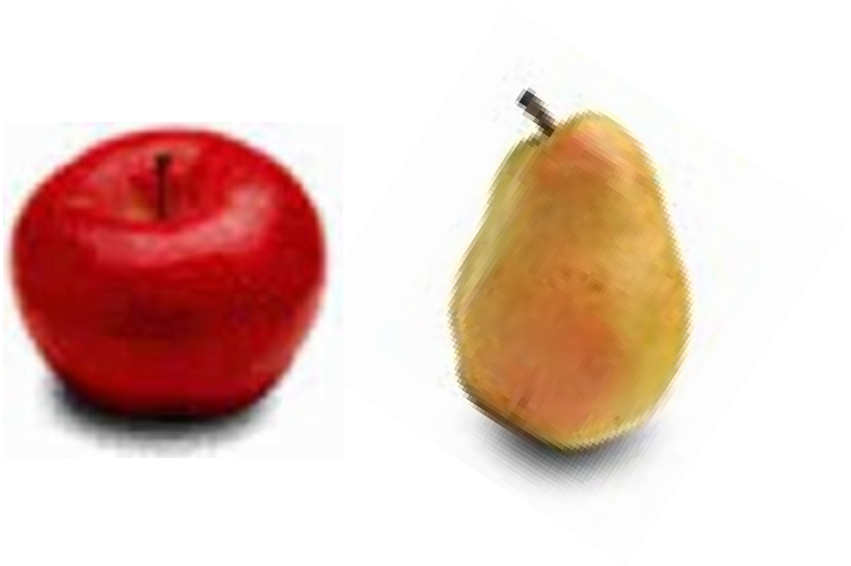
Pest and Pesticide Use Assessment and Personal Protective Equipment Use for Apples and Pears in New York State for 1995



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Introduction

Scientists at Cornell's College of Agriculture and Life Sciences (CALS) continue to research pest control techniques for apple and pear production systems. The scientists confront two different problems: the pests and the losses the pests cause, and the more general problem of designing and implementing solutions that apple and pear growers can accept.

New York Agricultural Statistics 1994-1995 reports that apples were harvested from 57,000 bearing acres in New York State in 1994. Pears were harvested from 2400 bearing acres. Nationally, New York ranked second behind Washington State in the production of apples. New York ranks fourth nationally in the production of pears. The value of the 1994 apple crop was estimated at 130 million dollars, while the value of the pear crop was estimated at 4.85 million dollars.

Present pest management techniques for apples and pears rely heavily on pesticides. The dependence on chemical control can have negative consequences, including the development of pesticide resistance, for example, apple scab resistance to Benomyl is widespread in New York. (Cornell Pest Management Recommendations for Tree Fruit, 1995). Dependence on pesticides can also cause the destruction of the natural enemies of certain pests, thus causing more pesticides to be used. Overuse of pesticides can negatively affect endangered species, and contaminate groundwater as well. The latter is of greater concern in light of the New York State Pesticide and Groundwater Strategy: Draft Generic State Management Plan (GSMP), which, in the Environmental Protection Agency's (EPA) federal strategy, establishes goals and a general framework for more specific pesticide management plans and implementation. It is a beginning for approaches to manage pesticide use and protect groundwater.

The goal of the GSMP is to protect human health and the environment, and to protect the integrity of the State's groundwater resources. At the same time, it recognizes the need to sustain the productivity and economic viability of New York's agriculture, and to provide control of pests which pose significant threats to food production, human health, and natural ecosystems.

The importance of the availability of comprehensive detailed pesticide usage inventories, giving geographic locations, application rates and timing of use cannot be understated. Pesticide use data supports the development and implementation of preventative approaches to groundwater contamination, improves response to EPA regulatory activity, provides information for Cornell Cooperative Extension educational programs, identifies research needs and emerging

new pest problems, and helps in developing IPM strategies that provide alternative pesticide use. Such data is available in this report.

In addition, many pesticide handlers are unaware of the hazards of pesticide exposure and uninformed about the type of personal protective equipment (PPE) that should be worn. The health risks for these workers extend beyond the workplace when pesticide contaminated clothing is worn into the home or when it is washed with the family laundry. Worker safety also affects employers through lost workdays and costly litigation. Pesticide handlers, their families, and their employers need information about PPE that is based on current legislation, national education efforts, and ongoing research. To continue to serve the educational needs of pesticide handlers and their families, information is needed about their current practices and attitudes regarding the use of PPE. This report gives such information and reflects the requirements outlined in the new EPA Worker Protection Standard (WPS), and is based on specific pesticides and cultural practices of apple and pear producers.

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Identified Problems Associated With Pesticide Use In New York State

Pear Psylla

Registered insecticides (petroleum oils, amitraz, esfenvalerate, and permethrin) for summer use on pears have become increasingly unreliable in controlling pear psylla because of the development of resistance. In addition, New York growing conditions necessitate management practices for fruit size attainment that are favorable to the rapid buildup of psylla populations. Contributing to this situation of incomplete control is the widespread use of materials for other pests that are highly destructive to natural control agents, such as synthetic pyrethroids and carbamates. These factors virtually assure a yearly infestation of an insect that would otherwise be a relatively insignificant orchard resident. Now, at best, a grower can hope to keep psylla populations just barely under control. Large numbers of adults left in the orchard at the end of the summer overwinter and initiate the next spring population, while natural control agents don't have the chance to recover before the next encounter with destructive pesticides.

In response to the above situation, New York State requested an emergency exemption in 1994 and 1995 for avermectin to assist growers in controlling pear psylla. During 1996, the registrant of avermectin, Merck Inc., received a pesticide residue tolerance on pears

Obliquebanded leafroller

The obliquebanded leafroller has become one of the most serious pests directly damaging fruit in Western New York apple orchards. Growers began experiencing increased difficulty

controlling the obliquebanded leafroller with the recommended pesticides during the last several years and, despite multiple insecticide applications, problem orchards usually end up with at least 3-4% damaged fruit at harvest. Orchards were constantly monitored by Cornell researchers during the 1995 season and an emergency exemption has been applied for the 1996 growing season.

Objectives

A. To obtain the following information for apple and pear production systems within New York State for the 1995 growing season:
   1. Acres bearing and non-bearing, dwarf, semi-dwarf, and standard, and varieties
   2. For each pest affecting the crop (weeds, insects, diseases):
      a) Chemicals used for control
         (1) Acres treated, bearing and non-bearing
         (2) Rate of application
         (3) Method of application
         (4) Timing of application
         (5) Basis for application
      b) Cost comparison of chemicals
   3. Bird and other vertebrate pest control
   4. Equipment calibration, storage and disposal of pesticides and miscellaneous information
   5. Alternative pest control methods
   6. Comments and concerns of New York State growers

B. To obtain the following information about the current practices and attitudes regarding the use of personal protective equipment for those applying pesticides in field corn production systems:
   1. Use of work clothing and personal protective equipment
   2. Laundering procedures
   3. Replacement of work clothing and PPE
   4. Maintenance and storage of PPE
   5. Label requirements
   6. Use of enclosed vehicles
   7. Educational resources and applicator training programs
   8. Short- and long-term health problems associated with exposure to pesticides.

C. To develop informational programs for growers and expand the database of information currently accessible through Cornell's CENET system for access by university, USDA, NYSDEC, regulatory personnel and others needing pesticide impact assessment information.

Project Design, Implementation, and Analysis

Questionnaires were developed from previous NAPIAP and other surveys that had been conducted in New York State. The first drafts were reviewed by tree fruit specialists in the areas

of weed, insect and disease control, IPM specialists and extension agents for comment and critique. Final survey forms were printed and duplicated (see Appendix for survey form samples) based on input from these groups.

Letters were sent to tree fruit extension agents explaining the project and requesting assistance in the implementation of the survey. A presentation was made at each of the Western New York Fruit Schools as well as the Hudson Valley Fruit School. Another presentation was made at a calibration meeting in the Champlain Valley. After the presentation, surveys were haded out to growers, to complete and return, in postage-paid envelopes. Approximately 400 surveys were given out. The response rate was 10%. In addition, growers were able to receive 1 pesticide recertification credit for completing the survey.

One reason the response rate was low could be because fruit producers are feeling the pressure of too many surveys. With several different government agencies competing for the same data, growers may feel "surveyed to death." Some growers were suspicious that pesticide use data may be "used against them." The detailed pesticide use information that NAPIAP requires may also be a deterrent. Several growers returned surveys without filling out any of the pesticide section. One grower wrote, "This is really too much, don't you think?"

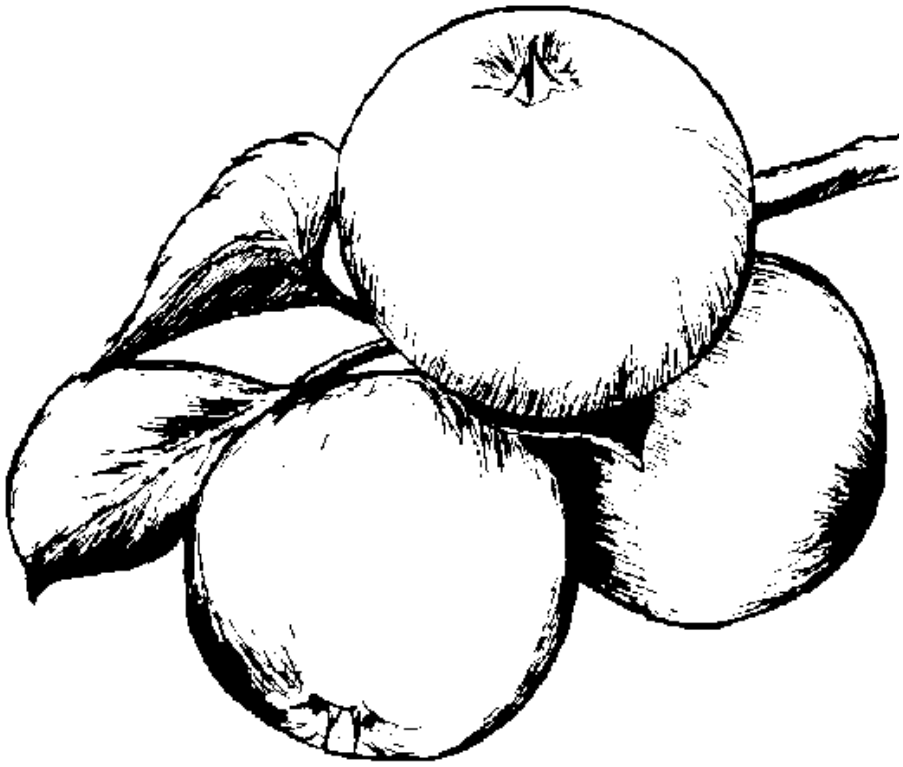
Once data were collected, database management files were developed using FileMaker Pro 3.0 for compilation and analysis of the data. This report contains data pertaining to the objectives stated previously.

Certain words and/or terms used throughout this report are defined below:

- **Active ingredient (ai)**
  The portion of the pesticide product which controls the pest.
- **Grower**
  The owner or employee who filled out the survey, an apple or pear producer.
- **Record**
  One survey complete with all responses within that survey (synonymous with one apple or one pear farm).
- **Response**
  One entry within a record (survey). Since there can be more than one response to certain questions, the distinction between records (growers) and responses is important.
- **Trade name**
  The name designated for a chemical by a company. Similar formulations can have different trade names.
- **Herbicides**
  Chemicals that control weeds.
- **Insecticides**
  Chemicals that control insects.

- **Work clothing**
  Garments growers have in their closet for everyday wear. They may worn for pesticide work if the label does not require any special protection, they may be required by the label, or they may be worn under a protective garment.
- **Personal Protective Equipment (PPE)**
  Garments that are worn specifically to protect from pesticides or pesticide residues.
- **Coveralls**
  One or two-piece garment that covers, at a minimum, the entire body except the hands, feet, and head.
- **Woven coveralls**
  Coveralls made of woven fabric, cotton or cotton/polyester and worn as the outer garment, but not over work clothes.
- **Woven coveralls over work clothes**
  Cotton or cotton/polyester coveralls worn as the outer garment, but over other work clothes.
- **Insulated coveralls**
  Padded coveralls for warmth.
- **Nonwoven coveralls (Limited use or disposable)**
  Coveralls made from fabric that is made by bonding fibrous webs. Examples are: Tyvek®, Kleenguard®, and Comfort Gard®.
- **Chemical-resistant coveralls**
  One or two-piece coveralls of plastic or rubber, or of fabrics coated with plastic or rubber. Examples are: PVC, Saranex-coated, Tyvek®, or rainsuits which are nylon fabric with PVC coating.
- **Barrier laminate**
  Lightweight laminate that resists permeation from a wide range of chemicals. Examples are: Silver Shield® and 4-H®.

Part I: Pest and Pesticide Use Assessment



Demographics

Results and Discussion

Thirty-two apple producers and 5 pear producers filled out a pesticide use survey. For purposes of this survey, the state was divided into two separate geographical areas: Western and Eastern New York.

Table 1: Apple/Pear Survey Areas

Eastern	Western
Orange	Wayne
Ulster	Orleans
Dutchess	Niagara
Rockland	
Greene	
Columbia	

Figure 1: Map of New York showing survey areas

Tables 3 and 4 show the number of apple and pear producers and total surveyed acreage. We received usable surveys from 32 apple growers and 5 pear growers. Growers grew apples on 4375 acres that we surveyed. Pears were grown on 148.5 acres.
Of the apples, 2447.7 acres were grown in the eastern part of New York, while 1897.3 acres were grown in the western part of the state. For pears, 136.5 acres were grown in the eastern region while only twelve acres were surveyed in the western region.

Of those acres that were surveyed, the vast majority of growers in the eastern half of New York were growing apples for the fresh market. 2,034.8 acres, or 82% of the total surveyed, were grown for the fresh market. More apples were grown for processing in western New York. 779.3 acres, or 41%, of the surveyed total were grown for the processor market.

Table 2: Number of Producers and Acreage: Apples

		Number of acres										
		Bearing				Non-bearing				Use		
Area County	# of records	Total	Dwarf	Semi- dwarf	Stand ard	Total	Dwarf	Semi- dwarf	Stand ard	Fresh	Process	Dual
Eastern	13	2,477.7	100.2	2,052.3	326.3	225.6	48.4	141.2	26.0	2,034.8	60.1	385.0
Columbia	2	16.2		16.2		0.2		0.2		16.4		
Dutchess	2	54.5	6.2	48.3		1.0	1.0			47.4	7.1	
Greene	1	8.0			8.0	6.0			6.0	8.0		
Orange	2	452.0	25.0	425.0	2.0	54.0	25.0	29.0		452.0		
Rockland	1	25.0		16.8	8.3	1.4	1.4			24.0	1.0	
Ulster	5	1,922.0	69.0	1,546.0	308.0	163.0	21.0	112.0	20.0	1,487.0	52.0	385.0
Western	19	1,897.3	470.0	1,023.5	403.8	198.7	153.7	42.0		1,055.3	779.3	213.0
Niagara	3	455.0	190.0	235.0	30.0	30.0	30.0			345.0	60.0	50.0
Orleans	5	537.0	162.0	278.0	97.0	27.0	12.0	12.0		277.0	190.0	87.0
Wayne	11	905.3	118.0	510.5	276.8	141.7	111.7	30.0		433.3	529.3	76.0

Table 3: Number of Producers and Acreage: Pears

		Number of acres										
		Bearing				Non-bearing				Use		
Area County	# of records	Total	Dwarf	Semi- dwarf	Stand ard	Total	Dwarf	Semi- dwarf	Stand ard	Fresh	Process	Dual
Eastern	4	136.5		24.0	112.5	8.0		5.0	3.0	12.5		119.0
Dutchess	1	10.0			10.0					10.0		
Rockland	1	2.5			2.5					2.5		
Ulster	2	124.0		24.0	100.0	8.0		5.0	3.0			119.0
Western	1	12.0			12.0					2.0	10.0	
Wayne	1	12.0			12.0					2.0	10.0	

Table 4: Varieties of apples grown in New York State, 32 growers

Eastern New York		Western New York		Western New York (cont.)	
Variety	**# of records**	**Variety**	**# of records**	**Variety**	**# of records**
Cortland	9	20 oz.	7	Melrose	1
Delicious	12	Baldwin	1	Monroe	2
Empire	10	Bananna	1	Mutsu	12
Fortune	1	Ben davis	2	Paula Red	3
Fuji	1	Cameo	1	R.I. Greening	12
Gala	1	Cortland	17	Rome	17
Golden Delicious	9	Delicious	18	Spartan	2
Idared	7	Earliblaze	1	Spy	6
Jersey Mac	6	Early Gold	1	Spy Jon	1
Jona Gold	3	Empire	17	Vista Bella	1
Jona Mac	4	Empress	1	Wayne's	2
Macoun	8	Fuji	2	Webster	1
McIntosh	12	Gala	8		
Mutsu	4	Ginger Gold	3		
Niagara	1	Golden Delicious	15		
Paula Red	6	Hedge's Red	1		
R.I. Greening	1	Idared	17		
Rome	9	Jersey Mac	3		
Spartan	4	Jona Gold	9		
Spy	2	Jona Mac	4		
Stayman	2	Jonathan	1		
Tydeman	4	Macoun	2		
Winesap	1	McIntosh	20		

Tables 4 and 5 give an itemized list of the varieties of apples and pears grown in the survey areas. Growers reported forty different varieties of apple grown in New York state in 1995. The top five varieties were:

- •Macintosh (100%)
- •Delicious (93.8%)
- •Empire (84.4%)
- •Cortland (81.3%)
- •Rome (81.3%)

There were some variations in the varieties grown in the eastern part of the state versus western New York. Growers in western New York grew significantly more varieties of apples than growers in eastern New York. Western producers grew 35 varieties while eastern producers grew only 23 varieties. This is notable because 580.4 more acres were surveyed in eastern New York. Perhaps this result is due to the larger number of growers surveyed in western New York, 19 in the western region, 13 in the eastern region.

There are also some differences in individual varieties. For example, only one grower in the east reported R.I. Greening as a variety, while 12 growers reported it in the west.

