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Agricultural Chemical Usage Postharvest Applications - Apples and Pears

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Postharvest Chemical Use Estimates for Apples and Pears

Overview

The agricultural chemical use estimates in this report are based on data compiled from the 2002 Postharvest Chemical Use Survey. The Postharvest Survey was conducted for apples and pears in the late summer to fall of 2002, referencing the 2001 crop year apples and pears stored. All results refer to pesticide applications made at off-farm storage facilities after the fruits were harvested. These applications were made at the fruit storage facility or the processing facility. On-farm postharvest applications were beyond the scope of this survey. The time frame for postharvest applications included in this publication was from August 1, 2001 to September 30, 2002 for apples; and from August 1, 2001 through July 31, 2002 for pears.

In the six States surveyed, there were 689 apple storage facility reports and 108 pear storage facility reports summarized. The U.S. map below depicts the number of summarized reports for each State in the 2002 Apple and Pear Postharvest Survey.

Apple and Pear Postharvest Number of Usable Reports, 2001-02 Marketing Year

a - Apples p - Pears



Overview (continued)

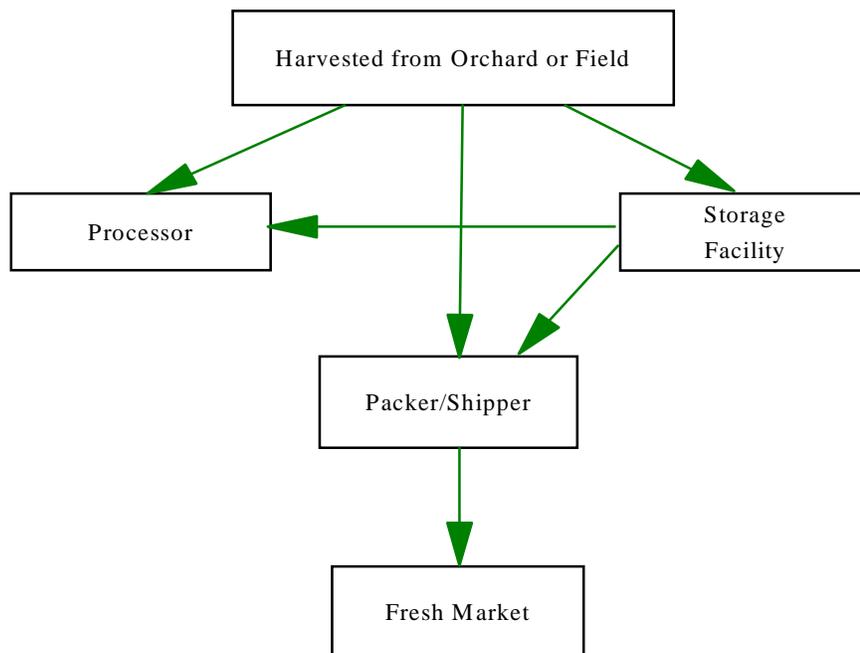
Apples and pears moving from a storage operation to a packing/shipping operation will be duplicated in the reported total amount handled. The intent of the survey was to obtain the entire amount of chemicals applied to stored apple and pears, therefore this duplication is necessary. All apples and pears handled in the selected States in the survey were included; State or region of origin was not considered a factor.

Totals for the States surveyed as well as individual State totals are published for the percent of apples and pears treated, rate per application, rate per marketing year, and the total amount of active ingredient applied. Other tables included in this report detail total pesticide usage by class, methods of pesticide applications, and volume of fruit treated with wax.

Though commonly used as a carrier, the active ingredient petroleum distillate is classified by the Environmental Protection Agency (EPA) as a pesticide. Therefore, petroleum distillate is reported in the insecticide class of postharvest chemicals applied, based on the EPA classification.

Apple and pear storage operators were also asked a series of questions concerning their pest management practices related to the fruit handled. Answers to these questions are summarized and included in this report. A copy of the survey instrument used to collect the data is also included.

Apple and Pear Postharvest Marketing Channels



Highlights

2001 Apple and Pear Postharvest Agricultural Chemical Use Survey: Apple storage facilities and processors applied a total of 222,100 pounds of postharvest active ingredients to stored apples during August 2001 through September 2002 in the five States surveyed. This total amount applied includes fungicides as well as other types of chemicals including antioxidants, waxes, and fruit wash/cleaner treatments. States surveyed for apple and pear postharvest chemical use do not necessarily correspond to major apple producing States.

Pear storage and processing facilities applied a total of 320,900 pounds of postharvest active ingredients to pears during August 2001 through July 2002 in the three States surveyed. This total amount applied includes insecticides and fungicides as well as other types of chemicals including antioxidants, waxes, and fruit wash/cleaner treatments. The pounds of active ingredients on certain pear wraps was also calculated and included in the total pounds applied. States surveyed for pear postharvest chemical use do not necessarily correspond to major pear producing States.

Commonly Used Active Ingredients on Apples: The active ingredient most commonly used as a postharvest application to apples, based on total pounds applied in the surveyed States, was diphenylamine, at 101,100 pounds, followed by thiabendazole, at 48,800 pounds. Diphenylamine is actually a plant growth regulator used to control storage scald and thiabendazole is a fungicide that prevents postharvest decay.

Of the total chemical applications made to the 2001-02 marketing year apples in the five selected States, 47 percent were drench applications, 28 percent by direct spray, and 17 percent in the dump tank, while 8 percent used a drip or brush-on method.

