2022 Cornell Pest Management Guidelines for Commercial Tree Fruit Production

Cornell Cooperative Extension

Additional information available at the Cornell fruit homepage: www.fruit.cornell.edu

These guidelines are not a substitute for pesticide labeling. Always read and understand the product label before using any pesticide.

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Every effort has been made to provide correct, complete, and up-to-date pest management information for New York State at the time this publication was released for printing (November 2021). Changes in pesticide registrations, regulations, and guidelines occurring after publication are available in county Cornell Cooperative Extension offices or from the Cornell Cooperative Extension Pesticide Safety Education Program (CCE-PSEP) (psep.cce.cornell.edu).

Trade names used in this publication are for convenience only. No endorsement of products is intended, nor is criticism of unnamed products implied.

These guidelines are not a substitute for pesticide labeling. Always read and understand the product label before using any pesticide.

The guidelines in this bulletin reflect the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this bulletin does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

Cover photo: Tart cherries in bloom. (*Photo: Art Agnello.*)

11 APPLES *(continued)*

1 Integrated Crop and Pest Management

1.1 Background

Cornell University and Cornell Cooperative Extension actively promote the use of Integrated Crop and Pest Management (IPM) by New York growers in order to address agricultural concerns. In many areas of New York State, there are horticultural, economic, social, and political pressures to reduce the environmental impact and use of pesticides in crop production. Public concerns with nutrient and sediment movement into ground and surface water and pressure against pesticide applications is growing. In other regions, agricultural producers are being asked to submit nutrient and soil management plans to address the offsite impacts of their practices. In addition, the development of pesticide resistance in key pests; registration of fewer and more expensive new chemicals for pest control; loss of existing products; and increased competition from other regions continue to push New York agriculture to look for nonchemical alternatives.

IPM requires a combination of long and short term production strategies to maximize net profit while minimizing risks of undesirable environmental impacts of practices. Some of these practices include site selection, crop-specific production strategies, nutrient management, and cover cropping. IPM is a pest control strategy that promotes the use of a variety of tactics including pest-resistant cultivars and biological, cultural, and physical controls. Pesticides are a control tactic employed in IPM, but they are used preferably only when needed. Pesticide use is thus minimized without jeopardizing crop quality or yield. Applying multiple control tactics minimizes the chance that pests will adapt to any one tactic and allows growers to choose the most environmentally sound, efficacious, and economically efficient pest management program for their situation.

This manual provides information and references that will allow New York fruit growers to practice IPM for many of their crops. While information for the proper use of pesticides is a main component of this manual, other information is contained that can help growers reduce their reliance on pesticides and take advantage of alternatives to pesticides that may be less expensive, less environmentally harmful, and more acceptable to the non-agricultural community.

1.2 Practicing IPM

In an IPM program, it is important to accurately identify the pests (vertebrates, diseases, insects, and weeds) and assess pest abundance. See the listing (at the end of this publication) of laboratories at Cornell that do pest and disease diagnosis and soil and tissue analysis for assistance in maintaining crop health and nutrition. It is important to have knowledge of the biology and ecology of the pest(s) attacking the crop and the factors that can influence pest infestations. An understanding of the influence of factors such as weather and natural enemies on pest abundance will aid the choice of management tactics. IPM programs stress suppression of insect and disease populations to levels that do not cause economic damage, rather than total eradication of a pest. In the case of insect pests, it may be important to have at least some pests present to ensure that natural enemies will remain in the crop to suppress subsequent infestations.

1.3 IPM Components

1.3.1 Monitoring (Scouting)

Scouting includes detecting, identifying, and determining the level of pest populations on a timely basis. Insect traps can often be used to detect pests and identify times when scouting should be intensified or control measures should be taken. Monitoring individual orchard blocks throughout the season is the most effective way of assessing the insect, disease, and weed situation and, therefore, the need for chemical treatment in that block. Scientifically based, accurate, and efficient monitoring methods are available for many pests on fruit crops in New York. Brief descriptions of the recommended techniques are given in this manual.

1.3.2 Forecasting

Weather data and other information helps predict when specific pests will most likely occur. Weather-based pest forecast models for diseases and insects of many crops have been developed in New York. This information will be referred to for the pests that have such models available. Weather forecasts are available through the NYS IPM Program's Network for Environment and Weather Awareness (NEWA) on a daily basis.

Access to a computer network to obtain weather, regional insect, and disease forecasts is useful but not essential. NEWA provides automated local weather information and the results of pest forecasts on a daily basis. Access NEWA online at www.newa.cornell.edu. Simple weather recording equipment such as thermometers, hygrometers, and rain gauges placed in orchards will assist the prediction of pest outbreaks. Information on the potential for pest outbreaks generally can also be obtained from local Cooperative Extension offices, newsletters, and regional crop advisors.

1.3.3 Thresholds

Use thresholds to determine when pest populations have reached a level that could cause economic damage. Thresholds have been scientifically determined by Cornell researchers. Following the thresholds indicated in this manual has reduced pesticide use by as much as 50%, saving significant money for growers. The term ***suggested action threshold*** is used in this publication to denote

2 Organic Tree Fruit Production in New York State

2.1 Introduction

A large number of both native and introduced pest species attack apples and other tree fruits grown in commercial orchards. Control of this pest complex is particularly challenging in N.Y., because unlike more arid production regions in the country, fruit orchards in N.Y. are commonly in close proximity to semi-wooded areas with an abundance of naturalized and wild host species that can harbor populations of certain tree fruit pests. Traditionally, conventional fruit orchards in N.Y. have been treated heavily with pesticides to control this extensive pest complex.

In the past, very few growers in the northeast have attempted to produce apples and other tree fruits organically because of the practical difficulties involved in controlling pests in this region without using conventional, broad-spectrum pesticides. However, during the last 10-15 years, studies have been conducted to develop management programs that may be able to replace current strategies that rely primarily on these pesticide applications. For example, recent studies have shown that the predaceous mite, *Typhlodromus pyri*, which is native to apple production regions in western N.Y., can successfully control populations of the key mite pest, European red mite, in commercial apple orchards so that no applications of miticides are required for seasonal control. Recent research in N.Y. and elsewhere has also shown that pheromones can be deployed in orchards to disrupt mating of key lepidopteran species such as oriental fruit moth, and borer species, and substantially reduce fruit damage from this complex of pests. In addition to some of these newer types of organically compatible pest control technologies, traditional control methods such as selective fruit thinning, pruning, sanitation (frequent removal of dropped fruit and/or vegetative tissue infested or infected with pests), removal of wild hosts near commercial plantings, and exclusion of pests with biological or physical barriers near or around trees, have also been shown to reduce populations of many types of pests in fruit plantings in this region.

Ideally, organic fruit production is the synthesis of an entire suite of practices intended to take advantage of natural ecosystem interactions and minimize synthetic inputs. Such a system might start with the selection of disease-resistant cultivars, to circumvent the need for the majority of normal disease sprays. This one tactic could eliminate or substantially reduce the need to manage apple scab, powdery mildew, cedar apple rust, and fire blight (Ellis et al., 1998). In lieu of resistance, a combined strategy of orchard sanitation and frequent applications of elemental sulfur and copper throughout most of the season would be the next practical alternative.

2.2 Fungicide Options in Organic Tree Fruit Production

Organic approved fungicides and bactericides are often not as effective and the conventional fungicides and antibiotics in temperate apple production regions such as NY and New England. In recent years, organic copper and sulfur products, and biopesticide products have greatly improved in terms of formulation and efficacy. In drier seasons and against lower disease pressure situations (e.g. low level of inoculum & among less susceptible cultivars), organic-approved products can provide a level of control comparable to conventional products. That being said, organic-approved products may need to be applied at higher rates and frequencies to match the activity of convention products. In field trials conducted at Cornell and other regional institutions, applied plant pathologists are achieving greater success in managing fire blight and summer diseases with biopesticides based on *Bacillus subtilis*, *B. amyloliquefaciens*, *B. mycoides*, and *Reynoutria sachalinensis*, and new low MCE copper products formulated to reduce risk of phytoxicity. In many instances, biopesticides and organic copper and sulfur products are being used in conventional production as means of resistance management or to avoid exceeding seasonal tolerances for key conventional fungicides. Biopesticides based on natural oils, such as white mineral oil or oil of thyme have similar potential for controlling fungal and bacterial diseases, but the use of oils complicates the use of other agrichemicals as oils act as intensifiers and could lead to problems with phytoxicity in tank mixes. Biopesticides based on potassium bicarbonate and peroxides have utility against fungal diseases, particularly, powdery mildew and sooty blotch fly speck. However, these would be need to be applied every 3-5 days or at each wetting event for maximum efficacy. Phosphorous acid fungicides are biopesticides and can be fairly effective against fire blight, powdery mildew, and flyspeck sooty blotch when applied at model recommendations and short intervals (e.g. 3-7 days). However, these products are not approved for organic agriculture. Additional biopesticides and organically approved copper and sulfur products are being developed and improved every year. While some of these products have been evaluated, many are either not commercially available or have yet to be thoroughly evaluated by multiple experts in the region. Products designated with the section symbol "§" indicate that they are suitable for organic production. A provisional program for managing the major diseases of apples covering might resemble:

- **Apple scab** [silver tip through midsummer] – copper [silver tip & green tip]; sulfur, *Bacillus sp,* potassium bicarbonate, and peroxides [tight cluster to midsummer]

3 Pesticide Information

3.1 Pesticide Classification and Certification

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) created two classifications of pesticides – general-use and restricted-use. **General-use pesticides** may be purchased and used by anyone. **Restricted-use pesticides** can only be purchased by a certified applicator. Restricted-use pesticides must also be used by a certified applicator or someone under their supervision.

The same federal law that classifies pesticides divides applicators into two groups: private and commercial. **Private applicators** use or supervise the use of pesticides to produce agricultural commodities or forest crops on land owned or rented by the private applicator or their employer. A farmer must be certified as a private applicator in order to purchase and use restricted-use pesticides on agricultural commodities. (No certification is needed if a farmer does not use restricted-use pesticides.)

A **commercial applicator** uses or supervises the use of pesticides for any purpose or on any property not covered by the private applicator classification. In New York, a commercial applicator must be certified to purchase or use any pesticide whether it is general- or restricted-use.

Information about pesticide certification and classification is available from your Cornell Cooperative Extension office (cce.cornell.edu/localoffices), regional NYSDEC pesticide specialist (www.dec.ny.gov/about/ 558.html), the Pesticide Applicator Training Manuals (https://www.cornellstore.com/books/cornell-cooperative-ext-pmep-manuals), or the Cornell Cooperative Extension Pesticide Safety Education Program (psep.cce.cornell.edu).