Table 5: Varieties of pears grown in New York State, 5 growers

Eastern New York		Western New York	
Variety	**# of records**	**Variety**	**# of records**
Bartlett	3	Bartlett	1
Bosc	4	Bosc	1
Clapp's Favorite	3	Clapp's Favorite	1
Devoe	1		
Flemish Beauty	1		
Gorham	1		
Seckel	3		

Table 5 shows the varieties of pears grown in New York State in 1995. It is difficult to say anything significant with only five growers reporting. However, all the growers who responded reported growing Bosc pears, and four out of the five grew Bartlett and Clapp's Favorite. Three out of the five grew Seckel. No conclusions can be made about any regional differences given the fact that only one pear grower responded from the western region, representing twelve acres.

All of the apple growers surveyed reported using at least one of the IPM practices on our list (Table 6, p.13). The average satisfaction ranged from a high of 1.6, to a low of 2.7, on a scale of 1 to 5 where 1 is very satisfied.

The top six IPM practices sorted by number of growers using them are:

- Mowing to control weeds (100% of growers)
- Scouting to determine spray needs (insects) (96.9% of growers)
- Sprayer calibration to reduce spray dosage (90.6% of growers)
- Usage of pesticides not harmful to predators (87.5% of growers)
- Tree-row volume spraying to control disease (84.4% of growers)
- Scouting/innocular estimation to determine spray needs (78.1% of growers)

The top six IPM practices sorted by satisfaction are:

•Sprayer calibration to reduce spray dosage	(1.6)
•Scouting/innocular estimation to determine spray needs	(1.6)
•Scouting to determine spray needs (insects)	(1.8)
•Tree-row volume spraying to control insects	(1.8)
•Tree-row volume spraying to control disease	(1.8)
•Mowing to control weeds	(1.8)

The fact that there is substantial overlap between the most frequently used practices, and the ones that growers are most satisfied with suggests that growers are doing a good job of identifying which IPM practices do in fact work best for them.

The three IPM practices that the fewest number of growers reported using were disease resistant cultivars, mechanical cultivation to control weeds, and mulching to control weeds. The growers that tried disease resistant cultivars and mulching reported fairly high satisfaction with these practices, but the growers who tried mechanical cultivation gave it the lowest average satisfaction score. This suggests that perhaps more growers should try disease resistant cultivars and mulching to control weeds.

For pear growers, the most commonly reported IPM practices were scouting to determine spray needs and mowing to control weeds, with 100% of growers using each one (Table 7, p.14). On the other hand, none of the pear growers reported growing disease resistant cultivars, or using mechanical cultivation to control weeds, or mulching to control weeds. Those practices were also unpopular with apple growers as well. Tables 6 and 7, documenting the specific the IPM practices used by apple and pear growers, are on the following two pages.

Table 6: IPM Practices to Control Insects and Mites/Apples

	Producers who used IPM practices to control insects/mites in New York State in 1995 (Apples, 32 growers)			
	Practice	**# of growers**	**# of acres**	**Average satisfaction with results †**
Insect control	Scouting to determine spray needs	31	4619.1	1.8
	Field sanitation practices to control insects	15	3042.6	2.1
	Trapping to monitor insect activity	20	3767.6	1.9
	Weather-based predictive model to control insects	13	3013.6	2.2
	Used pesticides not harmful to predators	28	4025.1	2.1
	Tree-row-volume spraying to control insects	26	2781.1	1.8
	Sprayer calibration to reduce spray dosage	29	4279.1	1.6
Disease control	Disease resistant cultivars	7	178.0	1.9
	Field sanitation practices to control disease	17	3172.6	2.3
	Weather-based predictive model to control disease	21	3930.6	2.0
	Tree-row volume spraying to control disease	27	2741.6	1.8
	Scouting/innocular estimation to determine spray needs	25	4185.6	1.6
Weed control	Mechanical cultivation to control weeds	4	512.6	2.7
	Mowing to control weeds	32	4604.6	1.8
	Mulching to control weeds	2	40.0	2.0

†Key: 1=Very satisfied, 2=Somewhat satisfied, 3=Neither satisfied nor unsatisfied, 4=Somewhat unsatisfied, 5=Very unsatisfied.

Table 7: IPM Practices to Control Insects and Mites/Pears

	Producers who used IPM practices to control insects/mites in New York State in 1995 (Pears, 5 growers)			
	Practice	**# of growers**	**# of acres**	**Average satisfaction with results †**
Insect control	Scouting to determine spray needs	5	154.5	1.4
	Field sanitation practices to control insects	2	133.0	2.0
	Trapping to monitor insect activity	3	136.0	1.7
	Weather-based predictive model to control insects	2	127.5	2.0
	Used pesticides not harmful to predators	4	140.5	2.8
	Tree-row-volume spraying to control insects	2	14.5	1.5
	Sprayer calibration to reduce spray dosage	4	144.5	1.3
Disease control	Disease resistant cultivars	0	-	-
	Field sanitation practices to control disease	3	135.5	1.7
	Weather-based predictive model to control disease	1	125.0	2.0
	Tree-row volume spraying to control disease	2	14.5	1.5
	Scouting/innocular estimation to determine spray needs	3	142.0	1.3
Weed control	Mechanical cultivation to control weeds	0	-	-
	Mowing to control weeds	5	154.5	1.8
	Mulching to control weeds	0	-	-

†Key: 1=Very satisfied, 2=Somewhat satisfied, 3=Neither satisfied nor unsatisfied, 4=Somewhat unsatisfied, 5=Very unsatisfied.

Wildlife Pests and Other Questions

Table 8 shows the methods used, both chemical and non-chemical, to control deer and/or rabbit damage in apple/pear orchards in 1995. Deer and/or rabbits were a problem for 89.2% of the apple/pear producers surveyed in 1995. Chemical control was not widely used against this pest. Three growers had "other" responses to this question. Two of the growers reported using Hinder, while the other grower did not list the chemical used. Soap bars were the most popular non-pesticidal means of control, (soap is a chemical, while not being a registered pesticide for this use), with 81.8% of growers who had a problem with deer and or rabbits reporting their use.

The 1995 Pest Management Recommendations for Tree Fruit has this to say about soap bars: "Many growers also experiment with soap bars as a noncommercial deer repellent. Growers should carefully evaluate the cost effectiveness of bars before applying them, as hanging bars requires a substantial labor investment. In addition, soap bars may also increase vole damage" (p.168). The popularity of soap bars suggests that growers are willing to make the labor investment.

Growers did not report using habitat modification to control deer and/or rabbits. The Pest Management Recommendations state that habitat modification and exclusion methods offer the best chance of long-term control (p.169). The initial expense of these efforts is higher than other methods, though.

Table 8: Deer/Rabbit Management **e in 1995**

Were deer/rabbits a problem?	# of records	Chemical control used	# of records	Other control used	# of records
no	4				
yes	33				
		BGR-Deer Away	0	soap bars	27
		Chew-Not	0	exclusion	4
		Bonide Rabbit-Deer	0	habitat modification	0
		Hot Sauce Animal Repellent	0	trapping	1
		Other	3	shooting	12
				other	4

Table 9 shows the methods, both chemical and non-chemical, that growers used to control meadow and pine vole damage. Meadow and pine voles were a problem for 97.3% of the apple/pear producers surveyed in 1995. The most popular chemical control used against these pests was "Rodenticide for Orchard Mice" (Zinc phosphide). The rest of the chemical controls used had the active ingredient Zinc phosphide as well. Zinc phosphide is the only legally registered material in New York State.

Non-chemical control used against meadow and pine voles included mowing/herbicides, and wire or nylon guards. The Tree Fruit Recommendations state, "Careful mowing and herbi-

cide treatment will lower rodent numbers because voles require green, growing vegetation for survival and breeding" (p.170). Nylon guards are also recommended for younger, more sensitive trees.

Table 9: Meadow and Pine Vole Management in 1995

Were voles a problem?	# of records	Chemical control used	# of records	Other control used	# of records
no	1				
yes	36				
		2-100 Field Mouse Bait	0	mowing/herbicides	33
		Rodenticide for Orchard Mice	11	field sanitation	12
		ZP	4	wire or nylon guards	24
		Hopkins ZP Bait	8	other	1
		ZP Rodent Bait AG	7		
		ZP on wheat	0		
		ZP on rolled oats	6		
		ZP concentrate	0		
		other	3		

Table 10 shows the methods used to combat woodchuck damage by apple and pear growers. Woodchucks were a problem for 70.3% of the apple/pear producers surveyed in 1995. A small number of growers tried fumigation to combat this pest. One grower mentioned using fire to "smoke" the woodchuck out of its den. Non-chemical means seemed to be more popular against woodchucks. Shooting and trapping were the two methods most commonly used while one grower used nylon guards specifically against woodchucks. It should be noted that the Pest Management Recommendations states that lethal controls are only somewhat successful in protecting orchards against woodchucks (p.170).

Four growers mentioned other wildlife problems besides the ones described on the survey. Two growers reported "birds" as a problem, while another grower reported that turkeys posed a problem. Raccoons and chipmunks were also reported as causing crop damage. The controls ranged from nets to control birds, to shooting to control the raccoons.

Table 10: Woodchuck Damage Management

Were woodchucks a problem?	# of records	Chemical control used	# of records	Other control used	# of records
no	11				
yes	26				
		fumigation	7	shooting	19
		other	2	trapping	11
				fencing	0
				predator odors	0
				other	1

Table 11 shows the number of apple and pear producers who are certified pesticide applicators. All of the apple/pear producers surveyed were certified pesticide applicators. In order to purchase restricted-use pesticides, a grower must be a certified pesticide applicator.

Table 11: Number of Apple/Pear Producers who are Certified Pesticide Applicators

Are you certified?	# of records
yes	37

Cost	# of records
0$ per acre	0
less than $50 per acre	1
$51-75 per acre	3
$76-100 per acre	1
$101-150 per acre	1
$151-200 per acre	8
$201-250 per acre	5
over $250 per acre	16

Table 12: Cost of chemical pest control by apple/pear producers in New York State in 1995

Chemical pest control remains a major expense for apple and pear producers. Of the 35 growers who responded to this question, 29, or 82.9% spent over 151 dollars per acre on chemical pest control. In fact, 45.7% of the growers reported spending over 250 dollars per acre on chemical pest control. Despite the use of IPM practices documented earlier, apple and pear producers still find it necessary to purchase chemical controls.

Table 13 shows the frequency of pesticide equipment calibration by apple and pear growers. According to the New York State Pesticide Applicators Training Manual (PAT manual), calibration of pesticide application equipment is the first step in controlling the amount of pesticide applied to orchards. Without accurate calibration, a grower has no way of knowing if the amount of pesticide applied is at the recommended rate. Calibration should ideally be performed often. The two most popular responses for apple and pear growers were “once a season” and “two to three times a season.”

This may not be often enough to be considered accurate calibration. 90.6% of the apple growers and 4 of 5 pear growers reported using equipment calibration to reduce spray dosage as a method of integrated pest management. The actual reported frequency of calibration suggests that spray dosage might not be reduced by a significant amount.

Table 13: Frequency of Calibration of Pesticide Application Equipment

Frequency of calibration	# of records
At the time of equipment purchase	0
Before each application	4
Once a season	14
Two to three times a season	14
Every two to three years	3
Never	1
Other	4

Table 14 shows the storage practices of apple/pear producers. Storage of pesticides should occur, if possible, in a separate building designed for storing pesticides. If this is not possible, then a wing or corner on the ground floor of a building should be used (PAT manual, 1990). The pesticide storage area should be locked to prevent access from anyone not trained in the use of pesticides. This includes pets and other animals. Herbicides should be stored separately from pesticides and other materials to avoid contamination. 83.8% of the apple and pear growers indicated that they stored pesticides locked up in separate pesticide only location. 81% indicated that they stored pesticides only in original containers. This helps prevent cross-contamination of pesticides. It could be disastrous if an herbicide were accidentally mixed with an insecticide.

Table 14: Storage Practices of Apple/Pear Producers

Storage practice	# of records
Stored with non-pesticide materials	7
Stored only in original containers	30
Locked up in separate “pesticide only” location	31
Stored in unlocked “pesticide only” location	6
Other	3

Tables 15 and 16 address the issue of pesticide disposal. Disposal is a twofold problem: unwanted or unused pesticides, and empty pesticide containers. According to the PAT manual, disposal of unwanted/unused pesticides can be done in several ways: (a) factory-sealed pesticides may be returned to the manufacturer, (b) excess pesticide mixture can be sprayed on another labeled site where the same pest problem is, or (c) they can be picked up at “Pesticide Clean Up Days.” 81.1% of apple and pear growers responded that they carry over pesticides to the next season. Only 29.7% of those surveyed return unused pesticides to the manufacturer or dealer.

Table 15: Disposal of Unwanted/Unused Pesticides

Disposal method	# of records
Bury	0
Landfill	0
Give to other growers	2
Return to pesticide manufacturer/dealer	11
Spray on noncrop land areas	0
Carryover to next season	30
Do not have any unused/unwanted pesticides	5
Other	4

Table 16: Disposal of Empty Pesticide Containers

Disposal method	# of records
Bury	2
Burn	26
Landfill after triple-rinsing	15
Recycle after triple-rinsing	5
Return to pesticide manufacturer/dealer	1
Other	5

Empty pesticide containers still contain small amounts of pesticide even after rinsing (PAT manual, 1990). Containers should be separated into “burnable,” “non-burnable” and those that contain mercury, lead, cadmium, or inorganic pesticides. The PAT manual gives these rules:

1. When disposing of containers that held liquid formulations:
   - triple-rinse the container immediately after emptying
   - puncture the top and bottom of the container to prevent reuse, crush flat
   - deposit the container in a licensed sanitary landfill
2. When using containers holding dry formulations:
   - completely empty the contents of the container into the tank
   - open both ends of the container to help remove any remaining pesticide and to prevent reuse of container
   - deposit the container in a licensed sanitary landfill
3. Burnable containers can only be burned with state approval and permission on the label. Never burn containers that held 2,4-D type weed killers as the smoke from such a fire could cause serious damage to plants and trees.
4. Non-burnable containers may be returned to the manufacturer for reuse.
5. Burial is the least preferred option for pesticide waste disposal. It is no longer

listed on the label as an option, and is only legal if specifically allowed by state or local laws.

The majority of apple/pear producers surveyed burned their empty pesticide containers in 1995 (70.3%). An additional 40.5% took their containers to a landfill after triple-rinsing them (more than one response was allowed for this question). Very few growers either buried their used containers or returned them to the manufacturer.

Table 17 shows the resources New York apple and pear producers used in 1995 to help make their decisions regarding pest control options for their orchards. The three most common responses were "Cornell Recommends," "Cooperative Extension agent/specialist," and "past success with product." "Past success with product" may be a problematic response because relying on the same pesticides year after year can build pest resistance.

Table 17: Resources used by apple/pear growers to make pesticide decisions.

Who/what	# of records
Magazine, radio or TV advertisement	0
Cooperative Extension agent/specialist	30
Another farmer/grower	7
Farm supply dealer	3
Chemical salesperson	16
Private consultant	18
Past success with product	27
Cornell Recommends	32
Other	1

Specific Pesticides

Some notes about the pesticide-use tables: Only 35 growers of the 37 who returned surveys remitted usable pesticide-use information. The two growers who did not fill out the pesticide-use section properly were apple growers. The five pear growers filled this section out properly. These two apple growers instead sent printouts of their spray records. Unfortunately this data was not detailed enough for NAPIAP's purposes and did not meet the objectives of this survey.

Also, the acreages reported in the pesticide-use tables may seem inconsistent. For example, in the tables where pesticide usage is shown by active ingredient and trade name, certain pesticides may appear to have been applied to more acreage than the total acreage reported in tables 2 and 3 on page 9. This is because a grower may have reported using the same pesticide at different rates on the same acreage.

In addition, the survey had a question on the first page asking growers to indicate the total number of acres, bearing and non-bearing, of their apple or pear orchard. Two growers reported the total number of acres treated with pesticides was greater than the total size of the orchard. This leads to inconsistent results in tables 26, 35, and 43, which show the percentage of total acreage treated with pesticides. The total acreage treated with each class of pesticide was calculated by adding the greatest number of non-bearing acres treated to the greatest number of bearing acres treated, per grower.

Insecticides

Tables 18 and 19 (pages 25, 26 and 27) show the active ingredients, trade names, acres treated, average number of times applied, average rate of product per acre, average rate of active ingredient per acre and total amount of active ingredient applied for each of the insecticides used by apple and pear growers in this survey. All insecticide applications were applied by apple and pear producers themselves or an employee. The insecticide active ingredients used by the greatest number of apple growers in 1995 were refined petroleum distillate, chlorpyrifos, carbaryl, propargite, and azinphos-methyl. At least two-thirds of the apple growers used one of these active ingredients in their orchards. Of those active ingredients only azinphos-methyl (Guthion) is a restricted-use pesticide. When we look at total amount of active ingredient applied, propargite drops out of the list to be replaced by phosmet. The top five insecticides by total amount applied were:

• refined petroleum distillate	58055.985 lbs.†
• chlorpyrifos	10464.291 lbs.
• phosmet	8959.162 lbs.
• azinphos-methyl	7367.545 lbs.
• carbaryl	7192.099 lbs.

Of course, measuring refined petroleum distillate (spray oil) in pounds is somewhat misleading because it is normally measured in gallons. Also, the formulated pesticide is nearly 100% active ingredient, unlike most other pesticides registered for use on apples. That is why the total amount of refined petroleum distillate applied to apples is so much greater than other insecticides.

For pears, there were only 8 different insecticide active ingredients reported, while apple growers reported using 21 different insecticide active ingredients. In addition, pear growers used two active ingredients that apple growers did not: abamectin and amitraz. All 5 pear growers used abamectin in their orchards while 3 of 5 used amitraz. The insecticides used by the greatest number of pear growers were refined petroleum distillate and abamectin. There were only 595.393 lbs. of total insecticide active ingredients applied to the pear acreage in this survey. That is a very small percentage of that applied to the apple acreage.