Commonly Used Active Ingredients on Pears: The three active ingredients used most commonly in the three States surveyed were sodium silicate, sodium sulfate anhydrous, and sodium o-phenylphenate. Sodium silicate had the highest total quantity used, at 159,100 pounds applied during 2001 in the surveyed States. Sodium sulfate anhydrous had the second highest total pounds used, at 91,300 pounds, followed by sodium o-phenylphenate, for which 32,700 total pounds were applied in the selected States.

No pear chemical use data were able to be published for California due to National Agricultural Statistics Service (NASS) confidentiality and disclosure restrictions.

Of the total chemical applications made to the 2001-02 marketing year pears in the three selected States, 40 percent were applied in the float tank, 36 percent by direct spray, 10 percent were drench applications, 9 percent by hand wrapping with pear wraps, and 3 percent used a drip or brush-on method. An insignificant number of gas or fog applications was used on pears.

**Apples: Postharvest Chemical Applications,
Percent Treated and Total Applied,
Program States and Total, 2001-02 Marketing Year**

State	Volume Handled	Percent Treated and Total Applied			
		Fungicide		Other Chemical	
	<i>Mil. Lbs.</i>	<i>Percent</i>	<i>1,000 Lbs.</i>	<i>Percent</i>	<i>1,000 Lbs.</i>
CA	599.3	5.28	2.9	18.20	2.9
MI	1,261.0	7.51	1.1	18.77	4.7
NY	1,089.0	13.84	3.9	19.94	4.3
PA	860.5	8.28	2.5	19.84	3.1
WA	5,810.7	43.97	45.1	60.06	151.6
Total	9,620.4	30.18	55.4	43.90	166.7

**Apples: Postharvest Chemical Applications,
Chemical Application Rates and Total Applied,
2001-02 Marketing Year^{1 2}**

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	<i>Percent</i>	<i>Number</i>	<i>Pounds per 1,000 Lbs.</i>	<i>Pounds per 1,000 Lbs.</i>	<i>1,000 Lbs.</i>
Fungicides:					
Captan	1.51	1.0	0.02	0.02	3.0
Sodium o-phenylphenate	0.55	1.0	0.06	0.06	3.3
Thiabendazole	28.76	1.3	0.01	0.02	48.8
Other:					
Calcium chloride	0.51	1.0	0.15	0.15	7.2
Chlorine	15.62	1.0	*	*	1.4
Chlorine dioxide	9.52	1.0	*	*	1.4
Citric acid	4.10	1.1	0.04	0.04	15.5
Diphenylamine	21.76	1.0	0.05	0.05	101.1
Dodecylbenzene sodium sulfonate	2.31	1.0	*	*	0.3
Dodecylbenzenesulfonic acid	3.01	1.1	*	*	0.9
Hydrogen chloride	5.97	1.1	0.01	0.01	6.0
Phosphoric acid	10.60	1.1	0.01	0.01	13.9
Silicon emulsion	11.36	1.2	*	*	0.1
Sodium hypochlorite	9.87	1.1	0.02	0.02	18.2

* Rate applied is less than 0.01 pounds per 1,000 pounds.

¹ Volume handled by apple storage and processing facilities in the five States surveyed was 9,620.4 million pounds. States included are CA, MI, NY, PA, and WA.

² Insufficient or limited reports to publish usage data for benomyl, acidic cleaner, alkaline cleaner, Candida oleophila isolate, ethoxyquin, fruit wax, organic cleaner, Pseudomonas syringae ESC-10, Pseudomonas syringae ESC-11, and sodium chlorite.

**Apples: Postharvest Chemical Applications,
Chemical Application Rates and Total Applied,
California, 2001-02 Marketing Year ^{1 2}**

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	<i>Percent</i>	<i>Number</i>	<i>Pounds per 1,000 Lbs.</i>	<i>Pounds per 1,000 Lbs.</i>	<i>1,000 Lbs.</i>
Diphenylamine	7.04	1.9	0.02	0.04	1.7

¹ Volume handled by California apple storage and processing facilities was 599.3 million pounds.

² Insufficient or limited reports to publish usage data for acidic cleaner, alkaline cleaner, calcium chloride, chlorine, citric acid, dodecylbenzene sodium sulfonate, fruit wax, sodium hypochlorite, silicon emulsion, sodium o-phenylphenate, and thiabendazole.

**Apples: Postharvest Chemical Applications,
Chemical Application Rates and Total Applied,
Michigan, 2001-02 Marketing Year ^{1 2}**

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	<i>Percent</i>	<i>Number</i>	<i>Pounds per 1,000 Lbs.</i>	<i>Pounds per 1,000 Lbs.</i>	<i>1,000 Lbs.</i>
Chlorine dioxide	2.16	1.0	*	*	0.1
Diphenylamine	9.13	1.0	0.04	0.04	4.3
Thiabendazole	7.34	1.1	0.01	0.01	1.0

* Rate applied is less than 0.01 pounds per 1,000 pounds.

¹ Volume handled by Michigan apple storage and processing facilities was 1,261.0 million pounds.

² Insufficient or limited reports to publish usage data for alkaline cleaner, calcium chloride, captan, chlorine, dodecylbenzene sodium sulfonate, and fruit wax.

**Apples: Postharvest Chemical Applications,
Chemical Application Rates and Total Applied,
New York, 2001-02 Marketing Year ^{1 2}**

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	<i>Percent</i>	<i>Number</i>	<i>Pounds per 1,000 Lbs.</i>	<i>Pounds per 1,000 Lbs.</i>	<i>1,000 Lbs.</i>
Captan	5.84	1.0	0.02	0.03	1.6
Diphenylamine	12.48	1.0	0.03	0.03	3.7
Thiabendazole	11.74	1.2	0.01	0.01	1.2

¹ Volume handled by New York apple storage and processing facilities was 1,089.0 million pounds.

