2024 Cornell Pest Management Guidelines for Commercial Tree Fruit Production

Cornell Cooperative Extension

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

2024 Cornell Pest Management Guidelines for Commercial Tree Fruit Production

Authors

Anna Wallis (NYS IPM Program, Geneva, NY; *Editor, integrated pest management*)

Bryan Brown (New York State Integrated Pest Management Program, Geneva, NY; *weed management)*

Lailiang Cheng (Section of Horticulture, Ithaca, NY; *nutrient management*)

Kerik Cox (Section of Plant Pathology and Plant-Microbe Biology, Geneva, NY; *disease management, characteristics of crop protectants, general pest management*)

Paul Curtis (Department of Natural Resources, Ithaca, NY; *wildlife damage control*)

Amara Dunn (NYS IPM Program, Geneva, NY; *biological control*)

Michael Helms, (Cornell Cooperative Extension Pesticide Safety Education Program (CCE-PSEP), Ithaca, NY; *pesticide information*)

Monique Rivera (Department of Entomology, Geneva, NY; *Insect and mite management, characteristics of crop protectants, general pest management*)

Terence Robinson (Section of Horticulture, Geneva, NY; *growth regulators, nutrient management*)

Lynn Sosnoskie (Section of Horticulture, Geneva, NY; *weed management*)

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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 (December 2023). 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: *Anna Wallis, NYSIPM.*

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Organization of this Publication

The first part of this manual contains introductory information about pesticides, sprayer calibration, and references pertaining to crop protectant efficacy and use characteristics for each pest category (diseases, insects, etc.). This is followed by a section on nutrient management and fertilizer recommendations for apple orchards. Information on forecasting, sampling and monitoring is included for selected pests.

Weed control guidelines are listed next, separately for each crop. Next comes a section on nutrient management and fertilizer recommendations for apple orchards. Then, for each crop, a Pesticide Spray Table, which lists specific products for the control of each disease, insect and mite pest of this crop, giving products (listed by IRAC/FRAC group and then alphabetically within each group), rates, re-entry and pre-harvest intervals, product efficacy, and comments keyed to specific sections of the written notes listed in the General Pest Management Considerations section. Pests are addressed phenologically through the season. Following the Pesticide Spray Table are the General Pest Management Considerations. This section contains numbered comments keyed to the Pesticide Spray Table on the biology, cultural notes, monitoring, and pesticide use for each pest, in the following order:

- Diseases
  - Disease 1
    - Biology & Cultural
    - Monitoring & Forecasting
    - Biological & Non-chemical Control
    - Pesticide Application Notes
    - Pesticide Resistance
  - Disease 2, etc.

- Insects and Mites
  - Insect 1, Etc.

Diseases are addressed first, followed by insects and mites (as a group), each in alphabetical order. Reference may be made here to additional publications available for further information.

Lastly is an appendix of tables listing common names, product names, EPA registration numbers, personal protective equipment guidelines, and spray mixture compatibility suggestions for the materials included in this publication, followed by a list of other fruit reference materials, diagnostic services, and faculty and Extension programs.

A key to the abbreviations and footnotes used in this publication is found in the back of this book.

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 harvest] – 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

Pesticides can be classified as general-use or restricted-use. **General-use pesticides** may be purchased and used by anyone. **Restricted-use pesticides** can only be purchased and used by a certified applicator or used by someone under a certified applicator's supervision. In some cases, the pesticide label may limit use of a restricted-use pesticide to only a certified applicator.

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. If a private applicator wants to use or supervise the use of restricted-use pesticides, they need to be a **certified private applicator**. Certified private applicators are also allowed to purchase restricted-use pesticides. Certification is not needed if a private applicator uses general-use pesticides.

In New York State, a **certified commercial applicator**, **certified commercial technician**, or **commercial apprentice** working under the supervision of a certified commercial applicator is allowed to apply any type of pesticide on property that is not a private application (described above) or is a residential application. (A residential application is the use of general-use pesticides on property owned or rented by the applicator, excluding establishments selling or processing food and residential structures other than where the applicator lives.) Certified commercial applicators are allowed to purchase restricted-use pesticides.

Information on 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/contact-us/statewide-office-information), the Pesticide Applicator Training Manuals (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 Properly

Using pesticides requires the user to protect their health, the health of others, and the environment. Keep in mind "pesticide use" is more than just the application. It 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 also require you to comply with state and federal laws and regulations intended to protect human health and the environment from the adverse effects pesticides may cause.

3.2.1 Plan Ahead

Many safety precautions should be taken *before* you begin using pesticides. 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 label directions and precautions. 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

Transporting pesticides carelessly can result in broken containers, spills, and contamination of people and the environment. Accidents can occur even when transporting pesticides 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 (PPE) needs depend on the pesticide being handled. **Required PPE are listed on pesticide labels.** Any required PPE is based on the pesticide's toxicity, route(s) of exposure, and formulation. Label-listed PPE are the minimum that must be worn when using a pesticide. You can always use more than what's listed!

The type of PPE used depends on the type and duration of the activity, where pesticides are being used, and the user's exposure. For example, mixing/loading procedures often require more PPE than when applying a pesticide. Studies show you are at a greater risk of accidental poisoning when handling pesticide concentrates. Pouring pesticide concentrates is the most hazardous activity.

Engineering controls are devices that help reduce a pesticide user's exposure. An example is a closed transfer system that reduces the exposure risk when dispensing pesticide concentrates. 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 non-target areas, and harm the environment. Choose weather conditions, pesticides, application equipment, pressure, droplet size, formulations, and adjuvants to minimize drift and runoff potential. Product labels may have specific application and/or equipment requirements to reduce issues with drift and runoff.

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.

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 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.

Protective Clothing Lockers – To prevent contamination of the tractor or sprayer cab interior, protective clothing should be removed before entering the cab. A few sprayer companies offer a simple compartment (or locker) mounted to the side or front of the sprayer where protective clothing can be stored. Alternatively a locker can be fitted to the nurse tank.

4. Controlling Drift

Low-Drift Nozzles – Low-drift nozzles create larger-size droplets than conventional nozzles. The larger droplet sizes

		GPM																	
		30 PSI	40 PSI	50 PSI	60 PSI	70 PSI	80 PSI	90 PSI	100 PSI	120 PSI	140 PSI	160 PSI	180 PSI	200 PSI	220 PSI	240 PSI	260 PSI	280 PSI	300 PSI
TXVK-1	100	0.015	0.017	0.018	0.020	0.021	0.022	0.023	0.024	0.026	0.028	0.030	0.031	0.032	0.034	0.035	0.036	0.037	0.038
TXVK-2	100	0.029	0.033	0.037	0.040	0.043	0.045	0.047	0.050	0.054	0.058	0.061	0.064	0.067	0.070	0.073	0.075	0.078	0.080
TXVK-3	100	0.044	0.050	0.055	0.060	0.064	0.068	0.071	0.075	0.081	0.086	0.092	0.096	0.101	0.105	0.109	0.113	0.117	0.120
TXVK-4	50	0.058	0.067	0.074	0.080	0.086	0.091	0.096	0.101	0.110	0.118	0.125	0.132	0.139	0.145	0.151	0.157	0.162	0.167
TXVK-6	50	0.088	0.100	0.111	0.120	0.129	0.137	0.145	0.152	0.165	0.177	0.188	0.199	0.208	0.218	0.226	0.235	0.243	0.251
TXVK-8	50	0.116	0.133	0.148	0.162	0.174	0.186	0.196	0.207	0.225	0.243	0.259	0.274	0.288	0.301	0.314	0.326	0.338	0.349
TXVK-10	50	0.145	0.167	0.185	0.202	0.218	0.232	0.246	0.258	0.282	0.303	0.323	0.342	0.360	0.376	0.392	0.408	0.422	0.437
TXVK-12	50	0.174	0.200	0.223	0.243	0.261	0.279	0.295	0.310	0.338	0.364	0.388	0.410	0.432	0.452	0.471	0.489	0.507	0.524
TXVK-18	50	0.260	0.300	0.335	0.367	0.396	0.423	0.449	0.473	0.517	0.558	0.597	0.633	0.667	0.699	0.730	0.759	0.788	0.815
TXVK-26	50	0.376	0.433	0.484	0.530	0.572	0.611	0.648	0.683	0.747	0.807	0.862	0.914	0.963	1.01	1.05	1.10	1.14	1.18
TX†800050VK	100	0.044	0.050	0.055	0.060	0.064	0.068	0.071	0.075	0.081	0.086	0.092	0.096	0.101	0.105	0.109	0.113	0.117	0.120
TX†800067VK	50	0.058	0.067	0.074	0.080	0.086	0.091	0.096	0.101	0.110	0.118	0.125	0.132	0.139	0.145	0.151	0.157	0.162	0.167
TX†8001VK	50	0.088	0.100	0.111	0.120	0.129	0.137	0.145	0.152	0.165	0.177	0.188	0.199	0.208	0.218	0.226	0.235	0.243	0.251
TX†80015VK	50	0.131	0.150	0.167	0.182	0.196	0.209	0.221	0.232	0.254	0.273	0.291	0.308	0.324	0.339	0.353	0.367	0.380	0.393
TX†8002VK	50	0.174	0.200	0.223	0.243	0.261	0.279	0.295	0.310	0.338	0.364	0.388	0.410	0.432	0.452	0.471	0.489	0.507	0.524
TX†8003VK	50	0.260	0.300	0.335	0.367	0.396	0.423	0.449	0.473	0.517	0.558	0.597	0.633	0.667	0.699	0.730	0.759	0.788	0.815
TX†8004VK	50	0.347	0.400	0.447	0.489	0.528	0.564	0.598	0.630	0.690	0.745	0.796	0.843	0.889	0.932	0.973	1.01	1.05	1.09