Tables 20 and 21 (pages 28, 29 and 30) show the pests each insecticide active ingredient was intended to control for apple and pear growers in this survey. For apples, the most often mentioned pests for which insecticides or miticides were applied were:

• European red mite	55 records
• Obliquebanded leafroller	52 records
• Apple maggot	38 records
• Plum curculio	29 records
• Green aphids	28 records
• Codling moth	27 records
• White apple leafhopper	26 records
• Spotted tentiform leafminer	22 records

Obliquebanded leafroller is a major concern of apple growers in New York state, as mentioned in the introduction. European red mite is also a major concern now that the EPA has suspended the registration of propargite on apples. The insecticides or miticides which were applied to combat the greatest variety of pests on apples were azinphos-methyl, endosulfan, chlorpyrifos, esfenvalerate, methomyl, and imidacloprid.

On pears the major pests for which insecticides/miticides were applied were pear psylla, codling moth, and obliquebanded leafroller. Pear psylla is a concern, as noted in the introduction, because of the development of resistance to the registered pesticides. Abamectin, which received an emergency exemption on pears for this pest, was used by each of the pear growers surveyed.

Tables 22 and 23 (pages 31 and 32) show the insecticide application equipment and methods used by the apple and pear growers we surveyed. In the two tables “HV air blast” stands for

a high volume air blast sprayer that sprays greater than 100 gallons per acre. “LV air blast” stands for a sprayer that sprays less than 100 gallons per acre. For apples, growers used high volume air blast sprayers nearly twice as much as low volume air blast sprayers. 2 growers used a hand-held sprayer, one application of refined petroleum distillate, and one application of methomyl. Pear growers slightly preferred high volume air blast sprayers to low volume sprayers, but there were 4 instances of hand-held sprayers being used, a much higher percentage of insecticide application by this method than with the apple growers.

The insecticide application method most preferred by the apple and pear growers we surveyed was foliar. However, many growers indicated that they used a drench method of application for certain insecticides. The drench method of application should only be used for insecticides that target boring insects. It is a method of applying a pesticide to the bark or the ground beneath a tree. The dogwood borer is the only pest for which drench would be an appropriate application method. Only 2 apple growers mentioned dogwood borer as a pest problem in their orchards. There are simply too many records of drench application. This data is highly suspect. Probably growers were confused as to the meaning of drench application in the context of tree fruit, because it is relatively rare. The survey itself did not specifically describe the different application methods. In conclusion, it is probably best to assume that the application method of the insecticides used on apples and pears was foliar.

Tables 24 and 25 (pages 33 ,34 and 35) show the timing and basis for the application of insecticides to apples and pears. Most growers based their insecticide or miticide applications on the presence of a specific pest on their farm. Another popular response was “action thresholds.” Carbaryl is a notable exception. Although this material is an insecticide, most applications of carbaryl were for its fruit thinning effect on apples.

Table 26 (page 35) shows the total acreage, broken down by survey area, that insecticides were applied to in 1995. Please note the discrepancy in acreage explained on page 22. Insecticides were applied to nearly 100% of the apple and pear acreage we surveyed, both bearing and non-bearing.

Table 18: Insecticides used on apples sorted by active ingredient and trade name

Apples (30 growers)

Active Ingredient	Trade Name	# of records	Average # of times applied	Average rate of product (per acre)	Bearing acres treated	Non-bearing acres treated	Average rate of active ingredient (lbs/acre)	Total active ingredient applied (lbs)
azinphos-methyl		20			1669.600	148.250		
	Guthion 3	11	3.000	0.803 gal.	728.200	66.900	2.410	5748.709
	Guthion Solupak	9	3.222	0.982 lbs.	941.400	81.350	0.491	1618.836
Bacillus thuringiensis		4			461.000	0.000		
	Dipel 2X	3	2.000	1.832 lbs.	372.000	0.000	26.600 billion I.U.	19790.156 billion I.U.
	MVP	1	1.000	0.500 gal.	89.000	0.000	0.450 (lbs. endotoxin)	40.050(lbs. endotoxin)
carbaryl		22			4492.700	110.200		
	Sevin brand 4F	3	1.000	0.375 gal.	140.000	5.000	1.500	217.500
	Sevin brand 50W	17	1.647	1.920 lbs.	4306.200	105.200	0.960	6974.599
	Sevin brand 80S	2	1.000	2.500 lbs.	46.500	0.000	2.000	93.000
chlorpyrifos		23			5107.100	134.200		
	Lorsban 4E	5	1.200	0.269 gal.	1676.000	80.000	1.078	2270.508
	Lorsban 50W	18	1.944	2.418 lbs.	3431.100	54.200	1.209	8193.783
dicofol		1			60.000	0.000		
	Kelthane 50	1	1.000	3.000 lbs.	60.000	0.000	1.500	90.000
dimethoate		2			1595.000	0.000		
	Cygon	2	1.500	0.219 gal.	1595.000	0.000	0.875	2093.438
endosulfan		15			1472.000	109.700		
	Thiodan 3EC	2	2.000	0.418 gal.	160.000	15.000	1.254	438.867
	Thiodan 50WP	13	2.308	2.037 lbs.	1312.000	94.700	1.019	3306.785
esfenvalerate		16			1408.400	104.700		
	Asana XL	16	1.438	0.064 gal.	1408.400	104.700	0.042	91.404
fenbutatin-oxide		2			1535.000	80.000		
	Vendex 50WP	2	2.000	1.250 lbs.	1535.000	80.000	0.625	2018.750

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Table 18: Insecticides used on apples sorted by active ingredient and trade name (cont.)

Apples (cont.)

Active Ingredient	Trade Name	# of records	Average # of times applied	Average rate of product (per acre)	Bearing acres treated	Non-bearing acres treated	Average rate of active ingredient (lbs/acre)	Total active ingredient applied (lbs)
formetenate hydrochloride		2			49.000	0.000		
	Carzol SP	2	1.000	0.626 lbs.	49.000	0.000	0.576	28.203
imidacloprid		10			1116.000	108.050		
	Provado 1.6 flowable	10	1.400	0.039 gal.	1116.000	108.050	0.063	107.770
insecticidal soap		1			20.000	0.000		
	M-Pede	1	1.000	2.000 gal.	20.000	0.000	N/A	40.000 gal.
methidathion		1			200.000	0.000		
	Supracide 2E	1	2.000	0.250 gal.	200.000	0.000	0.500	200.000
methomyl		10			2259.900	206.000		
	Lannate	6	1.667	0.552 lbs.	2009.900	155.000	0.497	1792.808
	Lannate LV	4	1.750	0.231 gal.	250.000	51.000	0.555	292.396
methyl parathion		15			1373.400	82.700		
	Penncap-M	15	1.867	0.411 gal.	1373.400	82.700	0.822	2233.334
oxamyl		4			1761.000	0.000		
	Vydate L	4	1.250	0.422 gal.	1761.000	0.000	0.844	1857.305
oxythioquinox		1			43.000	0.000		
	Morestan	1	1.000	5.000 lbs.	43.000	0.000	1.250	53.750
permethrin		2			43.000	25.000		
	Ambush 25W	2	1.000	0.141 lbs.	43.000	25.000	0.035	2.391
phosmet		12			2331.000	132.000		
	Imidan 50-WP	12	2.250	3.233 lbs.	2331.000	132.000	1.617	8959.162
propargite		21			3444.600	58..250		
	Omite 30W	7	1.714	3.411 lbs.	1764.200	0.200	1.023	3094.902
	Omite CR	10	1.600	0.600 lbs.	1478.900	56.700	0.180	442.299
	Omite-6E	4	2.000	0.207 gal.	201.500	1.350	1.242	503.837
refined petroleum distillate		26			2472.300	97.700		
	Sunspray 6E	20	1.000	3.093 gal.	2030.400	97.700	21.957†	46726.160†
	Ultra-Fine Spray Oil	6	1.333	2.708 gal.	441.900	0.000	19.229†	11329.825†

Table 19: Insecticides used on pears sorted by active ingredient and trade name

Pears (5 growers)

Active Ingredient	Trade Name	# of records	Average # of times applied	Average rate of product (per acre)	Bearing acres treated	Non-bearing acres treated	Average rate of active ingredient (lbs/acre)	Total active ingredient applied (lbs.)
abamectin		5			154.500	6.000		
	Agri-mek	5	1.200	0.141 gal.	154.400	6.000	0.021	4.063
amitraz		3			17.500	0.000		
	Mitac 1.5EC	2	1.000	0.500 gal.	15.000	0.000	0.750	11.250
	Mitac WP	1	2.000	0.375 lbs.	2.500	0.000	0.188	0.938
azinphos-methyl		3			19.500	0.000		
	Guthion 3	2	2.000	0.625 gal.	17.000	0.000	1.875	63.750
	Guthion Solupak	1	3.000	1.500 lbs.	2.500	0.000	0.750	5.625
dicofol		1			12.000	0.000		
	Kelthane 50	1	1.000	3.000 lbs.	12.000	0.000	1.500	18.000
esfenvalerate		3			42.000	2.000		
	Asana XL	3	1.000	0.049 gal.	42.000	2.000	0.033	1.437
methomyl		1			125.000	0.000		
	Lannate	1	2.000	0.375 lbs.	125.000	0.000	0.338	84.375
methyl parathion		2			17.000	0.000		
	Penncap-M	2	1.000	0.375 gal..	17.000	0.000	0.750	12.750
refined petroleum distillate		5			41.500	2.000		
	Sunspray 6E	2	1.000	1.625 gal.	17.000	2.000	11.538†	219.213†
	Ultra-Fine Spray Oil	3	1.000	1.000 gal.	24.500	0.000	7.100†	173.950†

Table 20: Insecticide active ingredients and pests: Apples

Apples (30 growers)

Active Ingredient	Pest	# of records
azinphos-methyl (20 records)	apple maggot	12
	codling moth	10
	european apple sawfly	7
	oriental fruit moth	2
	plum curculio	15
	european corn borer	1
	san jose scale	2
	green fruitworms	3
	lesser appleworm	1
	obliquebanded leafroller	1
	white apple leafhopper	1
Bacillus thuringiensis (4 records)	obliquebanded leafroller	4
carbaryl (22 records)	comstock mealybug	1
	white apple leafhopper	8
	plum curculio	1
	codling moth	1
	apple maggot	1
	green aphids	1
	green fruitworms	1
chlorpyrifos (23 records)	apple maggot	5
	codling moth	3
	blister spot	1
	obliquebanded leafroller	14
	comstock mealybug	1
	dogwood borer	2
	european corn borer	2
	european red mite	1
	twospotted spider mite	1
	green fruitworms	1

Apples (cont.)

Active Ingredient	Pest	# of records
chlorpyrifos (cont.)	plum curculio	3
	redbanded leafroller	1
	rosy apple aphid	5
	san jose scale	4
	tarnsihed plant bug	3
	spotted tentiform leafminer	1
dicofol (1 record)	european red mite	1
dimethoate (2 records)	green aphids	1
	obliquebanded leafroller	1
	redbanded leafroller	1
endosulfan (15 records)	green aphids	6
	green fruitworms	2
	tarnished plant bug	3
	potato leafhopper	2
	spirea aphid	1
	obliquebanded leafroller	1
	spotted tentiform leafminer	3
	plum curculio	1
	rosy apple aphid	6
	san jose scale	1
	white apple leafhopper	4
esfenvalerate (16 records)	apple maggot	1
	codling moth	1
	green aphids	2
	green fruitworms	1
	obliquebanded leafroller	7
	spotted tentiform leafminer	8
	tarnished plant bug	7
	rosy apple aphid	9
	plum curculio	1
	redbanded leafroller	1

(Continued on next page)

Table 20: Insecticide active ingredients and pests: Apples (cont.)

Apples (cont.)

Active Ingredient	Pest	# of records
esfenvalerate (cont.)	san jose scale	1
	wooly apple aphid	1
fenbutatin-oxide (2 records)	european red mite	2
formetenate hydrochloride (2 records)	european red mite	2
	white apple leafhopper	1
imidacloprid (10 records)	green aphids	7
	potato leafhopper	3
	obliquebanded leafroller	1
	rosy apple aphid	1
	spirea aphid	1
	spotted tentiform leafminer	2
	white apple leafhopper	3
	redbanded leafroller	1
	tarnished plant bug	1
insecticidal soap (1 record)	european red mite	1
methidathion (1 record)	european red mite	1
methomyl (10 records)	apple maggot	1
	green aphids	6
	obliquebanded leafroller	6
	white apple leafhopper	5
	potato leafhopper	1
	green fruitworms	2
	oriental fruit moth	1
	spotted tentiform leafminer	4
	plum curculio	1
	rosy apple aphid	1
methyl parathion (15 records)	apple maggot	6
	codling moth	2
	obliquebanded leafroller	10

Apples (cont.)

Active Ingredient	Pest	# of records
methyl parathion (cont.)	san jose scale	1
	green fruitworms	1
	green aphids	2
	spotted tentiform leafminer	1
	wooly apple aphid	1
oxamyl (4 records)	apple maggot	1
	green aphids	2
	spotted tentiform leafminer	1
	white apple aphid	1
oxythioquinox (1 record)	european red mite	1
permethrin (2 records)	green aphids	1
	white apple leafhopper	1
	obliquebnded leafroller	1
	spotted tentiform leafminer	1
phosmet (12 records)	apple maggot	10
	codling moth	6
	obliquebanded leafroller	2
	plum curculio	5
	redbanded leafroller	1
	green aphids	1
	white apple leafhopper	1
	tarnished plant bug	1
propargite (21 records)	european red mite	21
	twospotted spider mite	3
refined petroleum distillate (26 records)	european red mite	22
	apple rusts	1
	san jose scale	1
	twospotted spider mite	1
	fire blight	3
	plum curculio	1

Table 21: Insecticide active ingredients and pests: Pears

Pears (5 growers)

Active Ingredient	Pest	# of records
abamectin (5 records)	pear psylla	5
	pear rust mite	1
amitraz (3 records)	pear psylla	3
azinphos-methyl (3 records)	codling moth	3
	european apple sawfly	1
	oriental fruit moth	1
	pear midge	1
	tarnished plant bug	1
dicofol (1 record)	european red mite	1
	pear rust mite	1
esfenvalerate (3 records)	obliquebanded leafroller	1
	pear psylla	2
methomyl (1 record)	obliquebanded leafroller	1
methyl parathion (2 records)	codling moth	1
	comstock mealybug	1
	obliquebanded leafroller	2
refined petroleum distillate (5 records)	pear psylla	4
	pear rust mite	1

Table 22: Insecticide application equipment and methods: Apples

Active Ingredient	Equipment	# of records	Method	# of records
azinphos-methyl (20 records)	HV air blast LV air blast	7 13	Drench Foliar	1 19
bacillus thuringiensis (4 records)	HV air blast LV air blast	1 3	Foliar	4
carbaryl (22 records)	HV air blast LV air blast	13 9	Banded Drench Foliar	1 2 19
chlorpyrifos (23 records)	HV air blast LV air blast	12 11	Drench Foliar	2 21
dicofol (1 record)	LV air blast	1	Foliar	1
dimethoate (2 records)	HV air blast	2	Foliar	2
endosulfan (15 records)	HV air blast LV air blast	8 7	Drench Foliar	2 13
esfenvalerate (16 records)	HV air blast LV air blast	4 12	Drench Foliar	1 15
fenbutatin-oxide (2 records)	HV air blast	2	Foliar	2
formetenate (2 records)	LV air blast	2	Foliar	2
imidacloprid (10 records)	HV air blast LV air blast	3 7	Drench Foliar	1 9
insecticidal soap (1 record)	HV air blast	1	Foliar	1
methidathion (1 record)	HV air blast	1	Foliar	1
methomyl (10 records)	HV air blast LV air blast Hand-held	4 5 1	Foliar	10
methyl parathion (15 records)	HV air blast LV air blast	6 9	Drench Foliar	1 14
oxamyl (4 records)	HV air blast	4	Drench Foliar	2 2
oxythioquinox (1 record)	HV air blast	1	Foliar	1
permethrin (2 records)	HV air blast LV air blast	1 1	Foliar	2
phosmet (12 records)	HV air blast LV air blast	7 5	Foliar	12
propargite (21 records)	HV air blast LV air blast	9 12	Drench Foliar	2 19
refined petroleum distillate (26 records)	HV air blast LV air blast Hand-held	12 13 1	Drench Foliar	2 24

Table 23: Insecticide application equipment and methods: Pears

Active Ingredient	Equipment	# of records	Method	# of records
abamectin (5 records)	HV air blast	3	Drench	1
	LV air blast	1	Foliar	4
	Hand-held	1		
amitraz (3 records)	HV air blast	1	Drench	1
	LV air blast	1	Foliar	2
	Hand-held	1		
azinphos-methyl (3 records)	HV air blast	1	Foliar	3
	LV air blast	2		
dicofol (1 record)	HV air blast	1	Foliar	1
esfenvalerate (3 records)	HV air blast	1	Foliar	3
	LV air blast	1		
	Hand-held	1		
methomyl (1 record)	HV air blast	1	Foliar	1
methyl parathion (2 records)	HV air blast	1	Foliar	2
	LV air blast	1		
refined petroleum distillate (5 records)	HV air blast	2	Drench	1
	LV air blast	2	Foliar	4
	Hand-held	1		

Table 24: Insecticide application timing and basis: Apples

Active Ingredient	Timing	# of records	Basis	# of records
azinphos-methyl (20 records)	petal fall	13	presence of pest	13
	cover sprays	17	action thresholds	14
	7-10 day intervals	1	calendar spray	10
	10-14 day intervals	2	tree phenology	2
	14-21 day intervals	1	weather	3
			per consultant	1
bacillus thuringiensis (4 records)	cover sprays	3	presence of pest	3
	5-7 day intervals	1	action thresholds	3
carbaryl (22 records)	pink	1	presence of pest	7
	petal fall	5	action thresholds	3
	cover sprays	13	calendar spray	2
	7-10 day intervals	1	tree phenology	21
			chem. fruit thinning	18
			fruit drop control	1
chlorpyrifos (23 records)	dormant	1	presence of pest	13
	half-inch green	3	action thresholds	9
	tight cluster	1	calendar spray	9
	pink	3	tree phenology	4
	petal fall	1	weather	1
	cover sprays	12	neighbor's farm	1
	5-7 day intervals	1		
	7-10 day intervals	1		
	10-14 day intervals	2		
dicofol (1 record)	cover sprays	1	presence of pest	1
dimethoate (2 records)	cover sprays	2	presence of pest	2
			action thresholds	1
endosulfan (15 records)	tight cluster	1	presence of pest	11
	pink	7	action thresholds	5
	cover sprays	12	calendar spray	2
			tree phenology	2
			per consultant	2
esfenvalerate (16 records)	dormant	1	presence of pest	12
	tight cluster	1	action thresholds	4
	pink	8	calendar spray	2
	cover sprays	6	tree phenology	5
			weather	1
fenbutatin-oxide (2 records)	cover sprays	2	presence of pest	2
			action thresholds	1
formetenate (2 records)	cover sprays	2	presence of pest	1
			action thresholds	1

(Continued on next page)

Table 24: Insecticide application timing and basis: Apples (cont.)

