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Agricultural Chemical Usage

Postharvest Applications - Apples and Potatoes

May 1998

Overview

The agricultural chemical use estimates in this report are based on data compiled from the Postharvest Chemical Use Surveys. Separate surveys were conducted for apples and potatoes in the summer of 1997, covering the 1996 crop. All results refer to pesticide applications after the crops were harvested. Data were collected during the summer to ensure that only the 1996 crop was included and that all applications were completed.

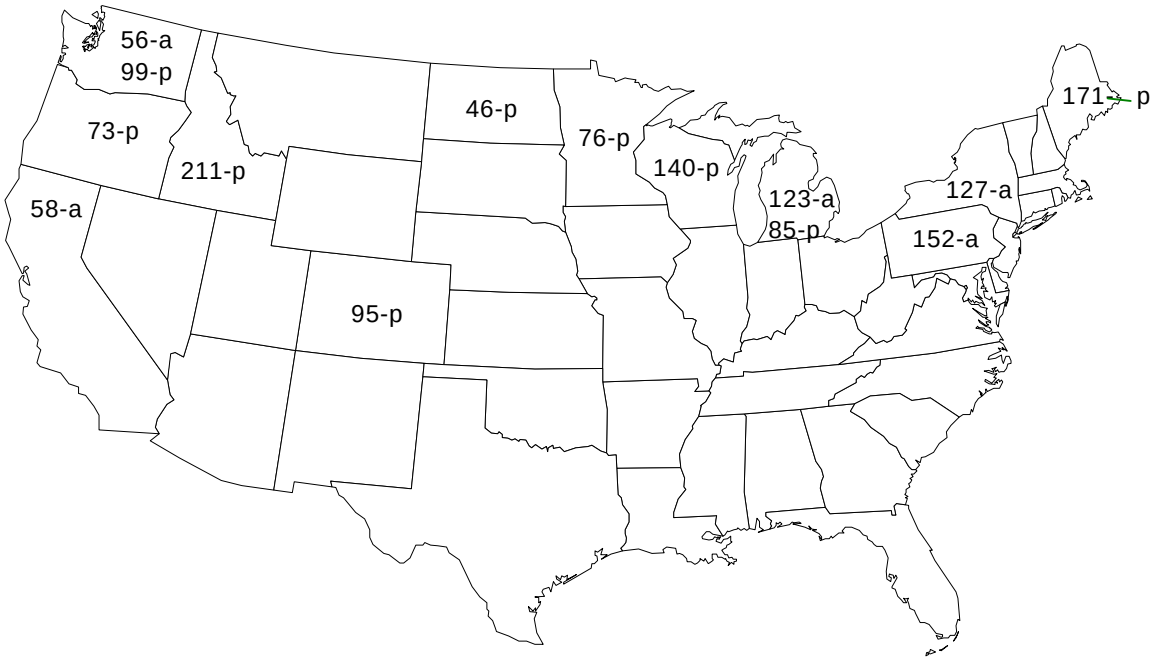
The table below shows survey coverage for the 1996 marketing year. In the table, are statistics on the number of States surveyed, the number of reports summarized, and the percent of the U.S. production accounted for by the surveyed States. The following U.S. map shows the number of usable reports by State in the 1996 survey.

Agricultural Chemical Use Survey Coverage, 1996 Marketing Year

Crop	States Surveyed	Reports Summarized	U.S. Production Included
	--- Number ---		Percent
Apples	5	516	83
Potatoes, Fall	9	996	92

Number of Usable Reports, 1996

a - apples; p - potatoes



Highlights

After harvest, apples and potatoes are generally marketed to processors or to the fresh market through packers and shippers. This is largely based on variety. A portion of these commodities goes from the orchard or field to the storage facility. These are later marketed either to the processors or to the packers and shippers for the fresh market as the need arises. For this report, if a processor also has a fresh packing line, these apples or potatoes are counted with the processor, not in the total for packers and shippers. The diagram following these comments demonstrates the postharvest marketing channel for apples and potatoes.

Apples or potatoes moving from a storage operator to a packer and shipper will be duplicated in the total amount handled. The intent of the survey was to obtain the entire amount of chemicals applied to the apples or potatoes, so this duplication in quantity handled is necessary. No provision was made for cross-State movement. The State or region of origin of the apples or potatoes was not part of the survey, so all apples or potatoes handled in a survey State were included in this survey.

Apples: Processors, packers and shippers, and storage facilities in five States were surveyed for the 1996 marketing year. These States accounted for 83 percent of the total U.S. apple production.

Individual State totals for all five States are published for the percent of apples treated with pesticides by variety for all marketing segments (processors, packers and shippers, and storage operators). The total amount of pesticides applied for all varieties is published for each State. Due to the widespread use of washes, rates are not applicable. Washes are formulated based on the size of the dump tank, not necessarily the volume of apples being treated.

Totals for all five States are published for the percent of apples treated with pesticides by variety and market segment. The total amount of pesticide applied to all varieties is published by market segment.