†Specify "A" or "B." See pages 37 and 38 for more information on ConeJet spray tips.
Note: *Always double check your application rates. See pages 149-163 for useful formulas and information.*

Please note: *Where trade names appear, no discrimination is intended and no endorsement by the author or Cornell University is implied.*

4.9 Calibrating Airblast Sprayers

Videos showing calibration and nozzle selection may be found on the internet at www.youtube.com. Type in: "Calibration of airblast sprayers for orchards part 1 selecting and changing nozzles" or "Calibration of airblast sprayers for orchards part 2 measuring liquid flow".

4.9.1 Air Blast Sprayer Calibration (Use Clean Water)

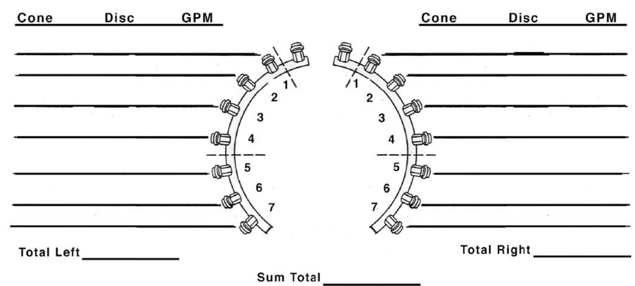
1. Pressure check
   Place the pressure gauge on the nozzle fitting farthest away from the pump and turn the sprayer on. If pressure is lower at the nozzle than specified, increase pressure at the regulator. ________________

   Pressure at nozzle _______psi

   Pressure at sprayer gauge _______psi_
2. Nozzle output
   a. Use a flow meter (obtainable from Gemplers, Spraying Systems, etc.) attached to individual nozzles OR
   b. Connect hoses to each of the nozzles and measure the flow from each nozzle into a calibrated jug for one minute.

Remember 128 fl. oz. in one gallon. Example: If the output of one nozzle has been measured at 34.5 fl. oz. in one minute, then output per minute is divided by 128 = 0.27 GPM.

Replace all nozzle tips that are more than 10% inaccurate.



Formula: $\frac{\text{Total GPM} \times 495}{\text{mph} \times \text{row spacing (ft)}} = \text{GPA}$

Your figures: $\frac{\_\_\_\_\_\_ \times 495}{\text{mph} \times \text{ft}} = \text{GPA}$

GPM = gallons per minute = gal/min

GPA = gallons per acre = gal/acre Calibrating A Kinkelder Sprayer (Use Clean Water)

4.9.2 Calibrating a Kinkelder Sprayer

$$\frac{\text{Rate of spray gals/acre} \times \text{Forward speed mph} \times \text{Row spacing ft} \times 60}{500} = \text{gals/hr delivery or index setting}$$

$$\text{Your figures: } \frac{\text{gallons/acre} \times \text{mph} \times \text{ft} \times 60}{500} = \text{gals/hr delivery or index setting}$$

This figure should be set on both scales.

Both taps should be set on the distribution conduit in such a way that the index is set on the sign 162 on the index plate of the distribution conduit. The emission indication on the

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) Arysta **(F)**

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

fenazaquin – (Magister) Gowan **(A)**
fenbuconazole – (Indar) Corteva Agriscience **(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 (*†Tesaris) 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)**
isofetamid – (Kenja 400SC) Summit Agro USA, LLC **(F)**
inpyrfluxam– (Excalia) Valent® BioSciences (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) Corteva Agriscience; (Manzate) DuPont; (Penncozeb) UPL NA **(F)**
maneb – (Manex) Griffin **(F)**
mefanoxam – (Ridomil Gold) Syngenta **(F)**

5.3 Bactericides

Kasugamycin (Kasumin 2L) is a bactericide used for fire blight of apples and pears. It is formulated as kasugamycin hydrochloride in a 2.3% liquid solution. Kasugamycin is applied at bloom at the rate of 64 fl oz/100 gal for fire blight control, and it can be used in combination with wetting agents to enhance efficacy. It should be applied only in conjuction with disease forecasting models. It can be applied until 90 days prior to harvest, but Kasumin may not be applied after petal fall. Kasugamycin should not be applied in orchards that have been fertilized with animal waste/manure. Also, animal grazing in treated orchards is prohibited and posting of restriction sign around the application perimeter is required

Resistance to kasugamycin has not been detected in the fire blight pathogen *Erwinia amylovora*. However, indiscriminate use of this material during summer covers or for shoot blight control may hasten the development of resistance.

Lifegard (*Bacillus mycoides* isolate J) is a natural systemic acquired resistance inducer labeled for apples against fire blight. The material acts by inducing natural plant defenses to protect against invasion and migration of the fire blight bacterium. Younger trees and young shoot tissue will respond better to the product than older trees with heart wood tissues. It's an attractive option for apple growers during establishment years when one doesn't wish to use prohexadione calcium to manage fire blight (shoot blight), which slows host growth. Lifegard is made as a foliar application, beginning at 20% bloom to ensure that host response is high when shoot blight infections occur later in the season. A minimum of 5 days is needed for the best induced resistance response. Repeat application can be made throughout bloom and a petal fall to restrict the development of fire blight.

Oxytetracycline (Mycoshield , Fireline), another antibiotic, is registered for foliar use on peaches and nectarines to control bacterial spot. It is also registered on peach for microinjection to manage peach X-disease. It is also registered for control of fire blight on apples and pear, but is not as effective as streptomycin.

Streptomycin (Streptrol, Firewall) is a bactericide used for control of fire blight of apples and pears. It is formulated as streptomycin sulfate in a 17% wettable powder form. Streptomycin is commonly used in bloom at the rate of 1/2 lb/100 gal for fire blight control, but can be used at 1/4 lb/100 gal in combination with 1 pt of Regulaid/100 gal dilute spray. It can be applied to pears until 30 days before harvest and to apples until 50 days before harvest. However, summer sprays of streptomycin are NOT recommended, except following a hailstorm.

Tests of streptomycin applied during bloom at a constant amount in different volumes of water indicated that control of fire blight was reduced at concentrations in excess of 6X. Thus, concentration of streptomycin sprays greater than 6X is specifically not recommended.

Resistance is widespread among populations of the fire blight bacterium in Pacific Coast and Midwest production districts, and has recently been detected in several NY counties. Indiscriminate use of this material during summer covers or for shoot blight control will hasten the further development of resistance.

5.4 Other Materials

Acibenzolar-S-methyl (Actigard) is a systemic acquired resistance inducer. The material acts by inducing natural plant defenses to protect against infection bacteria and fungi. Trees with young tissue will respond better to the product than older trees. It's an attractive option for apple growers during establishment years when one doesn't wish to use prohexadione calcium to manage fire blight (shoot blight) as it restricts host growth. Actigard may be used in a drench in 8-16 fl oz water per tree. Drench applications may be fairly effective in 1-2 year old trees timed at green tip, but labor availability may make the practice less feasible in large operations. Actigard, may also be used in a foliar application, beginning at 20% bloom to ensure that host response is high when shoot blight infections occur later in the season. A minimum of 5 days is needed for the best induced resistance response.

DoubleNickel 55/LC (Bacillus amyloliquefaciens) is a biofungicide labeled for control of fire blight, apple scab, powdery mildew, and summer diseases like fly speck and sooty blotch. Double Nickel 55 is a 25% water-dispersible granule (WDG) formulation, while Double Nickel LC is a 99% aqueous suspension of the bacterium Bacillus amyloliquefaciens, a common soil resident. The bacterium acts by releasing lipipeptides during growth that destroy the cell walls of plant pathogenic fungi and bacteria. DoubleNickel may be less effective than conventional fungicide for controlling fungal diseases under the favorable climatic conditions that exist in New York. However, tests at Cornell AgriTech have indicated that it provides good control of fly speck and sooty blotch when used in combination with low MCE organic copper (e.g. Cueva). When used alone, DoubleNickel provides only some control of fire blight. In alternation with streptomycin, it sometimes provides control approaching that of a full streptomycin program. DoubleNickel should be applied as a preventive and can be applied up to and including the day of harvest.