Active Ingredient	Timing	# of records	Basis	# of records
imidacloprid (10 records)	dormant	1	presence of pest	8
	swollen bud	1	action thresholds	7
	cover sprays	8	per consultant	1
	10-14 day intervals	1		
insecticidal soap (1 record)	cover sprays	1	presence of pest	1
			action thresholds	1
methidathion (1 record)	cover sprays	1	presence of pest	1
methomyl (10 records)	pink	3	presence of pest	8
	cover sprays	7	action thresholds	5
			calendar spray	1
methyl parathion (15 records)	petal fall	1	presence of pest	11
	cover sprays	15	action thresholds	7
	7-10 day intervals	1	calendar spray	3
			tree phenology	2
			per consultant	1
oxamyl (4 records)	cover sprays	4	presence of pest	4
			action thresholds	2
oxythioquinox (1 record)	tight cluster	1	presence of pest	1
permethrin (2 records)	pink	2	presence of pest	1
			action thresholds	1
			calendar spray	1
phosmet (12 records)	tight cluster	1	presence of pest	7
	petal fall	2	action thresholds	4
	cover sprays	11	calendar spray	4
	7-10 day intervals	1	tree phenology	1
	10-14 day intervals	1	weather	1
			per consultant	1
propargite (21 records)	swollen bud	1	presence of pest	16
	petal fall	2	action thresholds	12
	cover sprays	18	calendar spray	1
	7-10 day intervals	1	per consultant	1
refined petroleum distillate (26 records)	dormant	3	presence of pest	15
	green cluster	2	action thresholds	7
	green tip	6	calendar spray	5
	half-inch green	7	tree phenology	9
	tight cluster	8	weather	1
	pink	2	per consultant	2
	cover sprays	2		

Table 25: Insecticide application timing and basis: Pears

Active Ingredient	Timing	# of records	Basis	# of records
abamectin (5 records)	petal fall	2	presence of pest	4
	cover sprays	3	action threholds	2
			tree phenology	1
			neighbor farms	1
amitraz (3 records)	cover sprays	2	presence of pest	2
			action threholds	1
azinphos-methyl (3 records)	tight cluster	1	presence of pest	2
	petal fall	2	action threholds	1
	cover sprays	2	calendar spray	2
			tree phenology	2
dicofol (1 record)	petal fall	1	presence of pest	1
			tree phenology	1
esfenvalerate (3 records)	dormant	1	presence of pest	3
	cover sprays	2	tree phenology	1
methomyl (1 record)	cover sprays	1	presence of pest	1
methyl parathion (2 records)	cover sprays	2	presence of pest	2
refined petroleum distillate (5 records)	swollen bud	1	presence of pest	4
	green tip	1	action threholds	2
	petal fall	2	tree phenology	2
	cover sprays	1		

Table 26: Summary of acreage treated with insecticides

Apples (30 growers)				
Area	**# of records**	**Total Acreage (bearing & non-bearing)**	**Acreage treated with insecticides**	**Percent of total acreage†**
Eastern	13	2703.3	2676.3	99.0
Western	17	1873.0	1834.3	97.9
Pears (5 growers)				
Eastern	4	144.5	150.5	104.2†
Western	1	12.0	12.0	100.0

(†Totals more than 100% due to discrepancy in reported acreage. See page 22)

Fungicides

Tables 27 and 28 (pages 38, 39, and 40) show the active ingredients, trade names, acres treated, average number of times applied, average rate of product per acre, average rate of active ingredient per acre, and total amount of active ingredient applied for each of the fungicides used by apple and pear growers in this survey. All fungicide applications were applied by apple and pear producers themselves, or an employee. The fungicide active ingredients used by the greatest number of apple growers in 1995 were mancozeb, captan, benomyl, and fenarimol. At least two-thirds of the apple growers used one of these active ingredients in their orchards. None of the most commonly used active ingredients are restricted-use pesticides.

The most commonly applied fungicides, by amount of active ingredient applied:

•mancozeb	28928.423 lbs.
•captan	12904.123 lbs.
•sulfur	10281.500 lbs.
•thiophanate methyl	2977.187 lbs.

As you can see, benomyl and fenarimol drop out of the list of most commonly used pesticides when rated by the amount of active ingredient applied. Sulfur has a high per acre application rate, and the formulated pesticide has a high percentage of active ingredient. Thiophanate methyl was applied 4 times to a large number of acres by one particular grower. Mancozeb and captan are clearly the two top fungicides on apples.

For pears, mancozeb was used by all five pear producers surveyed, but captan was used by only one pear grower. The fungicide ziram was used by a much higher percentage of pear growers than apple growers. Only 3 of 30 apple growers applied ziram while 4 of 5 pear growers used ziram on their orchards. One pear grower used ferbam, a fungicide active ingredient not used by apple growers.

Tables 29 and 30 (pages 41 and 42) show the pests each active ingredient was intended to control for apple and pear growers in this survey. For apples, the most often mentioned pests for which fungicides or bactericides were applied were:

•Apple scab	72 records
•Powdery mildew	41 records
•Sooty blotch	29 records
•Fly speck	28 records
•Black rot	17 records

Apple scab (not surprisingly) was the most important disease pest for the apple growers surveyed.

For pears, the major pests for which fungicides/bactericides were applied were Fabraea leaf spot and Pear scab.

Tables 31 and 32 (pages 43 and 44) show the fungicide application equipment and methods used by apple and pear growers in this survey. In the two tables “HV air blast” stands for a high volume air blast sprayer that sprays greater than 100 gallons per acre. “LV air blast” stands for a sprayer that sprays less than 100 gallons per acre. Apple growers applied fungicides using low volume air blast equipment approximately 30% more often than they used high volume sprayers. This is in contrast to insecticide applications, where apple growers used high volume application equipment much more often than low volume. One apple grower each reported applying fungicides with a hand-held sprayer, an airplane, and as a dip. For pears, fungicide application equipment was divided evenly between high volume and low volume sprayers, with 3 growers mentioning the use of a hand-held sprayer.

The most prevalent fungicide application method was foliar, as with the insecticides, however, far fewer growers mentioned drench as an application method for fungicides. For those that did mention drench as a method, it is hard to know what those responses could have meant.

Tables 33 and 34 (pages 45, 46 and 47) show the timing and basis for the application of fungicides to apples and pears. Many growers based their fungicide applications on “presence of pest” or “calendar spray,” however, many more fungicide applications than insecticide applications were based on “disease conducive weather.”

Table 35 (page 47) shows the total acreage, broken down by survey area, that fungicides were applied to in 1995. Please note the discrepancy in acreage explained on page 22. Fungicides were applied to nearly 100% of the apple and pear acreage we surveyed, both bearing and non-bearing.

Table 27: Fungicides used on apples sorted by active ingredient and trade name

Apples (30 growers)								
Active Ingredient	**Trade Name**	**# of records**	**Average # of times applied**	**Average rate of product (per acre)**	**Bearing acres treated**	**Non-bearing acres treated**	**Average rate of active ingredient (lbs/acre)**	**Total active ingredient applied (lbs)**
benomyl		23			2508.6000	52.9000		
	Benlate	23	3.000	0.547 lbs.	2508.6000	52.9000	0.274	2102.542
captan		26			2268.200	187.550		
	Captan 50-WP	16	3.000	2.861 lbs.	1383.7	133.550	1.430	6511.136
	Captan 80-WP	10	3.600	2.365 lbs.	884.500	54.000	1.892	6392.987
copper hydroxide		4			255.000	10.000		
	Kocide DF	4	1.000	7.250 lbs.	255.000	10.000	4.423	1171.963
copper oxychloride		8			261.000	46.000		
	C-O-C-S WDG	3	1.000	3.833 lbs.	95.000	21.000	3.412	395.753
	C-O-C-S Wettable	5	1.000	4.960 lbs.	166.000	25.000	4.414	843.150
dodine		2			27.000	1.350		
	Syllit 65WP	2	1.500	1.594 lbs.	27.000	1.350	1.036	44.053
fenarimol		20			2644.700	50.900		
	Rubigan E.C.	20	2.850	0.172 gal.	2644.700	50.900	0.172	1324.745
mancozeb		26			4160.100	246.250		
	Dithane DF	7	3.426	2.800 lbs.	984.900	124.700	2.100	7989.120
	Manzate 200DF	7	3.143	2.093 lbs.	376.200	30.200	1.570	2004.838
	Penncozeb DF	12	3.417	2.226 lbs.	2799.000	91.350	1.917	18934.465
metiram		7			187.500	2.000		
	Polyram 80DF	7	3.857	2.029 lbs.	187.500	2.000	1.623	1186.193
myclobutanil		12			1202.900	106.700		
	Nova 40W	12	3.083	0.432 lbs.	1202.900	106.700	0.173	689.436
phosetyl-Al		1			8.000	0.000		
	Aliette	1	3.000	0.813 lbs.	8.000	0.000	0.650	15.600

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Table 27: Fungicides used on apples sorted by active ingredient and trade name (cont.)

Apples (cont.)

Active Ingredient	Trade Name	# of records	Average # of times applied	Average rate of product (per acre)	Bearing acres treated	Non-bearing acres treated	Average rate of active ingredient (lbs/acre)	Total active ingredient applied (lbs.)
streptomycin sulfate		2			100.000	0.000		
	Agri-mycin 17	2	1.000	0.969 lbs.	100.000	0.000	0.650	15.600
sulfur		5			735.900	78.700		
	Sulfur, dusting	1	2.000	20.000 lbs.	12.000	0.000	16.800	403.200
	Sulfur, wettable	4	3.000	4.459 lbs.	723.900	78.700	4.103	9878.300
thiabendazole		1			-	-		
	Mertect 340-F	1	1.000	-	-	-	-	-
thiophanate methyl		7			1909.000	132.000		
	Topsin M 4.5F	1	4.000	0.094 gal.	1520.000	80.000	0.422	2700.000
	Topsin M 70W	6	2.000	0.449 lbs.	389.000	52.000	0.314	277.187
thiram		1			8.200	0.200		
	Thiram 65%	1	3.000	2.250 lbs.	8.200	0.200	1.463	36.855
triademefon		1			15.000	0.000		
	Bayleton	1	1.000	0.438 lbs.	15.000	0.000	0.219	3.281
ziram		3			262.000	50.000		
	Ziram 76	3	2.667	3.834 lbs.	262.000	50.000	2.914	2424.420

Table 28: Fungicides used on pears sorted by active ingredient and trade name

Pears (5 growers)

Active Ingredient	Trade Name	# of records	Average # of times applied	Average rate of product (per acre)	Bearing acres treated	Non-bearing acres treated	Average rate of active ingredient (lbs/acre)	Total active ingredient applied (lbs.)
benomyl		4			142.500	8.000		
	Benlate	4	3.000	0.453 lbs.	142.500	8.000	0.227	102.293
captan		1			10.000	0.000		
	Captan 50WP	1	3.000	4.000 lbs.	10.000	0.000	2.000	60.000
copper hydroxide		1			12.000	0.000		
	Kocide DF	1	1.000	7.000 lbs.	12.000	0.000	4.270	51.240
fenarimol		1			12.000	0.000		
	Rubigan E.C.	1	1.000	0.500 gal.	12.000	0.000	0.500	6.000
ferbam		1			12.000	0.000		
	Carbamate WDG	1	1.000	3.000 lbs.	12.000	0.000	2.280	27.360
mancozeb		5			148.500	6.000		
	Manzate 200DF	2	3.000	3.500 lbs.	22.000	0.000	2.625	173.250
	Penncozeb DF	3	2.667	3.833 lbs.	126.500	6.000	2.875	1015.833
streptomycin sulfate		1			12.000	0.000		
	Agri-mycin 17	1	2.000	1.000 lbs.	12.000	0.000	0.212	5.088
ziram		4			144.500	6.000		
	Ziram 76	4	3.750	2.250 lbs.	144.500	6.000	1.710	965.081

Table 29: Fungicide active ingredients and pests: Apples

Apples (30 growers)

Active Ingredient	Pest	# of records
benomyl (23 records)	Obliquebanded leafroller	1
	Apple scab	4
	Black rot	5
	Fly speck	15
	Powdery mildew	10
	Sooty blotch	13
	Blossom end rot	1
	Bitter rot	1
	Apple rusts	1
captan (26 records)	Blossom end rot	3
	Apple scab	20
	Bitter rot	5
	Black rot	10
	Apple rusts	2
	Fly speck	9
	Sooty blotch	10
	Fire blight	1
copper hydroxide (4 records)	Apple scab	3
	Fire blight	3
copper oxychloride (8 records)	Apple scab	3
	Fire blight	6
dodine (2 records)	Apple scab	2
fenarimol (20 records)	Apple rusts	1
	Apple scab	18
	Powdery mildew	14
	Blister spot	1
	Cedar apple rust	2
mancozeb (26 records)	Apple rust mite	1
	Apple rusts	3
	Apple scab	24
	Bitter rot	1
	Fabraea leaf spot	1
	Sooty blotch	4

Apples (cont.)

Active Ingredient	Pest	# of records
mancozeb (cont.) (26 records)	Cedar apple rust	3
	Fly speck	2
	Powdery mildew	1
metiram (7 records)	Apple rusts	3
	Apple scab	7
	Cedar apple rust	1
	Powdery mildew	1
myclobutanil (12 records)	Apple rusts	2
	Apple scab	11
	Cedar apple rust	1
	Powdery mildew	6
phosetyl-Al (1 record)	Blister spot	1
streptomycin (2 records)	Fire blight	2
sulfur (5 records)	Powdery mildew	5
thiabendazol (1 record)	Storage scald	1
thiophanate methyl (7 records)	Apple scab	1
	Black rot	2
	Sooty blotch	1
	Rosy apple aphid	1
	San Jose scale	1
	Powdery mildew	3
thiram (1 record)	Apple rusts	1
	Apple scab	1
triademefon (1 record)	Cedar apple rust	1
	Powdery mildew	1
ziram (3 records)	Apple scab	2
	Fire blight	1
	Fly speck	2
	Sooty blotch	1

Table 30: Fungicide active ingredients and pests: Pears

Pears (5 growers)

Active Ingredient	Pest	# of records
benomyl (4 records)	Fabraea leaf spot	2
	Fly speck	1
	Sooty blotch	1
captan (1 record)	*not listed*	-
copper hydroxide (1 record)	Fire blight	1
fenarimol (1 record)	Pear scab	1
ferbam (1 record)	Pear scab	1
mancozeb (5 records)	Fabraea leaf spot	2
	Fly speck	1
	Sooty blotch	1
	Pear scab	2
	Pear plant bug	1
streptomycin (1 record)	Fire blight	1
ziram (4 records)	Fabraea leaf spot	3
	Pear scab	2
	Fly speck	1

Table 31: Fungicide application equipment and methods: Apples

Active Ingredient	Equipment	# of records	Method	# of records
benomyl (23 records)	HV air blast	7	Drench	1
	LV air blast	16	Foliar	22
captan (26 records)	HV air blast	11	Drench	3
	LV air blast	15	Foliar	23
copper hydroxide (4 records)	LV air blast	4	Foliar	4
copper oxychloride (8 records)	HV air blast	4	Drench	1
	LV air blast	3	Foliar	7
	Hand-held	1		
dodine (2 records)	HV air blast	1	Foliar	2
	LV air blast	1		
fenarimol (20 records)	HV air blast	7	Foliar	20
	LV air blast	13		
mancozeb (26 records)	HV air blast	12	Drench	1
	LV air blast	14	Foliar	24
	Airplane	1		
metiram (7 records)	HV air blast	3	Drench	1
	LV air blast	4	Foliar	6
myclobutanil (12 records)	HV air blast	6	Drench	1
	LV air blast	6	Foliar	11
phosetyl-Al (1 record)	LV air blast	1	Foliar	1
streptomycin (2 records)	HV air blast	1	Foliar	2
	LV air blast	1		
sulfur (5 records)	HV air blast	2	Drench	1
	LV air blast	3	Foliar	4
thiabendazole (1 record)	*Other - dip*	1	Drench	1
thiophanate methyl (7 records)	HV air blast	5	Drench	1
	LV air blast	2	Foliar	6
thiram (1 record)	HV air blast	1	Foliar	1
traidemefon (1 record)	LV air blast	1	Foliar	1
ziram (3 records)	HV air blast	1	Foliar	3
	LV air blast	2		

Table 32: Fungicide application equipment and methods: Pears

Active Ingredient	Equipment	# of records	Method	# of records
benomyl (4 records)	HV air blast	2	Drench	1
	LV air blast	1	Foliar	3
	Hand-held	1		
captan (1 record)	Hand-held	1	Drench	1
copper hydroxide (1 record)	LV air blast	1	Foliar	1
fenarimol (1 record)	LV air blast	1	Foliar	1
ferbam (1 record)	LV air blast	1	Foliar	1
mancozeb (5 records)	HV air blast	2	Drench	1
	LV air blast	2	Foliar	4
	Hand-held	1		
streptomycin (1 record)	HV air blast	1	Foliar	1
ziram (4 records)	HV air blast	2	Foliar	4
	LV air blast	2		

Table 33: Fungicide application timing and basis: Apples

Active Ingredient	Timing	# of records	Basis	# of records
benomyl (23 records)	green tip	1	presence of pest	5
	half-inch green	1	action thresholds	5
	tight cluster	1	calendar spray	12
	pink	1	tree phenology	1
	bloom	1	weather	9
	petal fall	1	per consultant	1
	cover sprays	21		
	post harvest	1		
	7-10 day intervals	2		
	10-14 day intervals	2		
captan (26 records)	green cluster	1	presence of pest	11
	green tip	1	action thresholds	4
	half-inch green	1	calendar spray	15
	pink	1	tree phenology	2
	bloom	2	weather	11
	petal fall	1		
	cover sprays	21		
	post harvest	1		
	7-10 day intervals	3		
	10-14 day intervals	2		
copper hydroxide (4 records)	swollen bud	1	presence of pest	3
	green tip	3	tree phenology	4
copper oxychloride (8 records)	dormant	3	presence of pest	3
	green cluster	1	action thresholds	1
	silver tip	2	calendar spray	2
	green tip	1	tree phenology	1
	half-inch green	1	weather	1
			per consultant	1
dodine (2 records)	green cluster	1	tree phenology	1
	half-inch green	1	weather	1
	tight cluster	1		
fenarimol (20 records)	swollen bud	1	presence of pest	7
	green cluster	1	action thresholds	4
	silver tip	1	calendar spray	7
	green tip	3	tree phenology	4
	half-inch green	5	weather	13
	tight cluster	11	per consultant	1
	pink	14		
	bloom	7		
	petal fall	10		
	cover sprays	5		
mancozeb (26 records)	dormant	1	presence of pest	5
	green cluster	2	action thresholds	3
	silver tip	1	calendar spray	7
	green tip	2	tree phenology	5
	half-inch green	6	weather	15
	tight cluster	7	per consultant	2
	pink	16		
	bloom	8		
	petal fall	12		
	cover sprays	14		
	7-10 day intervals	1		
	10-14 day intervals	1		

(Continued on next page)

Table 33: Fungicide application timing and basis: Apples (cont.)