Totals for all five states are also published in the “When Applied” tables by market segments. The percentages in these tables apply to the total amount handled. The data are broken out by regular storage and controlled atmosphere (CA) storage. Operators may treat the same quantity of apples prior to storage, during storage, and after storage. The percentages may not add across and compare with the percent applied to all varieties in the Five-State Total table for each agricultural chemical.

State data are published for percent of apples treated with wax by variety. All market segments are combined in this table.

The primary postharvest chemicals used on apples are diphenylamine and thiabendazole. Thiabendazole is a fungicide that prevents postharvest decay in apples. Diphenylamine is used to help control apple scald.

Potatoes, Fall: Processors, packers and shippers, and storage operators in nine States were surveyed following the 1996 marketing year. These States accounted for 92 percent of the total U.S. fall potato production.

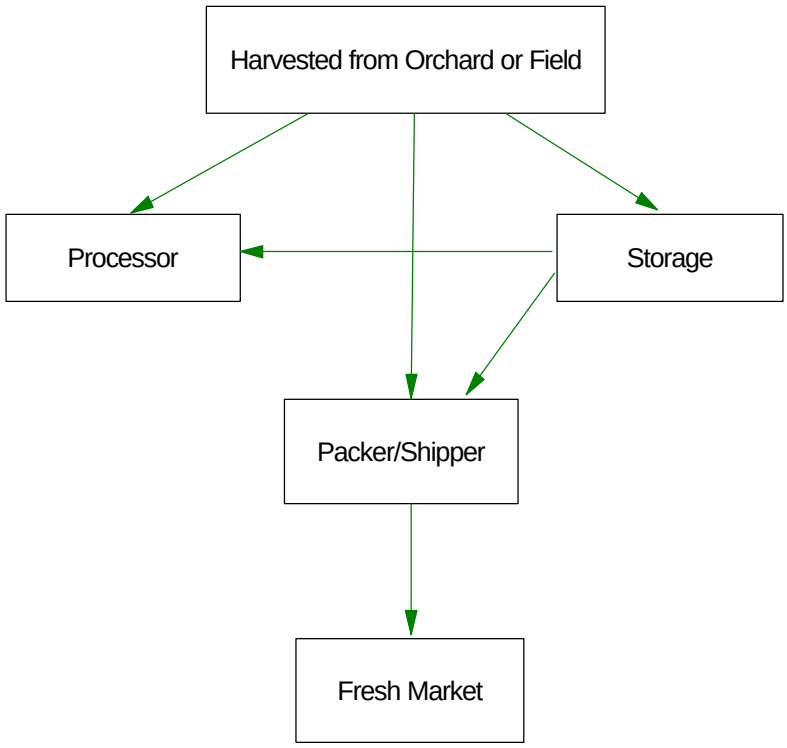
In order to avoid disclosure of data from individual firms, State data for Colorado and Maine are published after combining the data from all market segments (processors, packers and shippers, and storage operators). Data for Washington, Idaho, and Oregon are combined into the Pacific Northwest region, while data for Michigan, Minnesota, North Dakota, and Wisconsin are combined into the Midwest region. Both regions are published by market segment.

Totals for all nine States are published for the percent of potatoes treated with pesticides and the total amount applied for each market segment. Rates are also published.

Totals for all nine states are also published in the "When Applied" tables by market segments. The percentages in these tables apply to the total amount handled. Operators may treat the same quantity of potatoes prior to storage, during storage, and after storage. The percentages may not add across and compare with the percent applied to all varieties in the Nine-State Total table for each agricultural chemical.

The primary postharvest chemicals used on potatoes are chlorpropham and thiabendazole. Chlorpropham is used to inhibit sprouting. Thiabendazole is a fungicide used to control Fusarium spp., which causes dry rot.

Apples and Potatoes Postharvest Market Channels



Apples: Postharvest Chemical Applications
Processors, by Variety,
California, 1996 Marketing Year

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Diphenylamine	*	*
Sodium hypochlorite	*	*
Sodium o-phenylphenate	*	*
Thiabendazole	*	*
	1,000 Lbs	
Volume Handled	621,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Packers and Shippers, by Variety,
California, 1996 Marketing Year

Agricultural Chemical	Fuji	Gala	Granny Smith	Other Varieties
	Percent of Volume Treated			
Chlorine	*	*	*	*
Diphenylamine	22	*	63	*
Piperonyl butoxide	*	*	25	*
Pyrethins	*	*	25	*
Sodium hypochlorite	42	62	47	*
Sodium o-phenylphenate	29	26	13	*
Thiabendazole	36	*	29	*
	1,000 Lbs			
Volume Handled	122,000	57,000	136,000	138,000

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Apples: Postharvest Chemical Applications
Packers and Shippers, by Variety,
California, 1996 Marketing Year (continued)

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Chlorine	*	*
Diphenylamine	28	6.1
Piperonyl butoxide	16	*
Pyrethins	16	*
Sodium hypochlorite	34	3.7
Sodium o-phenylphenate	15	1.8
Thiabendazole	22	.6
	1,000 Lbs	
Volume Handled	453,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Storage Operators, by Variety,
California, 1996 Marketing Year