Howler EVO (*Pseudomonas chlororaphis strain AFS009*) is a biofungicide labeled for control of fire blight, apple scab, powdery mildew, and summer diseases like fly speck and sooty blotch. Howler EVO may be less effective than conventional fungicide for controlling fungal diseases under the favorable climatic conditions

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	—	—
Bacillus subtilis strain AFS032321 (Theia)	Microbial	BM02	4[i]	2	—	2	—	2	—
benzovindiflupyr (*Aprovia) [h]	SDHI	7	4[i]	2	2	3	4	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	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	—

Table continued on next page.

Table 6.1.3. Characteristics of apple scab fungicides.

Fungicide and Rate/100 Gal (assuming 300 gpa for std. trees)	Protection	Retention	Redistribution	After-Infection Activity (hr) [4]	Pre-symptom	Post-symptom
*†Tesaris (fluxapyroxad) 1.5 fl oz	E	E	G	48	?	F
Theia (*Bacillus subtilis* strain AFS032321)	E	VG	G	VG	E	G
*†Sovran (kresoxim-methyl) 50WP, 1.33 oz	VG	E	G	48-72[2]	none	G
sulfur, 5 lb actual §	F	F-G	F-G	none	none	none
Syllit (dodine) 3.4 FL, 12 oz [1]	VG	VG	G	18-24	E	VG
(flutriafol) 4.3 fl oz						
Topsin M (thiophanate-methyl) 70WP, 6 oz [1]	F	G	P-F	18-24	E	VG
Vangard (cyprodinil) 75WG, 1.67 oz	G	G	?	48-72	none	none
Ziram (ziram) 76DF1 1/2 lb	F-G	P-F	F-G	15-20	none	none

[1] Not effective against resistant strains of the fungus.
[2] The after-infection activity of *†Sovran and Flint may be only 48 hr in orchards with resistant populations of apple scab.
[3] Note that efficacy will drop if the lower rate program is used.
[4] Given the wide spread prevalence of fungicide resistance in regional populations of apple scab, one should not rely on post-infection activity.
§ potentially acceptable in certified organic programs.
(§) not all formulations of the active ingredient are acceptable in certified organic programs.
Key: **P** = poor, **F** = fair, **G** = good, **VG** = very good, **E** = excellent.

6.2 Notes on Apple Scab Management

6.2.1 Implications of Inoculum Dose

Economic losses to apple scab in commercial orchards usually appear following convergence of three factors:

1. High levels of carry-over inoculum are present in leaf litter in the orchard.
2. Weather conditions favor ascospore infections between green tip and bloom.
3. Fungicide protection is inadequate to prevent infections at some point between green tip and bloom.

The importance of high inoculum levels as a contributor to scab epidemics cannot be over-emphasized. No one can control the weather, and bad weather may interfere with fungicide applications. However, several methods are available for reducing inoculum in orchards. Any one of these methods can reduce inoculum by at least 70%, thereby converting high-inoculum orchards into moderate or low-inoculum orchards. Using one of these inoculum reduction strategies does not eliminate the need for fungicide protection beginning at green tip, but it reduces risks of control failures in bad scab years.

6.2.2 Orchard Sanitation for High-inoculum Orchards

The inoculum dose in overwintering leaves can be reduced by using any one of the following methods:

a) Apply 40 lb/A of urea fertilizer (mixed in 100 gal of water/A) sometime after winter but before bud break. Urea softens senescent and fallen leaves and stimulates their microbial breakdown, promoting faster removal by earthworms that feed on them. It may also directly suppress ascospore formation. Treat the entire orchard, including the ground cover in the row middles. Apply the spray using either an air blast sprayer with the upper nozzles turned off or a boom sprayer set up to spray both under the trees and the row middles. Reduce subsequent nitrogen fertilizer rates by the amount of N applied under the drip line of the tree rows. Ignore the amount of N applied to the row middles, as the ground cover will use this. Repeat practice after harvest during leaf drop the following seasons with severe scab outbreaks
b) Shred overwintering leaves using a flail mower set low enough to contact the fallen leaves. Leaves must be raked or blown from under trees, or mower must be offset to reach them. Shredded leaves decay more quickly, and flail-mowing leaves in spring disorients many of the leaf pieces so they eject ascospores toward the soil instead of up into the air. Prunings can be chopped at the same time. However, the low mower settings required to effectively shred leaves may leave row middles so denuded as to be slippery or muddy at the time when early fungicide sprays are needed.
c) Apply 2.5 ton/A of lime in early winter after leaves have fallen from trees. Lime raises the pH of fallen leaves enough to increase the rate of microbial breakdown of the fallen leaves.

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	—
†Nexter (pyridaben)	21	—	0	—	—	—	2	—	—	3	—	—	—	—	—	—

Table 7.1.2. Relative toxicity of pome fruit insecticides and acaricides to beneficials.

	Beneficial Species				
Active Ingredient (Trade Name)	Bees[1]	*Amblyseius fallacis*[2]	*Typhlodromus pyri*[3]	*Stethorus punctum*[4]	*Aphidoletes aphidimyza*[5]
Acaricides					
*Agri-Mek (abamectin)	L	M	M	M	L
Apollo (clofentezine)	L	L	L	L	L
*†Envidor (spirodiclofen)	L	L	M	M	—
Kanemite (acequinocyl)	L	L	L	L	—
Magister (fenazaquin)	H	—	—	—	—
*†Minecto Pro (cyantraniliprole/abamectin)	H	M	M	M	L
Nealta (cyflumetofen)	L	L	L	L	—
†Nexter (pyridaben)	H	M-H[d]	M-H[d]	M	M
§oil (Sunspray, PureSpray, Damoil, Stylet, Omni)	L	L-M[a]	L-M[b]	L	L
Portal (fenpyroximate)	L	L	L	—	—
*Proclaim (emamectin benzoate)	H	—	—	—	—
Savey, Onager (hexythiazox)	L	L	L	—	—
*Vendex (hexakis)	L	L	L	L	L
Zeal (etoxazole)	L	M	M	—	L

[1]Bees = honeybees
[2] A predatory mite found throughout New York State
[3]A predatory mite found mostly in Western New York
[4]A ladybird beetle predator of mites
[5]A cecidomyiid predator of aphids

* Restricted-use pesticide.
† Not for use in Nassau and Suffolk Counties.
§ = Potentially acceptable in certified organic programs

Key to toxicity ratings:

Bees:

L = Low; not hazardous to honey bees at any time. 1 hr to 1 day residual toxity
M = Moderate; not hazardous if applied either in evening or early morning when honey bees are not foraging, except during periods of high temperature. 3 hr to 1 day residual toxicity
H = High; hazardous to honey bees at any time. 1 day to 2 week residual toxicity
— = no data.

All other Beneficials:

L = low impact on population (less than 30% mortality).
M = moderate impact on poppulati (between 30% and 70% mortality).
H = high impact on opulation (more than 70%mortality).

Notes:

[a] = low impact on immatures, moderate impact on eggs.
[b] = low impact on adults, moderate impact on eggs and immatures. However,general population recovery occurs within 7 days.
[c] = This information derived from application field tests conducted at the NYS Agricultural Experiment Station.
[d] = Dependent on rate.

(Information compiled from 48-hr residue tests conducted at the NYS Agr. Exp.Sta. except where noted. Pesticides with long residual periods (pyrethroids) will have a greater impact than those with a shorter residual (like some organophosphates)).

Table 7.1.3. Activity spectrum of stone fruit insecticides.

Insecticide	IRAC‡	APB	Aphids	CFF	JB	OFM	PC	PTB/LPTB	SWD	TPB	WFT
*†Actara (thiamethoxam)	4A	—	3	2	—	—	3	—	—	3	2
*Admire Pro (imidacloprid)	4A	0	3	2	2	0	1	0	—	2	—
*†Altacor (chlorantraniliprole)	28	—	—	2	—	3	—	—	—	—	—
*Pounce (permethrin)	3A	—	—	3	—	2-3	3	2	—	3	2
*Asana (esfenvalerate)	3A	2	3	3	—	2-3	3	3	3	3	2
*Assail (acetamiprid)	4A	—	3	3	3	3	2	—	—	2	—

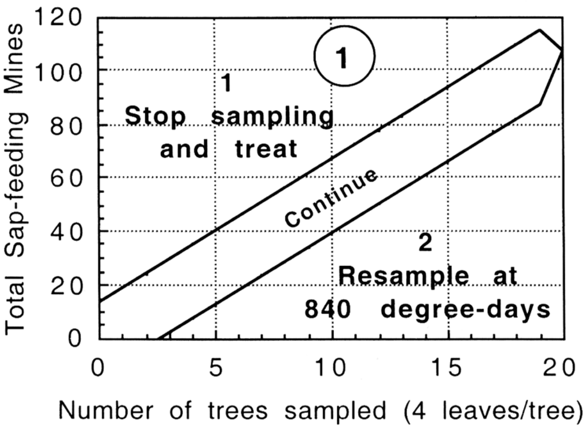
Table continued on next page.

Table 7.1.4. Degree-day accumulations (from Jan. 1) corresponding to selected fruit phenology and arthropod pest events.