Active Ingredient	Timing	# of records	Basis	# of records
metiram	swollen bud	1	presence of pest	4
(7 records)	green cluster	1	action thresholds	3
	green tip	2	calendar spray	5
	half-inch green	3	tree phenology	2
	tight cluster	5	weather	4
	pink	5		
	bloom	2		
	petal fall	4		
	cover sprays	3		
myclobutanil	swollen bud	1	presence of pest	4
(12 records)	half-inch green	1	action thresholds	1
	tight cluster	2	calendar spray	5
	pink	8	tree phenology	1
	bloom	3	weather	6
	petal fall	8		
	cover sprays	6		
	10-14 day intervals	1		
phosetyl-Al	7-10 day intervals	1	presence of pest	1
(1 record)				
streptomycin	bloom	2	presence of pest	2
(2 records)	petal fall	1	tree phenology	1
			weather	1
sulfur	petal fall	1	presence of pest	1
(5 records)	cover sprays	5	action thresholds	1
			calendar spray	1
			weather	2
			per consultant	1
thiabendazole	storage	1	*none listed*	-
(1 record)				
thiophanate methyl	dormant	1	presence of pest	4
(7 records)	green cluster	1	action thresholds	2
	half-inch green	2	calendar spray	3
	bloom	1	weather	2
	cover sprays	4		
	7-10 day intervals	1		
thiram	cover sprays	1	action thresholds	1
(1 record)			calendar spray	1
traidemefon	petal fall	1	presence of pest	1
(1 record)				
ziram	cover sprays	3	presence of pest	2
(3 records)			action thresholds	2
			weather	1

Table 34: Fungicide application timing and basis: Pears

Active Ingredient	Timing	# of records	Basis	# of records
benomyl (4 records)	cover sprays	2	presence of pest	1
	5-7 day intervals	1	calendar spray	1
	10-14 day intervals	1	tree phenology	1
			weather	1
captan (1 record)	*None listed*	-	*None listed*	-
copper hydroxide (1 record)	green tip	1	presence of pest	1
			tree phenology	1
fenarimol (1 record)	pink	1	weather	1
ferbam (1 record)	cover sprays	1	weather	1
mancozeb (5 records)	dormant	1	presence of pest	2
	white bud	1	calendar spray	1
	green tip	1	weather	3
	tight cluster	2		
	pink	1		
	bloom	2		
	petal fall	2		
	cover sprays	1		
streptomycin (1 record)	bloom	1	tree phenology	1
			weather	1
ziram (4 records)	cover sprays	3	presence of pest	2
	5-7 day intervals	1	calendar spray	1
	10-14 day intervals	1	weather	3

Table 35: Summary of acreage treated with fungicides

Apples (30 growers)				
Area	**# of records**	**Total Acreage (bearing & non-bearing)**	**Acreage treated with fungicides**	**Percent of total acreage†**
Eastern	13	2703.3	2676.3	99.0
Western	17	1873.0	1842.3	98.4
Pears (5 growers)				
Eastern	4	144.5	150.5	104.2†
Western	1	12.0	12.0	100.0

(†Totals more than 100% due to discrepancy in reported acreage. See page 22)

Herbicides

Tables 36 and 37 (page 49) show the active ingredients, trade names, acres treated, average number of times applied, average rate of product per acre, average rate of active ingredient per acre and total amount of active ingredient applied for each of the herbicides used by apple and pear growers in this survey. All herbicide applications were applied by apple and pear producers themselves or an employee. The herbicide active ingredients used by the greatest number of apple growers in 1995 were glyphosate, paraquat, and simazine. Almost 60% of the apple growers surveyed who applied herbicides applied a product containing one of those active ingredients. Paraquat was the only herbicide used by apple growers that is classified as a restricted-use pesticide. Those three active ingredients also were the top three active ingredients in terms of total active ingredient applied:

•glyphosate	5529.353 lbs.
•simazine	5088.978 lbs
•paraquat	3016.766 lbs.

For pears, glyphosate, paraquat, and simazine were the only herbicide active ingredients used by the growers we surveyed. 4 of the 5 pear growers applied herbicides.

Tables 38 and 39 (pages 50 and 51) show the pests each herbicide active ingredient was intended to control. There were 6 weed pests listed on the survey: annual grasses, annual broadleaves, perennial grasses. perennial broadleaves, established perennials, and woody brush and vines. The weed pests New York state apple growers seemed to have the most trouble with were annual grasses and broadleaves, with 37 and 36 records, respectively. Annual grasses and broadleaves were the most prevalent weed pests for pear growers as well.

Tables 40 and 41 (pages 51 and 52) show the herbicide application equipment and methods used by apple and pear growers in this survey. In the two tables “HV air blast” stands for a high volume air blast sprayer that sprays greater than 100 gallons per acre. “LV air blast” stands for a sprayer that sprays less than 100 gallons per acre. The most common application equipment used to apply herbicides by both apple and pear growers was a boom sprayer, followed by a hand-held sprayer. Nearly every single grower used a banded application method for herbicides. A few growers mentioned using a spot treatment for their application method, presumably for a few problem areas in their orchards.

Tables 42 and 43 (pages 53 and 54) show the timing and basis for the application of herbicides to apples and pears. The most common basis for the application of herbicides by apple and pear growers in this survey was the presence of weed pests in the orchard.

Table 44 (page 54) shows the total acreage, broken down by survey area, that herbicides were applied to in 1995. Please note the discrepancy in acreage explained on page 22. Herbicides were applied to 94.4% of the acres of apple growers who reported using herbicides.

Table 36: Herbicides used on apples sorted by active ingredient and trade name

Apples (21 growers)

Active Ingredient	Trade Name	# of records	Average # of times applied	Average rate of product (per acre)	Bearing acres treated	Non-bearing acres treated	Average rate of active ingredient (lbs/acre)	Total active ingredient applied (lbs)
2,4-D		2			15.000	0.000		
	Justice	2	1.500	0.563 lbs.	15.000	0.000	0.478	10.758
diuron		9			921.000	10.000		
	Karmex	9	1.111	1.500 lbs.	921.000	10.000	1.200	1241.333
glyphosate		14			1924.100	42.000		
	Roundup	14	1.179	0.575 gal.	1924.100	42.000	2.300	5329.353
norflurazon		1			120.000	0.000		
	Solicam DF	1	1.000	3.000 lbs.	120.000	0.000	2.370	284.400
oryzalin		1			200.000	0.000		
	Surflan A.S.	1	1.000	0.750 gal.	200.000	0.000	3.000	600.000
oxyfluorfen		1			4.000	19.000		
	Goal 1.6E	1	2.000	0.100 gal.	4.000	19.000	0.160	7.360
paraquat		12			2621.000	220.050		
	Gramaxone Extra	12	1.750	0.243 gal.	2621.000	220.050	0.607	3016.766
pendimethalin		2			0.000	23.700		
	Prowl 3.3EC	2	1.500	0.500 gal.	0.000	23.700	1.650	58.658
simazine		12			2876.000	200.000		
	Princep 4L	10	1.200	0.348 gal.	2626.000	170.000	1.390	4663.728
	Princep Caliber 90	2	1.500	1.125 lbs.	250.000	30.000	1.013	425.250
terbacil		4			447.000	2.000		
	Sinbar	4	1.000	1.500	447.000	2.000	1.200	538.800

Table 37: Herbicides used on pears sorted by active ingredient and trade name

Pears (4 growers)

Active Ingredient	Trade Name	# of records	Average # of times applied	Average rate of product (per acre)	Bearing acres treated	Non-bearing acres treated	Average rate of active ingredient (lbs/acre)	Total active ingredient applied (lbs)
glyphosate		3			72.000	2.000		
	Roundup	3	1.333	0.375 gal.	72.000	2.000	1.500	148.000
paraquat		2			127.500	6.000		
	Gramaxone Extra	2	1.500	0.313 gal.	127.500	6.000	0.781	156.445
simazine		1			125.000	6.000		
	Princep 4L	1	2.000	0.500 gal.	125.000	6.000	2.000	524.000

Table 38: Herbicide active ingredients and pests: Apples

Apples (21 growers)

Active Ingredient	Pest	# of records
2,4-D (2 records)	Annual broadleaves	2
	Perennial grasses	1
	Perennial broadleaves	1
diuron (9 records)	Annual grasses	6
	Annual broadleaves	7
	Perennial grasses	1
	Perennial broadleaves	1
glyphosate (14 records)	Annual grasses	5
	Annual broadleaves	4
	Perennial grasses	4
	Perennial broadleaves	4
	Established perennials	5
	Woody brush and vines	6
norflurazon (1 record)	Annual grasses	1
	Annual broadleaves	1
oryzalin (1 record)	Annual grasses	1
	Annual broadleaves	1
	Perennial grasses	1
	Perennial broadleaves	1

Apples (21 growers)

Active Ingredient	Pest	# of records
oxyfluorfen (1 record)	Annual grasses	1
	Annual broadleaves	1
paraquat (12 records)	Annual grasses	11
	Annual broadleaves	7
	Perennial grasses	6
	Perennial broadleaves	4
	Established perennials	4
	Woody brush and vines	2
pendimethalin (2 records)	Annual grasses	1
	Annual broadleaves	1
	Perennial grasses	1
	Perennial broadleaves	1
simazine (12 records)	Annual grasses	9
	Annual broadleaves	10
	Perennial grasses	1
	Perennial broadleaves	1
	Established perennials	1
terbacil (4 records)	Annual grasses	2
	Annual broadleaves	2
	Perennial grasses	1

Table 39: Herbicide active ingredients and pests: Pears

Pears (4 growers)

Active Ingredient	Pest	# of records
glyphosate (3 records)	Annual grasses	1
	Annual broadleaves	1
	Perennial grasses	1
	Perennial broadleaves	1
	Established perennials	2
	Woody brush and vines	1
paraquat (2 records)	Annual grasses	2
	Annual broadleaves	1
	Perennial grasses	1
simazine (1 record)	Annual grasses	1
	Annual broadleaves	1

Table 40: Herbicide application equipment and methods: Pears

Active Ingredient	Equipment	# of records	Method	# of records
glyphosate (3 records)	Boom sprayer	2	Banded	2
	Hand-held	1		
paraquat (2 records)	Boom sprayer	2	Banded	2
simazine (1 record)	Boom sprayer	1	Banded	1

Table 41: Herbicide application equipment and methods: Apples

Active Ingredient	Equipment	# of records	Method	# of records
2,4-D	Boom sprayer	1	Banded	2
(2 records)	Hand-held	1		
diuron	Boom sprayer	9	Banded	8
(9 records)			Foliar	1
glyphosate	Boom sprayer	11	Banded	10
(14 records)	Hand-held	3	Drench	1
			Foliar	1
			Spot	1
norflurazon	Boom sprayer	1	Banded	1
(1 record)				
oryzalin	Boom sprayer	1	Banded	1
(1 record)				
oxyfluorfen	Boom sprayer	1	Foliar	1
(1 record)				
paraquat	Boom sprayer	10	Banded	9
(12 records)	Hand-held	2	Foliar	3
pendimethalin	Boom sprayer	1	Banded	1
(2 records)	Hand-held	1	Foliar	1
simazine	Boom sprayer	12	Banded	10
(12 records)			Drench	1
			Foliar	1
terbacil	Boom sprayer	3	Banded	2
(4 records)	Hand-held	1	Foliar	1

Table 42: Herbicide application timing and basis: Apples

Active Ingredient	Timing	# of records	Basis	# of records
2,4-D (2 records)	cover sprays	1	presence of pest	1
diuron (9 records)	dormant	1	presence of pest	5
	green cluster	1	action thresholds	1
	tight cluster	1	calendar spray	2
	pink	3		
	cover sprays	3		
glyphosate (14 records)	dormant	1	presence of pest	8
	swollen bud	1	action thresholds	3
	green cluster	1	calendar spray	1
	pink	2	improve uniform ripening	1
	petal fall	1	per consultant	1
	cover sprays	3		
	post harvest	1		
norflurazon (1 record)	*none listed*	-	presence of pest	1
oryzalin (1 record)	dormant	1	presence of pest	1
oxyfluorfen (1 record)	dormant	1	*none listed*	-
paraquat (12 records)	dormant	2	presence of pest	5
	green cluster	1	action thresholds	1
	half-inch green	1	calendar spray	3
	tight cluster	2	per consultant	1
	pink	3		
	bloom	2		
	cover sprays	4		
	14-21 day intervals	1		
pendimethalin (2 records)	green cluster	1	per consultant	1
simazine (12 records)	dormant	2	presence of pest	6
	green cluster	1	action thresholds	1
	half-inch green	1	calendar spray	1
	tight cluster	2	per consultant	1
	pink	4		
	bloom	1		
	cover sprays	4		
	post harvest	1		
terbacil (4 records)	dormant	1	action thresholds	1
	green cluster	1	calendar spray	1
	tight cluster	1		
	pink	1		

Table 43: Herbicide application timing and basis: Pears

Active Ingredient	Timing	# of records	Basis	# of records
glyphosate (3 records)	cover sprays	2	presence of pest	3
paraquat (2 records)	cover sprays	2	presence of pest	2
simazine (1 record)	cover sprays	1	presence of pest	1

Table 44: Summary of acreage treated with herbicides

Apples (30 growers)				
Area	**# of records**	**Total Acreage (bearing & non-bearing)**	**Acreage treated with herbicides**	**Percent of total acreage†**
Eastern	11	2644.8	2535.5	95.8
Western	10	1411.4	1292.7	91.6
Pears (4 growers)				
Eastern	3	137.5	143.5	104.4†
Western	1	12.0	12.0	100.0

(†Totals more than 100% due to discrepancy in reported acreage. See page 22)

Other Pesticides

Eighteen apple growers and one pear grower used other pesticides (pesticides other than insecticides/miticides, fungicides/bactericides and herbicides). Table 45 (page 56) shows the active ingredients, trade names, acres treated, average number of times applied, average rate of product per acre, average rate of active ingredient per acre, and total amount of active ingredient applied for each of the other pesticides used by apple and pear growers in this survey. NAA was by far the most commonly used "other" pesticide active ingredient. Every grower surveyed who applied an "other" pesticide, both apple and pear growers, used NAA. However, ethephon had a greater total amount of active ingredient applied, even though only two growers used it.

No pests were associated with other pesticides, because they were used mostly for chemical fruit thinning, or improving ripening, color, or fruit drop control. They were not used against weed, insect, or disease pests.

Table 46 (page 56) shows the application equipment and methods that apple and pear growers used to apply "other" pesticides. High volume air blast sprayers (greater than 100 gpa) were used nearly twice as often as low volume air blast sprayers (less than 100 gpa). Foliar was the preferred method of application.

Table 47 (page 57) shows the application timing and basis of "other" pesticides. Chemical fruit thinning was the basis for most applications of other pesticides, by a wide margin. Other responses included, "promote fruit coloring," "fruit drop control," and "prevent fruit russeting."

Table 48 (page 57) shows the total acreage, broken down by survey area, that "other" pesticides were applied to in 1995. Other pesticides were applied to 81.6% of the acreage of the apple growers who reported applying other pesticides. The figures in this table should be accurate, because the growers who had discrepancies in their acreage reporting did not report the use of "other' pesticides.

