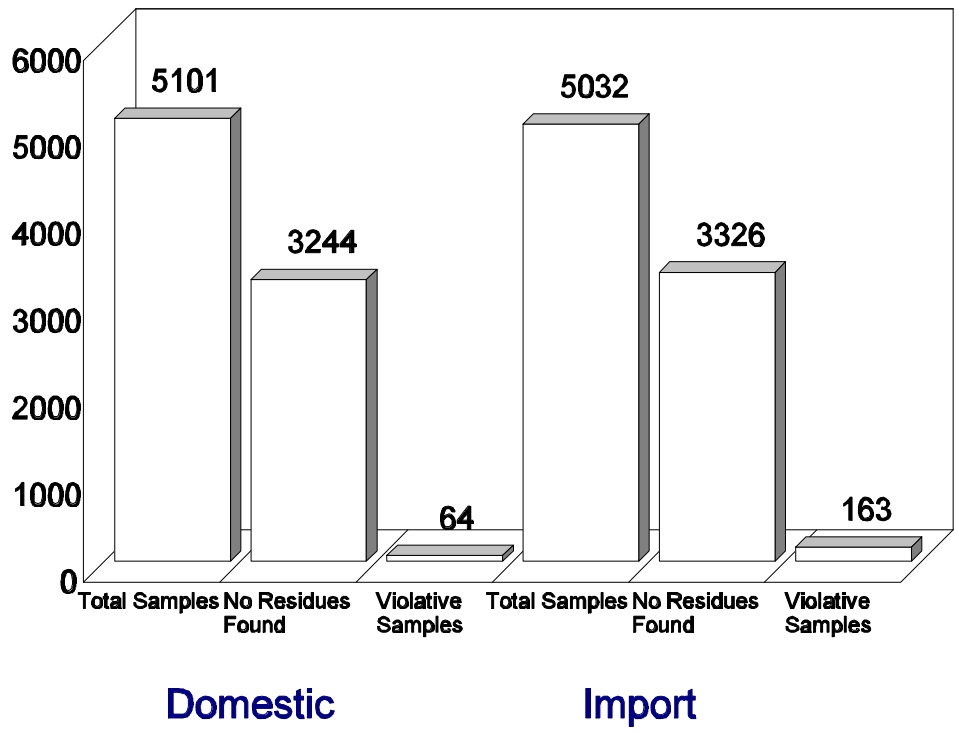


FIGURE 4. COMPARISON OF RESULTS FOR DOMESTIC AND IMPORT SURVEILLANCE SAMPLES IN 1995



Foodcontam Data

In 1995, 11 states participated in the Foodcontam project. A wide variety of commodities was reflected in the 9394 samples reported by the 10 states whose data were available. Table 4 lists the 10 states, the number of samples for each, and the number and percentage of samples with positive and "significant" findings. In this instance, a significant finding indicates a residue that exceeds federal or state regulatory limits, is not covered by a tolerance for the particular chemical/commodity combination, or denotes some unusual finding(s). For the 9394 samples reported, 0.8% were classified as significant.

Table 4

Summary of Foodcontam Findings for 1995[a]

State	Total Samples	No. Positive	Positive, %	No. Significant	Significant, %
Arkansas	351	14	4.0	2	0.6
California	4694	1164	24.8	40	0.9
Georgia	540	128	23.7	7	1.3
Indiana	158	93	58.9	0	-
North Carolina	688	215	31.3	9	1.3
New York	965	321	33.3	14	1.5
Oregon	277	39	14.1	0	-
Pennsylvania	582	124	21.3	5	0.9
Virginia	703	88	12.5	2	0.3
Wisconsin	538	7	1.3	0	-
Total	9394	2193	23.3	79	0.8

[a]Data from Florida not available.

Animal Feeds

In 1995, 556 domestic feed samples (532 surveillance and 24 compliance) and 69 import feed samples (65 surveillance and 4 compliance) were collected and analyzed by FDA. Of the 532 domestic surveillance samples, 301 (57%) had no pesticide residues detected and 2 (<1%) contained violative residues (Table 5). The latter involved 2 corn samples with chlorpyrifos-methyl residues. Of the 65 import surveillance samples, 29 (45%) had no pesticide residues detected and 1 (2%), a sample of feather meal (for poultry) from Canada, contained diphenylamine. No tolerance for chlorpyrifos-methyl on corn or for diphenylamine on poultry has been set. Thus, these samples were considered to have exceeded regulatory standards.