² Insufficient or limited reports to publish usage data for benomyl, calcium chloride, chlorine, fruit wax, and sodium o-phenylphenate.

**Apples: Postharvest Chemical Applications,
Chemical Application Rates and Total Applied,
Pennsylvania, 2001-02 Marketing Year ^{1 2}**

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	<i>Percent</i>	<i>Number</i>	<i>Pounds per 1,000 Lbs.</i>	<i>Pounds per 1,000 Lbs.</i>	<i>1,000 Lbs.</i>
Diphenylamine	6.05	1.2	0.03	0.03	1.6

¹ Volume handled by Pennsylvania apple storage and processing facilities was 860.5 million pounds.

² Insufficient or limited reports to publish usage data for captan, chlorine, ethoxyquin, fruit wax, silicon emulsion, sodium hypochlorite, sodium o-phenylphenate, and thiabendazole.

**Apples: Postharvest Chemical Applications,
Chemical Application Rates and Total Applied,
Washington, 2001-02 Marketing Year ^{1 2}**

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	<i>Percent</i>	<i>Number</i>	<i>Pounds per 1,000 Lbs.</i>	<i>Pounds per 1,000 Lbs.</i>	<i>1,000 Lbs.</i>
Calcium chloride	0.53	1.0	0.18	0.18	5.6
Chlorine	22.27	1.0	*	*	1.4
Chlorine dioxide	15.29	1.0	*	*	1.3
Citric acid	6.57	1.1	0.04	0.04	15.1
Diphenylamine	30.08	1.0	0.05	0.05	89.8
Dodecylbenenesulfonic acid	4.98	1.1	*	*	0.9
Dodecylbenzine sodium sulfonate	2.57	1.0	*	*	0.2
Hydrogen chloride	9.89	1.1	0.01	0.01	6.0
Phosphoric acid	17.56	1.1	0.01	0.01	13.9
Silicon emulsion	17.68	1.2	*	*	0.1
Sodium hypochlorite	15.22	1.1	0.02	0.02	16.7
Thiabendazole	42.48	1.3	0.01	0.02	44.8

* Rate applied is less than 0.01 pounds per 1,000 pounds.

¹ Volume handled by Washington apple storage and processing facilities was 5,810.7 million pounds.

² Insufficient or limited reports to publish usage data for acidic cleaner, alkaline cleaner, Candida oleophila isolate, captan, fruit wax, organic cleaner, Pseudomonas syringae ESC-10, Pseudomonas syringae ESC-11, sodium chlorite, and sodium o-phenylphenate.

**Pears: Postharvest Chemical Applications,
Percent Treated and Total Applied,
Program States and Total, 2001-02 Marketing Year**

State	Volume Handled	Percent Treated and Total Applied					
		Insecticide ¹		Fungicide		Other Chemical	
	<i>Mil. Lbs.</i>	<i>Percent</i>	<i>1,000 Lbs.</i>	<i>Percent</i>	<i>1,000 Lbs.</i>	<i>Percent</i>	<i>1,000 Lbs.</i>
CA ²	216.1						
OR ²	508.7						
WA	1,070.6			41.66	23.3	61.05	96.2
Total	1,795.4	2.20	0.2	48.30	40.0	67.35	280.7

¹ Insufficient reports to publish individual state data for this pesticide class.

² Data not published due to disclosure restrictions.

**Pears: Postharvest Chemical Applications,
Chemical Application Rates and Total Applied,
2001-02 Marketing Year ^{1 2}**

Agricultural Chemical	Volume Treated	Appli-cations	Rate per Application	Rate per Mkt. Year	Total Applied
	<i>Percent</i>	<i>Number</i>	<i>Pounds per 1,000 Lbs.</i>	<i>Pounds per 1,000 Lbs.</i>	<i>1,000 Lbs.</i>
Insecticides:					
Petroleum distillate	2.20	1.0	0.01	0.01	0.2
Fungicides:					
Captan	9.74	1.0	*	*	0.8
Copper (metallic)	7.39	1.0	0.01	0.01	1.1
Sodium o-phenylphenate	27.28	1.0	0.07	0.07	32.7
Thiabendazole	44.96	1.1	0.01	0.01	5.1
Other:					
Calcium lignosulfonate	9.71	1.0	0.12	0.12	20.9
Chlorine	31.31	1.0	*	*	1.8
Chlorine dioxide	2.40	1.0	0.01	0.01	0.2
Ethoxyquin	24.64	1.0	*	*	1.2
Sodium silicate	14.56	1.1	0.57	0.61	159.1
Sodium sulfate anhydrous	25.18	1.0	0.20	0.20	91.3

* Rate applied is less than 0.01 pounds per 1,000 pounds.

¹ Volume handled by pear storage and processing facilities in the three States surveyed was 1,795.4 million pounds. States included are CA, OR, and WA.

² Insufficient or limited reports to publish usage data for acidic cleaner, alkaline cleaner *Candida oleophila* isolate, citric acid, dodecylbenzine sodium sulfonate, fruit wax, hydrogen chloride, phosphoric acid, potassium carbonate, *Pseudomonas syringae* ESC-10, *Pseudomonas syringae* ESC-11, silicon emulsion, sodium carbonate, sodium hypochlorite, and sucrose esters.

**Pears: Postharvest Chemical Applications,
Chemical Application Rates and Total Applied,
Oregon, 2001-02 Marketing Year ^{1 2}**

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	<i>Percent</i>	<i>Number</i>	<i>Pounds per 1,000 Lbs.</i>	<i>Pounds per 1,000 Lbs.</i>	<i>1,000 Lbs.</i>
Captan	27.53	1.0	0.01	0.01	0.7
Ethoxyquin	33.36	1.0	*	*	0.6
Sodium o-phenylphenate	35.51	1.0	0.07	0.07	13.3
Sodium sulfate anhydrous	67.57	1.0	0.24	0.24	83.4

* Rate applied is less than 0.01 pounds per 1,000 pounds.