3.2 Use Pesticides Safely

Using pesticides imparts a great responsibility on the user to protect their health and that of others and to protect the environment. Keep in mind there is more to "pesticide use" than the application. Pesticide use includes mixing, loading, transporting, storing, or handling pesticides after the manufacturer's seal is broken; cleaning pesticide application equipment; and preparing a container for disposal. These activities require thoughtful planning and preparation. They are also regulated by state and federal laws and regulations intended to protect the user, the community, and the environment from any adverse effects pesticides may cause.

3.2.1 Plan Ahead

Many safety precautions should be taken *before* you actually begin using pesticides. Too many pesticide applicators are dangerously and needlessly exposed to pesticides while they are preparing to apply them. Most pesticide accidents can be prevented with informed and careful practices. **Always read the label on the pesticide container before using the pesticide.** Make sure you understand and can follow all directions and precautions on the label. Be prepared to handle an emergency exposure or spill. Know the first aid procedures for the pesticides you use.

3.2.2 Move Pesticides Safely

Carelessness in transporting pesticides can result in broken containers, spills, and contamination of people and the environment. Once pesticides are in your possession, you are responsible for safely transporting them. Accidents can occur even when transporting materials a short distance. You are responsible for a pesticide accident so take every effort to transport pesticides safely. Be prepared for an emergency.

3.2.3 Personal Protective Equipment and Engineering Controls

Personal protective equipment needs depend on the pesticide being handled. ***Required personal protective equipment (PPE) are listed on pesticide labels.*** The required PPE are is based on the pesticide's toxicity, route(s) of exposure, and formulation. Label required PPE are the minimum that must be worn during the pesticide's use. Pesticide users can always wear more protection than required.

The type of protective equipment used depends on the type and duration of the activity, where pesticides are being used, and exposure of the handler. Mixing/loading procedures often require extra precautions. Studies show you are at a greater risk of accidental poisoning when handling pesticide concentrates. Pouring pesticide concentrates from one container to another is the most hazardous activity.

Engineering controls are devices that help prevent accidents and reduce a pesticide user's exposure. One example is a closed mixing/loading system that reduces the risk of exposure when dispensing concentrated pesticides. Consult the product label for more information on using engineering controls in place of PPE.

3.2.4 Avoid Drift, Runoff, and Spills

Pesticides that move out of the target area can injure people, damage crops, and harm the environment. Choose weather conditions, pesticides, application equipment, pressure, droplet size, formulations, and adjuvants that minimize drift and runoff hazards. See product labels for specific application and equipment requirements.

4 Sprayer Information

4.1 Solutions For Safer Spraying

4.1.1 Reducing Risk of Pesticide Exposure Through Use Of Engineering Controls

Because handling and applying pesticides is risky business, keeping pesticide exposure to a minimum should be a chief concern of any pesticide applicator. To reduce the risks associated with handling and applying pesticides, devices known as engineering controls can be used that help to reduce or practically eliminate exposure to toxic chemicals. This section describes various engineering controls that can help reduce applicator exposure to pesticides in five areas of potential contamination.

4.1.2 Areas of Potential Contamination

1. Loading the Sprayer

Closed Transfer Systems – Closed transfer systems allow concentrated pesticide to be moved from the original shipping container to the sprayer mix tank with minimal or no applicator contact. Many systems provide a method to measure the concentrated pesticide. Some systems also include a container rinsing system. Currently available closed transfer systems use a probe inserted into the pesticide container, a connector on the container that mates to a similar connector on the application equipment, or a vacuum-type (venturi) system that uses flowing water to transfer the chemical from the container.

Induction Bowls – Induction bowls are metal, plastic or fiberglass hoppers attached to the side of the sprayer or nurse tank that allow pesticides to be added to the mix tank without the applicator climbing onto the spray rig. Pesticides are poured into the bowl and water is added to flush out the bowl and carry the pesticide to the spray tank. Often a rinse nozzle is mounted inside the bowl for rinsing out empty pesticide containers. Typically induction bowls are raised out of the way during spraying and lowered to about 3 feet above ground when loading the sprayer.

Direct Pesticide Injection System – Direct pesticide injection systems allow pesticides to be mixed directly with water in the sprayer plumbing system rather than in the main spray tank. The pesticide is pumped from its container and mixed with the water either in a manifold or at the main water pump. Only clean water is held in the main tank of the sprayer. An electronic controller and up to four pumps adjust the amount of concentrated pesticide that is injected into the water stream, allowing for variable application rates.

Container Rinse System – Container rinse systems consist of a rinse nozzle and a catch bowl that traps the container washings (rinsate). The empty container is placed over the rinse nozzle and a jet of water cleans the inside of the container. The rinsate caught in the bowl is pumped into the spray tank to be used along with the spray mixture. Often rinse nozzles are installed in chemical induction bowls. Most closed transfer systems also provide a way of rinsing containers and piping the rinse water into the spray tank.

2. Reducing Contamination at the Boom

Boom Folding/Extending – Manually folding booms can be a major source of operator contamination because the boom can be covered with pesticide from drift or dripping nozzles. Consider the use of hydraulic or mechanical folding methods.

Diaphragm Check Valves – Typically, when a sprayer is shut off and as the system pressure drops, any liquid remaining in the boom piping drips from the nozzles, possibly dripping onto the boom or even the operator. Diaphragm check valves installed at each nozzle prevent this by using a spring-loaded rubber diaphragm to close off the flow of liquid once the system pressure drops below about 10 pounds per square inch. When the sprayer is switched on and system pressure builds up, the valve opens and allows the liquid to flow through the nozzles.

Multiple Nozzle Bodies – Contamination can occur when operators change or unclog nozzles during an application. Multiple nozzle bodies (or turret nozzles) allow operators to switch between nozzles with a turn of the nozzle body rather than having to unscrew or undo a threaded or a bayonet fitting.

Hand Wash Water Supply – Providing adequate wash water is essential (and often required). A simple container with a hand-operated valve can be mounted on the side of the sprayer to provide clean water for hand washing and personal hygiene.

3. Protecting from Drift and Contaminated Clothing in Cabs

Cab Filtration Using Carbon Filters – Carbon filtration systems are used to remove pesticide odor and pesticide-laden mist from fresh air used in a tractor or self-propelled sprayer cab. Carbon filtration systems are often a standard feature on self-propelled sprayers. Now many factory installed tractor cabs offer optional filtration systems. In 1998, the American Society of Agricultural Engineers (ASAE) adopted testing standards for operator cabs used in pesticide application. Cabs certified under this standard meet the requirements for enclosed cabs contained in the Worker Protection Standard.

Protective Clothing Lockers – To prevent contamination of the tractor or sprayer cab interior, entering the cab. A few sprayer companies offer a simple compartment (or

Table 4.4.1. Gallonage of dilute spray per acre required to provide equivalent coverage for mature trees of different sizes and spacings.

Distance Between Rows (feet)	Tree Width (feet)	Tree Heigh (feet)	Dilute spray Per acre[1] (gal/acre)
40	28	20	427
40	28	16	342
30	20	15	305
25	16	14	273
22	14	13	252
20	12	12	220
18	10	12	203
16	8	10	152
14	6	10	131
12	5	10	127
11	4	10	111
10	3	9	82

[1]Minimum dilute gallons per acre=tree width x tree height x linear feet of row per acre (43,560 divided by distance between rows) x approximately 0.7 gallon per 1,000 cu ft of tree volume.

4.4.8 Travel Speed Calibration

Travel speed is a critical factor in maintaining accurate application rates and will influence spray deposition depending on location within the canopy. The slower a sprayer travels, the greater the uniformity in spray deposition. Although there is inconsistency in research results that try to determine the effect of travel speed on average spray deposition, all studies to date have been in agreement that the higher the travel speed, the greater the variability in spray deposit. Variation in spray deposit is an important factor where uniformity of spray coverage throughout the canopy is required. Conclusions from research were drawn using travel speeds of 1-4 mph.

Factors that will affect travel speed include:

- weight of sprayer to be pulled
- slope of terrain
- ground conditions traveled over (wheel slippage!)

The best way to measure travel speed is to pull a sprayer with tank half filled with water on the same type of terrain that the sprayer will be operated on.

Set up test course at least 100 feet long, measure the course with a tape measure. Do not pace the distance. The longer the course the smaller the margin of error. Run the course in both directions.

Use an accurate stop watch to check the time required to travel the course in each direction. Average the two runs and use the following formula to calculate the speed in MPH.

Formula: $\text{MPH} = \dfrac{\text{ft traveled}}{\text{sec traveled}} \times \dfrac{60}{88}$

Your figures:

Tractor gear ________ Engine revs.__________

$\text{MPH} = \_\_\_\_\_ \quad \dfrac{\text{ft traveled}}{\text{sec traveled}} \times \dfrac{60}{88} = \_\_\_$

A modern alternative to using the above method is to purchase a hand-held GPS receiver. A number of systems are available, costing $80-150 and are available from electronics stores, hunting equipment suppliers and the internet. The small device is potable so can be used in all tractors to determine forward speed in specific tractor gears at known engine r.p.m. They may also be used to measure row length and determine block size.

4.5 Rate of Output (GPM)

The gallons of spray desired per acre and the time required to spray an acre determine the rate of output for which the sprayer must be nozzled. Since volume of spray needed per acre varies with tree size, the most common row-spacing for the tree size to be sprayed should be used in calibrating the sprayer. The gallons of dilute spray required for various row-spacing and tree-size combinations are indicated in Table 4.4.1. Gallons of concentrate spray required is determined by dividing dilute gallonage by the concentration desired. The rate of output by the sprayer is calculated by dividing the gallons of concentrate spray by the time required to spray 1 acre, Table 4.5.1.

Table 4.5.1. Approximate time required to spray 1 acre of orchard (two-sided sprayer operation, spraying both sides of trees).

Distance between Rows (feet)	Linear feet of Row/ acre[1]	Travel speed (mph)				
		1	1.5	2	2.5	3
		minutes per acre[2]				
40	1089	12.4	8.2	6.2	5.0	4.1
30	1452	16.5	11.0	8.2	6.6	5.5
25	1742	19.8	12.4	9.9	7.9	6.6
22	1980	22.5	15.0	11.2	9.0	7.5
20	2178	24.8	16.5	12.4	9.9	8.3
18	2420	27.5	18.3	13.8	11.0	9.2
16	2723	30.9	20.6	15.5	12.4	10.3
14	3112	35.4	23.6	17.7	14.1	11.8

[1]Linear feet of row per acre = 43,560 divided by distance between rows.
[2]Minutes per acre = linear feet of row per acre divided by speed in feet per minute. Speed in feet per minute = mph x 88.

4.5.1 Example for Calibrating Rate of Output:

Rows 30 feet apart, trees 20 feet wide x 15 feet high. A 4X concentrate application is to be made at a speed of 2.5 miles per hour.

