



# Agricultural Chemical Usage - Fruit Methodology and Quality Measures

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## Fruit Chemical Use Survey Methodology

**Scope and Purpose:** The National Agricultural Statistics Service (NASS) Fruit Chemical Use Survey (FCUS) collects entire farm level chemical use data from growers of select fruits in program states. The fruit and vegetable chemical surveys have been conducted in alternating years since 1990 with data collected on vegetables in even numbered years and fruits in odd numbered years. The states involved and the commodities surveyed are selected based on NASS acres planted and evaluated each cycle to ensure maximum coverage. NASS aims to cover at a minimum 80 percent of targeted fruit crop acres planted in the United States. Farm level data are combined during summary and, pending compliance with disclosure rules, published at state and national levels. Data are published for 23 targeted fruit crops in 12 States.

**Survey Timeline:** Data collection may begin on October 1 and continue through mid January of the following year to ensure completion of the crop year. NASS Field Offices (FOs) along with NASS Headquarters (HQ) spend the next several months reviewing reported data for reasonableness and conduct producer follow-ups, as necessary. The estimates were released to the NASS Quick Stats 2.0 system during the first week of August.

**Sampling:** The target population for the FCUS is all agricultural establishments with more than \$1,000 in agricultural sales (or potential sales). NASS uses a dual frame approach, consisting of list frame and area frame components, to provide complete coverage of this target population.

NASS maintains a list of farm and ranch operators. NASS is constantly seeking new operations from outside list sources confirmed to be qualifying farms before being added to the list. A profile, known as control data, of each operation is maintained which indicates what the farm has historically produced and a general indication of size. This information allows NASS to define sampling populations that are specific to each survey and employ advanced and more efficient sample designs.

The FCUS list sample is selected based on a calculated Farm Value of Sales (FVS). All farms on the list frame with an estimated FVS of \$1,000 or more are eligible. The value of sales control data need not be exact as it is used to stratify similar list operations into homogeneous groups.

**Sampling Frames and Methods:** The sample for the FCUS is selected from the NASS List Sampling Frame. The population of interest is fruit growers having positive list frame acreage for one or more of the target fruit crops. The sample will use the Multivariate Probability Proportional to Size (MPPS) design, in which each reporting unit's probability of selection depends on its total acres of the target crops. The reporting unit is one farm associated with the selected operator. Sampled units that were known to have multiple farms had one farm randomly selected as the reporting unit.

The 2011 FCUS consists of a single data collection phase. The sample size for the FCUS is 6,573.

**Data Collection:** All federal data collections require approval by the Office of Management and Budget (OMB). NASS must document the public need for the data, show the design applies sound statistical practice, ensure the data do not already exist elsewhere, and show that the public is not excessively burdened. The fruit chemical use questionnaires must display an active OMB number that gives NASS the authority to conduct the survey, a statement of the survey purpose and the use of the collected data, a response burden statement that estimates the time required to complete the form, a

confidentiality statement that the respondent's information will be protected from disclosure, and a statement that response to the survey is voluntary and not required by law.

Using these questionnaires, chemical data are collected only by personal visit from an enumerator. Letters were mailed out to producers prior to field contact stating the importance of cooperation and that contact will be made in the coming weeks. Once contact is made by the field enumerator, an appointment is made to collect data when the farm operator indicates no further chemical applications are remaining. The field enumerator returns the questionnaires to the NASS FO for editing. The FO sends their completed questionnaires to the National Processing Center (NPC) for keying and scanning. Questionnaire responses are captured and edited for consistency using automated systems.

**Survey Edit:** As survey data are collected and captured, they are edited for consistency and reasonableness using automated systems. Reported data are typically first edited as a "batch" of data when first captured. The edit logic ensures administrative coding follows the methodological rules associated with the survey design. Relationships between data items on the current survey are verified and in certain situations, items are compared to data from earlier surveys to make sure certain relationships are logical. The edit determines the status of each record to be either "dirty" or "clean". NASS FO statisticians will correct the errors on the report or comment to their validity if the data are deemed to be correct. Only clean records are eligible for analysis tools and summary.