¹ Volume handled by Oregon pear storage and processing facilities was 508.7 million pounds.

² Insufficient or limited reports to publish usage data for chlorine, chlorine dioxide, dodecylbenzene sodium sulfonate, fruit wax, petroleum distillate, potassium carbonate, Pseudomonas syringae ESC-10, sodium carbonate, sodium silicate, sucrose esters, and thiabendazole.

**Pears: Postharvest Chemical Applications,
Chemical Application Rates and Total Applied,
Washington, 2001-02 Marketing Year ^{1 2}**

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	<i>Percent</i>	<i>Number</i>	<i>Pounds per 1,000 Lbs.</i>	<i>Pounds per 1,000 Lbs.</i>	<i>1,000 Lbs.</i>
Calcium lignosulfonate	16.28	1.0	0.12	0.12	20.9
Chlorine	33.64	1.0	*	*	1.5
Copper (metallic)	12.39	1.0	0.01	0.01	1.1
Ethoxyquin	25.47	1.0	*	*	0.6
Sodium o-phenylphenate	28.88	1.0	0.06	0.06	19.4
Sodium silicate	8.36	1.2	0.59	0.72	64.2
Sodium sulfate anhydrous	10.11	1.0	0.07	0.07	7.9
Thiabendazole	37.21	1.1	0.01	0.01	2.5

* Rate applied is less than 0.01 pounds per 1,000 pounds.

¹ Volume handled by Washington pear storage and processing facilities was 1,070.6 million pounds.

² Insufficient or limited reports to publish usage data for acidic cleaner, alkaline cleaner, Candida oleophila isolate, captan, chlorine dioxide, citric acid, dodecylbenzene sodium sulfonate, fruit wax, hydrogen chloride, petroleum distillate, phosphoric acid, Pseudomonas syringae ESC-10, Pseudomonas syringae ESC-11, silicon emulsion, and sodium hypochlorite.

**Apples: Postharvest Wax Applications,
Percent of Apples Treated with Wax,
Program States and Total, 2001-02 Marketing Year**

State	Percent of Volume Treated	Total Volume Handled
	<i>Percent</i>	<i>Million Lbs.</i>
CA	14.24	599.3
MI	10.46	1,261.0
NY	10.39	1,089.0
PA	17.17	860.5
WA	39.03	5,810.7
Total	28.54	9,620.4

**Pears: Postharvest Wax Applications,
Percent of Pears Treated with Wax,
Program States and Total, 2001-02 Marketing Year**

State	Percent of Volume Treated	Total Volume Handled
	<i>Percent</i>	<i>Million Lbs.</i>
CA	*	216.1
OR	*	508.7
WA	19.26	1,070.6
Total	17.98	1,795.4

* Data not published due to disclosure restrictions.

**Apples: Postharvest Chemical Use,
Application Methods Used,
Total of Program States, 2001-02 Marketing Year**

Application Method	Total of States Surveyed
	<i>Percent</i>
Dip in Float/Dump Tank	17.0
Direct Spray	28.1
Drench	46.6
Drip/Brush-On	8.2
Gas/Fog	0.1

**Pears: Postharvest Chemical Use,
Application Methods Used,
Total of Program States, 2001-02 Marketing Year**

Application Method	Total of States Surveyed
	<i>Percent</i>
Dip in Float/Dump Tank	40.2
Direct Spray	36.1
Drench	10.2
Drip/Brush-On	3.5
Gas/Fog	0.5
Hand Wrap	9.5

**Apples: Pest Management Practices,
Percent of Operations Utilizing Practice,
Total of Program States, 2001-02 Marketing Year**

Practice	Program States					
	CA	MI	NY	PA	WA	ALL
	<i>Percent of Operations</i>					
Mechanical Devices:						
Bin liners to ease scuffing	21	3	6	9	51	15
Cull rotten fruit	42	43	44	28	46	40
Elevated CO2 levels	6	20	25	3	13	15
Frequently changed dump tank or process water	53	42	44	29	61	44
Infrared		1			2	1
Insecticides on bin piles	2	2	5		6	3
Low oxygen levels	4	34	31	6	43	27
Ozone to cleanse process water	4	1			3	1
Pest or rodent controls	60	63	79	52	72	66
Plastic bins to reduce spore counts	34	8	10	11	24	14
Cleaning Activities:						
Clean or sanitize packing equipment	74	59	53	54	69	59
Clean or sanitize structures in CA rooms	25	38	30	18	66	36
Control vegetation around bins	74	55	64	57	76	63
Hose down or empty bins/boxes	64	46	42	47	52	48
Pick up spilled fruit	91	83	86	84	82	84
Spray bins/walls with insecticide	26	36	29	16	65	34
Sweep, spray, or vacuum facility floors	92	88	90	93	89	90

**Apples: Pest Management Practices,
Percent of Operations Utilizing Practice,
Total of Program States, 2001-02 Marketing Year**

Practice	Program States					
	CA	MI	NY	PA	WA	ALL
	<i>Percent of Operations</i>					
Measure Storage Facility Temperature:						
Controlled Atmosphere:						
Automatically monitored	21	11	10	8	50	18
Hourly	2	1	4		6	2
Daily	11	26	20	4	7	16
Twice a week	2	1				1
Weekly	2	1			1	1
Other		5	1	1		2
Do not monitor	2			1		
Regular Storage:						
Automatically monitored	11	9	10	10	31	13
Hourly	6	2	1		7	2
Daily	34	54	53	65	31	51
Twice a week	4	4	2	7	2	4
Weekly		5	2	4	3	3
Other		5	1	5	7	4
Do not monitor	15	2	2	5	1	4
Other Structures:						
Automatically monitored		1			7	2
Hourly					1	
Daily	2	3	6	5	4	4
Twice a week	2					
Weekly						
Other			1	1	5	1
Do not monitor	13	5	7	2	2	5