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Diphenylamine	*	*
Sodium hypochlorite	*	*
	1,000 Lbs	
Volume Handled	147,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Processors, by Variety,
Michigan, 1996 Marketing Year

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Captan	*	*
Diphenylamine	*	*
Sodium hypochlorite	*	*
Thiabendazole	*	*
	1,000 Lbs	
Volume Handled	462,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Packers and Shippers, by Variety,
Michigan, 1996 Marketing Year

Agricultural Chemical	Crispin (Mutsu)	Empire	Fuji	Gala
	Percent of Volume Treated			
Captan	*	*		
Diphenylamine	*	69	19	6
Sodium hypochlorite	*	*	*	*
Sodium o-phenylphenate		*		
Thiabendazole	*	59	*	*
	1,000 Lbs			
Volume Handled	4,000	26,000	2,000	4,000

Agricultural Chemical	Golden Delicious	Idared	Jonagold	Jonathan
	Percent of Volume Treated			
Captan	*	*		*
Diphenylamine	29	56	51	41
Sodium hypochlorite	*	*	*	*
Sodium o-phenylphenate	*	*		
Thiabendazole	26	42	49	31
	1,000 Lbs			
Volume Handled	34,000	29,000	4,000	27,000

Agricultural Chemical	McIntosh	Northern Spy	Red Delicious	Rome
	Percent of Volume Treated			
Captan			*	*
Diphenylamine	28	53	61	57
Sodium hypochlorite	*		*	*
Sodium o-phenylphenate	*		*	*
Thiabendazole	*	*	50	49
	1,000 Lbs			
Volume Handled	16,000	17,000	70,000	38,000

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Apples: Postharvest Chemical Applications
Packers and Shippers, by Variety,
Michigan, 1996 Marketing Year (continued)

Agricultural Chemical	Spartan	Winesap/ Stayman	Other Varieties
	Percent of Volume Treated		
Diphenylamine	57	41	3
Sodium hypochlorite		*	*
Thiabendazole	57	14	3
	1,000 Lbs		
Volume Handled	3,000	2,000	11,000

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Captan	*	*
Diphenylamine	48	6.0
Sodium hypochlorite	*	*
Thiabendazole	39	3.3
Sodium o-phenylphenate	*	*
	1,000 Lbs	
Volume Handled	287,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Storage Operators, by Variety,
Michigan, 1996 Marketing Year

Agricultural Chemical	Golden Delicious	Idared	Red Delicious	Rome
	Percent of Volume Treated			
Diphenylamine	*	*	52	35
Thiabendazole	*	*	*	*
	1,000 Lbs			
Volume Handled	12,000	12,000	12,000	13,000

Agricultural Chemical	Other Varieties	All Varieties	Total Applied
	Percent of Volume Treated		1,000 Lbs
Diphenylamine	10	20	.6
Thiabendazole	*	*	*
	1,000 Lbs		
Volume Handled	32,000	81,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Processors, by Variety,
New York, 1996 Marketing Year

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Captan	*	*
Diphenylamine	4	1.0
Sodium hypochlorite	*	*
Sodium o-phenylphenate	*	*
Thiabendazole	4	.2
	1,000 Lbs	
Volume Handled	560,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Packers and Shippers, by Variety,
New York, 1996 Marketing Year

Agricultural Chemical	Cortland	Empire	Golden Delicious	Idared
	Percent of Volume Treated			
Captan	*	*	*	*
Diphenylamine	56	50	24	74
Sodium o-phenylphenate	*	*	*	*
Thiabendazole	47	51	*	74
	1,000 Lbs			
Volume Handled	15,000	66,000	27,000	14,000

Agricultural Chemical	Macoun	McIntosh	Paula Red	Red Delicious
	Percent of Volume Treated			
Captan		6		6
Diphenylamine	*	44	*	85
Sodium o-phenylphenate	*	*	*	*
Thiabendazole	69	43	*	79
	1,000 Lbs			
Volume Handled	8,000	112,000	11,000	94,000

Agricultural Chemical	Rome	Spartan	Winesap/ Stayman	Other Varieties
	Percent of Volume Treated			
Captan	6	22	*	*
Diphenylamine	92	76	84	27
Sodium o-phenylphenate	*	*	*	*
Thiabendazole	85	76	82	33
	1,000 Lbs			
Volume Handled	81,000	13,000	8,000	33,000

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Captan	5	1.0
Diphenylamine	62	28.9
Sodium o-phenylphenate	*	*
Thiabendazole	60	44.2
	1,000 Lbs	
Volume Handled	482,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Storage Operators, by Variety,
New York, 1996 Marketing Year

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Captan	*	*
Diphenylamine	*	*
	1,000 Lbs	
Volume Handled	50,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Processors, by Variety,
Pennsylvania, 1996 Marketing Year