5 Characteristics of Crop Protectants Used on Tree Fruits

5.1 Cross Reference of Chemical vs. Trade Names of Pesticides

Key to pesticide type: (**A**) = Acaricide; (**B**) = Bactericide; (**F**) = Fungicide; (**I**)= Insecticide.

NOTE: See Chapter 8 for a discussion of herbicides used in tree fruit.

5.1.1 By Common Name

abamectin/avermectin – (*†Agri-Flex, *Agri-Mek) Syngenta; (*Abba) Makhteshim; (*Gladiator) FMC **(A,I)**
acequinocyl – (Kanemite) Arysta LifeScience **(A)**
acetamiprid – (Assail) UPL NA (**I**)
afidopyropen – (*†Versys Inscalis) BASF **(I)**
azadirachtin – (§Aza-Direct) Gowan; (§Neemix 4.5) Certis **(I)**

Bacillus subtilis – (§Serenade ASO) Bayer **(B, F)**
Bacillus amyloliquefaciens – (§DoubleNickel prodcucts) Certis **(B, F)**
Bacillus mycoides isolate J– (§LifeGuard) Certis **(B, F)**
benzovindiflupyr (*Aprovia) Syngenta (F)
bifenazate – (Acramite) Chemtura **(A)**; (Banter) UPL NA **(A)**
bifenthrin – (*Brigade) FMC (**I, A**)
boscalid + pyraclostrobin – (Pristine) BASF (**F**)
Bacillus thuringiensis (B.t.) – (§Agree) Certis; (§Dipel) Valent BioSciences; (§Deliver) Certis; (§Javelin) Certis **(I)**
buprofezin – (*†Centaur) Nichino **(I)**
Burkholderia spp. strain A396 – (§Venerate XC) Marrone Bio Innovations **(I)**

captan – (Captan) Micro Flo, Drexel, Makhteshim Agan **(F)**
carbaryl – (Carbaryl) Drexel; (Sevin) TKI **(I)**
chlorantraniliprole – (*†Altacor) DuPont; (*†Voliam Flexi, *†Beseige) Syngenta **(I)**
chlorothalonil – (Bravo) Syngenta; (Echo) Sipcam Agro; (Equus) Makhteshim Agan **(F)**
Chromobacterium subtsugae – (§Grandevo WDG) Marrone Bio Innovations **(I)**
clofentezine – (Apollo) Makhteshim Agan **(A)**
copper hydroxide – (Kocide, Champ) DuPont, Nufarm Americas **(B, F)**
copper oxychloride/copper sulfate – (C-O-C-S) Loveland **(B, F)**
copper oxychloride/ copper hydroxide – (Badge SC, §Badge X2) Gowan **(B, F)**
copper octanoate – (§Cueva) Certis **(B, F)**
copper sulfate – (Cuprofix Ultra 40 Disperss) UPL NA **(B, F)**
cyantraniliprole – (*†Exirel) FMC **(I)**
cyantraniliprole/abamectin – (*†Minecto Pro) Syngenta **(I)**
cyclaniliprole – (*†Verdepryn) Summit Agro; (*†Cyclaniliprole) ISK Biosciences **(I)**
cyflumetofen – (Nealta) BASF **(A)**
cyfluthrin – (*Baythroid, *Leverage) Bayer **(I)**
cyprodinil – (Vangard) Syngenta **(F)**

diazinon – (*Diazinon) Makhteshim **(I)**
difenoconazole + cyprodinil– (Inspire Super) Syngenta **(F)**
difenoconazole + fludioxonil– (Academy) Syngenta **(F)**
dimethoate – (*Dimethoate) Loveland (*Dimethoate) Drexel **(I)**
dodine – (Syllit FL) Agriphar **(F)**

emamectin benzoate – (*Proclaim) Syngenta **(I)**
esfenvalerate – (*Asana) Valent **(I)**
etoxazole – (Zeal) Valent **(A)**

fenazaquin – (Magister) Gowan **(A)**
fenbuconazole – (Indar) Dow AgroSciences **(F)**
fenbutatin-oxide – (*Vendex) UPL NA **(A)**
fenhexamid – (Elevate) Arysta **(F)**
fenpropathrin – (*Danitol) Valent BioSciences **(I)**
fenpyroximate – (Portal) Nichino America **(A,I)**
flonicamid – (Beleaf) FMC **(I)**
flupyradifurone – (*†Sivanto Prime) Bayer **(I)**
flutriafol – (†Rhyme) FMC **(F)**
fluopyram + pyrimethanil (*†Luna Tranquility) Bayer (**F**)
fluopyram + trifloxystrobin (*†Luna Sensation) Bayer (**F**)
fluopyram + tebuconazole (*†Luna Experience) Bayer (**F**)
fluxapyroxad (*†Sercadis) BASF (**F**)
fluxapyroxad + pyraclostrobin) (*†Merivon) BASF (**F**)
ferbam – (Ferbam Granuflo) Taminco **(F)**
fludioxonil – (Scholar) Syngenta **(F)**
fosetyl-Al – (Aliette) Bayer **(F)**

GS-omega/kappa-Hxtx-Hv1a – (Spear-Lep) Vestaron **(I)**

hexakis – (*Vendex) UPL NA **(I)**
hexythiazox – (Savey, Onager) Gowan **(A)**

imidacloprid – (*Admire Pro, *Leverage) Bayer **(I)**
indoxacarb – (Avaunt) DuPont **(I)**
insecticidal virus – (§Cyd-X, §Madex) Certis;(§Virosoft CP4) BioTEPP **(I)**
iprodione – (Rovral) Bayer; (Iprodione) MicroFlo **(F)**

kaolin – (§Surround) TKI (**A,F,I**)
kasugamycin – (Kasumin 2L) Arysta LifeScience **(B)**
kresoxim-methyl – (*†Sovran) FMC **(F)**

lambda-cyhalothrin – (*Lambda-CY EC) UPL NA; (*Warrior; *†Endigo) Syngenta **(I)**

malathion – (Clean Crop Malathion) Loveland; (Malathion) Drexel; (*Prentox Malathion) Prentiss **(I)**
mancozeb – (Dithane) Dow AgroSciences; (Manzate) DuPont; (Penncozeb) UPL NA **(F)**
maneb – (Manex) Griffin **(F)**
mefanoxam – (Ridomil Gold) Syngenta **(F)**
mefentrifluconazole – (*†Cevya) BASF (**F**)

calcium does not have direct antibiotic activity against the fire blight bacteria, rather it prevents invasion from the site of initial infection. This growth regulator will not protect against initial infection of flowers, but it may slow the invasion of bacterial within infected floral tissues and prevent spread to subsequent tissues. For this use, early applications of prohexadione calcium may be applied at "Pink" as described in the 2EE labeling. Pink application may also reduce bitter pit in 'Honeycrisp'. Prohexadione calcium will reduce the severity of shoot blight if applied 10-14 days in advance of infections. For maximum reduction in fire blight susceptibility, For shoot blight management, Apogee should be applied early in the growing season (when shoots are 1 to 3 inches long) and reapplied 14-21 days later to prevent vigorous shoot growth. Prohexadione calcium may be helpful in rescuing orchards of 5 or more years developing considerable shoot blight. Removal of shoot strike may stimulate new shoot growth and further systemic infections. A late application of prohexadione calcium may slow this growth and reduce systemic infection. Do not tank mix prohexadione calcium with calcium sprays because calcium will reduce the effectiveness of prohexadione calcium. One pound of ammonium sulfate may be added for each pound of prohexadione calcium if the water source for spray applications contains high levels of calcium carbonate (hard water). Use a standard adjuvant/non-ionic surfactant.

Serenade ASO (*Bacillus subtilis* strain QST 713) is a biofungicide labeled for control of fire blight, apple scab, powdery mildew, and some other fungal diseases. The bacterium acts by releasing cell contents during growth in order to eliminate or reduce competitors in its immediate environment. Serenade may be less effective than conventional fungicide for controlling fungal diseases under the favorable climatic conditions that exist in New York. When used alone, Serenade provides only some control of fire blight. In alternation with streptomycin, it sometimes provides control approaching that of a full streptomycin program. Serenade should be applied as a preventive and can be applied up to and including the day of harvest.

5.5 Insecticides

The insecticides and acaricides used to control fruit pests can be divided into several categories according to their chemical composition, mode of action, persistence, and other properties. To plan and carry out an effective spray program, it is important to understand these characteristics. A simplified classification of most of the insecticides and acaricides recommended in this bulletin is given, along with some of their general properties and uses.

Notes on Materials

The hazard of a material poisoning honey bees is given as follows: High = hazardous to bees at any time; 1 day to 2 wk residual toxicity. Moderate = not hazardous if applied in either evening or early morning when bees are not foraging, except during periods of high temperature; 3 hr to 1 day residual toxicity. Low = not hazardous to bees at any time; 1 hr to 1 day residual toxicity.

5.5.1 Organophosphates

Most organophosphate insecticides are highly toxic to warm-blooded animals when inhaled, swallowed, or absorbed through the skin. Persons handling or applying these materials should take every precaution for their own safety and for that of others. Although the organophosphates in general are less persistent than the chlorinated hydrocarbons, their toxicity often prohibits their use close to harvest (see following materials). Organophosphates are contact insecticides as well as stomach poisons. Therefore, they are useful for a quick kill of all insect forms present at the time of application, as well as for reasonable residual protection. When used alone or in combination with other materials, some organophosphates cause phytotoxicity on fruit varieties. Check this reference under the pest, the crop, and the product for more details about this situation.

Diazinon has caused russeting or related finish problems on R.I. Greening, Golden Delicious, and Baldwin. No injury has been reported on McIntosh or closely related varieties. Observations on other varieties are limited. The material should not be used in combination with copper. It is principally used prebloom for control of San Jose scale or postbloom for broad-spectrum control of major pests. It is generally less persistent than other standard phosphates and has a high bee-poisoning hazard.

Malathion is a mild phosphate that is used where a high degree of safety to people or animals is desired. It is no longer labeled for apples. It is registered for use on cherry, peach, nectarine and apricot for a variety of pests including aphids, scales, codling moth, oriental fruit moth, plum curculio and Japanese beetle. It has a very short PHI, is compatible with most other insecticides and fungicides and has a high bee-poisoning hazard.