**Pears: Pest Management Practices,
Percent of Operations Utilizing Practice,
Total of Program States, 2001-02 Marketing Year**

Practice	Program States			
	CA	OR	WA	ALL
	<i>Percent of Operations</i>	<i>Percent of Operations</i>	<i>Percent of Operations</i>	<i>Percent of Operations</i>
Mechanical Devices:				
Bin liners to ease scuffing	25	41	53	43
Cull rotten fruit	54	59	53	54
Elevated CO2 levels		18	11	9
Frequently changed dump tank or process water	43	68	65	60
Infrared		5	2	2
Insecticides on bin piles		5	5	4
Low oxygen levels		50	42	32
Ozone to cleanse process water	7		4	4
Pest or rodent controls	61	68	80	72
Plastic bins to reduce spore counts	46	32	22	30
Cleaning Activities:				
Clean or sanitize packing equipment	71	68	76	73
Clean or sanitize structures in CA rooms	14	59	62	48
Control vegetation around bins	75	50	76	71
Hose down or empty bins/boxes	71	68	55	62
Pick up spilled fruit	93	100	91	93
Spray bins/walls with insecticide	14	45	64	47
Sweep, spray, or vacuum facility floors	96	100	93	95

**Pears: Pest Management Practices,
Percent of Operations Utilizing Practice,
Total of Program States, 2001-02 Marketing Year**

Practice	Program States			
	CA	OR	WA	ALL
	<i>Percent of Operations</i>	<i>Percent of Operations</i>	<i>Percent of Operations</i>	<i>Percent of Operations</i>
Measure Storage Facility Temperature:				
Controlled Atmosphere:				
Automatically monitored	14	27	51	36
Hourly		5	4	3
Daily	7	18	5	8
Twice a week				
Weekly	4			1
Other				
Do not monitor	4		2	2
Regular Storage:				
Automatically monitored	25	18	38	31
Hourly	7	9	7	8
Daily	39	32	29	32
Twice a week			2	1
Weekly				
Other		14	5	6
Do not monitor	7	18	2	6
Other Structures:				
Automatically monitored			11	6
Hourly				
Daily	4	9	7	7
Twice a week				
Weekly				
Other			2	1
Do not monitor	18	5	4	8

Survey Procedures

Operations were chosen from those on the NASS List Sampling Frame known or expected to handle apples or pears. Generally, all operations known to engage in processing, packing or shipping, or storing apples and pears were included in this survey. There were slightly over 2,000 operations selected to participate in the 2002 Apple and Pear Postharvest Survey, referencing the 2001-02 apple and pear marketing year.

Estimation Procedures

The chemical applications data, reported by product name or trade name were reviewed within State and across States for reasonableness and consistency. This review compared reported data with manufacturers' recommendations and with data from other operations using the same product. Following this review, product information was converted to active ingredient level. The chemical usage estimates in this publication consist of survey estimates of those active ingredients.

Detailed data within a table may not multiply across or add down due to independent rounding of the published values.

Reliability

The probability nature of the survey provides for expansion of data so estimates are statistically representative of chemical use on the targeted commodities in the surveyed States. The reliability of these survey results are affected by sampling variability and nonsampling errors.

Nonsampling errors are errors that occur during a survey process and, unlike sampling variability, are difficult to measure. They may be caused by interviewers failing to follow instructions, poorly worded questions, non-response, problematic survey procedures, or data handling between collection and publication. In this survey, procedures and analysis were carried out in a consistent and orderly manner to minimize the occurrence of these types of errors.

Variability for estimates of volume of the commodity handled will be higher than the variability for estimates of application rates. This is because application rates have a narrower range of responses, are recommended by the manufacturer of the product, and are generally followed.

Sampling variability of the estimates differs by chemical and crop. In general, the more often the chemical was applied, the smaller the sampling variability. For example, estimates of use of a commonly used product, such as diphenylamine on apples, exhibit less variability than a rarely used product.

Terms and Definitions

Active ingredient: The active ingredient is the specific chemical which kills or controls the target pests. Usage data are reported by pesticide product and are converted to an amount of active ingredient.

Agricultural chemicals: The phrase agricultural chemicals refers to the active ingredients in pesticides.

Amount applied: This amount represents the percentage of total volume handled receiving one or more applications of a specific agricultural chemical.

Antioxidant: A substance that prevents or slows the breakdown of another substance by oxygen. Often antioxidants are added to foods to prevent them from becoming rancid or from discoloring.

Application rates: The application rates refer to the average number of pounds of a pesticide active ingredient applied to a volume of product. Rate per application is the average number of pounds applied in one application. Rate per marketing year is the average number of pounds applied counting multiple applications. Number of applications is the average number of times a treated volume receives a specific agricultural chemical.

Common name: The common name is an officially recognized name for an active ingredient. This report shows active ingredient by common name.

Controlled Atmosphere (CA) storage: CA storage, or controlled atmosphere storage, is a storage facility in which the atmospheric gases are controlled in their amount or in temperature for the purpose of controlling the condition and maturity of fresh apples or pears. Certified and non-certified controlled atmosphere storage facilities were included in this survey.