**Analysis Tools:** Chemical use data are processed through an interactive data analysis tool which displays data for all reports by product or commodity. This application tool provides various tables, charts, and listing tools that allow the analyst to compare an individual record to other similar records within their state or at a national level. Outliers and unusual data relationships are investigated by FO and HQ statisticians to determine validity. Suspect data found to be in error are corrected.

**Nonsampling Errors:** Nonsampling errors are present in any survey process. These errors include reporting, recording, editing, and imputation errors. Steps are taken to minimize the impact of these errors, such as comprehensive interviewer training, validation and verification of processing systems, detailed computer edits, and the analysis tool. Re-contact with respondents is conducted on an as needed basis.

**Nonresponse Adjustment:** Response to the FCUS is voluntary. Some producers refuse to participate in the survey, others cannot be located during the data collection period, and some submit incomplete reports. These nonrespondents must be accounted for if accurate estimates of total chemical usage. For this survey, item level nonresponse is accounted for by imputing data where there are missing values. Imputed rates of application for chemicals are calculated through an automated imputation system that calculates an unweighted mean for an imputation group based on commodity, state, and product. When a group lacks sufficient responses, groups are collapsed to preserve as much of the homogeneity as possible.

**Calibration:** Calibration is a weighting technique used in survey sampling to adjust the survey weights for sampled elements so that the weighted sum of a set of benchmark variables equals a pre-determined set of values for the population. The input to the calibration algorithm is the weights generated from the sampling procedures. Sampling weights are calculated based on numerous factors so that the sample allocations are representative of the entire population of farms at the state level for the target fruit crop(s) in that state. Due to survey nonresponse, weights are adjusted through a calibration algorithm. Calibration adjusts the sampling weights so the expanded data will match planted acreage totals from the July Noncitrus Fruits and Nuts report and the September Citrus Fruits Summary. This ensures that the chemical data collected will accurately represent the chemical usage for all target fruit crops for the entire target population.

**Estimators:** The FCUS utilizes direct expansions and/or ratio indications for all survey indications. Direct expansions are calculated by applying sampling weights and non-response adjustments to reported data and summing these values.

**Outliers:** NASS conducts a review of outliers found in the chemical use data by reviewing application rates for all records for the same product and commodity combinations. The FO and HQ statisticians work together to ensure the data are as accurate as possible. The FO statisticians review outliers within their states, and the HQ statistician examines outliers across all states for the published categories. A determination is made as to whether an adjustment to the application data

is required. Most outliers trace back to unique situations that do not exist in the target population as much as the survey weight would indicate.

**Estimation:** HQ statisticians execute a summary that generates state level and national level indications. Field office statisticians are responsible for performing a detailed review of their survey results and providing comments that justify their survey results. HQ statisticians conduct a final review of survey results from all states. Any irregularities revealed by the summary must be investigated and, if necessary, resolved. After final review, national level summary results are adopted as official national estimates except in cases where strong justification supports deviating from survey totals.

For this survey there are two main types of data that NASS estimates - pesticide application and Integrated Pesticide Management (IPM) data. For the application data, NASS collects information about commercial pesticides applied during the crop year. Fertilizer data is collected every other survey year. For pesticides, these applications are collected at the product level, generally per application. These product level data are converted to pounds of active ingredient, summarized, and published. If there are not a sufficient number of reports, the data are suppressed from publication, along with any needed complementary suppression.

For the pesticide application data, NASS estimates Area Applied (percent acres treated), Number of Applications, Rate per Application (pounds of active ingredient per acre), Rate per Crop Year (number of applications multiplied by rate per application), and Total Amount Applied. In order to publish data for an active ingredient, there must be a minimum number of reports for the specific active ingredient at the summary level (by crop, by state, or all program states). If there are not a sufficient number of reports, the data is suppressed from publication, along with any needed complementary suppression.

The standard deviation for each active ingredient is calculated to determine data distribution for each crop. Chemical distribution rates are given by active ingredient for the Percent of Acres Treated, Number of Applications, Rate per Application, and Rate per Crop Year. Rate Distribution tables include the median, the 10<sup>th</sup> and 90<sup>th</sup> percentiles, the mean, and the coefficient of variation (CV) for an active ingredient when a sufficient number of farm operators report applying it on the specified crop.