Phosmet (*Imidan) is a broad-spectrum material with a lower toxicity to mammals than many other commonly used organophosphates. It is compatible with most commonly used insecticides and fungicides, but is incompatible with alkaline materials such as Bordeaux mixture and lime. It may cause severe leaf injury to sweet cherries, particularly those of Emperor Francis parentage. It can be used in summer sprays in integrated mite-control programs because of its low toxicity to predator mites. In some seasons in which rainfall has been negligible during the late summer, the fruit occasionally shows a buildup of the carrier used in the wettable powder. *Imidan is effective in controlling codling moth, apple maggot, redbanded leafroller, plum curculio, peach twig borer, and oriental fruit moth on apple, pear, peach, apricot, nectarine, and plums to be used for prunes. It has been ineffective against

6 Disease Management

6.1 Apple Scab Fungicides

Apple scab fungicides can control disease through four different types of activity: protection, post-infection activity, presymptom activity, and postsymptom activity. Understanding these activities and knowing which fungicides exhibit them can help a grower determine the materials that are likely to give the best results under a certain set of conditions.

Protection. Protection refers to the ability of fungicide residues to kill or inactivate scab spores (and thereby prevent infection) when the residue is already on or in the leaf or fruit before the infection takes place. A good protective fungicide must exhibit satisfactory retention, that is, the fungicide residue must stick to the leaf surface or be retained within to resist excessive washing away of the deposits by rain. On the other hand, a good protective fungicide should also have good redistribution properties, that is, fungicide residues should have a tendency to be washed by rain and redeposited on previously unprotected tissue. Ideally, a fungicide should stick well enough not to be washed off the tree, but should be redistributed well enough during rains to protect new growth.

Post-infection activity. Post-infection activity refers to the ability of a fungicide to kill or stop the growth of the fungus and thereby prevent the establishment of scab lesions, if applied within a given period after the start of a wetting period. It is expressed as the period of time from the beginning of a wetting period within which the fungicide must be applied to stop infection. The data given in Table 6.1.3 are accurate at average temperatures of 50-60°F. At lower temperatures, the periods of after-infection activity for contact fungicides are longer than those listed.

Presymptom activity. Presymptom activity can be thought of as an extension of post-infection activity. When applied following an infection period, but beyond the time limits of its post-infection activity listed in Table 6.1.3, a fungicide with significant presymptom activity will allow small chlorotic lesions to develop; however, it will inhibit or greatly reduce the production of secondary spores from those lesions. Thus, if applied too late to completely stop infection, it will still greatly reduce the amount of inoculum available for secondary spread.

Postsymptom activity. Postsymptom activity refers to the ability of a fungicide, when applied to an actively sporulating scab lesion, to prevent or greatly inhibit the further production of secondary scab spores from that lesion. Because such applications do not kill the fungus, but merely arrest its development, they must be repeated to maintain this suppression. As with presymptom activity, this has the obvious benefit of reducing the pressure for the spread of secondary scab.

Table 6.1.1. Activity spectrum of apple fungicides.

			Ratings for the Control of						
Active Ingredient (Trade Name)	**Fungicide Family**	**FRAC code‡**	*Scab*	*Powdery Mildew*	*Cedar Apple Rust*	*Black/ White Rot*	*Sooty Blotch/ Fly speck*	*Bitter Rot*	*Mite Suppres-sion(a)*
§*Bacillus amyloliquefaciens* strain D747 (§Double Nickel 55/LC)	Microbial	44	—	—	—	—	2	—	—
captan[g]	Phthalimide	M4	4	0		2	3	2[e]	3[e]
cyprodinil (Vangard)	Anilinopyrimidine	9	2(f)[i]	1		0	0	0	0
dodine (Syllit)	Guanidine	M7	4[i]	0	1	1	1	0	0
difenoconazole + cyprodinil (Inspire Super MP)[f]	DMI (SI) and Anilinopyrimidine	3	4[c]	3	4	2	4	2	
fenarimol (Rubigan)[f]	DMI (SI)	3	4[c]	4	4	0	0	0	
ferbam (Ferbam)	Dithiocarbamate	M3	2	0	2	1	2	1	0
fenbuconazole (Indar 2F)[f]	DMI (SI)	3	4[c]	3	4	2	2	2	
fluopyram + pyrimethanil (*†Luna Tranquility)	SDHI and Anilinopyrimidine	7 & 9	4[i]	3	1	3	3	3	—
fluopyram + trifloxystrobin (*†Luna Sensation)	SDHI and Strobilurin (QoI)	7 & 11	4[i]	4	1	3	3	3	—
flutriafol (†Rhyme)	DMI (SI)	3	4[c]	4	4	2	2	2	—
fluxapyroxad (*†Sercadis)	SDHI	7	4[i]	3	2	3	4	3	—
fluxapyroxad + pyraclostrobin (*†Merivon)	Strobilurin (QoI) and SDHI	11 & 7	4[i]	3	2	3	4	3	—
kresoxim-methyl (*†Sovran)	Strobilurin (QoI)	11	4[c]	4	2	3	4	2	0

Table continued on next page.

Table 6.4.1. Activity spectrum of stone fruit fungicides.

Fungicide	Fungicide Family	FRAC code‡	Registered for use on: Apricot	Cherry	Peach	Plum	For Control of: Brown Rot *Blossom Blight*	Brown Rot *Fruit Rot*	Cherry Leaf Spot	Powdery Mildew	Black Knot	Peach Leaf Curl	Peach Scab
*Procure	DMI (SI)	3	—	+	—	—	1	—	3[f]	4	—	—	—
Quash	DMI (SI)	3	+	+	+	+	4[f]	4 [f]	3[f]	3	—	—	—
Rovral, Iprodione	Dicarboxi-mide	2	+	+	+	+	4	—	2	0	—	—	—
Rubigan	DMI (SI)	3	—	+	—	—	—	—	3[f]	3	—	—	—
Scala	Anilino-pyrimidines	9	+	—	+	+	3	1	—	—	—	—	—
§Sulfur	Inorganic	M2	+	+	+	+	2	1	1	2	0	—	3
Syllit	Guanidine	M7	—	+	+	—	—	1[e]	2	0	—	—	—
Thiram	Dithiocar-bamate	M3	—	—	+	—	1	1	—	—	—	3	3
Topsin M, Thiophanate-methyl	Benzimi-dazole	1	+	+	+	+	—[a]	—[a]	—[a]	2	2	—	3[a]
Vangard	Anilino-pyrimidines	9	+	+[b]	+	+	3	—	—	—	—	—	—
Ziram	Dithiocar-bamate	M3	+	+	+	—	2	1	2	—	—	3	2

Key to Control Ratings: **—** = does not apply or unknown, **0** = none, **1** = slight; **2** = fair; **3** = good; **4** = excellent.

[a] Because of widespread resistance to thiophanate-methyl in NY, these fungicides are NOT recommended for brown rot control..

[] Do not use on tart cherry.

[b] Do not use on sweet cherry. Some captan products have a 24-hr REI.

[c] Leaf injury may occur on Schmidt, Emperor Francis, and Giant sweet cherry varieties from sprays applied between petal fall and harvest. Injury may occur on 'Stanley' or Japanese-type plums if applied repeatedly early season.

[d] See special requirements for eye protection for 7 days after application.

[e] Significant timing or crop restrictions; check label.

[f] May fail to provide brown rot and/or leaf spot control in orchards where pathogens have developed resistance.

§ Potentially acceptable in certified organic programs.

‡ The Fungicide Resistance Action Committee (FRAC: www.frac.info/frac/index.htm) is an organization committed to prolonging the effectiveness of fungicides at risk for resistant development and to minimizing crop loss due to resistance development. With the exception of lettered codes, fungicides with the same FRAC code have a similar chemistry (modes of action) and the propensity for cross-resistance development.

6.5. Cherry Leaf Spot

6.5.1 Determining Cherry Leaf Spot Infection Periods

Cherry leaf spot infection is highly dependent on hours of continuous leaf wetness. Table 6.5.1 shows the minimum duration of wetting required for infection and predicted leaf spot severity at various temperatures. The potential for leaf spot infection is highest during wetting events with temperatures ranging from 60-70˚F. Beyond this range longer wetting periods are needed to overcome the less optimal temperatures for infection. (See online: http://newa. cornell.edu/index.php?page=apple-lw.) The NEWA Apple Leaf Wetness Events log provides a table of wetting events and average temperatures during the wetting events to aid in disease prediction. The Apple Diseases apple scab page provides a table of forecasted wetting events and temperatures, updated on an hourly basis.

Table 6.5.1. Approximate hours of continuous leaf wetness (LW) necessary to produce cherry leaf spot infection [a].

Average Temp (˚F)	Degree of Infection [b]: *Light (hours LW)*	*Moderate (hours LW)*	*Heavy (hours LW)*
50	18	27	36
55	11	19	26
60	6	14	20
65	5	12	19
70	6	14	22
75	10	20	31

Determined by S. Eisensmith and A. Jones, Michigan State University.

[a] Hours of leaf wetness (LW) from the beginning of a rain.

[b] Assumes significant level of inoculum present.

7 Insect and Mite Management

Table 7.1.1. Activity spectrum of pome fruit insecticides and acaricides.