Dump tank/Float tank: Upon leaving CA storage, the apples and pears are subjected to chemical treatments in a float or dump tank where they are floated out of their storage containers. As each bin is completely submerged, the apples or pears float out. The water may contain some or no chemicals. The float solution usually disinfects the fruit prior to its entering the packing line. The number of float tanks per packing house usually ranges from one to four, with each ranging in size from 500 to several thousand gallons.

Marketing year: A marketing year refers to the period immediately following harvest of the crop through the marketing or disposition of the crop. For purposes of this survey, the apple marketing year was August 2001 through September 2002. For pears, the marketing year was defined as August 2001 through July 2002.

Terms and Definitions (continued)

Packers and Shippers: Packers and shippers generally prepare the commodity for fresh market distribution. They may have storage facilities as well. Those elements of the commodity which do not meet the fresh market standards are often moved to processors.

Pesticides: As defined by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), pesticides include any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest, and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.

Postharvest: After the commodity is harvested from the field, any subsequent activity is termed postharvest. Postharvest chemical usage refers to chemical applications after the commodity is taken from the field or orchard.

Processor: Processors actually change the form of the commodity. These firms may have storage facilities as well.

Regular storage: The cold storage warehouses consist of large refrigerated storerooms, where the temperature is kept at approximately 32 degrees and high humidity is maintained. This cold temperature slows down but does not stop the ripening process. Most fruit are in regular storage for shorter term than fruit in CA storage.

Storage operators: Storage operators store the commodity prior to processing or fresh market distribution. Some processing or packing and shipping facilities also have storage facilities.

Total volume handled: The volume of a commodity handled by the market segment. In this release, it is the total amount of a commodity that passed through the firms summarized in the particular table.

Trade name: A trademark is the name given to a specific formulation of a pesticide product. A formulation contains a specific concentration of the active ingredient, carrier materials, and other ingredients such as emulsifiers and wetting agents. Some formulations, as in the case of pre-mixes, can contain more than one active ingredient.

Trade Names, Common Names, and Classes

The following is a list of common name, associated class and trade name of active ingredients in this publication. The classes are insecticides (I), fungicides (F), and other chemicals (O). This list is provided as an aid in reviewing the data. Pre-mixes are not cataloged. The list may not be complete for all postharvest chemicals used on apples and pears. NASS does not mean to imply use of any specific trade name.

Class :	Common Name	:	Trade Name
O	Calcium chloride		Stop-It, Cor-Clear, several calcium chloride concentrates
O	Calcium lignosulfonate		Lignosite AF
F	Captan		several Captan formulations
O	Chlorine		Drench-chlor, Chlorine
O	Chlorine dioxide		Chlorine dioxide
O	Citric acid		Tri-Circ, Citric Acid
F	Copper		several
O	Diphenylamine		several
O	Dodecylbenzene sodium sulfonate		EpiClean
O	Dodecylbenzenesulfonic acid		Fresh-Pak
O	Ethoxyquin		several
O	Hydrogen chloride		Fresh-Pak, Tri-Circ
I	Petroleum distillate		several
O	Phosphoric acid		several
O	Sodium hypochlorite		Agchlor 310
F	Sodium o-phenylphenate		several
O	Sodium silicate		several
O	Sodium sulfate anhydrous		several
F	Thiabendazole		several



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**2002 APPLE and PEAR
POSTHARVEST
CHEMICAL USE SURVEY**

Form Approved
O.M.B. Number 0535-0218
Approval Expires 1st '03
Project Code 143

VERSION	ID	SUBT.	T-TYPE	TABLE	LINE
3	_____	___	0	000	00

CONTACT RECORD		
DATE	TIME	NOTES

RESPONSE CODES	
3 - COMPLETE	
4 - SCREENOUT	
5 - NO APPLES/PEARS HANDLED/RECEIVED	OFFICE USE 910
8 - REFUSAL	
9 - INACCESSIBLE	
OPTIONAL	002

INTRODUCTION
[Introduce yourself, and ask for the operator. Rephrase in your own words.]

We are collecting information on chemical use and need your help to make the information as accurate as possible. Authority for collection of information on the Apple and Pear Postharvest Chemical Use Survey is Title 7, Section 2204 of the U.S. Code. This information will be used for analysis and to compile and publish estimates for your state and the United States. Response to this survey is confidential and voluntary.

We encourage you to refer to your operation records during the interview.

BEGINNING TIME [MILITARY]

Name _____

Address _____

Phone (____) _____

[Name, address and partners verified and updated if necessary.]

1. Did this operation (as listed on the label) store, pack/ship, or process any 2001 crop year apples and/or pears?
- YES** - [Go to page 3, **Screening**.]
- NO** - [Go to next page, **Change in Operator**.]

CHANGE IN OPERATOR

[Complete this section only if item 1 on the front page is answered "No".]

2. Has the operation named on the label been **sold, rented, or turned over** to someone else?

YES - [Continue.] NO



3. Please provide the name and address of the operation that has taken over the business you formerly operated:

Operation Name:

Operator Name:

Address:

City:

State:

Zip:

Phone:

a. Will the operation handle or receive apples and/or pears or other crops at any of its facilities in 2002?

YES

DON'T KNOW

NO

[Regardless of answer above, write a note to explain the situation, then go to back page Conclusion.]