The IPM data are generally a series of yes/no questions pertaining to specific pest management practices. IPM data are collected for the entire operation. From these data, NASS releases the percent of operations using the practice as well as the percent of acreage. The percent of acreage assumes that, if the operation uses the practice on one acre, it is used on all acres. This also means that the IPM data are not crop specific; they are distributed across all fruit acres.

## Quality Metrics for Agricultural Chemical Usage

**Purpose and Definitions:** Under the guidance of the Statistical Policy Office of the Office of Management and Budget (OMB), the United States Department of Agriculture’s National Agricultural Statistics Service (NASS) provides data users with quality metrics for its published data series. The metrics tables below describe the performance data for the survey contributing to the publication. The accuracy of data products may be evaluated through sampling and non-sampling error. The measurement of error due to sampling in the current period is evaluated by the coefficient of variation for each estimated item. Non-sampling error is evaluated by response rates and the percent of the estimate from respondents.

**Sample Size** is the number of observations selected from the population that are used to be representative of the entire population.

**Response rates** measure the proportion of the sample that is represented by the responding units in the survey.

**Coefficient of Variation** provides a measure of the size for the standard error relative to the point estimate and is used to measure the precision of the results of a survey estimator.

### Fruit Chemical Distribution, Sample Size, and Response Rates – Program States: 2011

State	Sample size	Response rate
	2011	2011
California .....	2,287	52.2
Florida .....	565	63.4
Georgia .....	158	72.8
Michigan .....	622	70.6
New Jersey .....	167	68.3
New York .....	384	64.8
North Carolina .....	256	72.3
Oregon .....	614	68.4
Pennsylvania .....	239	72.8
South Carolina .....	75	68.0
Texas .....	377	62.1
Washington .....	829	65.5
Program States .....	6,573	62.0

**Apples: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
2,4-D, dimeth. salt .....	12	4	8	9
Carfentrazone-ethyl .....	25	6	5	7
Diuron .....	21	3	8	11
Glyphosate iso. salt .....	16	9	5	11
Glyphosate pot. salt .....	27	8	9	8
Oryzalin .....	43	19	12	18
Paraquat .....	18	4	7	7
Pendimethalin .....	16	7	8	12
Rimsulfuron .....	30	11	8	11
Simazine .....	23	4	6	8
Terbacil .....	50	2	23	23
<b>Insecticides</b>				
Abamectin .....	10	3	5	5
Acetamiprid .....	8	8	4	6
Azinphos-methyl .....	9	5	3	5
Beta-cyfluthrin .....	19	6	4	7
Bifenazate .....	23	1	3	3
Bt kurstaki ABTS-351 .....	23	15	(NA)	(NA)
Carbaryl .....	8	3	4	5
Chlorantraniliprole .....	10	4	2	4
Chlorpyrifos .....	9	2	3	3
Clothianidin .....	17	10	6	12
Cyfluthrin .....	17	7	12	13
Diazinon .....	22	4	9	7
Emamectin benzoate .....	13	6	2	7
Endosulfan .....	62	18	10	18
Esfenvalerate .....	11	6	6	7
Etoxazole .....	21	2	5	5
Fenpropathrin .....	15	8	6	10
Fenpyroximate .....	12	3	4	3
Flubendiamide .....	20	6	6	7
Formetanate hydro. ....	11	7	3	8
Imidacloprid .....	9	5	3	7
Indoxacarb .....	28	13	7	10
Kaolin .....	31	10	7	7
Lambda-cyhalothrin .....	10	8	4	7
Methomyl .....	14	20	13	17
Methoxyfenozide .....	14	3	2	4
Novaluron .....	19	4	6	6
Petroleum distillate .....	35	17	13	20
Phosmet .....	8	6	5	8
Pyridaben .....	20	5	5	9
Pyriproxyfen .....	27	12	7	12
Spinetoram-J .....	13	4	3	3
Spinetoram-L .....	13	4	3	3
Spinosad .....	30	7	6	12
Spirotetramat .....	26	8	4	8
Thiacloprid .....	9	4	3	5
Thiamethoxam .....	9	8	4	6

See footnote(s) at end of table.