In the 231 domestic surveillance feed samples in which 1 or more pesticides were detected, a total of 346 residues were detected (254 quantifiable and 92 trace). Malathion, chlorpyrifos-methyl, and diazinon were the most frequently found residues. The findings in samples with quantifiable residues were as follows:

Pesticide	No. of Samples with Quantifiable Residues	Residue Found, ppm Range	Median
malathion	149	0.01-7.7	0.09
chlorpyrifos-methyl	39	0.01-1.1	0.11
diazinon	23	0.01-0.81	0.06
chlorpyrifos	10	0.01-0.08	0.03
pirimiphos-methyl	9	0.01-9.9	0.05
others	24	0.01-41	0.19

Table 5

Summary of Findings in Domestic Surveillance Feed Samples in 1995

Type of Feed	Total No. of Samples	Samples with No Residues Found		Violative Samples	
		No.	%	No.	%
Whole/ground grains	167	98	59	2	1
Plant by-products	120	76	63	0	-
Mixed feed rations	116	35	30	0	-
Animal by-products	104	74	71	0	-
Hay & hay products	25	18	72	0	-
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Total	532	301	57	2	<1

Summary: Regulatory Monitoring

In summary, no residues were found in 64% of domestic surveillance samples and 66% of import surveillance samples (Figure 4) analyzed under FDA's regulatory monitoring approach in 1995. Less than 1% of domestic and import surveillance samples had residue levels that were over tolerance and less than 1% of domestic and 3% of import surveillance samples had residues for which there was no tolerance. The findings for 1995 demonstrate that pesticide residue levels in foods are generally well below EPA tolerances, corroborating results presented in earlier reports (6).

Incidence/Level Monitoring

Statistically Based Survey

The statistically based monitoring survey of domestic and imported fresh apples and processed rice that was begun in 1994 was completed in 1995. The original goal had been to collect 1600 samples of apples (800 domestic and 800 import). Actually, 769 domestic and 1062 import samples were collected and analyzed. For rice, 575 domestic and 800 import samples had been the goal; 598 domestic and 612 import samples were actually collected and analyzed. (These numbers are not included in the counts under Fruits and Grains and Grain Products in Appendixes A and B.) The results of the survey are being evaluated and will be submitted for publication in the scientific literature.

Triazine Herbicides

The triazines are one of the most widely used classes of herbicides, and EPA has established tolerances for them on many commodities. Interest in triazines has increased recently because of potential leaching of the herbicides and their degradation products into ground and surface water. Residues of these chemicals have rarely been detected in foods, although FDA has routinely looked for the parent compounds.

Recently, FDA's Atlanta District Laboratory developed a method capable of determining 19 triazine herbicides and 4 metabolites (12). Average recoveries ranged from 81 to 106% for the parent herbicides and 60 to 88% for the metabolites. The method was validated by the Minneapolis District Laboratory (13) and used to analyze a number of food samples in 1995. This new method was used to analyze 232 samples (92 domestic samples from 9 states and 140 import samples from 19 countries) (Table 6). Residues were found in 5 domestic samples, all of simazine in oranges. Four samples had trace amounts and 1 sample had 0.04 ppm (LQ, 0.02 ppm). None were violative. No triazine residues were detected in the import samples.

Summary: Incidence/Level Monitoring

Under this approach, a statistically based monitoring survey of domestic and imported apples and processed rice was completed in 1995. A survey of triazine herbicides in various commodities was carried out. Few residues were found, and none were violative.

Total Diet Study

The Total Diet Study is unique in that it determines pesticide residues in foods that have been prepared as they would be consumed (5). Of the nearly 300 chemicals that can be determined by the analytical methods used, 86 pesticide and pesticide-related chemicals were found in the foods analyzed in the 3 collections reported here. To measure the low levels of pesticides found in the Total Diet Study foods, the analytical methods used are modified to permit measurement at levels 5-10 times lower than those normally used in regulatory monitoring. In general, residues present at or above 1 part per billion can be measured.

Table 7 lists the 17 most frequently found residues, the total number of findings, and the percent occurrence in the 783 food items analyzed in 1995. DDT, an environmentally persistent chemical whose U.S. registration was higher than it has been in the past several years. This may not be an indicator of an increasing trend in DDT findings in Total Diet Study foods; however, the occurrence will be investigated. Malathion, which is used on a wide variety of crops both pre- and postharvest, was the next most frequently found residue. The levels of these 2 pesticides, as well as the others listed in Table 7, were well below regulatory limits.