Agricultural Chemical	Rome	Red Delicious	Winesap/ Stayman	Other Varieties
	Percent of Volume Treated			
Captan	*	*	*	*
Diphenylamine	13	52	19	3
Hydrogen peroxide		*		*
Peroxyacetic acid		*		*
Sodium hypochlorite	*	*	*	*
Thiabendazole	*	*	*	*
	1,000 Lbs			
Volume Handled	35,000	53,000	5,000	137,000

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Captan	*	*
Diphenylamine	16	.2
Hydrogen peroxide	*	*
Peroxyacetic acid	*	*
Sodium hypochlorite	*	*
Thiabendazole	*	*
	1,000 Lbs	
Volume Handled	230,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Packers and Shippers, by Variety,
Pennsylvania, 1996 Marketing Year

Agricultural Chemical	Empire	McIntosh	Red Delicious	Rome
	Percent of Volume Treated			
Captan			*	*
Chlorine		*	*	
Diphenylamine	*	*	57	46
Sodium hypochlorite	*	*	*	*
Thiabendazole	8	7	35	35
	1,000 Lbs			
Volume Handled	4,000	7,000	36,000	11,000

Agricultural Chemical	Winesap/ Stayman	Other Varieties	All Varieties	Total Applied
	Percent of Volume Treated			1,000 Lbs
Captan	*	*	*	*
Chlorine			*	*
Diphenylamine	27	24	26	.9
Sodium hypochlorite	*	*	*	*
Thiabendazole	25	18	37	.4
	1,000 Lbs			
Volume Handled	3,000	28,000	89,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications by Storage Operators, by Variety, Pennsylvania, 1996 Marketing Year

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Diphenylamine	*	*
Thiabendazole	*	*
	1,000 Lbs	
Volume Handled	29,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications by Processors, by Variety, Washington, 1996 Marketing Year

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Diphenylamine	*	*
Sodium hypochlorite	*	*
Thiabendazole	*	*
	1,000 Lbs	
Volume Handled	1,611,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications by Packers and Shippers, by Variety, Washington, 1996 Marketing Year

Agricultural Chemical	Braeburn	Fuji	Gala	Golden Delicious
	Percent of Volume Treated			
Diphenylamine	18	25	*	6
Hydrogen chloride	*	*	*	*
Phosphoric acid	*	*	*	*
Sodium chlorite	*	*	*	*
Sodium hypochlorite	28	55	19	21
Sodium o-phenylphenate	*	*	4	6
Thiabendazole	50	68	55	62
	1,000 Lbs			
Volume Handled	76,000	340,000	189,000	832,000

Agricultural Chemical	Granny Smith	Jonagold	Red Delicious	Rome
	Percent of Volume Treated			
Diphenylamine	88		64	43
Hydrogen chloride	*	*	*	*
Phosphoric acid	*	*	*	*
Sodium chlorite	*	*	*	*
Sodium hypochlorite	50	27	32	22
Sodium o-phenylphenate	*	*	8	*
Thiabendazole	92	59	75	65
	1,000 Lbs			
Volume Handled	279,000	36,000	2,176,000	48,000

Agricultural Chemical	Other Varieties	All Varieties	Total Applied
	Percent of Volume Treated		1,000 Lbs
Diphenylamine	*	45	89.9
Hydrogen chloride	*	*	*
Phosphoric acid	*	*	*
Sodium chlorite	*	*	*
Sodium hypochlorite	14	32	33.6
Sodium o-phenylphenate	*	7	3.8
Thiabendazole	24	71	48.7
	1,000 Lbs		
Volume Handled	44,000	4,020,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Storage Operators, by Variety,
Washington, 1996 Marketing Year

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Diphenylamine	*	*
Thiabendazole	*	*
	1,000 Lbs	
Volume Handled	315,000	

* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Processors, by Variety,
Five-State Total, 1996 Marketing Year 1/

Agricultural Chemical	Cortland	Empire	Granny Smith	McIntosh
	Percent of Volume Treated			
Captan	*	3	*	3
Diphenylamine	5	18	13	6
Sodium hypochlorite		*	15	*
Sodium o-phenylphenate		*	*	*
Thiabendazole	*	17	*	5
	1,000 Lbs			
Volume Handled	30,000	35,000	187,000	99,000

Agricultural Chemical	Red Delicious	Rome	Winesap/ Stayman	Other Varieties
	Percent of Volume Treated			
Captan	4	2	6	*
Diphenylamine	12	4	8	*
Hydrogen peroxide	*			*
Peroxyacetic acid	*			*
Sodium hypochlorite	*	5	*	6
Sodium o-phenylphenate	*			*
Thiabendazole	11	3	*	2
	1,000 Lbs			
Volume Handled	631,000	190,000	16,000	2,296,000

Agricultural Chemical	All Varieties	Total Applied
	Percent of Volume Treated	1,000 Lbs
Captan	1	.7
Diphenylamine	4	7.6
Hydrogen peroxide	*	*
Peroxyacetic acid	*	*
Sodium hypochlorite	8	8.3
Sodium o-phenylphenate	2	.5
Thiabendazole	5	1.8
	1,000 Lbs	
Volume Handled	3,484,000	

* Insufficient reports to publish usage data.
1/ States included are CA, MI, NY, PA, and WA.