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**Apples: Agricultural Chemical Distribution Table – Program States: 2011 (continued)**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Fungicides</b>				
Bacillus subtilis .....	33	7	(NA)	(NA)
Basic copper sulfate .....	11	6	8	8
Boscalid .....	10	4	2	4
Calcium polysulfide .....	21	6	6	4
Captan .....	2	4	4	5
Copper chloride hyd. ....	28	12	17	15
Copper hydroxide .....	21	9	16	12
Cyprodinil .....	8	6	3	8
Difenoconazole .....	5	5	6	8
Dodine .....	23	9	8	13
Fenarimol .....	20	7	5	5
Fenbuconazole .....	11	8	3	8
Kresoxim-methyl .....	10	6	4	5
Mancozeb .....	5	4	2	3
Metiram .....	15	9	8	11
Mono-potassium salt .....	21	11	17	15
Myclobutanil .....	13	7	2	7
Oxytetracycline calc .....	22	9	7	13
Potassium bicarbon. ....	85	38	3	40
Pyraclostrobin .....	10	4	2	4
Pyrimethanil .....	19	7	7	7
Streptomycin sulfate .....	8	10	6	13
Sulfur .....	13	7	6	5
Thiophanate-methyl .....	8	7	7	10
Trifloxystrobin .....	18	6	4	8
Triflumizole .....	15	4	4	7
Ziram .....	10	8	5	7
<b>Other Chemicals</b>				
Benzyladenine .....	9	3	10	9
Butenoic Acid Hydro. ....	14	4	5	5
Cytokinins .....	23	12	5	14
Dodecadien-1-ol .....	11	2	12	13
Dodecanol .....	13	3	4	5
Ethephon .....	13	4	11	10
Flutriafol .....	23	6	2	6
Gibberellins A4A7 .....	14	5	5	9
Mineral oil .....	10	7	7	13
NAA, Ammonium salt .....	18	6	26	26
NAA, Potassium salt .....	15	3	19	20
NAA, Sodium .....	8	10	7	9
NAD .....	25	5	7	10
Prohexadione calcium .....	18	6	8	10
Spirodiclofen .....	16	3	3	2
Tetradecanol .....	13	3	4	4

(NA) Not available.

**Avocados: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
Herbicides				
Glyphosate iso. salt .....	47	17	18	14
Insecticides				
Abamectin .....	20	9	15	22
Other Chemicals				
Mineral oil .....	25	5	9	11

**Blackberries: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
Fungicides				
Boscalid .....	20	10	19	16
Calcium polysulfide .....	45	13	22	23
Pyraclostrobin .....	21	10	19	15

**Blueberries: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
Diuron .....	15	3	9	11
Flumioxazin .....	22	5	5	6
Glufosinate-ammonium .....	27	10	9	16
Glyphosate iso. salt .....	17	7	12	15
Hexazinone .....	18	6	14	15
Mesotrione .....	12	5	11	15
Norflurazon .....	17	3	7	8
Oryzalin .....	20	5	13	12
Paraquat .....	19	18	6	18
Sethoxydim .....	30	10	18	15
Simazine .....	19	7	10	15
Terbacil .....	20	5	12	11
<b>Insecticides</b>				
Acetamiprid .....	25	6	3	6
Azinphos-methyl .....	20	9	4	10
Carbaryl .....	23	12	6	14
Diazinon .....	20	12	15	8
Esfenvalerate .....	14	6	9	11
Imidacloprid .....	19	6	6	8
Malathion .....	11	13	10	13
Methomyl .....	22	10	6	13
Methoxyfenozide .....	16	5	6	10
Phosmet .....	8	6	1	6
Xylene .....	20	13	13	14
Zeta-cypermethrin .....	11	6	5	6
<b>Fungicides</b>				
Azoxystrobin .....	19	22	5	19
Boscalid .....	7	7	2	8
Calcium polysulfide .....	34	2	29	29
Captan .....	10	7	4	8
Chlorothalonil .....	23	6	9	11
Copper hydroxide .....	31	19	25	13
Cyprodinil .....	13	11	4	15
Fenbuconazole .....	7	6	6	8
Fenhexamid .....	29	9	5	10
Fludioxonil .....	13	11	4	15
Propiconazole .....	28	12	8	13
Pyraclostrobin .....	7	7	2	8
Ziram .....	13	7	2	7
<b>Other Chemicals</b>				
Reynoutria sachaline .....	23	26	13	31