Information obtained through the Total Diet Study is used to estimate dietary intakes of pesticides; these intakes are then compared with established standards. Food consumption data to be used in estimating dietary intakes for the revised food list have not been finalized. Therefore, dietary intake information for the market baskets collected during this period is not presented.

For several years, FDA has collected and analyzed a number of baby foods in addition to those covered under the Total Diet Study. Between 1991 and 1995, this adjunct to the Total Diet Study included 23 different food items (14 fruit juices or fruits, 4 fruit desserts, 4 grain products, and 1 vegetable). (These numbers are not included in the analyses reported in Table 7.) Table 8 lists the 16 most frequently found pesticide residues in those 23 foods in 1991-1995. Carbaryl, the residue found most frequently, is an insecticide with tolerances on many fruits and grains. Dimethoate, the next most frequently found residue, also has tolerances on a number of fruits.

Summary: Total Diet Study

In 1995, the types of pesticide residues found and their frequency of occurrence in the Total Diet Study were generally consistent with those given in previous FDA reports (6,14). The pesticide residue levels found were well below regulatory standards. An adjunct survey of baby foods in 1991-1995 also provided evidence of only small amounts of pesticide residues in those foods.

Summary

A total of 10,615 samples of domestically produced food and imported food from 94 countries was analyzed for pesticide residues in 1995. Of these, 10,133 were surveillance samples, which are collected when there is no evidence of a pesticide problem. No residues were found in 64% of the domestic surveillance samples and 66% of the import surveillance samples. The higher violation rates in the 482 compliance samples reflect the fact that they are collected and analyzed when a pesticide problem is suspected. In addition, a survey of triazine herbicides was carried out and a statistically based monitoring survey of fresh apples and processed rice that had been initiated in 1994 was completed. Most of the Total Diet Study findings for 1995 were generally similar to those found in earlier periods

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Table 6

Commodity Targeted Monitoring of Domestic and Imported Foods for Triazine Herbicides Conducted in 1995

Commodity	Number of Samples Analyzed	
	Domestic	Import
Apples	9	16
Bananas	2	23
Cherries	25	-
Corn	10	15
Corn, whole grain	--	1
Grapefruit	8	4
Grapes	5	20
Olives	-	25
Oranges	20	5
Pears	6	19
Plums	7	13
	---	---
Total	92	140

Table 7

Frequency of Occurrence of Pesticide Residues Found in Total Diet Study Foods in 1995[a]

Pesticide[b]	Total No. of Findings	Occurrence, %
DDT	192	25
Malathion	141	18
Chlorpyrifos-methyl	130	17
Chlorpyrifos	97	12
Dieldrin	92	12
Endosulfan	81	10
Chlorpropham	44	6
Methamidophos	40	5
Carbaryl[c]	39	5
Iprodione	31	4
Thiabendazole[d]	29	4
Dimethoate	28	4
Permethrin	25	3
Hexachlorobenzene	24	3
BHC	22	3
Dicloran	21	3
Diazinon	21	3

[a]Based on 3 market baskets analyzed in 1995 consisting of 783 items.
[b]Isomers, metabolites, and related compounds are not listed separately; they are covered under the "parent" pesticide from which they arise.
[c]Reflects overall incidence; however, only 95 selected foods per market basket (i.e., 285 items total) were analyzed for N-methylcarbamates.
[d]Reflects overall incidence; however, only 67 selected foods per market basket (i.e., 201 items total) were analyzed for the benzimidazole fungicides (thiabendazole and benomyl).

Table 8

Frequency of Occurrence of Pesticide Residues Found in Selected Baby Foods in 1991-1995[a]

Pesticide[b]	Total No. of Findings	Occurrence, %
Carbaryl[c]	77	28
Dimethoate	71	26
Iprodione	45	16
Omethoate	39	14
Malathion	36	13
Chlorpyrifos	35	13
Endosulfan	29	11
Chlorpyrifos-methyl	26	9
Thiabendazole[d]	23	8
Permethrin	22	8
Parathion	20	7
Dicloran	14	5
Propargite[e]	10	4
Acephate	9	3
Dieldrin	8	3
Benomyl[d]	7	3

[a]Based on 12 collections consisting of 276 items.
[b]Isomers, metabolites, and related compounds are not listed separately; they are covered under the "parent" pesticide from which they arise.
[c]Reflects overall incidence; however, only 17 selected foods per collection (i.e., 204 items total) were analyzed for N-methylcarbamates.
[d]Reflects overall incidence; however, only 16 selected items (i.e., 192 items total) were analyzed for the benzimidazole fungicides (thiabendazole and benomyl).
[e]Reflects overall incidence; however, only 16 selected foods per collection (i.e., 192 items total) were analyzed for this sulfur-containing compound.