Apples: Postharvest Chemical Applications
Packers and Shippers, by Variety,
Five-State Total, 1996 Marketing Year 1/

Agricultural Chemical	Braeburn	Cortland	Crispin	Empire
	Percent of Volume Treated			
Captan		*	*	*
Diphenylamine	19	48	5	53
Hydrogen chloride	*			
Phosphoric acid	*			
Sodium chlorite	*			
Sodium hypochlorite	27	*	*	3
Sodium o-phenylphenate	*	32		*
Thiabendazole	49	42	4	51
	1,000 Lbs			
Volume Handled	77,000	18,000	13,000	96,000

Agricultural Chemical	Fuji	Gala	Golden Delicious	Granny Smith
	Percent of Volume Treated			
Captan			*	
Chlorine	*	*		*
Diphenylamine	24	9	7	80
Hydrogen chloride	*	*	*	*
Phosphoric acid	*	*	*	*
Piperonyl butoxide	*	*		8
Pyrethrins	*	*		8
Sodium chlorite	*	*	*	*
Sodium hypochlorite	52	*	18	49
Sodium o-phenylphenate	9	9	6	8
Thiabendazole	59	45	54	71
	1,000 Lbs			
Volume Handled	465,000	252,000	987,000	416,000

Agricultural Chemical	Idared	Jonagold	Jonamac	Jonathan
	Percent of Volume Treated			
Captan	2	*		*
Diphenylamine	61	6	*	35
Hydrogen chloride		*		
Phosphoric acid		*		
Sodium chlorite		*		
Sodium hypochlorite	*	24	*	4
Sodium o-phenylphenate	13	*	*	*
Thiabendazole	52	55	54	27
	1,000 Lbs			
Volume Handled	45,000	43,000	14,000	32,000

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Apples: Postharvest Chemical Applications
Packers and Shippers, by Variety,
Five-State Total, 1996 Marketing Year (continued)

Agricultural Chemical	Macoun	McIntosh	Northern Spy	Paula Red
	Percent of Volume Treated			
Captan		5		
Chlorine		*		
Diphenylamine	*	39	51	40
Sodium hypochlorite	*	*		*
Sodium o-phenylphenate	*	26		*
Thiabendazole	68	36	44	40
	1,000 Lbs			
Volume Handled	9,000	135,000	18,000	17,000

Agricultural Chemical	Red Delicious	Rome	Spartan	Winesap/ Stayman
	Percent of Volume Treated			
Captan	*	4	16	*
Chlorine	*			
Diphenylamine	64	68	69	62
Hydrogen chloride	*	*		
Phosphoric acid	*	*		*
Sodium chlorite	*	*		
Sodium hypochlorite	29	8	*	*
Sodium o-phenylphenate	9	27	*	*
Thiabendazole	73	69	69	58
	1,000 Lbs			
Volume Handled	2,406,000	179,000	18,000	17,000

Agricultural Chemical	Other Varieties	All Varieties	Total Applied
	Percent of Volume Treated		1,000 Lbs
Captan	*	1	1.3
Chlorine	*	1	1.0
Diphenylamine	11	46	131.8
Hydrogen chloride	*	5	8.8
Phosphoric acid	*	2	46.0
Piperonyl butoxide	*	1	*
Pyrethrins	*	1	*
Sodium chlorite	*	5	.3
Sodium hypochlorite	8	27	37.5
Sodium o-phenylphenate	*	10	5.9
Thiabendazole	25	63	97.3
	1,000 Lbs		
Volume Handled	74,000	5,331,000	

* Insufficient reports to publish usage data.
1/ States included are CA, MI, NY, PA, and WA.

Apples: Postharvest Chemical Applications
Storage Operators, by Variety,
Five-State Total, 1996 Marketing Year 1/

Agricultural Chemical	Empire	Golden Delicious	Red Delicious	Rome
	Percent of Volume Treated			
Diphenylamine	51	*	23	24
Thiabendazole	*	8	22	24
	1,000 Lbs			
Volume Handled	7,000	122,000	211,000	20,000

Agricultural Chemical	Other Varieties	All Varieties	Total Applied
	Percent of Volume Treated		1,000 Lbs
Captan	*	*	*
Diphenylamine	16	16	4.8
Sodium hypochlorite	20	9	1.9
Thiabendazole	1	11	1.6
	1,000 Lbs		
Volume Handled	262,000	622,000	

* Insufficient reports to publish usage data.
1/ States included are CA, MI, NY, PA, and WA.