## Cherries, Sweet: Agricultural Chemical Distribution Table – Program States: 2011

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
2,4-D, dimeth. salt .....	49	9	15	21
Glyphosate iso. salt .....	21	13	10	20
Oryzalin .....	29	8	10	13
Oxyfluorfen .....	21	12	30	41
Paraquat .....	14	9	24	23
Pendimethalin .....	25	6	28	32
<b>Insecticides</b>				
Abamectin .....	50	11	3	14
Acetamiprid .....	33	3	4	7
Azinphos-methyl .....	10	4	3	4
Carbaryl .....	17	6	5	5
Chlorpyrifos .....	11	4	3	6
Diazinon .....	33	11	5	12
Dimethoate .....	21	1	6	6
Esfenvalerate .....	31	9	10	8
Flubendiamide .....	19	9	5	12
Imidacloprid .....	12	4	2	4
Lambda-cyhalothrin .....	14	8	10	16
Malathion .....	20	14	5	11
Methoxyfenozide .....	26	5	5	8
Permethrin .....	34	9	19	18
Spinetoram-J .....	17	4	3	6
Spinetoram-L .....	17	4	3	6
Spinosad .....	17	15	21	12
Thiamethoxam .....	24	7	4	7
<b>Fungicides</b>				
Basic copper sulfate .....	21	5	14	12
Boscalid .....	12	4	2	4
Calcium polysulfide .....	108	30	59	29
Captan .....	12	13	7	17
Chlorothalonil .....	12	9	6	10
Copper hydroxide .....	19	8	4	10
Fenarimol .....	20	9	3	11
Fenbuconazole .....	9	7	11	13
Iprodione .....	29	6	6	4
Myclobutanil .....	24	5	2	6
Potassium bicarbon. ....	24	7	2	6
Propiconazole .....	28	8	3	7
Pyraclostrobin .....	10	4	2	4
Quinolin .....	16	5	1	5
Sulfur .....	16	10	5	8
Tebuconazole .....	44	19	13	12
Thiophanate-methyl .....	19	7	5	8
Trifloxystrobin .....	15	9	4	11
Triflumizole .....	15	5	2	5
Ziram .....	10	13	5	12
<b>Other Chemicals</b>				
Cytokinins .....	57	36	7	43
Ethephon .....	10	1	9	10
Gibberellic acid .....	14	4	18	19
Mineral oil .....	21	24	10	28

### Cherries, Tart: Agricultural Chemical Distribution Table – Program States: 2011

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
2,4-D, dimeth. salt .....	30	5	16	17
Glyphosate iso. salt .....	14	3	10	11
Paraquat .....	44	5	14	13
<b>Insecticides</b>				
Azinphos-methyl .....	8	19	24	10
Chlorpyrifos .....	29	14	26	38
Esfenvalerate .....	10	51	51	8
Imidacloprid .....	45	9	13	13
Permethrin .....	22	10	17	11
Phosmet .....	25	4	5	4
Thiamethoxam .....	34	5	4	5
<b>Fungicides</b>				
Boscalid .....	33	5	6	7
Captan .....	27	9	4	9
Chlorothalonil .....	8	32	12	21
Dodine .....	12	19	12	8
Fenbuconazole .....	38	10	11	14
Myclobutanil .....	22	19	7	15
Pyraclostrobin .....	33	5	6	7
Sulfur .....	18	57	67	15
Tebuconazole .....	59	15	10	23
Trifloxystrobin .....	17	40	28	14
<b>Other Chemicals</b>				
Ethephon .....	5	3	11	13
Gibberellic acid .....	39	6	17	17