Pest/Phenology Event	DD Base 43˚F mean	DD Base 43˚F std dev	DD Base 50˚F mean	DD Base 50˚F std dev	Approx. Date mean	Approx. Date std dev
STLM Traps set out			1-April			
Pear psylla – egg laying	84	44	33	21	4-Apr	11 days
RBLR – 1st catch	144	32	60	20	17-Apr	9 days
Rosy apple aphid – 1st nymphs present	189	55	86	30	25-Apr	7 days
STLM – 1st adult catch	168	48	73	28	20-Apr	9 days
STLM – 1st egg observed	208	65	94	36	27-Apr	5 days
Tight cluster (McIntosh)	228	27	105	19	27-Apr	7 days
Tarnished plant bug – 1st observed	222	105	105	62	25-Apr	15 days
OBLR – 1st overwintered larvae observed	236	78	112	48	29-Apr	7 days
Black stem borer – 1st adult catch	283	50	137	40	6-May	3 days
European red mite – egg hatch observed	284	53	134	34	6-May	4 days
STLM Egg Sample			Pink			
OFM Traps set out			Pink			
Pink (McIntosh)	289	26	139	21	3-May	7 days
Oriental fruit moth – 1st adult catch	229*	44*	126	33	2-May	8 days
RBLR – 1st flight peak	303	75	150	48	4-May	9 days
STLM – 1st flight peak	337	71	168	45	7-May	8 days
OBLR Overwintered Gen. Sample			Bloom			
Codling Moth Traps set out			Bloom			
Full bloom (McIntosh)	378	35	192	25	10-May	6 days
Lesser appleworm – 1st catch	420	144	217	88	13-May	12 days
American plum borer – 1st catch	457	64	240	45	16-May	7 days
OFM – 1st flight peak	369*	91*	223	57	15-May	11 days
Codling moth – 1st adult catch	475	85	249	55	18-May	7 days
San Jose scale – 1st adult catch	533	88	284	61	21-May	8 days
Cherry fruit fly traps set out			20-May			
STLM – 1st sap-feeding mines observed	472	129	241	76	18-May	13 days
Petal fall (McIntosh)	479	42	252	32	18-May	6 days
Lesser appleworm – 1st flight peak	569	205	313	130	22-May	13 days
Plum curculio – 1st oviposition scars observed	555	77	286	37	25-May	9 days
Pear psylla – hardshell stage observed	569	87	312	51	22-May	9 days
Lesser peachtree borer – 1st adult catch	570	94	308	59	24-May	8 days
San Jose scale – 1st flight peak	644	89	355	58	29-May	8 days
ERM Sample – 2.5 mites/leaf					1-Jun	
OBLR traps set out					1-Jun	
Black stem borer – 1st flight peak	681	170	383	122	1-Jun	9 days
RBLR – 1st flight ending	753	140	448	105	2-Jun	8 days
American plum borer – 1st flight peak	784	183	457	128	3-Jun	9 days
Codling moth – 1st flight peak	768	206	442	134	3-Jun	12 days
STLM – 1st flight ending	813	128	475	94	5-Jun	9 days
OBLR – 1st adult catch	884	90	523	62	9-Jun	6 days
OFM – 1st flight ending	825*	126*	576	97	12-Jun	8 days
Peachtree borer – 1st adult catch	1032	266	619	182	15-Jun	11 days
San Jose scale – 1st flight ending	1039	182	632	125	16-Jun	8 days
Black stem borer – 1st flight ending	1056	198	636	154	19-Jun	9 days

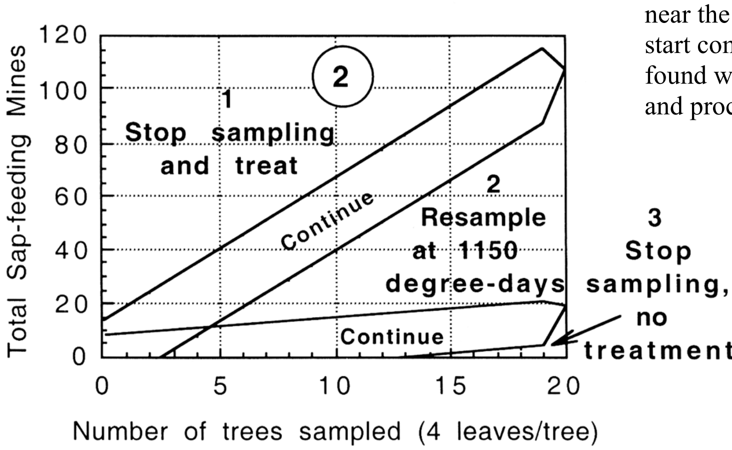
Table continued on next page.

Figure 7.1.7. STLM Summer Sampling Form



Because of variability in this pest's development from one site to the next, more than one sampling session may be needed to reach a treatment decision for 2nd generation STLM. The first sample should be taken at 690 degree-days (base 43°F) after the start of the 2nd moth flight (or approximately 25-30 days). Use July 9 as an approximate sampling date if you don't have access to pheromone trap catch data.

Start near one corner of the block and sample trees along a diagonal, moving toward the opposite corner of the block. At each tree, count all the **sap-feeding** mines on 4 mature terminal leaves randomly selected from around the outside of the canopy. Sampled leaves should be those located near the middle of the terminals. After sampling 3 trees, start comparing the accumulated total number of mines found with the appropriate chart for the sampling session and proceed as follows:



If the number of mines falls in the "Continue" zone on **Chart 1**, sample another tree and check again. If the total is above this zone (area 1). sampling is stopped and a treatment is recommended. If the total is below this zone (area 2), stop sampling and sample the block again at approximately 840 DD (about 31 days) after the start of the 2nd flight.

SAMPLING DONE AT 840-1149 DD, IF NECESSARY
If it is necessary to sample the population a second time, refer to Chart 2 after sampling the 3rd tree. If the accumulated total falls in one of the "Continue" zones, sample another tree and check again. If the count falls in area 1, a treatment is recommended and no further sampling is necessary. If the count falls in area 2, stop sampling and sample the block again at approximately 1150 DD (about 42 days) after the start of the 2nd flight. If the count falls in area 3, treatment is not recommended and no further sampling is necessary.

SAMPLING DONE AT 1150 OR MORE DD. IF NECESSARY
If it is necessary to sample a third time, refer again to **S**, the same as in the first sampling session. This time, however, if the accumulated total number of mines falls in area 2, treatment is not recommended and no further sampling is required for this brood of STLM.

Refer to the Apple Pesticide Spray Table for a choice of pesticide materials if a treatment is elected.

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		***2,4-D AMINE, *WEEDAR 64, or other labeled formulation** (*2,4-D, 3.8 lb/gal*) *Weeds Controlled:* broadleaves, *Rate (per acre):* 3 pt. *AI per acre (lbs/acre):* 1.4 *Days to harvest:* Apples and pears: 14; apricots, cherries, peaches, and plums: 40 *REI (hours):* 48 *Comments:* Established perennials, woody brush and vines can also be controlled by using in tank mix with glyphosate; fall applications of glyphosate may cause crop injury. To control dandelions and other broadleaf weeds in sod cover, apply in the fall (best) or early spring BEFORE TREES OR DANDELIONS BEGIN TO BLOOM. Yearly application is needed to control dandelions. Avoid contact with fruit, foliage, stems, or limbs of trees. Not all products may be labeled for all crops. Do not apply before irrigation or rainfall events. Do not apply to bare ground. Do not apply under windy conditions, under high temperatures or in temperature invesions. Maximum use and application timing restrictions apply, see label.
X	X	X	X		X		X	X		***UNISON or other labeled formulation** (*2,4-D, 1.74 lb/gal*) *Weeds Controlled:* broadleaves *Rate (per acre):* 3 pt. *AI per acre (lbs/acre):* 0.6525 *Days to harvest:* Apples and pears: 14; cherries, peaches, plums: 40 *REI (hours):* 48 *Comments:* Established perennials, woody brush and vines can also be controlled by using in tank mix with glyphosate; fall applications of glyphosate may cause crop injury. To control dandelions and other broadleaf weeds in sod cover, apply in the fall (best) or early spring BEFORE TREES OR DANDELIONS BEGIN TO BLOOM. Yearly application is needed to control dandelions. Avoid contact with fruit, foliage, stems, or limbs of trees. Not all products may be labeled for all crops. Do not apply before irrigation or rainfall events. Do not apply to bare ground. Do not apply under windy conditions, under high temperatures or in temperature invesions. Maximum use and application timing restrictions apply, see label.
X	X	X	X	X	X	X	X	X		**AIM EC** (*carfentrzone-ethyl, 2 lb/gal*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 1-2 oz, 2 oz. for green rootsucker control. *AI per acre (lbs/acre):* 0.03 *Days to harvest:* All tree fruits: 3 *REI (hours):* 12 *Comments:* Apply in tank mix with paraquat or glyphosate to extend the range of broadleaf and grass control, but avoid contact with green bark and foliage in new to 2 year old trees. Suckers must be young and succulent (when used for sucker control). Nonionic surfactants or crop oil concentrate improve control.