Table 45: Other pesticides used on apples and pears sorted by active ingredient and trade name

Active Ingredient	Trade Name	# of records	Average # of times applied	Average rate of product (per acre)	Bearing acres treated	Non-bearing acres treated	Average rate of active ingredient (lbs/acre)	Total active ingredient applied (lbs)
Apples (18 growers)								
ethephon		2			154.000	0.000		
	Ethrel	2	1.000	0.367 gal.	154.000	0.000	0.743	113.094
gibberellins A_4A_7		4			26.000	0.000		
	Provide	4	2.750	0.246 gal.	26.000	0.000	0.043	3.097
NAA		18			3002.000	5.000		
	Fruitone-N	16	1.375	0.445 lbs.	2896.000	5.000	0.016	62.056
	K-Salt Fruit Fix 200	1	1.000	0.047 gal.	6.000	0.000	0.021	0.124
	Tre-Hold	1	1.000	0.063 gal.	100.000	0.000	0.063	6.250
NAA, gibberellins A_4A_7		3			22.400	0.000		
	Promalin	3	1.000	0.153 gal.	22.400	0.000	0.001	0.014
Pears (1 grower)								
NAA		1			10.000	0.000		
	Fruitone-N	1	1.000	0.250	10.000	0.000	0.009	0.088

Table 46: "Other" pesticides application equipment and methods

Active Ingredient	Equipment	# of records	Method	# of records
Apples (18 growers)				
ethephon (2 records)	HV air blast	2	Drench	1
			Foliar	1
gibberellins A_4A_7 (4 records)	HV air blast	2	Drench	1
	LV air blast	2	Foliar	3
NAA (18 records)	HV air blast	11	Banded	2
	LV air blast	6	Drench	2
	Hand-held	1	Foliar	14
NAA, gibberellins A_4A_7 (3 records)	HV air blast	2	Foliar	3
	LV air blast	1		
Pears (1 grower)				
NAA (1 record)	Hand-held	1	Drench	1

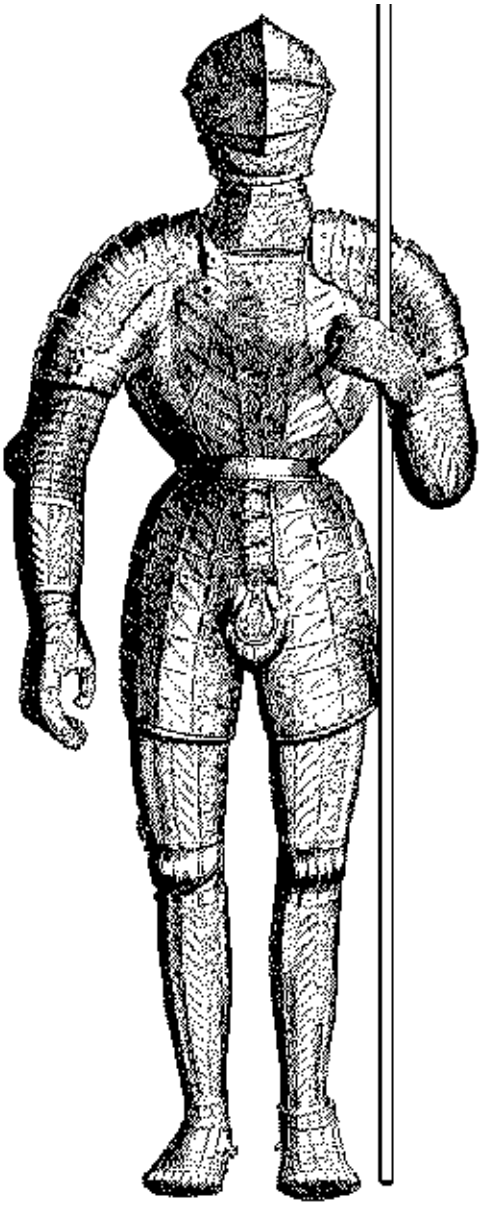
Table 47: "Other" pesticides application timing and basis

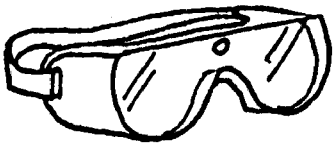
Apples (18 growers)				
Active Ingredient	**Timing**	**# of records**	**Basis**	**# of records**
ethephon (2 records)	*Not listed*	-	Advance fruit maturation Improve uniform ripening Promote fruit coloring	1 1 2
gibberellins A_4A_7 (4 records)	7-10 day intervals 10-14 day intervals	1 3	Disease conducive weather Prevent fruit russeting Improve shape	1 3 1
NAA (18 records)	Dormant Petal fall Cover sprays	1 5 9	Tree phenology Control root suckers Chemical fruit thinning Fruit drop control	2 1 16 3
NAA, gibberellins A_4A_7 (3 records)	Tight cluster Bloom	1 2	Calendar spray Improve shape	1 3
Pears (1 grower)				
NAA (1 record)	Petal fall	1	Chemical fruit thinning	1

Table 48: Summary of other pesticide acreage

Apples (18 growers)				
Area	**# of records**	**Total Acreage (bearing & non-bearing)**	**Acreage treated with other pesticides**	**Percent of total acreage**
Eastern	9	2663.9	2340.4	87.9
Western	9	922.4	586.0	63.5
Pears (1 grower)				
Eastern	1	10.0	10.0	100.0

Part II: Use and Care of Personal Protective Equipment





Use of Work Clothing and Personal Protective Equipment (PPE)

Thirty-two growers completed the survey on clothing and equipment. This number is lower than the number who filled out a pesticide use survey because most of the pear growers were apple growers as well. Therefore, they count as one grower in regards to wearing work clothing and PPE, but count as two separate growers in regards to pesticide application. At least 75% of the apple and pear producers "nearly always" wore the combination of undershirt/T-shirt, undershorts/long johns, jeans/work trousers, a baseball style cap, socks and leather shoes (Table 49). Exposure to pesticides through the skin decreases with more layers of clothing. 43.8% of apple and pear growers reported "nearly always" wearing a long-sleeved shirt, while 34.4% wore one "occasionally depending on the weather," and 12.5% indicated wearing a long-sleeved shirt "depended on the pesticide" that they were using. Work coats or jackets were worn "occasionally depending on the weather" by 81.3% of the growers, while over one-third of the growers wore some type of coverall (overalls, woven coveralls or insulated coveralls) "depending on the weather."

Leather shoes were "nearly always" worn by 81.3% of growers. Although leather may resist dust penetration, dust can sift into the inside, spray can be absorbed, and decontamination is a problem. The same is true of leather gloves, which were worn "nearly always" by 6.3% of growers, but "rarely or never" worn by 56.3%. This suggests that apple and pear grower are aware of the problems of decontamination that leather poses for gloves. Baseball-style caps (worn "nearly always" by 84.4% of growers) may keep the sun out of the eyes and allow ventilation, but they do not provide a good barrier to pesticides. In addition, contaminated caps can be a source of continued exposure as they are worn for many occasions, but rarely washed.

Exposure studies have shown hands to be the area of greatest exposure (Lavy, et. al., 1983). The use of chemical-resistant gloves will reduce this exposure. 68.8% percent of growers reported "nearly always" wearing chemical-resistant gloves, and 11.5% wore them "occasionally depending on the pesticide" (Table 50). Of the growers who wore chemical-resistant gloves "depending on the pesticide," or "rarely or never," nearly all of them indicated that they used a pesticide that requires the use of chemically-resistant gloves on the label. The most commonly used pesticides in this category include Asana XL, Omite, Guthion, and Penncap-M.

Chemical cartridge (half-face, full-face or PARC), or dust/mist respirators were "nearly always" worn by 65.6% of the growers, and goggles, safety glasses, or a face shield were "nearly always" worn by 47% of growers. Both Guthion and Penncap-M state on their label that both goggles and respirators are required to be worn. Guthion and Penncap-M were both widely used by apple and pear producers in 1995.

Table 49: Work clothes worn by apple and pear producers

Type of clothing	Nearly always wear	Wear occasionally depending on weather	Wear occasionally depending on pesticide	Rarely or never wear
Undershirt/T-shirt	81.3%	9.4%	3.1%	3.1%
Undershorts/long johns	75.0%	6.3%	0.0%	15.6%
Jeans/Work trousers	93.8%	3.1%	3.1%	0.0%
Overalls	15.6%	37.5%	6.3%	37.5%
Long-sleeved shirt	43.8%	34.4%	12.5%	6.3%
Short-sleeved shirt	25.0%	46.9%	3.1%	18.8%
Baseball style cap	84.4%	3.1%	6.3%	3.1%
Socks	100.0%	0.0%	0.0%	0.0%
Leather shoes	81.3%	3.1%	3.1%	9.4%
Canvas shoes	3.1%	9.4%	3.1%	75.0%
Woven coveralls	6.3%	31.3%	9.4%	46.9%
Insulated coveralls	0.0%	37.5%	3.1%	53.1%
Work coat or jacket	3.1%	81.3%	3.1%	9.4%
Cotton/canvas gloves	6.3%	28.1%	9.4%	53.1%
Leather gloves	6.3%	25.0%	6.3%	56.3%

Rubber boots were “nearly always” worn by 31.3% of growers, and another 40.6% wore them “depending on the pesticide.” Only 2 growers reported using a pesticide that required rubber boots on the label. Woven coveralls were not often worn, but nonwoven and chemical-resistant coveralls were worn by at least one-third of the growers (Table 50, next page).

Table 50: Protective equipment worn by apple and pear producers

Type of clothing	Nearly always wear	Wear occasionally depending on weather	Wear occasionally depending on pesticide	Rarely or never wear	Unnecessary for the types of pesticides I apply
Chemical-resistant gloves	68.8%	0.0%	11.5%	3.1%	0.0%
Rubber boots	31.3%	21.9%	40.6%	3.1%	0.0%
Woven coveralls over work clothes	9.4%	21.9%	12.5%	50.0%	3.1%
Nonwoven coveralls	37.5%	6.3%	18.8%	34.4%	0.0%
Chemical-resistant coveralls	31.3%	3.1%	18.8%	40.6%	3.1%
Chemical-resistant apron	15.6%	0.0%	18.8%	59.4%	3.1%
Wide brimmed plastic/rubber hat	18.8%	3.1%	25.0%	50.0%	3.1%
Hard hat	0.0%	3.1%	3.1%	78.1%	12.5%
Dust/mist respirator	15.6%	6.3%	40.6%	28.1%	6.3%
Half-face chem cartridge respirator	43.8%	0.0%	25.0%	25.0%	3.1%
Full-face chem cartridge respirator	3.1%	0.0%	9.4%	78.1%	6.3%
Powered air-purifying respirator (PARC)	3.1%	0.0%	0.0%	81.3%	6.3%
Goggles	21.9%	3.1%	53.1%	21.9%	0.0%
Safety glasses	18.8%	3.1%	37.5%	40.6%	0.0%
Face shield	6.3%	0.0%	21.9%	68.8%	0.0%

Table 51 shows the material of outer clothing worn by apple and pear growers. The most commonly worn material of outer clothing was limited-use or disposable (34.3%), followed by waterproof rubber or plastic (28.1%), and cotton/polyester blend (18.8%). This conflicts somewhat with the relatively low percentage of growers who reported wearing nonwoven coveralls (37.5%)

Table 51: Material of outer clothing worn by apple and pear producers most often when handling pesticides

Material	# of records
chemical-proof rain gear	1
cotton	3
cotton/polyester blend	6
limited-use or disposable	11
water-proof rubber/plastic	9

Certain pesticides have special PPE requirements for mixing and loading the pesticide. Table 52 shows the PPE worn by apple and pear producers when mixing and loading pesticides. Most of the fungicides applied by apple and pear producers had some sort of special PPE requirement for mixers and loaders, including protective eyewear, pesticide-resistant apron, or a respirator. Growers in general wore more protective equipment when mixing and loading pesticides, for example, many more growers reported wearing rubber boots (65.7%) when loading pesticides versus handling pesticides (31.3%).

Table 52: Personal protective equipment worn by apple and pear producers and their employees when mixing and/or loading pesticides

Protective equipment	# of responses
Chemically-resistant gloves	27
Rubber boots	21
Woven coveralls over work clothes	9
Chemically-resistant coveralls/rain gear	16
Chemically-resistant apron	10
Wide-brimmed plastic/rubber hat	10
Hard hat	0
Half-face chemical cartridge respirator	20
Full-face chemical cartridge respirator	4
Powered air-purifying respirator	1
Dust/mist respirator	11
Goggles	18
Safety glasses	14
Face shield	7
Do not mix/load pesticides	1
Other	0

Laundering Procedures

Proper management of clothing worn while working with pesticides can help to minimize pesticide exposure. According to the Department of Textiles and Apparel at Cornell University, the following rules should be used when washing clothing worn while applying pesticides:

- All clothing worn while handling or applying pesticides is contaminated
- Wash hands immediately after handling contaminated clothing; wear chemical-resistant gloves when highly contaminated
- Wash clothing daily
- Wash separately from family wash
- Hang garments outdoors to dry
- Prerinse or presoak
- Pretreat heavily soiled garments with detergent or a pre-wash product
- Wash only a few items at a time
- Use highest water level
- Use hot water
- Use longest wash time
- Use heavy-duty detergent
- Line dry to avoid contaminating dryer
- After washing - run machine through a complete cycle with detergent
- Rewash contaminated garments two or three times before reuse for more complete pesticide removal

Table 53 shows the number of hours apple and pear growers wear clothing that can be used again after being worn while handling pesticides (refurbishable) before washing it. The mean response was 11.0 hours, but the number of hours that received the greatest number of responses was 8 hours. 71.9% of the growers indicated that they laundered refurbishable clothing after 2-12 hours, or roughly on a daily basis, as recommended.

Table 54 shows the facilities used by apple and pear growers to launder pesticide contaminated clothing. Some growers gave more than one response to this question, indicating that they used one or more practices part of the time. The majority of growers used the family washer but in a load separate from regular family washing. This is an important common-sense step to avoid contamination. However as table 55 shows, most growers did not then take the extra step of running an extra empty wash cycle to remove traces of pesticide contamination.

Table 53: Number of hours refurbishable clothing is worn by apple and pear producers and their employees before it is discarded

# of hours	# of records
2 **Hours**	1
3 **Hours**	2
7 **Hours**	1
8 **Hours**	9
9 **Hours**	3
10 **Hours**	3
10.5 **Hours**	1
11 **Hours**	1
12 **Hours**	1
13 **Hours**	1
14 **Hours**	1
16 **Hours**	3
18 **Hours**	1
24 **Hours**	3
Average hours =	11.0 +/- 5.6

Table 54: Facilities used by apple and pear producers and their employees to launder clothing that was worn while handling pesticides

Facilities	# of responses
Commercial laundry service	1
Grower's special facilities reserved for laundry of pesticide-soiled clothing	0
Family washer, but in a SEPARATE load from family clothes	28
Family washer WITH family clothes	5
Coin operated laundromat	0
Don't know	0

Table 55: Steps used by apple and pear producers and their employees to launder clothes that were worn while handling pesticides

Step	Yes	No	Don't know
Presoak or rinse before washing with detergent	16	14	2
Wash in hot or warm water rather than cold	25	5	2
Wash more than once before drying	6	24	2
Line-dry outdoors	17	13	2
Clean washer after laundering by running a complete, but empty (no clothes) cycle with hot water and detergent	7	22	3

As mentioned before, table 55 shows the steps used by apple and pear producers to launder clothes that were worn while handling pesticides. More than one response was allowed for this question because many of the steps are complimentary. 78.1% of the growers washed contaminated clothes in hot or warm water. While 53.1% line-dried the clothes outdoors and 50% presoaked or rinsed before washing with detergent. Few growers took the extra steps of washing more than once before drying or cleaning the washer after laundering.

Replacement of Work Clothing and PPE

Table 56 shows the frequency of replacement of work clothing by apple and pear producers. Replacement of work clothing occurred most often when the clothing wore out (84.4%). Many growers gave more than one answer to this question. The combinations were either “when it wears out” and another answer such as “seasonally,” “annually” or “2 times a year,” or “if contaminated by a pesticide spill” combined with another answer. This suggests a strategy of replacing work clothes on a schedule, keeping in mind that clothing can wear out quickly on farms, and also keeping in mind that if an article is contaminated by a spill it should be discarded.

Table 56: Frequency of replacement of work clothing by apple and pear producers and employees

Frequency	# of records
when it wears out	27
annually	1
if contaminated by pesticide spill	13
2 times a year	2
seasonally	4
other	0

Table 57 shows the number of hours limited-use or disposable garments are worn by apple and pear producers before they are discarded. The mean answer was 13.5 hours, but answers ranged from 4 hours to 40 hours, with the most common response being 8 hours. Not every grower wore limited-use PPE.

According to the EPA, the U.S. Department of Agriculture - Extension Service (USDA-ES) and PPE manufacturers, workers should dispose of most nonwoven (limited-use or disposable) coveralls after one workday's exposure (8 hours). This is what most New York apple and pear growers appear to do. However, the instructions for some coated nonwoven suits may permit reuse if each period of use is short, if the inside of the garment is not contaminated, and if they do not get much pesticide on them. This may account for some of the responses where the disposable clothing was worn for much longer than 8 hours.

Table 57: Number of hours limited-use or disposable garments are worn by apple and pear producers and their employees before they are discarded

# of hours	# of records
4 **Hours**	3
7.5 **Hours**	1
8 **Hours**	5
9 **Hours**	3
10 **Hours**	1
12 **Hours**	1
20 **Hours**	1
24 **Hours**	2
40 **Hours**	2
Average hours =	13.5 +/- 10.8

Table 58 (next page) shows how limited use garments are disposed of once apple and pear growers have finished using them. 56.3% of apple and pear growers burn them, while 28.1% landfill disposable garments after using them. Only 1 grower mentioned rendering disposable garments unusable before disposal. This doesn't matter very much when the method of disposal is burning, but could potentially be a safety problem with other methods of disposal.

Table 58: How limited-use or disposable garments are discarded by apple and pear producers and their employees

Method of disposal	# of responses
Burn	18
Bury	1
Landfill	9
Render unusable	1
Don't know	0
Other	2

Chemical-resistant (reusable) gloves should be inspected before use for signs of wear or abrasion (EPA, USDA-ES pamphlets). If they show any sign of wear, they should be discarded. Even if there are no signs of wear, reusable chemical-resistant gloves should be replaced regularly since residues that cannot be detected may remain in the material even after washing and adequate airing. A good rule of thumb is to dispose of gloves that have been worn for about one week of work. Because hand protection is the most important concern for pesticide handlers, glove replacement is a high priority. 75% of the growers replaced chemical-resistant gloves "when a leak was detectable," and 37.5% of the growers replaced gloves "seasonally." Only 6.3% of apple and pear growers indicated that they replaced gloves weekly. Some growers gave more than response to this question, usually pairing "seasonally" with "when a leak is detectable," indicating that the default schedule is seasonally, with emergency replacement if a leak is found.