**Grapefruit: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
Bromacil .....	61	7	5	12
Diuron .....	43	10	6	12
Glyphosate iso. salt .....	65	16	18	32
Glyphosate pot. salt .....	69	24	12	23
Norflurazon .....	59	26	34	59
Simazine .....	65	7	4	11
<b>Insecticides</b>				
Abamectin .....	52	69	54	19
Chlorpyrifos .....	77	111	58	53
Diflubenzuron .....	70	39	9	36
Fenbutatin-oxide .....	79	11	2	12
Fenpropathrin .....	64	44	37	12
Imidacloprid .....	27	39	7	39
Pyridaben .....	61	4	9	7
Pyriproxyfen .....	85	45	62	40
Spirotetramat .....	41	35	6	36
Sulfur .....	51	73	8	76
Thiamethoxam .....	59	50	15	64
Zeta-cypermethrin .....	50	40	11	34
<b>Fungicides</b>				
Copper hydroxide .....	38	112	14	110
Fenbuconazole .....	37	43	16	59
Pyraclostrobin .....	92	26	41	64
Trifloxystrobin .....	64	99	65	37
<b>Other Chemicals</b>				
Mineral oil .....	44	59	14	47
Spirodiclofen .....	34	35	17	20

**Grapes, All: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
Carfentrazone-ethyl .....	34	4	17	18
Flumioxazin .....	23	10	15	16
Glufosinate-ammonium .....	14	6	13	13
Glyphosate iso. salt .....	21	5	7	9
Glyphosate pot. salt .....	26	18	5	16
Oryzalin .....	77	4	19	16
Oxyfluorfen .....	17	10	14	12
Paraquat .....	60	9	7	10
Pendimethalin .....	33	3	17	17
Rimsulfuron .....	55	4	27	26
Simazine .....	48	12	14	20
<b>Insecticides</b>				
Abamectin .....	33	8	7	4
Bifenthrin .....	28	7	13	13
Carbaryl .....	27	9	6	13
Fenpropathrin .....	50	15	21	21
Imidacloprid .....	15	5	12	13
Methoxyfenozide .....	21	4	10	10
Spirotetramat .....	31	3	4	5
<b>Fungicides</b>				
Azoxystrobin .....	43	12	2	12
Basic copper sulfate .....	107	29	29	10
Boscalid .....	18	5	5	4
Captan .....	17	23	6	28
Copper hydroxide .....	20	7	7	10
Cyprodinil .....	18	7	8	12
Difenoconazole .....	40	5	4	4
Fenarimol .....	49	4	12	16
Fenhexamid .....	28	5	2	5
Kresoxim-methyl .....	27	1	11	11
Mancozeb .....	9	7	3	7
Mandipropamide Techn .....	19	12	3	11
Myclobutanil .....	27	10	5	13
Potassium bicarbon. ....	36	18	9	13
Pyraclostrobin .....	18	5	5	4
Quinoline .....	26	3	3	5
Sulfur .....	11	21	9	16
Tebuconazole .....	32	20	3	22
Trifloxystrobin .....	13	19	6	14
Triflumizole .....	25	8	5	10
Ziram .....	31	7	8	13
<b>Other Chemicals</b>				
Gibberellic acid .....	13	28	22	31
Mineral oil .....	22	16	13	19

**Grapes, Raisin: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
Fungicides				
Sulfur .....	24	22	10	30

**Grapes, Wine: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
Herbicides				
Flumioxazin .....	24	13	14	16
Glufosinate-ammonium .....	14	7	19	17
Glyphosate iso. salt .....	26	8	9	12
Glyphosate pot. salt .....	20	9	11	12
Oxyfluorfen .....	21	12	17	14
Pendimethalin .....	33	3	18	18
Insecticides				
Abamectin .....	30	4	4	7
Imidacloprid .....	18	5	20	20
Fungicides				
Boscalid .....	32	7	9	6
Copper hydroxide .....	21	7	10	11
Cyprodinil .....	29	5	7	8
Kresoxim-methyl .....	31	4	5	6
Myclobutanil .....	22	5	4	6
Potassium bicarbon. ....	84	28	3	29
Pyraclostrobin .....	32	7	9	6
Quinoline .....	17	4	4	4
Sulfur .....	16	17	6	21
Tebuconazole .....	25	10	4	7
Trifloxystrobin .....	19	10	6	11
Other Chemicals				
Mineral oil .....	26	12	16	16

**Lemons: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
Herbicides				
Glyphosate iso. salt .....	56	22	55	48
Other Chemicals				
Gibberellic acid .....	32	6	13	14
Mineral oil .....	97	11	63	56