		Ratings for the Control of														
Trade Name (Active Ingredient)	**IRAC‡**	**AM**	**Aph**	**EAS**	**Int**	**GFW**	**LH**	**OBLR**	**PC**	**PPs**	**RAA**	**RBLR**	**SJS**	**STLM**	**TPB**	**WAA**
*†Actara (thiamethoxam)	4A	1	3	3	1	—	3	0	3	3	3	0	0	2	2	—
*Admire Pro (imidacloprid)	4A	—	3	—	—	—	3	—	—	2	3	—	2	3	—	2
*†Agri-Flex (abamectin/ thiamethoxam	6/4A	1	3	3	1	—	3	0	3	3	3	0	0	3	1	—
*Agri-Mek (abamectin)	6	—	—	—	—	—	3	—	—	3	—	—	—	3	—	—
*†Altacor (chlorantraniliprole)	28	2	1	3	3	3	—	3	2	—	—	3	2	—	1	—
*Pounce (permethrin)	3A	3	2	2	—	3	3	2-3	2	2	2	3	1	3	3	—
*Asana XL (esfenvalerate)	3A	3	2	2	2-3	3	3	2-3	2	2	2	3	1	3	3	—
Assail (acetamiprid)	4A	3	3	2	3	—	3	0	2	2	3	0	2	3	2	2
Avaunt (indoxacarb)	22	2	1	2	2	—	3	0	3	—	0	—	0	2	2	—
§Aza-Direct, §Neemix	18B	—	2	1	2	—	2	—	0	—	2	—	—	3	—	—
§B.t, (§Agree, §Biobit, §Deliver, §Dipel, §Javelin)	11A	0	0	—	2	3	0	3	0	0	0	3	—	0	0	—
*Baythroid (cyfluthrin)	3A	3	2	2	2-3	3	3	2-3	2	—	—	3	—	3	3	—
Beleaf (flonicamid)	9C	—	3	—	—	—	—	—	—	—	—	—	—	—	3	2
*†Besiege (chlorantraniliprole/ lambda-cyhalothrin)	3A/28	3	2	3	3	3	3	3	3	2	2	3	2	3	3	—
*†Centaur (buprofezin)	16	—	—	—	—	—	2	—	—	3	—	—	3	—	—	—
*Danitol (fenpropathrin)	3A	3	2	2	2-3	3	3	2-3	2	2	2	3	1	3	3	—
Delegate (spinetoram)	5	2	0	—	3	3	—	3	2	3	—	3	—	3	—	—
*diazinon	1B	3	1	—	2	2	1	0	2	0	3	0	2	1	1	3
*†Endigo (thiamethoxam/ lambda-cyhalothrin)	3A/4A	3	2	2	2-3	3	3	2-3	2	2	2	3	2	3	3	—
§Entrust (spinosad)	5	2	0	—	2	3	0	3	0	–	0	3	—	2	0	—
Esteem (pyriproxyfen)	7C	0	0	—	2	0	0	0	0	3	3	0	3	2	0	—
*†Exirel (cyantraniliprole)	28	2	1	3	3	3	3	3	3	3	3	3	0	3	0	0
§Grandevo WDG (*Chromobacterium subtsugae*)	—	—	—	—	2	—	—	2	—	—	—	—	—	—	—	—
*Imidan (phosmet)	1B	3	1	3	3	1	1	1	3	0	1	3	2	1	1	—
*†Intrepid (methoxyfen-ozide)	18A	0	0	—	2	—	0	3	0	—	0	3	0	2	0	—
*Lannate (methomyl)	1A	2	2	1	3	3	3	2-3	2	0	1	3	2	3	1	—
*Leverage (cyfluthrin/ imidacloprid)	3A/4A	3	3	2	3	3	3	2-3	3	2	3	3	2	3	3	—
§M-Pede, Des-X (insecticidal soap)	—	0	2-3	0	0	0	1	0	0	2	1	0	1	0	0	—
Magister (fenazaquin)	21	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—
Malathion	1B	2	2	2	2	1	1	1	2	0	1	2	—	1	1	—
*†Minecto Pro (cyantraniliprole/abamectin)	28/6	2	0	0	3	3	3	3	3	3	3	3	0	3	0	0
Movento (spirotetramat)	23	—	3	—	—	—	—	—	—	3	—	—	3	—	—	3
*Mustang Maxx (zeta-cypermethrin	3A	3	2	2	2-3	3	3	2-3	2	2	2	3	—	3	3	—

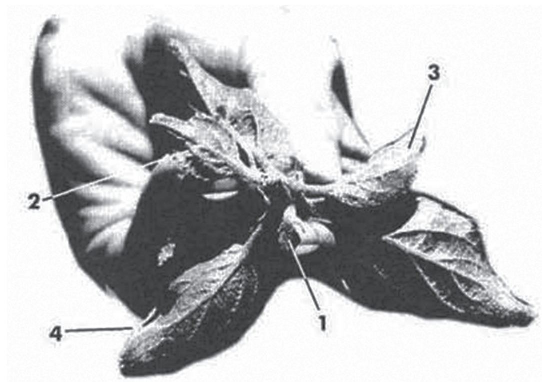
Table continued on next page.

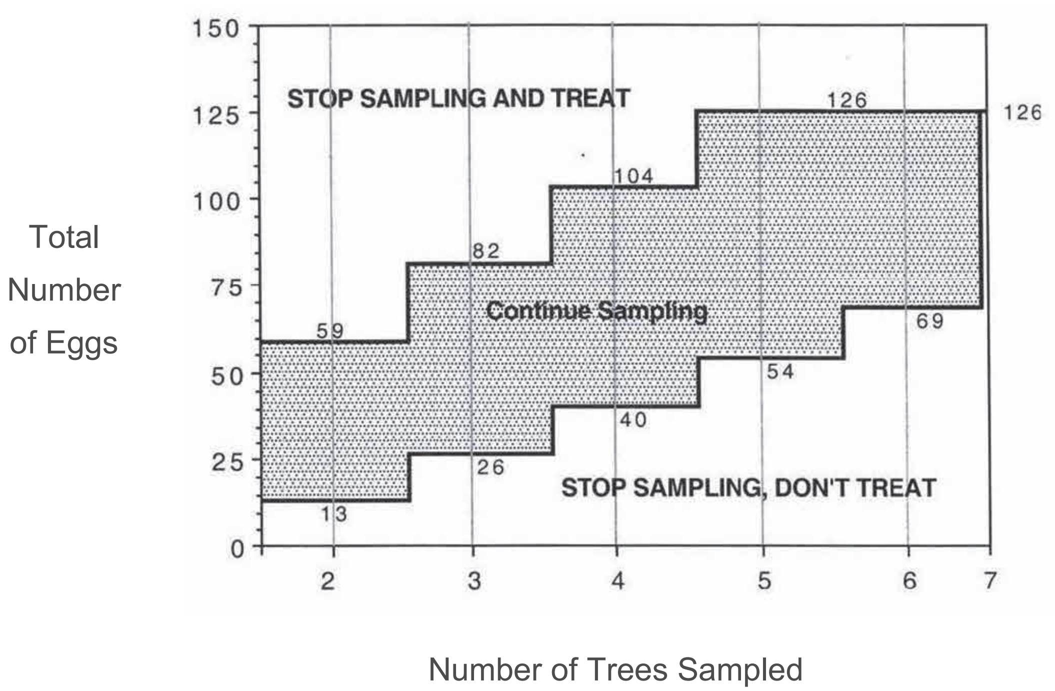
Figure 7.1.1. STLM Pink Sampling Form

- During the pink bud or early bloom stage, start near one corner of the block, and go to every other tree until you have sampled enough trees to reach a decision, Select 3 fruit clusters from around the canopy of each tree sampled.

- Using a magnifier, count the eggs on the undersides of the 2nd, 3rd, and 4th leaves in each cluster, counting leaves in the order they unfolded (see diagram at right).

- After 2 trees have been sampled, begin comparing the accumulated total number of eggs found with the decision lines shown in the chart below for that number of trees.





- If the number of eggs falls in the "Continue Sampling" zone, sample another tree. If the total is in the "Stop Sampling, Don't Treat" zone, sampling is stopped and no treatment is recommended. If the total is in the "Stop Sampling and Treat" zone, sampling is stopped and a treatment is recommended at either pink or petal fall. If 7 trees are sampled and the total number of eggs equals 126, the population is below threshold.

Refer to the Apple Pesticide Spray Table for a choice of pesticide materials.

8 Weed Management

8.1 Calibration to Ensure Correct Herbicide Rate

Herbicide labels indicate rate of application as amount of product per acre; that is, per acre actually treated. Only if you broadcast herbicide over the entire orchard floor will the treated acreage equal the orchard acreage. Follow the instructions below to assure application of the correct herbicide rate.

8.1.1 Calculating Nozzle Flow Rate

Travel Speed:
For most situations, 2-2.5 mph is best (176-220 ft. /min.).

Pressure:
Refer to labels and nozzle manufacturer guidelines regarding optimal targets for each herbicide-nozzle combination. Using low pressure (20-35 psi) can minimize the formation of small droplets, because small droplets can drift off target.

Spray Volume per Treated Acre:
Rates will be dependent on the herbicide being applied. For example, some products may have lower recommended spray volume rates in order to concentrate the product in droplets on treated tissue while others will recommend higher volumes to improve overall spray coverage. See label regarding use recommendations.

Shields:
By adding a shield over the spray boom, thin, young bark of fruit trees may be protected when using glyphosate or other herbicides that can injure sensitive tissue. If weeds are tall when treated, and spring back into the tree banches after application under a shield, herbicides can still come into contact with leaves, stems, branches, flowers, and fruit. Post-emergence products should be applied when weeds are sufficiently small so that good coverage can be achieved with minimized potential for injury.

Nozzles:
Unless specified on the label, avoid nozzles that produce fine mist. Generally, hollow cone nozzles produce the finest droplets, flat sprays are second, and full cone nozzles produce the coarsest spray.

A single boomless off-center flat spray nozzle, or a flooding nozzle, may be suitable for some orchards, but one or more regular flat spray nozzles on a boom may be better where branches are close to the ground.

Use the following formula to determine nozzle flow rate in gal./min., then consult a nozzle manufacturer's chart to select the proper nozzle.

8.1.2 Definition of Terms

1. **Gallons per Treated Acre (G/TA)** = Amount of herbicide spray you want to apply per treated acre.
2. **Swath (S)** = Width of the sprayed area in feet.
3. **Travel Speed (TS)** = Feet traveled per minute.
4. **Nozzle flow rate** (gallons per minute) = (Gallons per Acre x Swath x Travel Speed) divided by 43,560

Nozzle Flow Rate = **(G/TA x S x TS) / 43,560**

Example:
What nozzle flow rate do you need to apply 25 gallons of herbicide spray mix per treated acre, using a 3-foot-wide swath and a travel speed of 220 feet per minute (=2.5 miles per hour)?

Nozzle flow rate
= (25 x 3 x 220) divided by 43,560
= (16,500) divided by 43,560
= 0.38 gallons per minute.

If using 2 nozzles, select 2 that will give 0.19 gallon per minute each at the selected pressure.

8.1.3 Checking Herbicide Sprayer Output

Spray Pattern:
Check uniformity of spray pattern, using corrugated fiberglass roofing panels as a spraying surface. Spray from the same height as will be used in the orchard. Compare liquid volume collected in each trough. Although relatively more expensive, water-sensitive paper can be purchased to evaluate spray patterns.

Actual Spray Volume:
With proper nozzles installed, travel a measured distance at the selected speed and pump pressure. Use this formula to determine the actual spray volume in gallons per treated acre.

Gallons per Treated Acre:
= (Gallons sprayed during trial run x 43,560) divided by (feet traveled during trial run x swath width in feet).

Example:
You emptied a tank containing exactly 3 gallons in a distance of 1,200 feet. The treated swath was 3 feet wide. How many gallons of spray are you applying per treated acre?

Gallons per Treated Acre
= (3 x 43,560) divided by (1,200 x 3)
= (130,680) / (3,600)
= 36.3 gallons

Table 8.4.3. Weed control guidelines for tree fruit.

Refer to back of book for key to abbreviations and footnotes.