Table 59: Frequency of replacement of chemical-resistant gloves by apple and pear producers and their employees

Frequency	# of records
when a leak is detectable	24
weekly	2
monthly	5
seasonally	12
do not wear chemically resistant gloves	0
other	1

According to the EPA, USDA-ES pamphlets, replacement of respirator cartridges should occur:

- at the first indication of odor, taste, or irritation
- when the respirator manufacturer or pesticide label requires, or
- at the end of each day's work period, if no other instructions or indications of service life are available.

Table 60 shows how often respirator cartridges were replaced by New York apple and pear growers. The most popular response was "seasonally." Only 3 growers did not wear cartridge respirators at all. Only one-quarter of the growers who wore respirators indicated replacement "when odors were detectable," and only 1 grower replaced them daily, Other responses included 3 growers who changed cartridges "2 times per year," 2 growers who changed them "after 8 hours use," and one grower who changed them "every 3 applications." Several growers gave more than one response to this question, again indicating a general strategy of replacing PPE on a certain schedule unless a piece fails.

Table 60: Frequency of replacement of respirator cartridges by apple and pear producers and their employees

Frequency	# of records
daily	1
weekly	3
seasonally	13
when breathing becomes difficult	4
when odors are detectable	8
do not wear cartridge respirators	3
other	6

Maintenance and Storage of PPE

According to the EPA, USDA-ES pamphlets, proper maintenance of eyewear and respirators means to hand-wash goggles, face shields, safety glasses, and reusable respirator facepieces with mild detergent and warm water after each day of use. Then, rinse thoroughly and wipe dry or hang in a clean area to air dry. Respirators and eyewear should be stored where they are protected from dust, extreme sunlight, excessive moisture, pesticides and other chemicals. A zip-closable sturdy plastic bag works well for storage. Prior to reuse they should be test-fitted to make sure they fit correctly.

Table 62: Where apple and pear producers and their employees store protective equipment between

Table 61 indicates how New York apple and pear growers maintain chemical cartridge respirators and eyewear between uses. More than one response was allowed for this question. Again, 3 growers did not wear cartridge respirators. For the most part, apple and pear producers followed the washing procedures outlined by EPA, USDA-ES: hand wash, rinse, wipe or hang dry. 62.0% of those who indicated they used cartridge respirators "hand-wash parts separately with detergent." 51.7% "rinse with clean water," 34.5% "wipe dry," and another 55.2% "hang (air) dry." 44.8% stored chemical cartridge respirators in a zip-closable plastic bag, and 37.9% "test fit prior to wearing."

Table 61: How apple and pear producers and their employees maintain chemical cartridge respirators and eyewear between uses

Maintenance step	# of responses
Hand-wash parts separately with detergent	18
Wipe parts clean with towel or rag	10
Rinse with clear water	15
Wipe dry	11
Hang (air) dry	16
Store in zip-closable plastic bag	13
Store in original box	4
Hang outside or in barn until needed	6
Test fit prior to wearing	11
Do not wear cartridge respirators	3
Do not wear protective eyewear	3
Other	0

Table 62 shows where apple and pear producers store their personal protective equipment when they are not wearing it. Some growers gave more than one response to this question. "In dressing/changing area with no shower" was the most popular response with 34.4% of the growers. One-quarter of the growers indicated that they stored PPE in a pesticide storage area. This is not a good idea because while it may be convenient to have the PPE near the pesticides, their is a risk of cross-contamination.

Nearly one-quarter of the growers wrote in a response that was not listed on the survey. The most popular "other" practice was to store PPE in a locked cabinet. The growers that gave this response were trying to emphasize that while they did keep PPE in a pesticide storage area, the PPE was kept physically separate from the pesticides. Only 2 growers indicated that they kept PPE in a dressing/changing area with a shower. A shower can expose PPE to harmful moisture.

Table 62: Where apple and pear producers and their employees store protective equipment between wearings

Storage facility	# of records
with other clothing items at work	3
in pesticide storage area	8
in dressing/changing area with a shower	2
in dressing/changing area with no shower	11
in vehicle	5
at home	4
other	7

Label Requirements for Work Clothing and PPE and the Use of Enclosed Vehicles

Growers were asked if they wore the minimum protective equipment as required on the pesticide label. Table 63 illustrates the results. 56.3% indicated they wore "more than minimum requirements," or "minimum requirements." The other 43.7% "mostly wore minimum requirements," "often did not," or "did not know."

Table 63: Frequency with which apple and pear producers and their employees meet the minimum protective equipment requirements on the pesticide label

1=MORE THAN minimum requirements worn, 2=minimum requirements worn, 3=mostly wear minimum requirements, but not always, 4=often not, 5=don't know

Frequency	# of records
1	15
2	3
3	10
4	3
5	1
Average frequency =	2.1 +/- 1.2

Table 64 shows the reasons apple and pear growers give for not always wearing the minimum PPE requirements, as stated on the label. 23 growers answered this question, while only 14 growers indicated that they did not always wear the minimum requirements. It is possible that some growers interpreted this question as rhetorical. The most common reason given for not wearing proper PPE was that protective equipment is too hot.

Other responses included: “employees refuse,” “bulky clothing dangerous around farm machinery,” “spray from spray cab,” and “too busy.”

Table 64: Why apple and pear producers and their employees do not meet the minimum protective equipment requirements on the pesticide label

Reason	# of responses
Minimum requirements are too strict	1
Protective equipment is too hot	12
Protective equipment restricts movement	6
Protective equiment is not available where I/my employees live	0
Protective equipment is too expensive	0
Other	4

Applicators can reduce their exposure to pesticides by making pesticide applications from an enclosed vehicle. Table 65 shows the proportion of pesticide application in apple and pear orchards that are from an enclosed vehicle. 15 growers, or 46.9% did not make any applications from an enclosed vehicle. However, 10 growers, or 31.3% made essentially all pesticide applications from an enclosed vehicle. Nearly one-third of apple and pear growers are reducing their exposure to pesticides in this way. Of the growers who made nearly all their applications from an enclosed vehicle, 4 of the 10 had indicated that they did not always meet the minimum label requirements.

Table 65: Proportion of applications that apple and pear producers and their employees make from an enclosed vehicle

1=none, 2=less than one-third, 3=one-third to two-third, 4=more than two-thirds, 5=essentially all

Proportion of applications	# of records
1	15
2	1
3	2
4	4
5	10

average = 2.8 +/- 1.8

Educational Resources and Applicator Training

When asked what three resources field corn growers would most likely use to learn about protective equipment, they chose “pesticide applicator’s training manual” (71.9%), “fact sheets” (59.4%), and “kit of sample protective equipment” (53.1%, Table 66).

Table 66: Resources apple and pear producers and their employees would be most likely to use to learn about protective equipment

Resources	# of records
telephone hot line	1
media (TV, radio, newspaper)	0
exhibit	14
kit of sample protective equipment	17
computer program	1
pesticide applicator’s training manual	23
fact sheets	19
slide set	1
videotape	9

Table 67 shows what educational formats are preferred for pesticide applicator training by apple and pear growers. Three-quarters preferred a “training session.” Some of the growers gave more than one response. 100 percent of the apple and pear growers surveyed indicated that the “Extension Service” sponsors the applicator certification and continuing education programs they attend, while 68.8% indicated that a chemical company or dealer sponsored pesticide applicator training programs (Table 68).

Table 67: Educational formats preferred for pesticide applicator training by apple and pear producers

Format	# of responses
Conference	3
Training session	24
Satellite downlink	1
Study group	5
Self study	8

Table 68: Who sponsors the applicator certification and continuing education programs attended by apple and pear producers

Sponsor	# of responses
Employer	2
Extension service	32
Chemical company/dealer	22
Grower associations	5
Other	1

Short and Long-term Health Problems Associated with Exposure to Pesticides

There are many short-term or acute symptoms associated with exposure to pesticides. Table 69 illustrates the number of times apple and pear growers experienced acute symptoms they felt were related to exposure to pesticides. For the most part, apple and pear producers did not experience many short-term symptoms associated with pesticide exposure. However, there were some instances.

The most commonly reported acute symptom was eye irritation, followed by skin irritation. Five growers experienced eye irritation 2-3 times, and 4 growers experienced it 4-5 times, and 2 growers experienced it once. All told, over one-third of the growers experienced eye irritation at least once in 1995.

Skin irritation was experienced by 4 growers once, 2-3 times by 2 growers, and 4-5 times by 1 grower, for a total of 21.9% of the growers experiencing skin irritation.

When asked if they sought medical help for these symptoms, most growers answered "yes." Nearly every time a grower reported experiencing a short-term symptom that grower felt the symptom was serious enough to get medical attention. However, we have no way of knowing what sort of medical help that may have been.

Question 20 of the personal protective equipment survey asked growers if they had any chronic or long-term health problems that they believed to be associated with exposure to pesticides. All 32 apple and pear growers answered "no" to this question.

Table 69: Number of apple and pear producers having symptoms in the past crop year that they thought might be related to handling or applying pesticides

Symptom	Frequency	# of records	# of growers who sought medical help
Excessive fatigue	Never	29	-
	Once	1	1
	4-5 times	1	1
Headache	Never	25	-
	Once	1	1
	2-3 times	4	3
	4-5 times	1	1
Dizziness	Never	30	-
	2-3 times	1	1
Eye irritation	Never	20	-
	Once	2	2
	2-3 times	5	5
	4-5 times	4	4
Skin irritation	Never	24	-
	Once	4	4
	2-3 times	2	2
	4-5 times	1	1
Nausea	Never	28	-
	Once	2	2
	2-3 times	1	1
Diarrhea	Never	29	-
	4-5 times	2	2
General weakness	Never	30	-
	4-5 times	1	1
Chest discomfort	Never	31	-
Other	Never	21	-
	Once	1	1

When asked if they felt that a particular brand of pesticide caused their acute symptoms, several growers indicated that they could trace their symptoms to a specific brand (Table 70). Two growers complained that sulfur caused eye irritation, with one grower remarking, “Irritates eyes no matter what protection is used.” One grower was not sure of the exact pesticide, but felt the problem was caused by not wearing protective equipment.

Table 70: Apple and pear producers that felt a particular brand of pesticide caused these acute or short term exposure symptoms

Product (s)	# of growers	Why
Asana	1	Irritates skin
Manzate, syllit	1	Allergic reaction
Omite, Provado	1	Tank residue is hazardous. Can cause irritation if slight openings are left between goggles and face
Sulfur	2	Eye irritation
		Irritates eyes no matter what protection used
Unsure of pesticide	1	Not wearing protective equipment

Conclusions and Comparisons

Most apple and pear growers seem to be wearing personal protective equipment. However, it seems that they may be only regularly wearing PPE that is convenient and easy to use, thus leaving themselves open to exposure. Comparisons to other surveys are difficult, because there are many factors that can effect PPE usage, such as the different types of pesticides used in different commodities. On the other hand, some comparison could be useful to see if apple and pear growers are on par with other segments of agriculture. Similar surveys to this one were given to New York field corn growers in 1994, and New York grape growers in 1993. Table 71 shows a comparison of certain key work clothing and protective equipment that growers stated they “nearly always” wore when handling pesticides. Apple and pear growers are roughly comparable to the grape and field corn growers in each of the categories except for respirator use. Apple and pear growers wear chemical cartridge respirators significantly more often than their corn or pear growing counterparts. On the other hand, they wear dust/mist respirators less often than either grape or corn growers.

Table 71: Comparison of selected work clothing and PPE use of New York Apple/Pear, Field Corn, and Grape Growers

Clothing or PPE	NY Apple/Pear	NY Field Corn	NY Grape
Long sleeved shirt	43.8%	47.9%	55.4%
Undershirt	81.3%	80.3%	75.7%
Chemical-resistant gloves	68.8%	54.0%	61.5%
Rubber boots	31.3%	30.0%	28.4%
Chemical cartridge respirator	50.0%	18.3%	18.9%
Dust/mist respirator	15.6%	15.5%	45.9%
Goggles or face shield	28.2%	27.7%	19.6%

The majority of New York apple and pear growers are following the basic laundering procedures, separating contaminated clothing from the family wash, and washing in hot or warm water. However, more growers should be line drying the clothing to avoid leaving pesticide residues in the dryer, and more growers should be presoaking pesticide contaminated clothing. A small percentage of growers are cleaning the washer afterwards by running an empty load.

Most apple and pear growers are wearing disposable garments for the proper amount of time. The majority of field corn growers also disposed of limited-use PPE after 8 hours or so, but nearly one-third of grape growers wore disposable garments too long. Apple and pear growers are wearing disposable gloves longer than is recommended, the majority replacing them when “a leak is detectable,” instead of “weekly.”

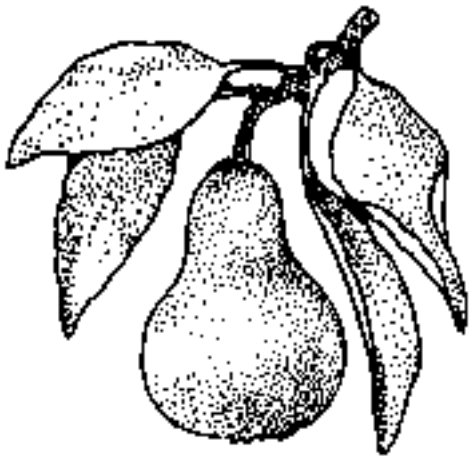
Table 72 shows how New York apple/pear, field corn, and grape producers store their PPE. Too many apple and pear growers are storing their PPE in a vehicle. This PPE could be exposed to conditions that will degrade the protection it offers.

Table 72: Comparison of selected PPE storage practices of New York Apple/Pear, Field Corn, and Grape growers

Storage Practice	NY Apple/Pear	NY Field Corn	NY Grape
In pesticide storage area	25.0%	38.7%	23.5%
In vehicle	15.6%	11.0%	3.4%

In conclusion, apple and pear growers are comparable to other growers in their use of PPE. Also, most growers recognize the importance of PPE in safe pesticide application. However, growers are not using the recommended PPE in all cases.

Appendix



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a. Avoiding Heat Stress
b. Choosing Chemical-Resistant PPE
c. Clothing Layers for Added Protection
d. Coveralls, Gloves and Other Skin Protection
e. Inspecting, Maintaining, and Replacing PPE
f. Protective Eyewear
g. Respirators

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Letter sent to apple/pear growers

January 22, 1996

Dear Apple or Pear Grower:

The Pesticide Management Education Program (PMEP) at Cornell University is conducting a pest and pesticide-use assessment survey of apples and pears in New York State. Alternatives to chemical pest control and the storage and disposal of pesticides are also included in the survey.

The information obtained from these studies is valuable for several reasons. When the Environmental Protection Agency (EPA) determines that a pesticide active ingredient poses a significant risk to humans and/or the environment, the active ingredient is placed under Special Review. Timely and accurate pesticide-use information, and information on the alternatives to the pesticide is vital when assessing the benefits of the active ingredient. Second, manufacturers reregistering products with the EPA rely on pesticide-use data to determine the need (economic justification) for reregistering a particular product.

We realize that many of you have completed several pesticide-use surveys already this year. You may be wondering why you should take the time to fill out another. The PMEP survey is the only survey that documents the benefits of pesticide-use. The other surveys do not go into the same depth. We've found that accurate pesticide-use data is essential in obtaining Section 18 emergency exemptions for growers. The data from this survey is also part of the Pesticide Impact Assessment Program at USDA (explained on the back of this sheet). The confidentiality of this survey is assured. Growers will only be asked to identify their county, and will not be personally identified in any way. We won't know, and don't want to know, who you are or where your farm is located.

When using the same pesticide (formulation) on different orchard blocks, and at different rates, you can simply indicate on the survey the "average" number of applications, rates, etc. for your farm. Also, we are very interested in hearing about any problems you are having controlling a pest with the materials you have now.

The PMEP survey is not just an academic enterprise. It directly affects decisions that affect the availability of pesticides for your crops. If you have any questions about the survey, please don't hesitate to call me or Bill Smith at (607) 255-1866. Thank you for your time.

Sincerely,

David Weingart
Research Aide

Pest and pesticide use assessment survey

PEST AND PESTICIDE USE ASSESSMENT FOR APPLE AND PEAR PRODUCTION SYSTEMS IN NEW YORK STATE IN 1995

Directions: Please fill out one survey for either apples or pears (indicate by checking or filling in appropriate circle), and answer all questions on the survey pertaining to that particular crop for the 1995 growing season. If you grow both apples and pears, please fill out two forms.

Commodity O Apples O Pears

County _____

Variety

Apples
- O Cortland
- O Delicious
- O Empire
- O Golden Delicious
- O Idared
- O McIntosh
- O Mutsu
- O R.I. Greening
- O Rome
- O Other... (specify)_____

Pears
- O Bartlett
- O Bosc
- O Clapp's Favorite
- O Seckel
- O Other... (specify)_____

Number of Acres

Bearing:	
Dwarf	
Semi-dwarf	
Standard	
Non-Bearing:	
Dwarf	
Semi-dwarf	
Standard	
Use:	
Process	
Fresh	
Dual	

IPM Practices	Y or N	# of acres	Satisfaction with results : 1 = very satisfied 2 = somewhat satisfied 3 = neither satisfied nor unsatisfied 4 = somewhat unsatisfied 5 = very unsatisfied
Insect and Mite Control:			
Trapping to monitor insect activity			
Weather-based predictive model			
Scouting to determine spray needs			
Field sanitation practices			
Used pesticides not harmful to predators			
Tree - row - volume spraying			
Sprayer calibration to reduce spray dosage			
Disease Control:			
Disease resistant cultivars			
Field sanitation practices			
Weather-based predictive models			
Tree - row - volume spraying			
Scouting/innocular estimation to determine spray needs			
Weed Control:			
Mechanical cultivation			
Mowing			
Mulch materials			

Conducted by: Pesticide Management Education Program, Cornell University
5123 Comstock Hall, Ithaca, NY 14853 Tel. (607) 255-1866

Directions: Fill in the following grid for pesticides (fungicides, insecticides, miticides, herbicides, growth regulators, thinning agents, etc.) applied to your 1995 crop. Please answer only for apples **or** pears (whichever you checked on page one). Use the **code list at right** to simplify your answers. You may enter more than one code in each square if necessary, but do not enter more than one code in the box for pesticide (list tank mixes on separate lines). If you do not see a code for your answer, please write the answer in the appropriate space. If you need more room, please ask for more sheets.