**Oranges, All: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
2,4-D, isoprop. salt .....	30	16	23	24
Bromacil .....	28	11	18	26
Diuron .....	26	15	23	20
Glyphosate iso. salt .....	42	40	24	28
Glyphosate pot. salt .....	122	38	34	63
Norflurazon .....	33	25	24	21
Paraquat .....	28	11	13	18
Pendimethalin .....	63	36	17	41
Rimsulfuron .....	270	124	23	115
Simazine .....	54	8	14	16
<b>Insecticides</b>				
Abamectin .....	13	19	15	23
Carbaryl .....	54	34	4	33
Chlorpyrifos .....	42	33	49	25
Diflubenzuron .....	45	42	76	45
Dimethoate .....	32	48	21	37
Fenpropathrin .....	25	49	5	53
Imidacloprid .....	35	22	21	19
Malathion .....	98	14	90	80
Phosmet .....	30	21	18	22
Pyriproxyfen .....	54	41	19	34
Spinetoram-J .....	26	11	5	14
Spinetoram-L .....	26	11	5	14
Spinosad .....	228	10	26	17
Spirotetramat .....	26	14	5	12
Sulfur .....	46	18	7	19
Thiamethoxam .....	31	6	37	35
Zeta-cypermethrin .....	14	20	2	20
<b>Fungicides</b>				
Basic copper sulfate .....	35	21	12	26
Copper hydroxide .....	19	18	11	13
Mefenoxam .....	32	13	29	26
Trifloxystrobin .....	34	4	21	24
<b>Other Chemicals</b>				
2,4-D, isoprop ester .....	23	46	25	70
Gibberellic acid .....	58	32	3	35
Mineral oil .....	13	24	15	19
Spirodiclofen .....	36	44	3	44

**Peaches: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
2,4-D, dimeth. salt .....	122	5	45	45
Glyphosate iso. salt .....	64	8	11	15
Oxyfluorfen .....	78	6	51	52
Paraquat .....	234	42	161	119
Pendimethalin .....	57	4	129	128
Simazine .....	61	18	18	21
<b>Insecticides</b>				
Acetamiprid .....	36	6	8	9
Beta-cyfluthrin .....	63	53	14	40
Carbaryl .....	30	10	21	23
Chlorantraniliprole .....	95	14	13	17
Chlorpyrifos .....	109	29	50	38
Cyfluthrin .....	26	73	4	72
Endosulfan .....	73	34	61	87
Esfenvalerate .....	36	14	14	26
Fenpropathrin .....	28	22	15	11
Imidacloprid .....	43	10	15	16
Lambda-cyhalothrin .....	59	42	19	31
Methomyl .....	22	11	12	13
Permethrin .....	150	91	27	98
Phosmet .....	65	36	20	25
Thiamethoxam .....	59	35	17	33
<b>Fungicides</b>				
Basic copper sulfate .....	78	16	69	85
Boscalid .....	50	12	9	7
Captan .....	31	19	8	17
Chlorothalonil .....	29	56	24	78
Copper hydroxide .....	53	54	52	87
Cyprodinil .....	252	13	3	13
Fenbuconazole .....	58	5	15	20
Iprodione .....	94	3	10	11
Myclobutanil .....	25	18	12	9
Oxytetracycline calc .....	36	7	13	10
Propiconazole .....	40	37	4	36
Pyraclostrobin .....	50	12	10	7
Sulfur .....	11	25	27	45
Tebuconazole .....	128	47	21	64
Thiophanate-methyl .....	46	75	26	53
Ziram .....	87	25	8	32
<b>Other Chemicals</b>				
Mineral oil .....	101	32	53	28