Apples: Postharvest Chemical Applications
Processors, When Applied,
Five-State Total, 1996 Marketing Year 1/

Active Ingredient	Storage: Before: Regular	Storage: Before: CA	Storage: During: Regular	Storage: During: CA	Storage: After: Regular	Storage: After: CA	Not Stored	Total Applied
	--- Percent of Volume Treated ---						1,000 Lbs	
Captan	*	1			*	*		.7
Diphenylamine	*	4			*	*		7.6
Hydrogen peroxide					*			*
Peroxyacetic acid					*			*
Sodium hypochlorite		3			2	3	1	8.3
Sodium o-phenyl.		2						.5
Thiabendazole	*	5						1.8

1/ Volume handled by processors in the five States surveyed was 3.5 billion pounds. States included are CA, MI, NY, PA, and WA.
* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Packers and Shippers When Applied,
Five-State Total, 1996 Marketing Year 1/

Active Ingredient	Storage: Before: Regular	Storage: Before: CA	Storage: During: Regular	Storage: During: CA	Storage: After: Regular	Storage: After: CA	Not Stored	Total Applied
	--- Percent of Volume Treated ---						1,000 Lbs	
Captan	*	*			*			1.3
Chlorine	*				*			1.0
Diphenylamine	6	40			*	*	*	131.8
Hydrogen chloride					*	5		8.8
Phosphoric acid		1			*	1		46.0
Piperonyl butoxide	*	*						*
Pyrethins	*	*						*
Sodium chlorite					*	5		.3
Sodium hypochlorite	3	2	2		10	13		37.5
Sodium o-phenyl.	1	4	2		*	3		5.9
Thiabendazole	8	41	*		9	22	*	97.3

1/ Volume handled by packers and shippers in the five States surveyed was 5.3 billion pounds. States included are CA, MI, NY, PA, and WA.
* Insufficient reports to publish usage data.

Apples: Postharvest Chemical Applications
Storage Operators When Applied,
Five-State Total, 1996 Marketing Year 1/

Active Ingredient	Storage: Before: Regular	Storage: Before: CA	Storage: During: Regular	Storage: During: CA	Storage: After: Regular	Storage: After: CA	Not Stored	Total Applied
		--- Percent of Volume Treated ---					1,000 Lbs	
Captan		*						*
Diphenylamine	*	14					*	4.8
Sodium hypochlorite					9			1.9
Thiabendazole		11						1.6

1/ Volume handled by storage operators in the five States surveyed was 0.6 billion pounds. States included are CA, MI, NY, PA, and WA.
* Insufficient reports to publish usage data.

Apples: Postharvest Wax Applications
Processors, Packers and Shippers, and Storage Operators
by State, 1996 Marketing Year

Variety	CA	MI	NY	PA	WA	Five-State Total
	Percent of Volume Treated					
Braeburn					64	64
Cortland		23	19	32		20
Crispin		16	5	47		9
Empire		32	36	58	56	36
Fuji	55			80	66	62
Gala	75	39		77	58	62
Golden Delicious	2	7		17	21	18
Granny Smith	54			57	64	59
Idared		17		13	10	15
Jerseymac				68		13
Jonathan	39	6		15	40	10
Jonagold		26	28	55	63	57
Jonamac		49	59			58
Macoun			64			62
McIntosh	61	14	22	40		23
Paula Red		26	49	68		42
Red Delicious	30	38	40	51	57	55
Rome		15	33	23	31	26
Spartan		49		82		58
Winesap/Stayman				35	27	33
Other Varieties	1	4	15	3	20	3
All Varieties	30	16	23	29	45	38
	Billion Pounds					
Total Handled	1.2	.8	1.1	.3	5.9	9.4*

* Totals handled does not add across due to rounding.

Potatoes: Postharvest Chemical Applications
Processors, Packers and Shippers, and Storage Operators,
Colorado, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per Cwt		1,000 Lbs
Chlorpropham	45	1.0	.0022	.0023	37.5
Thiabendazole	37	1.0	.0006	.0006	8.1

1/ Volume handled by Colorado processors, packers and shippers and storage operators was 35,757,000 cwt.
2/ Insufficient reports to publish usage data for Streptomycin sulfate, Maneb, Sodium hypochlorite, and Captan.

Potatoes: Postharvest Chemical Applications
Processors, Packers and Shippers, and Storage Operators,
Maine, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per Cwt		1,000 Lbs
Chlorpropham	16	1.0	.0017	.0017	5.6
Thiabendazole	43	1.0	.0007	.0007	6.3

1/ Volume handled by Maine processors, packers and shippers and storage operators was 20,970,000 cwt.
2/ Insufficient reports to publish usage data for Calcium hypochlorite, Sodium hypochlorite, and Chlorine.

Potatoes: Postharvest Chemical Applications
Processors,
Midwest, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per Cwt		1,000 Lbs
Chlorpropham	37	1.0	.0015	.0015	26.2

1/ Volume handled by Midwest processors was 47,167,000 cwt. Midwest region includes MI, MN, ND, and WI.
2/ Insufficient reports to publish usage data for Thiabendazole.