Table continued on next page.

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	BM02	Howler EVO	2.5-7.5 lb/acre	0	4	High	
	7 + 9	*†Luna Tranquility	11.2-16 fl oz/acre	72	12	High	
	M01 + M01	Badge SC	3.5-7.0 pts/acre	0	48		[8.4]
	M01 + M01	Badge X2	3.5-7.0 lb/acre	0	48		[8.4]
Bitter Rot	BM02	Howler EVO	2.5-7.5 lb/acre	0	4	High	
	BM02	Theia	1.5-5 lb/acre	0	4	High	
Blister Spot	P07	Phostrol	2.5-5.0 pts/acre	0	4	High	[5.1]
Cedar Apple Rust	BM02	Theia	1.5-5 lb/acre	0	4	Moderate	
Crown rot	4	Ridomil Gold SL	2 qt/acre 0.5 pt/100 gal water		48		[7.2]
	P07	Aliette WDG	2.5-5 lb/acre 0.5-1 pt/100 gal water	14	24		
	P07	Phostrol	2.5-5.0 pts/acre	0	4	High	
	P07	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	25	*Agri-mycin 50	8-16 oz/acre	50	12		[8.5]
	BM02	Howler EVO	2.5-7.5 lb/acre	0	4	High	
	M01	Kocide 3000-O	3.5-7.0 lb/acre 1.11-2.3 lb/100 gal water	HIG	48		
	M01	Previsto	2-4 qt/acre	See label	48		
	M01 + M01	Badge SC	3.5-7.0 pts/acre	0	48		[8.4]
	M01 + M01	Badge X2	3.5-7.0 lb/acre	0	48		[8.4]
Phytophthora rots	P07	Phostrol	2.5-5.0 pts/acre	0	4	High	[7.3]
	P07	Prophyt	2-4 pt/acre	0	4	High	[7.3]
Powdery Mildew	BM02	Howler EVO	2.5-7.5 lb/acre	0	4	Moderate	
	BM02	Theia	1.5-5 lb/acre	0	4	Moderate	
Woolly apple aphid	9D	*†Sefina Inscalis	7.0 fl oz/acre	7	12		[46.1]
Green Tip							
Apple scab		Polyram 80DF	3.0-4.5 lb/acre	BL, 77(A)	24		[1.3,2.2]
		Syllit FL	1.5 pts/acre	7	48		[2.15]
	3	*Cevya	3.0-5.0 fl oz/acre	0	12	High	

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.

11.6.2 Weather Factors That Affect Thinning Response

Frost. Frost before application of thinners can greatly increase the amount of thinning obtained from chemical thinners. Frost at bloom can damage fruitlets and reduce seed set, which can result in increased natural drop and greater chemical thinning response. Frost can also damage spur leaves, resulting in greater chemical uptake and thus greater thinning response. Wherever flowers and leaves have been damaged by frost, extreme caution should be used with chemical thinners. Typically, lower rates would be used in such cases. Surfactants and oil additives should be avoided following a frost and may cause overthinning.

Sunlight Levels before Application. The amount of sunlight for the 3-5 days preceding application of chemical thinners has an important effect on chemical uptake and response. Intense cloudy weather before application of thinners can result in increased chemical uptake and greater thinning response, due to greater succulence of the leaves and a thin wax cuticle. In addition, intense cloudy weather results in reduced carbohydrate supply for fruit growth and reduced fruit growth rate. This results in increased natural drop.

Temperature at Time of Application. The uptake of chemical thinners is greater at higher temperatures than at lower temperatures. The optimum is between 70-80°F. Above 80°F, uptake is substantially greater than below 80°F. The time of day applications are made appears to be unimportant. Applications made in the morning or evening when it is cool have a longer drying time on the leaf, resulting in a slow but sustained uptake of chemical, while at higher temperatures during mid-day, drying times are shorter, resulting in a short but rapid uptake of chemical. Thus, the total amount of chemical taken into the plant appears to be very similar regardless of the time of day. Similar thinning is achieved regardless of the time of day applications are made.

Weather After Application. Temperature and sunlight levels for the 5-day period after application of thinners are the predominant weather factors affecting chemical thinning response. The interaction of temperature and sunlight affect the production and demand for carbohydrates within the tree. Warmer temperatures increase carbohydrate production (photosynthesis) up to about 85F but higher temperatures reduce photosynthesis.

The demand for carbohydrate to support fruit growth and shoot growth increases linearly with increasing temperature. Increasing sunlight level increases photosynthesis. The combined effects of sunlight and temperature on chemical thinning are complex but a simplification is presented in Fig. 11.6.1. A more sophisticated estimate of the effects of light intensity and temperature on thinning is given by the Cornell Carbohdyrate thinning model available on the web at www.newa.cornell.edu.

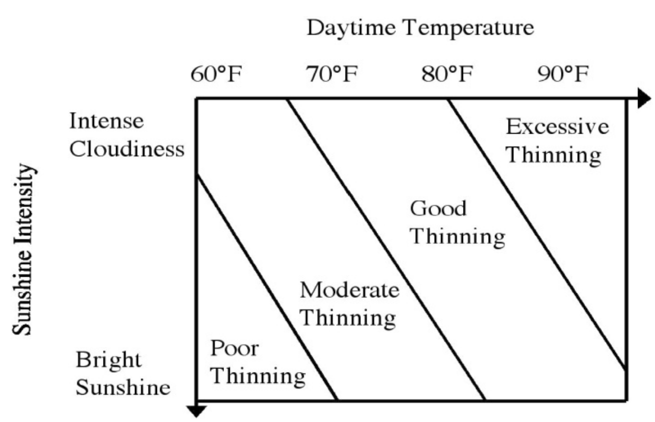


Figure 11.6.1. The interaction of temperature and sunlight intensity on thinner action.

12 Pears

12.1 Insecticides and Fungicides for Pears

See Sections 12.2 and 12.3 for comments related to this table.

Table 12.1.1 Pesticide Spray Table – Pears.

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

Pest	IRAC & FRAC	Product	Rates	PHI (days)	REI (hrs)	Efficacy	Comments (see text)
Dormant							
Crown rot	P07	Prophyt	2-4 pts/acre	0	4	High	[7.3a]
Fire Blight		oil	1.0 qt/100 gal water				[2.3]
	M 01	§Bordeaux mixture, 8-10-10	8.0 lb/100 gal water				[2.3]
	M01 + M01	C-O-C-S WDG	12.0-15.6 lb/acre	BL	24		
Pear psylla		oil	3 gal/100 gal water			High	[12.1,12.4]
	28	*†Exirel	13.5-20.5 fl oz/acre	3	12	High	[1.1,1.0a,1.2, 12.2,12.5]
Pearleaf blister mite	1B	*Diazinon 50W	1 lb/100 gal water	21	96	High	[14.1]
	1B	oil	1-1.5 gal/100 gal water				
Phytophthora rots	P07	Prophyt	2-4 pts/acre	0	4	High	[7.3a]
San Jose scale	4A	*Assail 30SG	8 oz/acre	7	12	Moderate	[20.1,20.1a,20.2]
	16	*†Centaur 0.7WDG	34.5-46 oz/acre	14	12	High	[20.1,20.2]
Sooty Blotch & Flyspeck	11 + 7	*†Merivon	4-5.5 fl oz/acre	0	12		
White "Peach" (Prunicola) Scale		oil	2 gal/100 gal water			High	[21.1]
Swollen Bud							
Crown rot	P07	Prophyt	2-4 pts/acre	0	4	High	[7.3a]
Pear midge	3A	§PyGanic 1.4EC	16 fl oz/acre	0	12	Moderate	[11.1]
	UN	Aza-Direct	11.5-42 fl oz/acre	0	4	Moderate	[11.1]
Pear psylla		DES-X	2 gal/100 gal water	0	12	Moderate	[12.3]
		M-Pede	2 gal/100 gal water	0	12	Moderate	[12.3]
		oil	3 gal/100 gal water			High	[12.1,12.4]
		§Surround 95WP	50 lb/acre	UDH	4	Moderate	[12.6]
	3A	*Asana XL	9.6-19.2 fl oz/acre 7.3-12.8 fl oz/100 gal water	28	12	Moderate	[12.2,12.2a,12.5]
	3A	*Danitol 2.4EC	16 fl oz/acre	14	24	Moderate	[12.2,12.2a,12.5]
	3A	*Mustang MAXX	1.28-4.0 fl oz/acre	14	12	Moderate	[1.1,6.1b,9.1a, 12.2,12.5]
	3A	*Pounce 25 WP	12.8-25.6 oz/acre	PB	12	Moderate	[12.2,12.2a]
	3A	*Warrior II	1.28-2.56 fl oz/acre	21	24		[12.2,12.2a,12.5]

13 Cherries

13.1 Insecticides and Fungicides for Cherries

See Sections 13.2, 13.3, and 13.4 for comments related to this table.