NOTES and CALCULATIONS:

SCREENING

1. On this operation, were any 2001 crop year apples and/or pears --

	APPLE CODE	PEAR CODE
<p>a. changed to a processed product by cooking, drying, fermenting, freezing, pressing or slicing?</p> <p><input type="checkbox"/> YES -[Enter code 1 and continue.] <input type="checkbox"/> NO - [Continue.]</p>	105	115
<p>b. sorted, graded, packaged or shipped primarily for fresh market?</p> <p><input type="checkbox"/> YES -[Enter code 1 and continue.] <input type="checkbox"/> NO - [Continue.]</p>	106	116
<p>c. stored in a permanent or temporary structure for later use to be shipped or processed?</p> <p><input type="checkbox"/> YES - [Enter code 1 and go to Section A.]</p> <p><input type="checkbox"/> NO - [Go to Section A.]</p>	107	117

ENUMERATOR NOTE: *Verify that respondent is aware that for purposes of this survey, that postharvest is defined for packer/shipper as the period of time when the fruit is picked until it is shipped from this operation for fresh market or processing.*

For processors postharvest is defined as the period of time when the whole fruit is received until right before the whole fruit is changed in form.

[ENUMERATOR NOTE: If NO apples, go to next page.]

Now I would like to ask about the 2001 crop year apples stored, packed/shipped, or processed by this operation.

Please use your records to help us get an accurate record of apple receipts.

1. What was the total quantity of the 2001 crop year apples stored, packed/shipped, or processed by this operation?

QUANTITY

200	
_____	_____

1 BIN	If unit equals "1" or "8", enter
2 BOX (42 lbs.)	
3 TON	
4 CWT. (100 lbs.)	
5 POUNDS (lbs.)	
6 BUSHELS (42 lbs.)	
8 OTHER	
UNIT	
201	202

a. Of the item 1 apples, how much **DID NOT** receive postharvest chemical applications?

QUANTITY

206	
_____	_____

**PERCENT OF
TOTAL
NOT TREATED**

OR

207

ENUMERATOR NOTE: [Does item code 200 equal item code 206?]

OR

[Does item code 207 equal 100%?]

YES - Verify the operation did not apply any postharvest chemicals to apples in storage, **on trucks, ships, railcars or air cargo containers** between August 2001 and September 2002. If no postharvest chemicals were applied go to next page. If postharvest chemicals were applied, correct either item code 206 or item code 207 and go to next page.

NO - Go to next page.

[ENUMERATOR NOTE: If NO pears, go to Section B.]

Now I would like to ask about the 2001 crop year pears stored, packed/shipped, or processed by this operation.

Please use your records to help us get an accurate record of pear receipts.

1. What was the total quantity of the 2001 crop year pears stored, packed/shipped, or processed by this operation?

QUANTITY
210
_____, _____, _____ . ____

1 BIN	If unit equals "1" or "8", enter
2 BOX (44lbs.)	
3 TON	
4 CWT. (100 lbs.)	
5 POUNDS (lbs.)	
6 BUSHELS (44 lbs.)	
8 OTHER	
UNIT	POUNDS/UNIT
211	212

a. Of the item 1 pears, how much **DID NOT** receive postharvest chemical applications?

QUANTITY
216
_____, _____, _____ . ____

PERCENT OF TOTAL NOT TREATED
217
____ . ____

ENUMERATOR NOTE: [Does item code 210 equal item code 216?]
OR
[Does item code 217 equal 100%?]

YES - Verify the operation did not apply any postharvest chemicals to pears in storage, **on trucks, ships, railcars or air cargo containers** between August 2001 and July 2002. If no postharvest chemicals were applied go to Section C, page 10. If no postharvest chemicals were applied, correct either item code 216 or item code 217 and go to Section B.

NO - Go to Section B.

COMPLETION CODE for
CHEMICAL EDIT TABLE

1 - Incomplete / Refusal	300
3 - Valid Zero	

B POSTHARVEST CHEMICAL TREATMENTS APPLIED B

Now I have some questions about postharvest chemical use on 2001 crop year **apples and/or pears** stored, packed/shipped, or processed by your operation. I will be collecting chemical data for apples and/or pears only. I will need information for all products applied. Include waxes, chlorine or bleach washes, and fumigation. I will be asking for specific product and amount used, quantity of apples treated, and timing and method of application. Please use your records to answer the questions as accurately as possible and to help make sure we do not miss any products used.

**OFFICE USE
LINES IN TABLE**

T-TYPE 3	TABLE 001	LINE 99	399
--------------------	---------------------	-------------------	-----

**CROP CODES for
COLUMN 1**

STORAGE CODES for COLUMN 3

53 Apples	1 On packing line	4 After CA storage	7 After regular storage
69 Pears	2 Before CA storage	5 Before regular storage	8 Not stored
	3 During CA storage	6 During regular storage	

NOTES	LINE	1	2		3	4
		[Enter crop code from above.] CODE	What product was applied? (In Respondent Booklet)		When was this product used? [Enter code from above.]	What was the total quantity of apples and/or pears treated with this chemical (in column 2)?
			a	b		
			COMMON OR TRADE NAME	PRODUCT CODE		
	01	301		302	303	304 .
	02	301		302	303	304 .
	03	301		302	303	304 .
	04	301		302	303	304 .
	05	301		302	303	304 .
	06	301		302	303	304 .
	07	301		302	303	304 .
	08	301		302	303	304 .