Potatoes: Postharvest Chemical Applications
Packers and Shippers,
Midwest, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per Cwt		1,000 Lbs
Chlorpropham	42	1.4	.0015	.0021	21.8
Thiabendazole	8	1.0	.0006	.0006	1.3

1/ Volume handled by Midwest Shippers and Handlers was 24,983,000 cwt. Midwest region includes MI, MN, ND, and WI.
2/ Insufficient reports to publish usage data for Sodium hypochlorite.

Potatoes: Postharvest Chemical Applications
Storage Operators,
Midwest, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per Cwt		1,000 Lbs
Chlorpropham	41	1.1	.0014	.0015	25.4
Thiabendazole	14	1.0	.0012	.0012	6.6

1/ Volume handled by Midwest storage operators was 39,917,000 cwt. Midwest region includes MI, MN, ND, and WI.
2/ Insufficient reports to publish usage data for Mancozeb, Sodium hypochlorite, and Chlorine dioxide.

Potatoes: Postharvest Chemical Applications
Processors,
Pacific Northwest, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per Cwt		1,000 Lbs
Chlorpropham	29	1.1	.0019	.0021	108.3

1/ Volume handled by Pacific Northwest processors was 173,482,000 cwt. Pacific Northwest region includes ID, OR, and WA.
2/ Insufficient reports to publish usage data for Chlorine dioxide and Thiabendazole.

Potatoes: Postharvest Chemical Applications
Packers and Shippers,
Pacific Northwest, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per Cwt		1,000 Lbs
Calcium hypochlorite	27	1.0	.0010	.0011	19.6
Chlorpropham	54	1.1	.0014	.0016	57.8
Thiabendazole	16	1.0	.0009	.0009	9.1

1/ Volume handled by Pacific Northwest packers and shippers was 67,671,000 cwt. Pacific Northwest region includes ID, OR, and WA.
2/ Insufficient reports to publish usage data for Chlorine and Chlorine dioxide.

Potatoes: Postharvest Chemical Applications
Storage Operators,
Pacific Northwest, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per Cwt		1,000 Lbs
Chlorpropham	56	1.1	.0023	.0026	162.6
Thiabendazole	13	1.0	.0011	.0011	14.9

1/ Volume handled by Pacific Northwest storage operators was 111,400,000 cwt. Pacific Northwest region includes ID, OR, and WA.
2/ Insufficient reports to publish usage data for Mancozeb.

Potatoes: Postharvest Chemical Applications
Processors,
Nine-State Total, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per cwt		1,000 Lbs
Chlorpropham	30	1.1	.0018	.0020	137.6
Thiabendazole	4	1.0	.0007	.0007	5.9

1/ Volume handled by processors in the nine States surveyed was 228,558,000 cwt. States included are CO, ID, MI, MN, ME, ND, OR, WA, and WI.
2/ Insufficient reports to publish usage data for Sodium hypochlorite and Chlorine dioxide.

Potatoes: Postharvest Chemical Applications
Packers and Shippers,
Nine-State Total, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per Cwt		1,000 Lbs
Calcium hypochlorite	14	1.0	.0010	.0011	19.7
Chlorine	2	1.0	.0007	.0007	2.1
Chlorpropham	49	1.2	.0016	.0019	117.7
Thiabendazole	22	1.0	.0007	.0007	20.2

1/ Volume handled by packers and shippers in the nine States surveyed was 129,112,000 cwt. States included are CO, ID, MI, MN, ME, ND, OR, WA, and WI.
2/ Insufficient reports to publish usage data for Streptomycin sulfate, Maneb, Sodium hypochlorite, Chlorine dioxide, and Captan.

Potatoes: Postharvest Chemical Applications
Storage Operators,
Nine-State Total, 1996 Marketing Year 1/ 2/

Agricultural Chemical	Volume Treated	Applications	Rate per Application	Rate per Mkt. Year	Total Applied
	Percent	Number	Pounds per Cwt		1,000 Lbs
Chlorpropham	49	1.1	.0021	.0024	190.3
Thiabendazole	15	1.0	.0010	.0010	26.1

1/ Volume handled by storage operators in the nine States surveyed was 163,677,000 cwt. States included are CO, ID, MI, MN, ME, ND, OR, WA, and WI.
2/ Insufficient reports to publish usage data Mancozeb, Sodium hypochlorite, Chlorine, and Chlorine dioxide.

Potatoes: Postharvest Chemical Applications,
Processors: When Applied,
Nine-State Total, 1996 Marketing Year 1/

Active Ingredient	Storage: Before		During		After		Not Stored		Total Applied
	Percent Treated	Rate	Percent Treated	Rate	Percent Treated	Rate	Percent Treated	Rate	
	Percent	Lbs per Cwt	Percent	Lbs per Cwt	Percent	Lbs per Cwt	Percent	Lbs per Cwt	1,000 Lbs
Chlorine dioxide					*				*
Chlorpropham			24	.0020	7	.0017			137.6
Sodium hypochlorite	*				*				*
Thiabendazole	2	.0008	*						5.9

1/ Volume handled by processors in the nine States surveyed was 228,558,000 cwt. States included are CO, ID, MI, MN, ME, ND, OR, WA, and WI.
* Insufficient reports to publish usage data.