Table 13.1.1 Pesticide Spray Table – Cherries.

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

Pest	IRAC & FRAC	Product	Rates	PHI (days)	REI (hrs)	Efficacy	Comments (see text)
Late Dormant							
Bacterial Canker	M01	Cueva Fungicide Concentrate	0.5 - 2.0 gal/acre	UDH	4	Moderate	[1.1,1.2]
	M01	Cuprofix Ultra 40 Disperss	5.0-8.0 lb/acre	BL, PH	48		[1.2]
	M01	Kocide 3000-O	3.5-7.0 lb/acre 1.11-2.3 lb/100 gal water	HIG	48		[1.1]
	M01	Previsto	0.1 - 10 qt/acre	See label	48		[1.1]
	M01 + M01	Badge SC	3.5 - 14 pts/acre	0	48	High	[1.1,1.2]
	M01 + M01	Badge X2	3.5 - 7 lb/acre	0	48		[1.1,1.2]
European Fruit Lecanium	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[16.1,16.1a]
	16	*†Centaur 0.7WDG	34.5 oz/acre	14	12	High	[16.1]
European Red Mite		oil	2 gal/100 gal water			High	[11.1]
Phytophthora rots	4	Ridomil Gold SL	2.0 qt/acre	0	48		[5.2]
	P07	Prophyt	2 pt/acre	0	4	High	[7.3b]
Powdery Mildew	3	*Procure 480SC	8.0-16.0 oz/acre	1	12		
	50	Vivando	15.2 fl oz/acre	7	12		
	3 + 9	Inspire Super	16-20 fl oz/acre	2	12		[4.4,6.1]
San Jose scale		oil	2 gal/100 gal water			High	[16.1]
	4A	*Assail 30SG	5.3-8 oz/acre	7	12	Moderate	[16.1,16.1a,16.2, 16.2a]
	4D	*†Sivanto Prime	10.5-14.0 fl oz/acre	14	4	High	[16.1a,16.2]
	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[16.1,16.1a,16.2]
	16	*†Centaur 0.7WDG	34.5 oz/acre	14	12	High	[16.1,16.2]
White "Peach" (Prunicola) Scale		oil	2 gal/acre			High	[20.1]
	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[20.1a]
White Bud							
Black cherry aphid		Grandevo WDG	2.0-3.0 lb/acre	0	4	Moderate	[9.1,9.2]
		M-Pede	2 gal/100 gal water	0	12	Moderate	[9.1,9.2]
	1B	Malathion 57 EC	1.5 pt/acre	3	12	Moderate	[9.1,9.2]
	3A	*Asana XL	4.8-14.5 fl oz/acre 2-5.8 fl oz/100 gal water	14	12	High	[9.1,9.2]
	3A	*Baythroid XL	2.4-2.8 fl oz/acre	7	12	High	[9.1,9.2]

Table 13.1.1 Pesticide Spray Table – Cherries.
(Refer to back of book for key to abbreviations and footnotes.)

Pest	IRAC & FRAC	Product	Rates	PHI (days)	REI (hrs)	Efficacy	Comments (see text)
***Autumn** (continued)*							
Bacterial Canker *(continued)*	M01	Kocide 3000-O	3.5-7.0 lb/acre 1.11-2.3 lb/100 gal water	HIG	48		[1.1]
Brown Rot	7	Kenja 400SC	12.5 fl oz/acre	1	12	High	
Powdery Mildew	3 + 9	Inspire Super	16-20 fl oz/acre	2	12		[4.4,6.1]
White "Peach" (Prunicola) Scale		oil	2 gal/acre			High	[20.1]

13.2 Cherry Disease Notes

13.2.1 Bacterial Canker (*Pseudomonas syringae*)

• Pesticide Application Notes

[1.1] The pathogen causing bacterial canker is favored by cool, wet weather (spring and fall). It can invade leaf scars in fall and fresh pruning wounds in spring if pruning is done under cool, wet conditions. When pruning, make sure to leave a 6-inch stub, especially when removing scaffold branches as the bacteria appear to be arrested within the stub. Avoid flush cut pruning.

[1.2] We recommend copper applications at 20% and 80% leaf drop in the fall, and one application in the spring late dormant. Position the two applications around any fall pruning. If you are treating sweet cherries, just make one application at 50% leaf drop. Try to time these applications to a warm, dry period. An additional application is also labeled for use after harvest in orchards where disease is severe, although this application should be avoided on sweet cherries in New York due to the potential for leaf injury. Several other commercial copper formulations in addition to those listed may be labeled for this use on cherries. Although they have not been tested, research on other crops suggests that most copper formulations should give comparable rates of control at comparable rates of metallic copper.

13.2.2 Black Knot

• Pesticide Application Notes

[2.1] Black knot has become an increasingly important problem on sour cherries in recent years. It is a difficult disease to control completely, but good sanitation—removing and destroying infected (knotted) limbs as they appear (make pruning cuts at least 6-8 in below visible swellings), destroying infected fence row trees and adjacent abandoned orchards (when possible)—is critical. Fungicide sprays are unlikely to provide satisfactory control without good sanitation practices. The most critical time for protecting against infection with fungicides is between white bud and shuck split. Black knot infection periods require rain and temperatures above 55°F; thus, fungicide sprays are most likely to be beneficial under these conditions. 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 disease.

[2.2] Bravo is the most effective fungicide for black knot control. Note that a minimum 10-day re-treatment interval is specified on the label.

13.2.3 Brown Rot (Blossom & Shoot Blight)

• Biology & Cultural

[3.1] Blossom blight is most likely to occur when the weather is warm (above 60°F) and wet during bloom or when large numbers of fruit were not harvested the previous year. Blossom blight may also be serious at lower temperatures if prolonged wetting periods occur. Blossom sprays on tart cherries may often be reduced or eliminated if none of these conditions occur. Blossom blight is much more serious on sweet cherry than on sour cherry.

[3.2] Sweet (but not sour) cherry fruit are very susceptible to brown rot for the first few weeks after they set. Protection is therefore important at this time, particularly in wet weather. Thiophanate-methyl (Topsin M) is no longer recommended for use on cherries because of widespread brown rot resistance.

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 disease.

• Pesticide Application Notes

[3.1] Blossom blight is most likely to occur when the weather is warm (above 60°F) and wet during bloom or when large numbers of fruit were not harvested the previous year. Blossom blight may also be serious at lower temperatures if prolonged wetting periods occur. Blossom sprays on tart cherries may often be reduced or eliminated if none of these conditions occur. Blossom blight is much more serious on sweet cherry than on sour cherry.

[3.2] Sweet (but not sour) cherry fruit are very susceptible to brown rot for the first few weeks after they

14 Peaches and Nectarines

14.1 Insecticides and Fungicides for Peaches and Nectarines

Table 14.1.1 Pesticide Spray Table – Peaches and Nectarines.

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

Pest	IRAC & FRAC	Product	Rates	PHI (days)	REI (hrs)	Efficacy	Comments (see text)
Dormant							
Bacterial Canker	M01	Kocide 3000-O	3.5-7.0 lb/acre 1.11-2.3 lb/100 gal water	HIG	48		
	M01	Previsto	0.1 - 10 qt/acre	See label	48		
Bacterial Spot	M01	Cueva Fungicide Concentrate	1.0 - 2.0 gal/acre	UDH	4		
	M01	Cuprofix Ultra 40 Disperss	1.0-2.5 lb/acre	SS	48		
	M01	Previsto	0.1 - 10 qt/acre	See label	48		
	M01 + M01	C-O-C-S WDG	12.0-15.6 lb/acre	BL, PF	48		
European Fruit Lecanium		oil	2-3 gal/100 gal water			High	[11.1]
	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[11.2]
European Red Mite		oil	2-3 gal/100 gal water			High	
Leaf Spot	M01	Previsto	0.1-10 qt/acre	See label	48		
Peach Leaf Curl		Echo 720	3.125-4.125 pt/acre	SS	12		
		Echo 90DF	2.25-3.5 lb/acre	SS	12		
		Ferbam Granuflo	4.5 lb/acre 1.5 lb/100 gal water	21	24		
	M03	Ziram 76DF	1.5 lb/100 gal water	14	48		
	M01 + M01	Badge SC	3.5 - 14 pts/acre	0	48	High	[3.1]
	M01 + M01	Badge X2	3.5 - 7 lb/acre	0	48	High	
	M01 + M01	C-O-C-S WDG	12.0-15.6 lb/acre	BL, PF	48		
Peach Scab	7 + 3	*†Luna Experience	8.0 to 10 fl oz/acre	0	12	High	
Phytophthora rots	4	Ridomil Gold SL	2.0 qt/acre	0	48		[6.2]
	P07	Prophyt	2 pt/acre	0	4		[7.3c]
San Jose scale	4A	*Assail 30SG	5.3-8 oz/acre	7	12	Moderate	[11.2]
	4D	*†Sivanto Prime	10.5-14.0 fl oz/acre	14	4	High	[11.1a,11.2]
	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[11.2]
	16	*†Centaur 0.7WDG	34.5 oz/acre	14	12	High	[11.2]
White "Peach" (Prunicola) Scale		oil	2 gal/100 gal water			High	[24.1]
	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[24.1a]

14.3.16 Western Flower Thrips

• Biology & Cultural

Drought conditions and high temperatures may encourage damaging populations in nectarines, particularly in the Hudson Valley region. Adults move from alternate weed or crop hosts to fruit just prior to and during harvest, feed on the fruit surface in protected sites, such as in the stem end, the suture, under leaves and branches, and between fruit. Feeding results in silver stipling or patches; injury is particularly obvious on highly colored varieties.