FDA pesticide monitoring data collected under the regulatory monitoring approach in 1995 are available for purchase on personal computer diskettes from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161 (telephone 703-487-4650); order number PB96-503156. The databases for 1992, 1993, and 1994 are also available from NTIS. The order numbers are: 1992, PB94-500899; 1993, PB94-501681; and 1994, PB95-503132.

Appendix A

Analysis of Domestic Surveillance Samples by Commodity Group in 1995

Commodity Group	Total No. of Samples	Samples with No Residues Found, %	Samples Violative, % Over Tolerance	Samples Violative, % No Tolerance
A. Grains and Grain Products				
Corn & corn products	53	81	0	0
Oats	18	67	0	0
Rice & rice products	56	86	0	0
Soybeans	38	82	0	0
Wheat	146	38	1	0
Cereal products	23	87	0	0
Other grains & grain products	55	38	2	0
Total	389	59	<1	0
B. Milk/Dairy Products/Eggs				
Cheese & cheese products	66	68	0	0
Eggs	259	98	0	0
Milk/cream & milk products	761	93	0	0
Total	1086	93	0	0
C. Fish/Shellfish				
Fish	295	53	0	0
Shellfish	128	90	0	0
Total	423	64	0	0
D. Fruits				
Blueberries	64	61	0	17
Cranberries	20	10	0	0
Grapes	52	52	0	0
Raspberries	33	24	0	0
Strawberries	107	15	1	2
Other berries	8	75	0	0
Grapefruit	22	27	0	0
Lemons	28	57	0	0
Oranges	171	6	0	0
Other citrus fruits	6	33	0	0
Apples	189	46	0	0
Pears	69	32	7	0
Apricots	28	25	4	0
Cherries	64	17	0	0
Nectarines	26	8	0	0
Olives	12	100	0	0

Peaches	200	20	<1	<1
Other pit fruits	11	73	0	0
Cantaloupe	45	62	0	2
Honeydew	14	57	0	0
Watermelon	73	86	0	0
Apple juice	110	76	0	<1
Other fruit juices	22	82	0	0
Fruit jams/jellies/pastes/ toppings	11	36	0	0
Other fruits	52	88	0	2
Total	1437	40	<1	1
E. Vegetables				
Corn	105	90	0	0
Green/snow/sugar/sweet peas	84	86	0	0
String beans	100	67	0	0
Other beans & peas	32	91	0	0
Cucumbers	41	61	0	2
Eggplant	17	71	0	12
Peppers, hot	12	83	0	0
Peppers, sweet	40	58	0	0
Squash	33	58	0	3
Tomatoes	100	56	0	0
Other fruits used as vegetables	10	100	0	0
Broccoli	23	74	0	0
Cabbage	65	83	0	0
Cauliflower	20	90	0	0
Celery	30	30	0	3
Collards	18	67	0	6
Endive/escarole	11	91	0	45
Kale	11	45	0	9
Lettuce, head	115	37	<1	0
Mustard greens	12	17	0	0
Romaine	85	35	4	1
Spinach	37	32	0	5
Other leaf/stem vegetables	48	60	0	19
Mushrooms/truffles & products	15	100	0	0
Carrots	130	57	2	0
Onions/leeks/scallions/shallots	28	89	0	0
Potatoes	239	56	0	2
Radishes	15	73	0	0
Red beets	15	100	0	0
Sweet potatoes/yams	25	64	0	0
Other root/tuber vegetables	9	89	0	0
Vegetables, dried or paste	45	89	0	0
Other vegetables/vegetable products	15	67	0	0
Total	1585	63	<1	2

F. Other				
Peanuts	50	94	0	0
Other nuts	17	100	0	0
Vegetable oils	13	100	0	0
Honey & other sweeteners	17	88	0	0
Baby foods/formula	61	97	0	0
Other food products	23	83	0	4
Total	181	94	0	<1
A-F Total	5101	64	<1	<1