[For pesticides not listed in Respondent Booklet, specify--]

LINE NO.	EPA No. or Trade name and Formulation	Form Purchased (Liquid or Dry)	Where Purchased [Ask only if EPA No. cannot be reported.]	Target Pest

B POSTHARVEST CHEMICAL TREATMENTS APPLIED B

UNIT CODES for COLUMN 5
1 - BIN
2 - BOX (apples 42 lbs.) (pears 44 lbs.)
3 - TON
4 - CWT. (100lbs.)
5 - POUNDS (lbs.)
6 - BUSHELS (apples 42 lbs.) (pears 44 lbs.)
8 - OTHER

UNIT CODES for COLUMN 8	
1 POUNDS	40 KILOGRAMS
12 GALLONS	41 LITERS
13 QUARTS	45 PELLETS
14 PINTS	46 TABLETS
15 OUNCES	49 TREATED FRUIT WRAPS
30 GRAMS	50 OTHER
	(Specify _____)

APPLICATION CODES for COLUMN 9
1 - DRENCH
2 - DRIP
3 - DIRECT SPRAY
4 - DIP in DUMP/FLOAT TANK
6 - GAS/FOG
7 - HAND WRAP
10 - OTHER
(Specify _____)

LINE	5	6	7	8	9
	[Enter unit code from above.]	If column 5 unit equals "1" or "8", enter pounds per unit.	What was the total amount of formulated product applied to the (column 4) amount of apples and/or pears?	[Enter unit code from above.]	What was the method used to apply this product?
	CODE			CODE	CODE
01	305	306	307	308	309
02	305	306	307	308	309
03	305	306	307	308	309
04	305	306	307	308	309
05	305	306	307	308	309
06	305	306	307	308	309
07	305	306	307	308	309
08	305	306	307	308	309

Enumerator Notes:

T-TYPE 0	TABLE 000	LINE 00
--------------------	---------------------	-------------------

Now I have some questions about pest management practices you may have used at your facilities on apples and/or pears.

1. Do you use--

		APPLE CODE	PEAR CODE
a.	infrared? YES = 1	550	650
b.	low oxygen levels? YES = 1	551	651
c.	elevated CO ₂ levels? YES = 1	552	652
d.	pest/rodent control measures? YES = 1	553	653
e.	frequently changed dump tank or processed water? YES = 1	554	654
f.	culling mechanisms? YES = 1	555	655
g.	bin liners to ease scuffing? YES = 1	556	656
h.	plastic bins to reduce spore counts? YES = 1	557	657
i.	ozone to cleanse process water? YES = 1	558	658
j.	insecticides on your bin piles? YES = 1	559	659

2. How often do you measure storage facility temperature?

	FREQUENCY CODES	APPLE CODE	PEAR CODE
Controlled atmosphere.	1 AUTOMATICALLY MONITORED	560	660
	2 HOURLY		
	3 DAILY	561	661
	4 TWICE A WEEK		
	5 WEEKLY		
Regular storage.	6 OTHER - (Specify _____)		
	7 DO NOT MONITOR		
Other Structures.	8 DO NOT HAVE THIS STRUCTURE	562	662

COMPLETION CODE for PEST MANAGEMENT SECTION

1 - Incomplete/Refusal	500
------------------------	-----

C PEST MANAGEMENT PRACTICES C

3. Which cleaning practices do you use at this storage facility on apples and/or pears—

	APPLE CODE	PEAR CODE
a. hose down or rinse empty bins/boxes? (<i>Include dump tank rinse.</i>) YES = 1	563	663
b. clean or sanitize packing equipment? YES = 1	564	664
c. pick up spilled fruit? YES = 1	565	665
d. control vegetation around bins? YES = 1	566	666
e. sweep or vacuum facility floors? YES = 1	567	667
f. clean or sanitize structures in CA rooms? YES = 1	568	668
g. clean coils and defrost pans in CA rooms? YES = 1	569	669

4. Do you do any other cleaning activities besides the ones listed above to your storage facilities?

YES - [*Enter code 1 and continue.*]
 NO - [*Go to item 5.*]
670

a. What did you do? [*Record responses below.*]

OFFICE USE
671
672
673
674

5. Do you fumigate apples and/or pears in storage rooms?

YES - [*Continue.*]
 NO - [*Go to Conclusion.*]

a. What strategy did you use to decide when to fumigate? [commodity]?

1	BASED ON MARKETING REQUIREMENT
2	PRESET CALENDAR DATE
3	BIN SAMPLES
4	COMBINED WITH OTHER HANDLING OPERATIONS
5	OTHER - (<i>Describe</i> _____)

ENTER ONE CODE

675

[ENUMERATOR NOTE - If item 5 = YES, verify that a fumigation product was reported in Section B.]

CONCLUSION

SURVEY PUBLICATIONS

That completes the survey. Would you like to receive a free copy of the results when they are published?

YES - [Enter code 1.] NO

[Thank the respondent then review this questionnaire.]

CODE
099

RECORDS USE

Did respondent use operation records to report chemical data?

YES - [Enter code 1.] NO

064

ENDING TIME [MILITARY]

065
_ _ _ _

**OFFICE USE -
TIME IN HOURS**
066

SUPPLEMENTS USED

Record the total number of pesticide supplements used to complete this interview.

NUMBER
068

RESPONDENT

- 1 OPERATOR/MANAGER
- 2 SPOUSE
- 3 ACCOUNTANT/BOOKKEEPER
- 4 OTHER
- 8 OFFICE HOLD
- 9 PARTNER

.....

CODE
101

Respondent's name: _____
(Phone) _____

ENUMERATOR _____

ENUMERATOR ID
098

DATE

MM DD YY
987
_ _ / _ _ / 02

**OFFICE USE
EVALUATION**
100

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The time required to complete this information collection is estimated to average 30 minutes per response.

Report Features

Released March 12, 2003, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S. Department of Agriculture. For information on "Agricultural Chemical Usage" call (202) 720-6146, office hours 7:30 a.m. to 4:00 p.m. ET.

The next "**Agricultural Chemical Usage: Postharvest Applications**" will be released during the spring of 2004. This report will cover the use of postharvest chemicals used on corn and soybeans.

Listed below are persons within the National Agricultural Statistics Service to contact for additional information.

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Kevin Hintzman, Head, Environmental and Demographics Section (202) 720-0684

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