Pesticide	who app.	# of times	label rate	Spray gallons per acre	acres treated		applic. equip.	applic meth.	timing	pest(s)	basis
					bearing	non bearing					
Example											

PEST CODES (CON'T)

INSECTS / MITES / DISEASES

Apple blotch leafminer	501	Crown collar rot	514	Obliquebanded leafroller	527	Rosy apple aphid	540
Apple maggot	502	Cutworms	515	Oriental fruit moth	528	San Jose scale	541
Apple rust mite	503	Dogwood borer	516	Oystershell scale	529	Sooty blotch	542
Apple rusts	504	European apple sawfly	517	Pear midge	530	Sparganothis fruitworm	543
Apple scab	505	European corn borer	518	Pear plant bug	531	Spirea aphid	544
Bitter rot	506	European fruit lecanium	519	Pear psylla	532	Spotted tentiform leafminer	545
Black rot	507	European red mite	520	Pear rust mite	533	Storage rots	546
Blister spot	508	Fabraea leaf spot	521	Pear scab	534	Storage scald	547
Blossom end rot	509	Fire blight	522	Pearleaf blister mite	535	Tarnished plant bug	548
Brooks fruit spot	510	Fly speck	523	Plum curculio	536	Two-spotted spider mite	549
Cedar apple rust	511	Green aphids	524	Potato leafhopper	537	Variegated leafroller	550
Codling moth	512	Green fruitworms	525	Powdery mildew	538	White apple leafhopper	551
Comstock mealybug	513	Lesser appleworm	526	Redbanded leafroller	539	Woolly apple aphid	552
						Other (please specify)	

WILDLIFE DAMAGE MANAGEMENT

Wildlife type	Problem	Chemical Control	Other Control
Deer/Rabbits	O yes O no	O BGR-Deer Away O Hot Sauce Animal Repellent O Chew-Not O Other (specify) O Bonide Rabbit-Deer	O soap bars O shooting O exclusion O other (specify) O modify habitat O trapping
Meadow and Pine Voles	O yes O no	O 2-100 Field Mouse Bait O ZP on Wheat O Rodenticide for Orchard Mice O ZP on Rolled Oats O ZP O ZP Concentrate O Hopkins ZP Bait O Other (specify) O ZP Rodent Bait AG	O mowing/herbicides O field sanitation O wire or nylon guards O other (specify)
Woodchucks	O yes O no	O fumigation O other (specify)	O shooting O predator odors O trapping O other (specify) O fencing
Other Wildlife (please specify)	O yes O no		

Miscellaneous Questions: Answer the following questions by filling in the circle(s). Check as many answers as apply to the 1995 growing season.

1. Are you a certified pesticide applicator? O yes O no

2. How much did you spend on chemical pest control (including weed control) per acre in 1995?

O $0 O less than $50 O $51-75 O $76-100 O $101-150 O $151-200 O $201-250 O over $250

3. How often do you calibrate your pesticide application equipment?

O at the time of equipment purchase O once a season O every two to three years O other (specify) _____
O before each application O two to three times a season O never

4. What practices do you use when storing pesticides?

O stored with non-pesticide materials O locked up in separate "pesticide only" location O other (please specify) _____
O stored only in original containers O stored in unlocked "pesticide only" location

5. How do you dispose of unwanted or unused pesticides?

O bury O return to pesticide manufacturer/dealer O do not have any unused/unwanted pesticides
O landfill O spray on noncrop land areas O other (please specify) _____
O give to other growers O carryover to next season

6. How do you dispose of empty pesticide containers?

O bury O landfill after triple-rinsing O return to pesticide manufacturer/dealer
O burn O recycle after triple-rinsing O other (please specify) _____

7. Who recommends, or how do you decide which pesticide(s) to use in your orchard?

O magazine, radio or TV advertisement O farm supply dealer O past success with product
O Cooperative Extension agent/specialist O chemical salesperson O Cornell Recommends
O another farmer/grower O private consultant O other (specify) _____

PEST CODES (CON'T)

INSECTS / MITES / DISEASES

Apple blotch leafminer	501	Crown collar rot	514	Obliquebanded leafroller	527	Rosy apple aphid	540
Apple maggot	502	Cutworms	515	Oriental fruit moth	528	San Jose scale	541
Apple rust mite	503	Dogwood borer	516	Oystershell scale	529	Sooty blotch	542
Apple rusts	504	European apple sawfly	517	Pear midge	530	Sparganothis fruitworm	543
Apple scab	505	European corn borer	518	Pear plant bug	531	Spirea aphid	544
Bitter rot	506	European fruit lecanium	519	Pear psylla	532	Spotted tentiform leafminer	545
Black rot	507	European red mite	520	Pear rust mite	533	Storage rots	546
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Blossom end rot	509	Fire blight	522	Pearleaf blister mite	535	Tarnished plant bug	548
Brooks fruit spot	510	Fly speck	523	Plum curculio	536	Two-spotted spider mite	549
Cedar apple rust	511	Green aphids	524	Potato leafhopper	537	Variegated leafroller	550
Codling moth	512	Green fruitworms	525	Powdery mildew	538	White apple leafhopper	551
Comstock mealybug	513	Lesser appleworm	526	Redbanded leafroller	539	Woolly apple aphid	552
						Other (please specify)	

WILDLIFE DAMAGE MANAGEMENT

Wildlife type	Problem	Chemical Control	Other Control
Deer/Rabbits	O yes O no	O BGR-Deer Away O Hot Sauce Animal Repellent O Chew-Not O Other (specify) O Bonide Rabbit-Deer	O soap bars O shooting O exclusion O other (specify) O modify habitat O trapping
Meadow and Pine Voles	O yes O no	O 2-100 Field Mouse Bait O ZP on Wheat O Rodenticide for Orchard Mice O ZP on Rolled Oats O ZP O ZP Concentrate O Hopkins ZP Bait O Other (specify) O ZP Rodent Bait AG	O mowing/herbicides O field sanitation O wire or nylon guards O other (specify)
Woodchucks	O yes O no	O fumigation O other (specify)	O shooting O predator odors O trapping O other (specify) O fencing
Other Wildlife (please specify)	O yes O no		

Miscellaneous Questions: Answer the following questions by filling in the circle(s). Check as many answers as apply to the 1995 growing season.

1. **Are you a certified pesticide applicator?** O yes O no

2. **How much did you spend on chemical pest control (including weed control) per acre in 1995?**
O $0 O less than $50 O $51-75 O $76-100 O $101-150 O $151-200 O $201-250 O over $250

3. **How often do you calibrate your pesticide application equipment?**
O at the time of equipment purchase O once a season O every two to three years O other (specify)
O before each application O two to three times a season O never _____

4. **What practices do you use when storing pesticides?**
O stored with non-pesticide materials O locked up in separate "pesticide only" location O other (please specify)
O stored only in original containers O stored in unlocked "pesticide only" location _____

5. **How do you dispose of unwanted or unused pesticides?**
O bury O return to pesticide manufacturer/dealer O do not have any unused/unwanted pesticides
O landfill O spray on noncrop land areas O other (please specify)
O give to other growers O carryover to next season _____

6. **How do you dispose of empty pesticide containers?**
O bury O landfill after triple-rinsing O return to pesticide manufacturer/dealer
O burn O recycle after triple-rinsing O other (please specify) _____

7. **Who recommends, or how do you decide which pesticide(s) to use in your orchard?**
O magazine, radio or TV advertisement O farm supply dealer O past success with product
O Cooperative Extension agent/specialist O chemical salesperson O Cornell Recommends
O another farmer/grower O private consultant O other (specify)_____

Personal protective equipment survey

PERSONAL PROTECTIVE EQUIPMENT USE BY APPLE AND PEAR PRODUCERS IN NEW YORK IN 1995

Instructions: Please complete the questionnaire items as they relate to you/your employees. Check the box most applicable. If other responses are needed, special instructions are given.

1. Indicate the work clothes and personal protective equipment that you/your employees wear when handling pesticides.

	Nearly always wear	Wear occasionally depending on the weather	Wear occasionally depending upon the pesticide	Rarely or never wear	Unnecessary for kinds of pesticides I apply
Work Clothing					
a. Undershirt/T-shirt	○ 1	○ 2	○ 3	○ 4	
b. Undershorts/Long Johns	○ 1	○ 2	○ 3	○ 4	
c. Jeans/Work trousers	○ 1	○ 2	○ 3	○ 4	
d. Overalls	○ 1	○ 2	○ 3	○ 4	
e. Long sleeved shirt	○ 1	○ 2	○ 3	○ 4	
f. Short sleeved shirt	○ 1	○ 2	○ 3	○ 4	
g. Baseball style cap	○ 1	○ 2	○ 3	○ 4	
h. Socks	○ 1	○ 2	○ 3	○ 4	
i. Leather shoes	○ 1	○ 2	○ 3	○ 4	
j. Canvas shoes	○ 1	○ 2	○ 3	○ 4	
k. Woven coveralls	○ 1	○ 2	○ 3	○ 4	
l. Insulated coveralls	○ 1	○ 2	○ 3	○ 4	
m. Work coat or jacket	○ 1	○ 2	○ 3	○ 4	
n. Cotton/canvas gloves	○ 1	○ 2	○ 3	○ 4	
o. Leather gloves	○ 1	○ 2	○ 3	○ 4	
Protective Equipment					
p. Chemically resistant gloves (rubber/plastic/barrier laminate)	○ 1	○ 2	○ 3	○ 4	○ 5
q. Rubber boots	○ 1	○ 2	○ 3	○ 4	○ 5
r. Woven coveralls over work clothes	○ 1	○ 2	○ 3	○ 4	○ 5
s. Nonwoven coveralls (limited use or disposable)	○ 1	○ 2	○ 3	○ 4	○ 5
t. Chemically resistant coveralls	○ 1	○ 2	○ 3	○ 4	○ 5
u. Chemically resistant apron	○ 1	○ 2	○ 3	○ 4	○ 5
v. Wide-brimmed plastic/rubber hat	○ 1	○ 2	○ 3	○ 4	○ 5
w. Hard hat	○ 1	○ 2	○ 3	○ 4	○ 5
x. Dust/mist respirator	○ 1	○ 2	○ 3	○ 4	○ 5
y. Half-face chemical cartridge respirator	○ 1	○ 2	○ 3	○ 4	○ 5
z. Full-face chemical cartridge respirator	○ 1	○ 2	○ 3	○ 4	○ 5
aa. Powered air-purifying respirator (PARC)	○ 1	○ 2	○ 3	○ 4	○ 5
bb. Goggles	○ 1	○ 2	○ 3	○ 4	○ 5
cc. Safety glasses	○ 1	○ 2	○ 3	○ 4	○ 5
dd. Face shield	○ 1	○ 2	○ 3	○ 4	○ 5
Other Items					
ee. Please describe: _____	○ 1	○ 2	○ 3		

2. What protective equipment, if any, do you/your employees wear to mix and/or load pesticides? (check all that apply)

○ chemically resistant gloves	○ wide-brimmed plastic/rubber hat	○ goggles
○ rubber boots	○ hard hat	○ safety glasses
○ woven coveralls over work clothes	○ half-face chemical cartridge respirator	○ face shield
○ nonwoven (limited-use) coveralls	○ full-face chemical cartridge respirator	○ do not mix pesticides
○ chemically resistant coveralls/rain gear	○ powered air-purifying respirator	○ other (please specify)
○ chemically resistant apron	○ dust/mist respirator	_____

3. What is the material of the outer clothing (coveralls, jeans, shirt, etc.) you/your employees wear most often when handling pesticides?

○ cotton	○ limited-use or disposable (Tyvek , Comfort-Gard , Kleenguard)
○ cotton/polyester blend	○ don't know
○ water-proof rubber/plastic (rain gear)	○ other (please specify) _____

4. How many hours do you/your employees wear limited-use or disposable garments before they are discarded? _____ hours

5. How do you/your employees discard of diposable garments? (check all that apply)

○ burn	○ render unusable (slash/cut)
○ bury	○ don't know
○ landfill	○ other (please specify) _____

6. How many hours do you/your employees wear refurbishable clothing (coveralls, jeans, shirts, etc.) before laundering: _____ hours

7. What facilities do you/your employees use to launder clothing that was worn when handling pesticides? (check all that apply)

○ a commercial laundry service	○ family washer WITH family clothes
○ grower's special facilities reserved for laundry of pesticide-soiled clothing	○ coin operated laundromat
○ family washer, but in a SEPARATE load from family clothes	○ don't know

8. Which of these steps do you/your employees use to launder clothes that were worn when handling pesticides? (check all that apply)

	Yes	No	Don't Know
a. Presoak or rinse before washing with detergent	○ 1	○ 2	○ 3
b. Wash in hot or warm water rather than cold	○ 1	○ 2	○ 3
c. Wash more than once before drying	○ 1	○ 2	○ 3
d. Line-dry outdoors	○ 1	○ 2	○ 3
e. Clean washer after laundering by running a complete, but empty (no clothes), cycle with hot water and detergent	○ 1	○ 2	○ 3

9. How frequently is your/your employees' work clothing replaced? (check all that apply)

○ when it wears out	○ 2 times a year
○ annually	○ seasonally
○ if contaminated by pesticide spill	○ other (please specify) _____

10. How frequently are your/your employees' chemically-resistant gloves replaced? (check all that apply)

○ when a leak is detectable	○ seasonally
○ weekly	○ do not wear chemically resistant gloves
○ monthly	○ other (please specify)_____

11. How often do you/your employees replace respirator cartridges?

- ○ daily
- ○ weekly
- ○ seasonally
- ○ when breathing becomes difficult
- ○ when odors are detectable
- ○ do not wear cartridge respirators
- ○ other (please specify)_____

12. How do you/your employees maintain chemical cartridge respirators and eyewear between uses? (check all that apply)

- ○ hand-wash parts separately with detergent
- ○ wipe parts clean with towel or rag
- ○ rinse with clear water
- ○ wipe dry
- ○ hang (air) dry
- ○ store in zip-closable plastic bag
- ○ store in original box
- ○ hang outside or in barn until needed
- ○ test fit prior to wearing
- ○ do not wear cartridge respirators
- ○ do not wear protective eyewear
- ○ other (please specify)_____

13. Where do you/your employees store <u>protective equipment</u> between wearings?

- ○ with other clothing items at work
- ○ in pesticide storage area
- ○ in dressing/changing area with a shower
- ○ in dressing/changing area with no shower
- ○ in vehicle
- ○ at home
- ○ other (please specify) _____

14. Do you/your employees wear the minimum <u>protective equipment</u> as required on the pesticide label?

- ○ yes, MORE THAN minimum requirements
- ○ yes, minimum requirements
- ○ mostly, but not always
- ○ often not
- ○ don't know

15. If the <u>protective equipment</u> used does NOT meet minimum requirements, why not?

- ○ minimum requirements are too strict
- ○ protective equipment is too hot
- ○ protective equipment restricts my/my employees' movements
- ○ protective equipment is not available where I/my employees live
- ○ protective equipment is too expensive
- ○ other (please specify)_____

16. Which of these resources would you be most likely to use to learn about protective equipment? (check <u>three</u>)

- ○ telephone hot line
- ○ media (TV, radio, newspaper)
- ○ exhibit
- ○ kit of sample protective equipment
- ○ computer program
- ○ pesticide applicator's training manual
- ○ fact sheets
- ○ slide set
- ○ videotape

17. Approximately what proportion of the pesticide applications that you make are from an enclosed vehicle?

- ○ none
- ○ less than one-third
- ○ one-third to two-thirds
- ○ more than two-thirds
- ○ essentially all

18. Below are ACUTE or SHORT TERM SYMPTOMS associated with exposure to pesticides. How often, if at all, have you had these symptoms in the past crop year that you think might be related to handling or applying pesticides? (Answer in Column A). If you experienced a symptom, did you seek medical help? (Answer in Column B).

	Column A					Column B	
						Seek Medical Help	
Symptom	Never	Once	2 to 3 Times	4 to 5 Times	5 Times or More	Yes	No
Excessive fatigue	○ 1	○ 2	○ 3	○ 4	○ 5	○ yes	○ no
Headache	○ 1	○ 2	○ 3	○ 4	○ 5	○ yes	○ no
Dizziness	○ 1	○ 2	○ 3	○ 4	○ 5	○ yes	○ no
Eye irritation	○ 1	○ 2	○ 3	○ 4	○ 5	○ yes	○ no
Skin irritation	○ 1	○ 2	○ 3	○ 4	○ 5	○ yes	○ no
Nausea	○ 1	○ 2	○ 3	○ 4	○ 5	○ yes	○ no
Diarrhea	○ 1	○ 2	○ 3	○ 4	○ 5	○ yes	○ no
General weakness	○ 1	○ 2	○ 3	○ 4	○ 5	○ yes	○ no
Chest discomfort	○ 1	○ 2	○ 3	○ 4	○ 5	○ yes	○ no
Other (explain)	○ 1	○ 2	○ 3	○ 4	○ 5	○ yes	○ no

_____

19. During this past crop year, did you feel that a particular brand of pesticide caused these acute or short term exposure symptoms?

○ no
○ yes ----> a. Please name the product(s): _____

_____

b. Why did this product cause more difficulty? _____

_____

20. Do you have any health problems of a CHRONIC or LONG-TERM NATURE that you believe were caused by exposure to pesticides?

○ no
○ yes ----> Please describe _____

_____

_____

21. Who sponsors the applicator certification and continuing education programs that you attend?

	Yes	No	Don't Recall
Employer	○ yes	○ no	○ don't recall
Extension service	○ yes	○ no	○ don't recall
Chemical company/dealer	○ yes	○ no	○ don't recall
Grower Association(s)	○ yes	○ no	○ don't recall
Other _____	○ yes	○ no	○ don't recall

22. Which of these education formats would you <u>prefer</u> for pesticide applicator training?

○ conference (state or regional)
○ training session (regional or county)
○ satellite downlink (county)
○ study group (county, town, village)
○ self study