Appendix B

Analysis of Import Surveillance Samples by Commodity Group in 1995

Commodity Group	Total No. of Samples	Samples with No Residues Found, %	Samples Violative, % Over Tolerance	Samples Violative, % No Tolerance
A. Grains and Grain Products				
Rice, basmati	22	77	0	5
Rice, jasmine	34	91	0	0
Other rice & rice products	23	91	0	0
Wheat & wheat products	21	71	0	0
Other grains & grain products	16	100	0	0
Bakery products	21	86	0	5
Breakfast/snack foods	12	67	0	0
Macaroni	43	79	0	0
Spaghetti	18	72	0	0
Other pasta products	28	61	0	0
Total	238	80	0	<1
B. Dairy Products/Eggs				
Cheese & cheese products	75	93	0	0
Eggs	27	74	0	0
Total	102	88	0	0
C. Fish/Shellfish				
Fish	99	83	0	0
Shellfish	22	95	0	0
Total	121	85	0	0
D. Fruits				
Blackberries	30	40	0	3
Blueberries	38	97	0	0
Grapes	202	31	0	1
Raspberries	53	36	0	9
Strawberries	67	18	0	10
Other berries	20	55	0	0
Clementines	11	82	0	0
Limes	18	67	0	0
Oranges	30	70	0	7
Tangerines	12	58	0	0
Other citrus fruits	14	100	0	0

Apples	48	50	0	8
Pears	69	48	0	1
Apricots	10	50	0	0
Cherries	19	47	0	0
Nectarines	16	50	0	0
Olives	77	92	0	1
Peaches	52	48	0	4
Plums	31	55	0	0
Other pit fruits	13	100	0	0
Bananas	228	34	<1	0
Kiwi fruit	20	75	0	0
Mangoes	69	96	0	0
Papayas	81	72	0	9
Pineapples	65	75	5	0
Plantains	18	89	0	0
Other tropical fruits	56	89	0	7
Cantaloupe	82	40	5	2
Honeydew	53	6	0	6
Watermelon	28	50	0	0
Other vine fruits	17	82	0	0
Apple juice	19	68	0	11
Other fruit juices	52	94	0	0
Fruit jams/jellies/toppings	41	90	0	0
Fruits, dried or paste	90	90	0	0
Other fruits & fruit products	8	88	0	0
Total	1757	57	<1	3
E. Vegetables				
Corn	45	100	0	0
Green/snow/sugar/sweet peas	90	51	0	12
Mung beans	11	91	0	0
String beans	78	47	3	8
Other beans, peas, & corn	63	81	0	5
Cucumbers	96	49	0	4
Eggplant	23	48	0	0
Okra	33	73	0	9
Peppers, hot	261	46	3[a]	5
Peppers, sweet	295	76	0	1
Squash/pumpkins	110	35	0	4
Tomatoes	332	59	0	0
Other fruits used as vegetables	30	87	0	10
Artichokes	26	96	0	0
Asparagus	101	63	12	1
Bamboo shoots	20	100	0	0
Broccoli	53	70	0	0
Cabbage	16	63	0	0
Celery	20	20	0	0
Chicory	16	94	0	6

Endive/escarole	45	98	0	0
Lettuce, head	40	38	3	8
Radicchio	59	98	0	2
Romaine	44	50	7	3
Spinach	22	36	5	0
Other leaf/stem vegetables	67	64	1	10
Mushrooms/truffles, whole	47	96	0	2
Mushrooms/truffles, pieces & pr oducts	51	96	0	2
Carrots	46	67	0	0
Cassava	18	100	0	0
Onions	27	89	0	0
Potatoes	22	95	0	0
Radishes	13	62	0	0
Shallots/scallions/leeks	23	91	0	0
Sweet potatoes/yams	14	100	0	0
Water chestnuts	46	100	0	0
Other root/tuber vegetables	42	86	0	0
Vegetables, dried or paste	140	83	0	6
Vegetables with sauce	22	77	0	9
Other vegetables & vegetable products	28	82	0	0
Total	2535	67	1[a]	3[a]
F. Other				
Spices	14	75	0	0
Cashews	42	62	0	7
Peanuts	20	85	0	0
Other nuts & nut products	35	89	0	3
Edible seeds	24	75	0	17
Vegetable oils, crude	14	100	0	0
Vegetable oils, refined	15	100	0	0
Beverage bases	13	100	0	0
Bottled water, mineral/spring	19	100	0	0
Honey & other sweeteners	25	76	0	0
Other food products	58	79	0	0
Total	279	83	0	3
A-F Total	5032	66	< 1[a]	3[a]

[a]Includes samples that have both residue(s) over tolerance and residue(s) with no tolerance.

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