**Pears: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
2,4-D, dimeth. salt .....	31	23	11	32
Glyphosate iso. salt .....	20	11	9	15
<b>Insecticides</b>				
Abamectin .....	12	3	3	4
Acetamiprid .....	24	6	4	6
Azinphos-methyl .....	23	6	4	5
Bifenazate .....	25	3	3	5
Buprofezin .....	20	16	4	18
Chlorantraniliprole .....	16	6	2	6
Chlorpyrifos .....	19	4	2	5
Endosulfan .....	16	7	3	10
Etoxazole .....	21	7	2	8
Imidacloprid .....	22	6	10	15
Kaolin .....	22	30	11	22
Lambda-cyhalothrin .....	13	4	2	6
Novaluron .....	20	5	2	5
Petroleum distillate .....	19	8	9	13
Piperonyl butoxide .....	15	9	9	18
Pyridaben .....	16	6	2	6
Pyriproxyfen .....	10	4	2	5
Spinetoram-J .....	13	5	1	6
Spinetoram-L .....	13	5	1	6
Spirotetramat .....	10	6	1	6
Thiamethoxam .....	16	6	5	6
<b>Fungicides</b>				
Basic copper sulfate .....	24	5	5	6
Boscalid .....	15	6	2	7
Calcium polysulfide .....	46	18	12	23
Copper hydroxide .....	15	15	18	13
Mancozeb .....	9	9	6	8
Oxytetracycline calc .....	16	29	11	21
Pyraclostrobin .....	15	6	2	7
Streptomycin sulfate .....	15	35	28	28
Sulfur .....	16	6	5	6
Thiophanate-methyl .....	18	5	5	6
Trifloxystrobin .....	45	21	2	21
Triflumizole .....	15	5	6	10
Ziram .....	38	21	8	24
<b>Other Chemicals</b>				
Benzyladenine .....	18	3	24	24
Cytokinins .....	31	13	8	19
Dodecadien-1-ol .....	29	11	11	10
Dodecanol .....	33	14	15	22
Mineral oil .....	8	4	8	8
NAA, Ammonium salt .....	32	3	14	15
NAA, Potassium salt .....	21	3	7	8
Tetradecanol .....	33	14	15	22



**Prunes: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
Glyphosate iso. salt .....	366	35	21	21
Oxyfluorfen .....	365	50	68	110
<b>Insecticides</b>				
Esfenvalerate .....	676	32	24	54
<b>Fungicides</b>				
Chlorothalonil .....	456	7	16	16
Propiconazole .....	614	53	7	46
Sulfur .....	641	22	129	120
<b>Other Chemicals</b>				
Mineral oil .....	828	39	12	43

**Raspberries: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
Carfentrazone-ethyl .....	12	10	8	14
Paraquat .....	6	8	6	8
Simazine .....	26	12	6	9
<b>Insecticides</b>				
Bifenthrin .....	9	8	1	8
Diazinon .....	15	6	15	14
<b>Fungicides</b>				
Boscalid .....	15	6	(Z)	6
Captan .....	6	8	19	16
Cyprodinil .....	8	10	21	23
Fludioxonil .....	8	10	21	23
Pyraclostrobin .....	15	6	(Z)	6

(Z) Less than half of the unit shown.

**Tangelos: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
Glyphosate iso. salt .....	42	27	28	51
<b>Insecticides</b>				
Abamectin .....	37	52	29	26
<b>Fungicides</b>				
Copper hydroxide .....	32	38	17	45
<b>Other Chemicals</b>				
Mineral oil .....	34	7	12	10
Spirodiclofen .....	48	17	13	8

**Tangerines: Agricultural Chemical Distribution Table – Program States: 2011**

Active ingredient	Percent of acres treated	Number of applications	Rate per application	Rate per crop year
	(CV percent)	(CV percent)	(CV percent)	(CV percent)
<b>Herbicides</b>				
Diuron .....	76	71	67	15
Glyphosate iso. salt .....	64	14	16	23
Glyphosate pot. salt .....	91	67	33	68
<b>Insecticides</b>				
Abamectin .....	138	83	39	76
Chlorpyrifos .....	178	12	332	345
Diflubenzuron .....	29	17	68	82
Fenpropathrin .....	225	67	70	10
Imidacloprid .....	216	99	51	111
Spinetoram-J .....	81	6	161	161
Spinetoram-L .....	81	6	161	161
Spirotetramat .....	38	10	11	18
Sulfur .....	30	27	15	21
Zeta-cypermethrin .....	21	12	3	14
<b>Fungicides</b>				
Copper hydroxide .....	301	211	123	93
<b>Other Chemicals</b>				
Mineral oil .....	137	78	183	246
Spirodiclofen .....	119	16	59	64

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