• Pesticide Application Notes

[1.0] For best effectiveness and insecticide resistance management, the use of pre-mixes should be reserved for those situations when the pest complex to be treated is appropriately matched to the combination of active ingredients and modes of action contained in the product.

[13.1a] Do not exceed 0.172 lb a.i./A of thiamethoxam-containing products per acre per growing season.

[15.1b] *†Altacor/chlorantraniliprole not registered for use in Nassau or Suffolk Counties.

[16.4] Not registered for use in Nassau or Suffolk Counties.

[22.1] In orchards with severe infestations, a petal fall application may be warranted against thrips feeding in fruit clusters.

[22.2] An application after the first harvest may prevent subsequent losses; however, an additional application may be needed if pressure is severe.

14.3.17 White "Peach" (Prunicola) Scale

• Biology & Cultural

Infestations are characterized by numerous white scales that cluster on the trunk and scaffolds, giving them a whitewashed appearance. Feeding reduces tree vigor, and foliage of affected trees may become sparse and yellow; heavy infestations can cause death of twigs, branches and entire trees if left unattended. This species overwinters as an adult female and deposits eggs in the spring.

• Pesticide Application Notes

[1.0] For best effectiveness and insecticide resistance management, the use of pre-mixes should be reserved for those situations when the pest complex to be treated is appropriately matched to the combination of active ingredients and modes of action contained in the product.

[24.1] Horticultural oil is recommended as a delayed dormant spray in April.

[24.1a] Apply Esteem at delayed dormant or against crawlers in mid-June through early July (about 700–1150 DD base 50°F from March 1).

[24.1b] Apply *†Centaur against crawlers in mid-June through early July (about 700–1150 DD base 50°F from March 1); maximum of 2 applications per season.

[24.1c] Apply Senstar against crawlers in mid-June through early July (about 700-1150 DD base 50F from March 1).

14.4 Storage Rots

• Pesticide Application Notes

[23.1] A postharvest treatment with Scholar SC via dipping, flooders, T-jet, or similar system for control of storage rots is recommended for fruit coming from orchards where sporulating brown rot was observed, or when one hopes keep fruit in cold storage for a few days prior to sale. Holding tanks in postharvest treatment equipment must have excellent agitation to keep fungicides in suspension. Solutions must be replenished regularly as directed on the product label. Never expose treated fruit to direct sunlight. This will cause the fungicide to break down.

14.5 Growth Regulation of Peaches and Nectarines

Table 14.5.1. Growth Regulator Uses in Peaches and Nectarines.

Refer to back of book for key to abbreviations and footnotes.
Refer to label for registration status before applying any pesticide to nectarines.

Timing	Product	Concentration	Rate of Formulated Product	Comments
Chemical Thinning				
30-90% Bloom	ATS (foliar nutrient)		4-6 gal/100 gal	Apply 100 gal/acre.
Apply 2 sprays for best results. The first spray at 30% bloom and the second spray at 90% bloom				
Pink to full bloom	Aminocyclopropane carboxylic acid (ACC)		34.5-69 fl oz/acre	Apply 100 gal/acre.
1-2 applications are needed. Make the first application from pink bud to full bloom. Make a second application if needed 7-10 days later. Do not exceed a total of 69 fl per acre in a single application Do not apply after petal fall.				
Preharvest Fruit Drop Control				
1**-2 weeks before anticipated harvest**	ReTain	132 ppm	333 g/acre (1 pouch)	See comments below.
Apply in sufficient water to ensure thorough but not excessive coverage. An organosilicone surfactant (12 oz/100 gal) should be used with ReTain.				

15 Apricots

15.1 Insecticides and Fungicides for Apricots

See sections 15.2, 15.3, and 15.4 for comments related to this table.

Table 15.1.1 Pesticide Spray Table – Apricots.

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

Pest	IRAC & FRAC	Product	Rates	PHI (days)	REI (hrs)	Efficacy	Comments (see text)
Late Dormant							
Bacterial Canker	M01	Cuprofix Ultra 40 Disperss	5.0-8.0 lb/acre	BL	48		[1.1]
	M01	Kocide 3000-O	3.5-7.0 lb/acre 1.11-2.3 lb/100 gal water	HIG	48		[1.1]
Bacterial Spot	M01	Cueva Fungicide Concentrate	1.0 - 2.0 gal/acre	UDH	4		
European Fruit Lecanium		oil	2 gal/100 gal water			High	[11.1]
	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[11.1,11.2]
	16	*†Centaur 0.7WDG	34.5 oz/acre	14	12	High	[11.1,11.2]
European Red Mite		oil	2 gal/100 gal water			High	[6.1]
Phytophthora rots	4	Ridomil Gold SL	2.0 qt/acre	0	48		[5.1]
	P07	Prophyt	2 pts/acre	0	4	High	[7.3d]
San Jose scale	4A	*Assail 30SG	5.3-8 oz/acre	7	12	Moderate	[11.1,11.2]
	4D	*†Sivanto Prime	10.5-14.0 fl oz/acre	14	4	High	[11.1,11.1a,11.2]
	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[11.1,11.2]
	16	*†Centaur 0.7WDG	34.5 oz/acre	14	12	High	[11.1,11.2]
White "Peach" (Prunicola) Scale		oil	2 gal/100 gal water			High	[17.1]
	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[17.1a]
Popcorn							
Blossom Blight	3	*Cevya	3.0-5.0 fl oz/acre	0	12	High	
	7	Kenja 400SC	12.5 fl oz/acre	1	12	High	
	7	*†Tesaris	3.5 to 5.6 fl oz/acre	0	12	High	
Brown Rot		Echo 720	3.125-4.125 pts/acre	SS	12		[2.4]
		Echo 90DF	2.25-3.5 lb/acre	SS	12		
		*†Fontelis	14.0-20.0 fl oz/acre	0	12		
	2	Rovral Brand 4 Flowable	1-2 pts/acre	PF	24		
	3	Indar 2F	6.0 fl oz/acre	UDH	12		
	3	Quash	2.5-3.5 oz/acre	14	12		
	3	Rally 40WSP	2.5-6.0 oz/acre 1.25-2.0 oz/100 gal water	UDH	24		
	3	Tilt	4.0 fl oz/acre	0	24		
	7	Kenja 400SC	12.5 fl oz/acre	1	12	High	
	9	Vangard WG	5.0 oz/acre	2	12		
	11	Flint Extra	3.8 fl oz/acre	1	12	Moderate	

16 Plums and Prunes

16.1 Plum and Prune Spray Table

Table 16.1.1 Pesticide Spray Table – Plums and Prunes.

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

Pest	IRAC & FRAC	Product	Rates	PHI (days)	REI (hrs)	Efficacy	Comments (see text)
Bud Burst							
Black Knot	1	Topsin 4.5 FL	20-30 fl oz/acre	1	48		[1.4]
Blossom Blight	3	*Cevya	3.0-5.0 fl oz/acre	0	12	High	
	7	Kenja 400SC	12.5 fl oz/acre	1	12	High	
	7	*†Tesaris	3.5 to 5.6 fl oz/acre	0	12	High	
Brown Rot	7	Kenja 400SC	12.5 fl oz/acre	1	12	High	
	11 + 7	*†Merivon	4-6.7 fl oz/acre	0	12	High	[3.9d]
European Fruit Lecanium		oil	2 gal/100 gal water			High	[14.1]
European Red Mite		oil	2 gal/100 gal water			High	[8.1]
Phytophthora rots	P07	Prophyt	2 pts/acre	0	4	High	[7.3e]
San Jose scale		oil	2 gal/100 gal water			High	[14.1]
	4A	*Assail 30SG	5.3-8 oz/acre	7	12	Moderate	[14.1,14.2]
	4D	*†Sivanto Prime	10.5-14.0 fl oz/acre	14	4	High	[14.1,14.1a,14.2]
	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[14.1,14.2]
	16	*†Centaur 0.7WDG	34.5 oz/acre	14	12	High	[14.1,14.2]
White "Peach" (Prunicola) Scale		oil	2 gal/100 gal water			High	[18.1]
	7C	Esteem 35WP	4-5 oz/acre	14	12	High	[18.1a]
White Bud to Petal Fall							
Black Knot	1	Topsin 4.5 FL	20-30 fl oz/acre	1	48		[1.4]
	1	Topsin M WSB	1.0-1.5 lb/acre 0.3-0.5 lb/100 gal water	1	48		[1.4]
Blossom Blight	3	*Cevya	3.0-5.0 fl oz/acre	0	12	High	
	7	Kenja 400SC	12.5 fl oz/acre	1	12	High	
	7	*†Tesaris	3.5 to 5.6 fl oz/acre	0	12	High	
Brown Rot		Echo 720	3.125-4.125 pts/acre 1.0-1.4 pt/100 gal water	SS	12		
		Echo 90DF	2.25-3.5 lb/acre	SS	12		
		*†Fontelis	14.0-20.0 fl oz/acre	0	12		[2.6]
	3	*Cevya	3.0-5.0 fl oz/acre	0	12	High	
	3	Indar 2F	6.0 fl oz/acre	UDH	12		
	3	Quash	2.5-3.5 oz/acre	14	12		