Potatoes: Postharvest Chemical Applications,
Packers and Shippers When Applied,
Nine-State Total, 1996 Marketing Year 1/

Active Ingredient	Storage: Before		During		After		Not Stored		Total Applied
	Percent Treated	Rate	Percent Treated	Rate	Percent Treated	Rate	Percent Treated	Rate	
	Percent	Lbs per Cwt	Percent	Lbs per Cwt	Percent	Lbs per Cwt	Percent	Lbs per Cwt	1,000 Lbs
Calcium hypochlorite			*		14	.0010			19.7
Captan	*								*
Chlorine	*		*		*				2.1
Chlorine dioxide					*		*		*
Chlorpropham	*		25	.0021	26	.0014	*		117.7
Maneb			*						*
Sodium hypochlorite			*		*				*
Streptomycin sulfate			*						*
Thiabendazole	18	.0008	2	.0005	2	.0002			20.2

1/ Volume handled by packers and shippers in the nine States surveyed was 129,112,000 cwt. States included are CO, ID, MI, MN, ME, ND, OR, WA, and WI.
* Insufficient reports to publish usage data.

Potatoes: Postharvest Chemical Applications,
Storage Operators When Applied,
Nine-State Total, 1996 Marketing Year 1/

Active Ingredient	Storage						Not Stored		Total Applied
	Before		During		After				
	Percent Treated	Rate	Percent Treated	Rate	Percent Treated	Rate	Percent Treated	Rate	
	Percent	Lbs per Cwt	Percent	Lbs per Cwt	Percent	Lbs per Cwt	Percent	Lbs per Cwt	1,000 Lbs
Chlorine	*								*
Chlorine dioxide	*								*
Chlorpropham	*		43	.0021	6	.0042			190.3
Mancozeb	*		*						*
Sodium hypochlorite	*								*
Thiabendazole	10	.0011	5	.0010	*				26.1

1/ Volume handled by storage operators in the nine States surveyed was 163,677,000 cwt. States included are CO, ID, MI, MN, ME, ND, OR, WA, and WI.
* Insufficient reports to publish usage data.

Survey Procedures: Operations were chosen from the NASS List Sampling Frame known or expected to handle apples or potatoes. Generally, all operations known to engage in processing or packing and shipping were included, while operations engaged only in storage were sampled.

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 manufacturer's 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 are of those active ingredients.

Estimates were made based on market segments. Three market segments were identified: processors, packers and shippers, and storage operators. If an operation reported processing a target commodity as well as storing it, they were classified as a processor for summary purposes and all their data were summarized in that category. If an operation with storage did no processing or packing and shipping, they were summarized as a storage facility. Market segment estimates are not mutually exclusive as the same apples or potatoes may have been treated by a storage facility and then treated again by a packer/shipper or processor as the product moved to market.

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 chlorpropham on potatoes, will 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.

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.

CA Storage: CA storage, or controlled atmosphere storage, is a storage facility in which the atmospheric gasses 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 in this survey.

Marketing year: A marketing year refers to the period immediately following harvest of the crop through the marketing or disposition of the crop.

Market Segment: The market channel was divided into three segments; processors, shippers and handlers, and storage operators. These were chosen to categorize the postharvest chemical usage by type of operation.

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 shipped 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.

Storage Operators: Storage operators store the commodity prior to processing or fresh market distribution. If these operators had processing facilities or packing and shipping facilities, they were included those market segments and excluded from the storage operator segment.

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 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.

Volume treated: The amount that represents the percentage of total volume handled receiving one or more applications of a specific agricultural chemical. This report does not contain total quantity treatments. However, total quantity treatments can be calculated by multiplying the total volume handled by the percent of volume treated and the average number of applications.

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 herbicides (H), 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 potatoes, and NASS does not mean to imply use of any specific trade name.

Class	Common Name	Trade Name
O	Calcium hypochlorite	several
F	Captan	Captan
O	Chlorine	Chlorine
O	Chlorine dioxide	Oxine
O	Chlorpropham	Sprout Nip, CIPC
O	Diphenylamine	several
O	Hydrogen chloride	Fresh Pak 2
O	Hydrogen peroxide	Tsunami 100
F	Mancozeb	Dithane
F	Maneb	Potato Seed Treater AS
O	Peroxyacetic acid	Tsunami 100
O	Phosphoric acid	Phos-Circ
I	Piperonyl butoxide	Pyrenone Flexi-Dust
I	Pyrethrins	Pyrenone Flexi-Dust
O	Sodium chlorite	Ivr-San 15
O	Sodium hypochlorite	several
O	Sodium o-phenylphenate	several
F	Streptomycin sulfate	Potato Seed Treater AS
F	Thiabendazole	several

Report Features

Released May 20, 1998, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S. Department of Agriculture. For information on "Agricultural Chemical Usage" call (202) 720-2127, 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 1999. This report will cover the use of postharvest chemicals used on wheat and corn during the 1997 marketing year.

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