Crop						Tree Age				
Apples	Pears	Cherries	Peaches	Apricots	Plum/Prune	Planting Year	1 year plus	2 years plus	3 years plus	**PRODUCT NAME** (*active ingredient, weight of active per unit of herbicide*) *Notes:*
X	X	X	X	X	X		X	X		**MATRIX 25DF** *(continued)* *Comments:* Can be applied once a year as a single application or two times if a banded application of 50% is used (do not exceed 4 oz/A/year). Rainfall or irrigation is necessary for activation. Best results observed is soil is moist at application. Has post-emergence activity on small weeds (< 1” tall). Avoid direct ontact with sensitive tissues. Spray solution pH should be between 4-8.
X	X	X	X	X	X	X	X	X		**POAST** (*sethoxydim,1.5 lb/gal*) *Weeds Controlled:* annual grasses *Rate (per acre):* 1.0-2.5 pt *AI per acre (lbs/acre):* 0.28-0.47 *Days to harvest:* Apples and pears: 14; apricots, cherries, and peaches: 25; plums/prune: 1 year (non-bearing application) *REI (hours):* 12 *Comments:* Apply to actively growing grass before tillering or seedhead formation. Do not apply to stressed plants. See label about use of crop oil concentrates. See additional notes on label about applications in peaches, plums and nectarines.
X	X	X	X		X		X	X	X	***†PRINCEP 4L** (*simazine, 4 lb/gal*) and other generics *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 1-2 qt *AI per acre (lbs/acre):* 1.0-2.0 *Days to harvest:* Apples: 150; pears, tart cherries: not listed; peaches, plums, sweet cherries: applied late fall to early spring *REI (hours):* 12 *Comments:* Apply early spring before weeds emerge. See soil-texture rate limitations on label. Trees must be established at least 1 year. Avoid contact with sensitive crop tissues.
X	X	X	X	X	X	X	X	X		**PROWL 3.3 EC** (*pendimethalin, 3.3 lb/gal*) *Weeds Controlled:* annual grasses and broadleaf weeds *Rates (per acre):* 2.4-4.8 qts. *AI per acre (lbs/acre):* 2-4 *Days to harvest:* Non-bearing use only. *REI (hours):* 24 *Comments:* Prowl 3.3 EC use limited to NONBEARING TREES ONLY. Do not apply until soil settles around newly transplanted trees. . Do not apply if buds have started to swell.
X	X	X	X	X	X	X	X	X		**PROWL H2O** (*pendimethalin, 3.8 lb/gal*) *Weeds Controlled:* annual grasses and broadleaf weeds *Rate (per acre):* 2-4 qts. *AI per acre (lbs/acre):* 1.9-3.8 *Days to harvest:* 60 (for all tree fruit) *REI (hours):* 24 *Comments:* Prowl H2O can be used in non-bearing and bearing trees. No more than 4.2 qts/acre/year of Prowl H2O may be applied. Rate is dependent of soil and weed species present. Do not allow contact with roots or other sensitive tissue.

9 Wildlife Damage Management

9.1 Deer and Rabbits

Several commercial repellents are available to reduce deer or rabbit browsing to orchards (Table 9.1.1). The effectiveness of repellents is extremely variable and is affected by factors such as deer or rabbit numbers, feeding habits, and environmental conditions, such as snow depth and duration. Repellents may be cost-effective for controlling wildlife damage when:

(1) light to moderate damage is evident,
(2) small acreages are damaged, and
(3) few applications will be needed for adequate control.

If these three conditions are not satisfied, it is best to look at the cost-benefit ratios for fencing and/or state permits for removing deer. The NYS Department of Environmental Conservation has a Deer Management Assistance Program (DMAP) to help growers reduce deer numbers and damage on their farms.

With the use of repellents some damage must be tolerated, even if browsing pressure is low. None of the existing repellents provides reliable protection for more than 5 weeks when deer or rabbit densities are high. If browsing pressure is severe, a long-term damage management program should be implemented, including potential habitat modifications, reductions in animal numbers, and an evaluation of fencing alternatives.

A landowner can use a variety of non-chemical alternatives to reduce wildlife damage to fruit trees. These techniques fall into three primary categories: exclusion, habitat modification, and wildlife population reductions. Fencing is the most common exclusion technique used to prevent damage to crops. Helpful information concerning wildlife management can be found online at wildlifecontrol.info.

Habitat modifications can reduce damage levels by making areas less suitable for problem wildlife species. Damage prevention with cultural manipulations should begin with site selection and plant establishment. Removal of brush, stone piles, and non-mowable wet areas in and near orchards, will reduce the attractiveness of sites to rodents and rabbits. Mowing in established plantings can reduce preferred foods of wildlife, remove protective cover, enhance predation, and expose animals to severe weather conditions. Sites adjacent to croplands should also be managed to reduce pest numbers, as nuisance wildlife may reinvade orchards from these habitats.

Wildlife population reductions may be necessary to reduce damage to tolerable levels. When trapping, care and experience are necessary to reduce captures of non-target species. Live-traps should be substituted for body-gripping or other kill traps in areas where pets or endangered wildlife may inadvertently be captured. In rural locations, shooting can be used to effectively remove problem animals. When practical, reductions in populations of game species (i.e., deer, rabbits, squirrels, etc.) should occur during open hunting seasons. The New York State Department of Environmental Conservation (DEC) offers permits through the Deer Management Assistance Program (DMAP) to help reduce deer abundance and impacts on agricultural and forested lands.

A license or special permit may be required from the New York State Department of Environmental Conservation (DEC) for lethal control or transport of wildlife species. Contact the nearest regional DEC office for more information concerning specific situations. If migratory birds are involved, federal permits may also be necessary from the USDA, Animal & Plant Health Inspection Service (APHIS), Wildlife Services Office in Albany (contact the State Director, at 518-477-4837).

Wildlife population reduction by lethal methods often fails to provide long-term relief from damage. Where habitat conditions are suitable, and exclusion is not attempted, most pests will repopulate the site soon after lethal control efforts have ceased. Habitat modification and exclusion methods usually require more initial effort and expense, but these techniques may provide longer-term damage prevention, especially when a few pest individuals can inflict substantial losses.

9.2 Meadow and Pine Voles

Two species of voles cause damage in New York orchards. Meadow voles are found throughout the state and probably inhabit every sod orchard. Pine voles are a problem in several orchards in the Hudson River Valley, especially in a 5-county area (Dutchess, Orange, Putnam, Ulster, and Westchester). Several orchards in these counties have both species present, and may experience considerable damage to trees during severe weather, or when other food sources become unavailable.

The contrasting living habits of meadow and pine voles have important implications for their detection and control. Meadow voles live primarily above the ground surface in dense sod or vegetation. Pine voles live primarily below ground and damage the root systems of trees. When feasible, hand placement of baits in tunnels or under roofing shingles, slabs of wood, or similar protected bait stations, is the preferred method for baiting pine voles. The optimum times to apply baits are in the early spring after snow melt, and after the fall harvest.

For orchards with persistent meadow vole problems, an annual post-harvest baiting program using a *zinc phosphide-treated bait is strongly recommended. Both grain-based and pelletized baits are available from commercial sources (Table 9.1.1). Do not apply baits (particularly grain-based products) to areas with bare

10 Nutrient Management of Apple Orchards

10.1 Introduction

When developing mineral nutrient management programs for tree fruits, it is important to consider the nutrient demand-supply relationship throughout the season.

10.2 Nitrogen

Early season canopy development and fruit growth require large amounts of nitrogen (N), while fruit quality development and the acquisition of adequate cold hardiness by the tree later in the season require only a minimum supply of N. Thus, an ideal seasonal pattern of tree nitrogen status should be to start the season with relatively high nitrogen status to promote rapid leaf development and early fruit growth. As the season progresses, nitrogen status should decline gradually to guarantee fruit quality development and wood maturity before the onset of winter. There are three sources of nitrogen supply tree fruits can use. First is reserve nitrogen that has accumulated in the tree from the previous growing season. This source of nitrogen is readily available for initial growth during the spring. In fact, spur leaf development and early fruit growth are mainly supported by the reserve N. The second source is the natural N supply from the soil mineralization process. This process provides substantial amounts of nitrogen for trees growing on soils with high organic matter. The third is nitrogen fertilizers applied to the soil or to the foliage. To determine the amount of fertilizer nitrogen needed, we need to know the total tree demand and the amounts the other two nitrogen sources can provide. However, there is not enough information currently available on this demand-supply relationship to make this approach practical. Instead, soil and leaf analyses have been developed over the years to help growers diagnose tree nutrient status and soil nutrient availability and make adjustments on their fertilization programs accordingly.

10.3 Soil Analysis

Soil analysis is very useful for determining lime requirement and mineral availability in the soil before orchard establishment. For existing orchards, it provides information necessary for interpreting leaf analysis results and modifying fertilization programs.

A soil nutrient analysis should be performed before planting a new orchard and every 2 to 3 years after orchard establishment. The soil sample taken should be representative of the soil type and conditions within the orchard. Generally, the area included in any one-sample collection should not exceed 10 acres. Scrape away the surface 1-inch of soil, then collect samples from the 1 to 8 inch depth, and separate samples from 8 to 16 inches. In a 10 acre orchard, a minimum of 10 to 20 subsamples is suggested. Thoroughly mix the 1-8 inch subsamples together to provide a representative sample for the topsoil, and treat the 8 to 16 inch subsamples similarly to get a representative sample for subsoil. Soil samples can be sent to Agro-One, 730 Warren Road, Ithaca, NY 14850.

10.4 Preplant Soil Preparation

New York soils are classified into 5 management groups on the basis of texture and parental materials (Table 10.4.1). Percentage of clay, buffering capacity, and potassium supply power decrease from group I to V.

10.4.1. Liming

The pH values of orchard soils should be maintained in the range of 6.0 to 6.5 throughout the soil profile to optimize plant growth and nutrient availability. For preplant soil preparation, we recommend the pH of topsoil (0-8 inch depth) be adjusted to 7.0 and that of subsoil to 6.5. Most soils in New York have pH values lower than optimum and need liming to raise the pH prior to planting a new orchard. This also ensures adequate calcium and magnesium supplies in the soil.

The amount of lime required to adjust topsoil pH to 7.0 and subsoil pH to 6.5 is determined by the current pH values of the topsoil and subsoil (determined from a soil analysis) and the buffering capacity of the soil, i.e. exchange acidity or cation exchange capacity, (CEC), of topsoil and subsoil (also determined from a soil analysis). Using these values, the lime requirement can be determined from Table 10.4.2 for topsoil and from Table 10.4.3 for subsoil. The amount of lime to be added is the sum of topsoil plus subsoil requirement. When complete soil tests are not available, Table 10.4.4 may be used to estimate lime requirement.