17 Appendices

17.1 Pesticide Data

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*
Insecticides and Acaricides						
abamectin/avermectin						
*Agri-Mek 8SC	28	21	21	21	28	21
*Abba 0.15EC	28	21	21	21	28	21
*†Agri-Flex SC	35	—	—	—	35	—
*Gladiator EC	28	21	21	21	28	21
acequinocyl						
Kanemite 15SC	14	—	—	—	14	—
acetamiprid						
Assail 30SG	7	7	7	7	7	7
afidopyropen						
*†Versys Inscalis 0.83DC	7	7	7	7	7	7
azadirachtin						
Neemix 4.5L, Aza-Direct 1.2L, §Azatin XL 0.27EC	0	0	0	0	0	0
bifenazate						
Acramite 50WS	7	3	3	3	7	3
Banter SC, WDG	7	3	3	3	7	3
bifenthrin						
*Brigade 10WS, 2 EC *Fanfare 2EC	—	—	—	—	14	—
Bt (*Bacillus thuringiensis*)						
Deliver 18WG	0	0	0	0	0	0
§Dipel 10.3 DF	0	0	0	0	0	0
§Biobit 2.IFC	0	0	0	0	0	0
Javelin 7.5WDG	0	0	0	0	0	0
§Agree 3.8 WS	UDH	—	UDH	UDH	UDH	UDH
buprofezin						
*†Centaur 0.7WDG	14	14	14	14	14	14
Burkholderia spp. strain A396						
Venerate XC	0	0	0	0	0	0
carbaryl						
Sevin 4EC	3	3	3	3	3	3
chlorantraniliprole						
*†Altacor 35WDG	5	10	10	10	5	10
*†Voliam Flexi WDG	35	14	14	14	35	14
*†Besiege CS-SC	21	14	14	14	21	14
Chromobacterium subtsugae						
Grandevo WDG	0	0	0	0	0	0
clofentezine						
Apollo 4SC	45	21	21	21	21	—
cyantraniliprole/cyazypyr						
*†Exirel	3	3	3	3	3	3
cyantraniliprole/abamectin						
*†Minecto Pro	28	21	21	21	28	21
cyclaniliprole						
*†Verdepryn 100SL	7	7	7	7	7	7
*†Cyclaniliprole 50SL	7	7	7	7	7	7
cyflumetofen						
Nealta	7	7	7	7	7	7
cyfluthrin						
*Baythroid XL 1E, 2EC, *Leverage 360	7	7	7	7	7	7

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
Accede	aminocyclopropanecarboxylic acid (ACC)	10% LC	73049-517	Apple Peach	-
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
Kudos	prohexadione calcium	27.5% WDG	62097-41-82917	Apple, pear cherry	45 days
Maxcel	cytokinin BA	1.9%	73049-407	Apple, pear	86 days
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	7 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	—
ProVide 10SG	gibberellin 4+7	10% SG	73049-409	Apple	—

17.3.1 Suggested Mixing Sequence

Always mix different spray materials in the following order, starting with:

- water soluble bags (WS)
- water dispersible granules and dry flowables (WDG, DF)
- wettable powders (WP)
- liquid flowables (L, F, FC)
- sprayable concentrates (S, SC, LC)
- emulsifiable concentrates (EC)
- surfactants, oils, and adjuvants Do not add oils, surfactants, or emulsifiable concentrates prior to dry formulations, or lumping may occur.

17.4. Tree Fruit Reference Materials.

See the Cornell Fruit Resources homepage at: **fruit.cornell.edu**

Most of the publications listed are available online. Copies of some can be obtained from your county Cornell Cooperative Extension Office.

17.4.1 Tree Fruit IPM Fact Sheets

Online at eCommons: https://ecommons.cornell.edu/handle/1813/41246
Type "Fruits IPM Fact Sheet" into the search box, and then click "Tree Fruit" in the left-hand navigation page under "Subject"; the list can be shown in alphabetical order by clicking the "gear" icon under "Show Advanced Filters" and selecting "Title Ascending".
A series of fact sheets developed for insect and disease pests of tree fruit crops. These outline the biology, monitoring, and management of various pests and include color photographs to aid in identification.

Disease IPM Fact Sheets

102GFSTF-D3	Fire Blight. 2020.
102GFSTF-D4	Apple Powdery Mildew. 2020.
102GFSTF-D5	Cedar Apple Rust. 2020.
102GFSTF-D6	Black Knot of Plum. 1992.
102GFSTF-D7	Phytophthora Root and Crown Rots. 1992.
102GFSTF-D8	Cherry Leaf Spot. 1993.
102GFSTF-D9	Apple Scab. 2020.
102GFSTF-D10	Brown Rot of Stone and Pome Fruit. 2019.
102GFSTF-D11	Sooty Blotch and Flyspeck. 1994.
102GFSTF-D12	Perennial Canker. 1995.
	Plum Pox Disease of Stone Fruits. 2008.

Insect IPM Fact Sheets

102GFSTF-I1	Pear Psylla. 1978.
102GFSTF-I2	Codling Moth. 1996.
102GFSTF-I3	Plum Curculio. 1980.
102GFSTF-I4	Green Fruitworm. 1980.
102GFSTF-I5	Obliquebanded Leafroller. 1980.
102GFSTF-I6	Peachtree Borer. 1980.
102GFSTF-I8	Apple Maggot. 1991.
102GFSTF-I9	Spotted Tentiform Leafminer. 1980.
102GFSTF-I10	European Red Mite. 1980.
102GFSTF-I11	Rosy Apple Aphid. 1980.
102GFSTF-I12	San Jose Scale. 1980.
102GFSTF-I13	White Apple Leafhopper. 1980.
102GFSTF-I14	Dogwood Borer. 1985.
102GFSTF-I16	Woolly Apple Aphid. 1988.
102GFSTF-I17	Oriental Fruit Moth. 1988.
102GFSTF-I18	Beneficial Insects. 1989.
102GFSTF-I19	Redbanded Leafroller. 1989.

17.6 County and Regional Extension Tree Fruit Specialists In New York

LAKE ONTARIO FRUIT TEAM (Monroe, Niagara, Orleans, Oswego & Wayne Counties)	
Mario Miranda Sazo	1581 Route 88 North, Newark, NY 14513 (315) 331-8415 mrm67@cornell.edu
Janet van Zoeren	12690 Route 31, Albion, NY 14411 office: (585) 798-4265, ext. 136 cell: (585) 797-8368 jev67@cornell.edu
Craig Kahlke	4487 Lake Ave., Lockport, NY 14904 (716) 433-8839 cjk37@cornell.edu
EASTERN NEW YORK COMMERCIAL HORTICULTURE PROGRAM (Albany, Clinton, Columbia, Dutchess, Essex, Fulton, Greene, Orange, Montgomery, Putnam, Rensselaer, Saratoga, Schenectady, Schoharie, Ulster, Warren, & Washington Counties)	
Mike Basedow	6064 State Rt 22, Plattsburgh, NY 12901 (518) 410-6823 mrb254@cornell.edu
Laura McDermott	415 Lower Main Street, Hudson Falls, NY 12839 (518) 746-2562 lgm4@cornell.edu
Dan Donahue	3357 Route 9W, P.O. Box 727, Highland, NY 12528 cell: (518) 322-7812 djd13@cornell.edu
SUFFOLK COUNTY	
	423 Griffing Ave., Suite 100, Riverhead, NY 11901 (631) 727-7850

17.7 Campus-Based Extension Faculty and Staff

Faculty/Staff Member	Area of Specialization	Phone/Email
Bryan Brown NYS IPM Program Cornell AgriTech, Geneva	**Integrated weed management**	315-787-2432 bryan.brown@cornell.edu
Susan K. Brown School of Integrative Plant Science, Horticulture Section Cornell AgriTech, Geneva	**Apple breeding and varieties**	315-787-2224 skb3@cornell.edu
Lailiang Cheng School of Integrative Plant Science, Horticulture Section Cornell University, Ithaca	**Tree fruit nutrition**	607-255-1779 lc89@cornell.edu
Donna Clements Produce Safety Alliance Cornell AgriTech, Geneva	**Food Safety, GAPS, FSMA**	909-552-4355 dmp274@cornell.edu