Table 10.4.1. Soil management groups

Soil group	Texture	Examples
I	Clayey soils, fine-textured soils.	Vergennes, Kingsbury, Hudson, Rhinebeck, Schoharie, Odessa.
II	Silty loam soils with medium to moderately fine texture.	Cazenovia, Hilton, Honeoye, Lima, Ontario, Lansing, Mohawk, Chagrin, Teel.
III	Silty loam soils with moderately coarse texture.	Barbour, Chenango, Palmyra, Tioga, Mardin, Langfor, Tunkhannock.
IV	Loamy soils, coarse- to medium-textured soils.	Bombay, Broadalbin, Copake, Empeyville, Madrid, Sodus, Worth.
V	Sandy soils, very coarse-textured soils.	Alton, Colton, Windsor, Colonie, Elmwood, Junius, Suncook

FIGURE 11.1.1
GROWTH STAGES IN APPLE

11 Apples

11.1 Insecticides and Fungicides for Apples

See Sections 11.2, 11.3, 11.4, and 11.5 for comments related to this table.

Table 11.1.1 Pesticide Spray Table – Apples.

(Refer to back of book for key to abbreviations and footnotes.)

Pest	IRAC & FRAC	Product	Rates	PHI (days)	REI (hrs)	Efficacy	Comments (see text)
Silver Tip							
Apple scab	9 + 7	*†Luna Tranquility	11.2-16 fl oz/acre	72	12	High	
	M1	Badge SC	3.5-7.0 pts/acre	0	48		[8.4]
	M1	§Badge X2	3.5-7.0 lb/acre	0	48		[8.4]
Blister Spot	33	Phostrol	2.5-5.0 pts/acre	0	4	High	[5.1]
Crown rot	4	Ridomil Gold SL	2 qt/acre 0.5 pt/100 gal water		48		[7.2]
	33	Aliette WDG	2.5-5 lb/acre 0.5-1 pt/100 gal water	14	24		
	33	Phostrol	2.5-5.0 pts/acre	0	4	High	
	33	Prophyt	2-4 pt/acre	0	4	High	[7.3]
European Fruit Lecanium		oil	2-3 gal/100 gal water			High	[20.2]
European Red Mite		oil	2-3 gal/100 gal water			High	[20.2]
Fire Blight		*Agri-mycin 50	8-16 oz/acre	50	12		[8.5]
		§Kocide 3000 O	3.5-7.0 lb/acre 1.11-2.3 lb/100 gal water	HIG	48		
	M 01	Previsto	2-4 qt/acre	See label	48		
	M1	Badge SC	3.5-7.0 pts/acre	0	48		[8.4]
	M1	§Badge X2	3.5-7.0 lb/acre	0	48		[8.4]
Phytophthora Rots	33	Phostrol	2.5-5.0 pts/acre	0	4	High	[7.3]
	33	Prophyt	2-4 pt/acre	0	4	High	[7.3]
Green Tip							
Apple scab	7	*†Sercadis	4.5 fl oz/acre	0	12	High	
	7	*Aprovia	5.5-7.0 fl oz/acre	30	12	High	
	M1	Badge SC	3.5-7.0 pts/acre	0	48		[8.4]
	M1	§Badge X2	3.5-7.0 lb/acre	0	48		[8.4]
	M3	Manzate ProStik	3.0-6.0 lb/acre 1.0-2.0 lb/100 gal water	BL, 77(A)	24		[1.3,2.2]
	M3	Penncozeb 75DF	3.0-6.0 lb/acre 1.0-2.0 lb/100 gal water	BL, 77(A)	24		[1.3,2.2,2.8]
	M3	Polyram 80DF	3.0-4.5 lb/acre	BL, 77(A)	24		[1.3,2.2]
	M4	Captan 50WP	8.0 lb/acre 1.0-2.0 lb/100 gal water	0	24		[2.1,2.2]
	M4	Captan 80WDG	5.0 lb/acre 0.65-1.25 lb/100 gal water	UDH	24		[2.1,2.2]
	U12	Syllit FL	1.5 pts/acre	7	48		[2.15]
	9	Scala	7.0-10.0 fl oz/acre	72	12		
	9	Vangard WG	3.0-5.0 oz/acre	0	12		
	9 + 7	*†Luna Tranquility	11.2-16 fl oz/acre	72	12	High	
	11 + 7	*†Luna Sensation	4.0 to 5.8 fl oz/acre	14	12	High	
	11 + 7	*†Merivon	4-5.5 fl oz/acre	0	12	High	

11.2.3 Blister Spot

• Pesticide Application Notes

[5.1] This is an economic problem primarily on the Mutsu, Fuji, and NY-1 (SnapDragon). Apply the 1st spray 10-14 days after petal fall. A delay in applying this spray will significantly reduce control in most years. Two additional sprays should be applied at weekly intervals if any rain occurs. Do not apply more than 3 sprays. The use of 2-4 lb Kocide /100 gal between green tip and 1/2-inch green in the spring may reduce overwintering inoculum and provide a small amount of additional control. Additionally, application of Aliette and labeled phosphorous acid or phosphite products (e.g. Phostrol) during pink, petal fall, and early cover sprays may also reduce infections.

11.2.4 Blossom End Rot

• Biology & Cultural

Blossom end rots can be caused by *Botrytis cinerea, Sclerotinia sclerotiorum,* and *Botryosphaeria obtusa*. It occurs sporadically and is most likely to become a problem if the weather is warm and wet between bloom and 1st cover and in orchards where only mancozeb, Polyram, or SI fungicides were applied during bloom and at petal fall. McIntosh, Delicious, Rome, and Paulared are most commonly affected.

• Pesticide Application Notes

[6.2] Where blossom end rot has occurred before, use captan, *†Sovran, or Topsin M in the bloom, petal fall, and 1st cover sprays if the weather conditions are favorable for infection.

11.2.5 Cedar Apple Rust

• Pesticide Application Notes

[1.3] The EBDC fungicides (mancozeb, maneb, Polyram) are labeled for use on apples in one of two different ways: (i) at a rate of 1.5-2 lb/100 gal (maximum 6 lb/A, no more than 24 lb/A per year), not to be applied after bloom; OR (ii) at a reduced rate of 3 lb/A (maximum 21 lb/A per year), which may be applied to within 77 days of harvest. The latter rate is adequate for control of rust diseases, and the extended timing is necessary to control rust infections on terminal leaves. It is illegal to combine or integrate the two treatment regimes.

[2.2] Fungicide rates per acre should never be reduced below either (i) 50% of the per-acre rate listed on the label or (ii) 1.5 multiplied by the Amt/100 gal listed on the label. This applies even when spraying small trees. Although tree-row volume calculations may suggest that lower rates are appropriate, applying less than 50% of the per-acre rate has frequently resulted in unsatisfactory scab control and/or more rapid development of fungicide resistance. In orchards with SI-resistant scab, a combination of a mancozeb fungicide at 3 lb/A plus a captan formulation that supplies 1.5 lb of active ingredient/A has provided excellent scab control when used in prebloom and bloom sprays. (A captan rate of 1.5 lb active ingredient/A translates to 3 lb/A of Captan 50W, 30 oz/A of 80W, or 1.5 qt/A for the 4L formulations.) This combination provides a better residual activity through heavy rains than would be available from either product used alone and it preserves the option of using mancozeb sprays after petal fall. The mancozeb-captan combination cannot be used close to prebloom oil sprays because of captan-oil incompatibilities. For reasons of economy and resistance management, it is recommended that SI and strobilurin fungicides not be used until pink, even when fungicidal protection is needed earlier; in such cases, make a single application of an alternative fungicide (captan, copper, EBDC) at green tip and half-inch green, then begin the SI/strobilurin program at pink. Do not apply captan or sulfur within 10 days of an oil spray. Do not apply liquid captan formulations with sulfur on sulfur-sensitive varieties. A further discussion of apple scab fungicide characteristics is presented in the section “Apple Scab Fungicides” and in Table 6.1.3.

11.2.6 Crown Rot (Collar Rot)

• Biology & Cultural

Crown rot is primarily associated with trees on moderately to highly susceptible rootstocks (particularly MM.106 and young trees on M.26). It can also develop on moderately resistant rootstocks planted in poorly drained sites or in very wet years. Seedling and M.9 appear to be the least susceptible of the common rootstocks.

Refer to the reference materials list at the end of this publication for a Fact Sheet containing more details on the biology and management of this pest.

• Pesticide Application Notes

[7.2] Ridomil should be considered in sections of the orchard where crown rot has been a problem, or where the combination of marginal drainage and rootstock susceptibility indicates a potential problem. Make a solution containing .5 pts Ridomil Gold 4SL in 100 gal of water and apply this solution to the soil around the trunk at the following rate: Trunk diameter at 12 inches above soil line Quantity of Diluted Solution <1 inch 1 qt. 1-3inches 3 qts. >5 inches 4 qts. Apply just as growth begins in the spring and repeat immediately after harvest. Do not apply to newly planted trees. Ridomil is an effective protective fungicide, but is unlikely to cure trees in moderate to severe stages of decline.

[7.3] Phosphorus acid or phosphite fungicides (e.g. Helena ProPhyt, Phostrol) can be used in foliar applications to manage crown and collar rot in low lying or wet apple planting. Applications of phosphorus acid or phosphite fungicides should be made prior to the onset of disease, but when condition favor disease. Foliar applications of phosphorus acid or phosphite fungicides are usually made on a 30-60 day interval beginning with available green tissue in the spring.

Table 11.5.1 Recommended diphenylamine concentrations for varieties in New York subject to scald.

Variety	Diphenylamine (ppm)	Variety	Diphenylamine (ppm)
Baldwin	1000-1500	Idared	1000
Braeburn	1000	Jonagold	1000
Cortland	2000	McIntosh	1000
Delicious	1000-1500	Mutsu	2000
Empire	1000	Rome	1500
Golden Delicious	1000	Stayman	1500

Chlorinated water can also be used to disinfect fruit after harvest. Numerous commercial formulations of calcium hypochlorite and sodium hypochlorite are available with postharvest labels. However, chlorine only kills spores in the treatment solution and on the fruit surface at the time of treatment. It does not provide any residual protection.

Chlorine is not compatible with diphenylamine. Thus, chlorination is most useful for disinfesting flume water on apple packing lines rather than as postharvest treatment prior to storage. Follow directions on the product label for maintaining appropriate levels of chlorine in treatment solutions.

11.4.2 Storage Scald

• Pesticide Application Notes

[38.1] Active ingredient may vary according to manufacturer: use label instructions to check rate required to obtain desired concentration. See Table 11.5.1 for varietal requirements.

11.4.3 Senescent Breakdown (McIntosh)

• Pesticide Application Notes

[39.1] The addition of calcium chloride to the postharvest scald and storage rot treatment is effective in reducing McIntosh breakdown. Only calcium chloride that meets Food Chemical Codex specifications can be used in postharvest treatment of apples. Calcium treatment will be of little benefit to apples harvested after the projected optimum harvest date. Fruit injury from calcium chloride has been found to be associated with iron in the solution. Coat steel tanks or use plastic tanks and piping to minimize this problem.

11.5 Notes on Scald Control

11.5.1 Materials

All DPA (diphenylamine) formulations are suspensions and become weaker with use. Replenishment with full-strength material does not replace the DPA removed by the apples. Test kits are available to determine concentrations of make-up material. Do not exceed 30 bins or 750 bushels/100 gal of made-up DPA; empty the reservoir tank and start again with fresh material.

Cartons containing apples that have been treated postharvest with DPA and fungicide must be so labeled.

11.5.2 Application Equipment

Bins of apples are sometimes dipped into a tank containing postharvest preservatives, but more often the bins are moved by conveyors, rollers, or truck bed under a cascade of the preservatives. The bins should be moved slowly under the cascade, with 35-40 gal of preservatives being delivered into each bin. The pump should be sized to deliver 35-40 gal of preservatives/bin at the desired rate of bin movement under the cascade. If stacked bins are moved under the cascade, the top bins should receive 35-40 gal and side nozzles should be positioned to deliver additional gallonage to the lower bins, even though drainage holes are provided in the bin floors. Application equipment is commercially available, but operators usually fabricate their applicators to meet the needs of their own operation. Dirty truckloads should be rinsed with clean water before treatment to minimize the accumulation of dirt in the reservoir tank.

11.5.3 Variety Requirements

Materials and concentrations for the major apple varieties in New York are listed in Table 11.5.1. Important: DPA retards chlorophyll loss in Golden Delicious and, therefore, should not be used unless the apples have developed full yellow color at harvest.

The very low susceptibility of Empire to scald indicates that it can be safely stored without any preservative treatment. However, if preservative treatment is demanded, then use 1000 ppm DPA in the drench solution.

11.6 Growth Regulator Use In Apples

11.6.1 Chemical Thinning

Fruit thinning is a management practice that reduces yield in the current season but results in increased fruit size and also increased return bloom and yield in the next season. Large fruit size is best obtained with consistent cropload reductions each year through chemical thinning. The use of growth regulating chemicals to thin apple trees is not an exact science and each grower must weigh and evaluate the many factors that affect chemical thinning response in deciding on a thinning program. Although the recommendations in this section are based on research and experience, growers are cautioned that their success with chemical thinning depends on many factors and they should use these recommendations only as a guide.

Table 12.4.1. Growth Regulator Uses in Pears.

Timing	*Product*	*Concentration*	*Rate of Formulated Product*
Induction of Lateral Branching in Young Trees			
1-2” of Terminal Shoot Growth	Promalin, Perlan, Typy	125-1000 ppm	0.25-2 pt / 5 gal
Include a non-ionic surfactant and apply as a directed spray to areas where additional branching is desired. This practice is more effective in the second and third growing seasons after planting. Response on weak or low-vigor trees is usually disappointing. For nursery stock treat after trees have reached a terminal height at which lateral branching is desired.			
Preharvest Fruit-Drop Control			
1-2weeks before anticipated harvest	ReTain	132 ppm	333 g / acre or 1 pouch
Apply in sufficient water to ensure thorough but not excessive coverage. An organosilicone surfactant (12 oz/100 gal) should be used with ReTain.			
5-7 days before harvest	Fruitone-N, Fruitone-L	10-15 ppm	4-6 oz (lb)/100 gal
Apply 7 days before harvest on D’Anjou, Bosc, and Bartlett. Make separate sprays to early and late maturing varieties.			

* To convert ounces (lb) to grams multiply ounces by 28.3. To convert fluid ounces to milliliters multiply fluid ounces by 29.57.

Table 17.1.1 Common names, product names, formulations, and days-to-harvest for insecticides, acaricides, fungicides, and bactericides used on tree fruits.

Common Names/ Products Formulations	DAYS TO HARVEST (A)					
	Apples	*Apricots*	*Cherries*	*Peaches*	*Pears*	*Plums*
***Fungicides and Bactericides** (continued)*						
thiophanate-methyl						
Topsin M WSB	1	1	1	1	1	1
Topsin 4.5L	1	1	1	1	*NR*	1
trifloxystrobin						
Flint	14	*NR*	*NR*	*NR*	14	*NR*
Gem 500 SC	*NR*	1	1	1	*NR*	1
triflumizole						
*Procure 480SC	14	*NR*	1	*NR*	14	*NR*
ziram						
Ziram 76DF	14	30	14	14	14	*NR*

Key:

BL Do not apply beyond bloom.
BS Do not apply between budswell and final harvest
GT Do not apply beyond green tip.
HIG Do not apply beyond 1/2-in green.
NB Non-bearing
NL None listed
PB Prebloom applications only.
PF Do not apply beyond petal fall.

[1] peaches/nectarines

NR Not registered for use on crop
— Follow REI as described on label.
* Restricted-use pesticide.
† Not for use in Nassau and Suffolk Counties.

PH Postharvest applications allowed. In the case of herbicides, apply after harvest before soil freezes.
SS Do not apply beyond shuck split.
UDH Up to day of harvest.
2C Do not apply after 2d cover spray.
(A) If more than one value is given, depends on rate, method and/or number of applications; check label.
(B) Nonbearing trees only.
(C) Tart cherries only.
(D) Sweet cherries only

Table 17.1.2. Common names, product names, formulations, and days-to-harvest for growth regulators.

Product Name	Common Name	Formulation	EPA Reg. No.	Crop	Preharvest Interval
Amid-Thin W	naphthalene-acetamide	8.4 WP	5481-426	Apple, pear	—
Apogee	prohexadione calcium	27.5% DF	7969-188	Apple	45 days
Ethephon	ethephon	2 lb/gal	various	Apple, cherries	7 days
Exilis 9.5 SC	cytokinin	9.5% liquid	62097-33-82917	Apple	86 days
Falgro 4L	gibberellin 3	4.0% liquid	62097-2-82917	Cherry, stone fruit, prune	0 days
Fruitone L	naphthalene-acetic acid	3.5% liquid	5481-541	Apple, pear	2 days
Fruitone N	naphthalene-acetic acid	3.5% WP	5481-427	Apple, pear	2 days
Harvista	1-MCP	1.3% SC	71297-17	Apple, pear	3 days
Maxcel	cytokinin BA	1.9%	73049-407	Apple, pear	86 days
Novagib	gibberellin 4+7	1.0% liquid	62097-7-82917	Apple	—
Perlan	cytokinin BA+gibberellin 4+7	1.8% + 1.8% liquid	62097-6-82917	Apple, pear, sweet cherry	—
Pomaxa	naphthalene-acetic acid	3.5% liquid	73049-487	Apple, pear	2 days
Pro-Gibb 4%	gibberellic acid 3	4% liquid	73049-15	Cherry, stone fruit, prune	0 days
Promalin	cytokinin BA+gibberellin 4+7	1.8% + 1.8% liquid	73049-41	Apple, pear, sweet cherry	—
Pro-Vide 10SG	gibberellin 4+7	10% SG	73049-409	Apple	—
ReTain	AVG	15% SP	73049-45	Apple, pear, stone fruit	7 days
RiteWay	cytokinin BA	1.9% liquid	71368-60	Apple, pear	86 days
Typy	cytokinin BA+gibberellin 4+7	1.8% + 1.8% liquid	55146-78	Apple, pear, sweet cherry	—

— Preharvest interval information not provided on label.

Table 17.2.1 Insecticides and acaricides

NOTE: *Always read product label to confirm required PPE.*

Product	EPA Reg. No.	Common Name	REI (hrs)	Applicator PPE	Early Entry PPE
§Venerate XC	84059-14	*Burkholderia* spp. strain A396	4	abchl	cfhk
*†Verdepryn 100SL	71512-34-88783	cyclaniliprole	4	acfh	cfhk
*†Versys Inscalis	7969-389	afidopyropen	12	acf	cef
§Virosoft CP4	72898-4	insecticidal virus	4	abch	abch
*†Voliam Flexi WDG	100-1319	thiamethoxam, chlorantraniliprole	12	acf	cfk
*†Vydate 2L	352-372	oxamyl	48	dfghijl	dfghj
*Warrior II 2.08 CS	100-1295	lambda-cyhalothrin	24	acfh	cfk
Zeal Miticide1 72WS	59639-138	etoxazole	12	acf	acf

Table 17.2.2. Fungicides and bactericides

NOTE: *Always read product label to confirm required PPE.*

Product	EPA Reg. No.	Common Name	REI (hrs)	Applicator PPE	Early Entry PPE
Academy	100-1529	difenoconazole & fludioxonil	–	abc	–
Actigard 50WG	100-922	actibenzolar-s-methyl	12	abc	cfk
*Agri-mycin 50	55146-98	streptomycin	12	acfhl	cfhk
Aliette WDG	264-516	fosetyl-Al	24	abch	cfhk
Apogee 27.5%	7969-188	prohexadione calcium	12	acf	cfk
*Aprovia	100-1471	benzovindiflupyr	12	dfghij	dfgh
Badge SC	80289-3	basic copper chloride & copper hydroxide	48	acf	dfgjh
Badge X2	80289-12	copper oxychloride & copper hydroxide	48	acfh	dfgjh
Bravo Weather Stik	66222-276	chlorothalonil	12	acf	cfhk
Bravo Ultrex	66222-277	chlorothalonil	12	dfghijl	dfghj
Cabrio EG	7969-187	pyraclostrobin	12		cfk
Captan 50WP	66330-234	captan	24 (E)	achil	cfhk
Captan 80WDG	66222-58	captan	24(E)	acfhil	cfhk
*†Cevya	7969-407	mefentrifluconazole	12	acf	cfk
§Champ Formula-2 4.6F	55146-64	copper hydroxide	48	acfh	cfhk
C-O-C-S WDG	34704-326	copper oxychloride & basic copper sulfate	48	acfh	efghj
§Cueva Fungicide	67702-2-70051	octanoic acid	4	acf	acf
§Cuprofix Ultra 40 Disperss	70506-201	basic copper sulfate	48	ac	efghj
§Double Nickel 55	70051-108	*Bacillus amyloliquefaciens*	4	abcl	bck
§Double Nickel LC	70051-107	*Bacillus amyloliquefaciens*	4	abcl	bck
Echo 720	60063-7	chlorothalonil	12	acfhl	cfhk
Echo 90DF	60063-10	chlorothalonil	12	acfhl	bchk
Elevate 50WDG	66330-35	fenhexamid	12	acf	cfk
Ferbam Granuflo	45728-7	ferbam	24	afl	cfk
Fireline	80990-1	oxytetracycline HCl	12	cdfhl	cdfh
Firewall	80990-4	streptomycin	12	acf	efg
Flint	264-777	trifloxystrobin	12	acf	cfk
Flint Extra	264-826	trifloxystrobin	12	acf	cfk
*†Fontelis	352-834 (NY SLN 130003)	penthiopyrad	12	ac	cfk
GEM 500 SC	264-826	trifloxystrobin	12	acf	cfk