2022
New York and Pennsylvania Pest Management Guidelines for Grapes

Cornell Cooperative Extension

PennState Extension

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

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Abbreviations and Symbols Used in This Publication

A .....acre	EC .....emulsifiable concentrate	SP.....soluble powder
AI.....active ingredient	F.....flowable	ULV.....ultra-low volume
D .....dust	G .....granular	W .....wettable
DF.....dry flowable	L.....liquid	WDG ....water-dispersible granule
DG .....dispersible granule	P.....pellets	WP.....wettable powder
E.....emulsion, emulsifiable	SC .....suspension concentrate	WSP.....water soluble packet

* ..... Federal restricted-use pesticide; may be purchased and used only by certified applicators
*[NY] .... Restricted-use pesticide in New York State
† ..... Not for use in Nassau and Suffolk Counties
^ ..... Not registered for use in New York State at press time.

Every effort has been made to provide correct, complete, and up-to-date pest management information for New York State and Pennsylvania at the time this publication was released for printing (February 2022). Changes in pesticide registrations, regulations, and guidelines occurring after publication are available in county cooperative extension offices or from the Cornell Cooperative Extension Pesticide Safety Education Program (CCE-PSEP) (psep.cce.cornell.edu) or from the Pennsylvania Department of Agriculture's Bureau of Plant Industry (www.agriculture.state.pa.us).

Where trade names appear, no discrimination is intended, and no endorsement by Cornell Cooperative Extension or Penn State Cooperative Extension is 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 efforts 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: Waterspout on Lake Erie (*Photo by:* Heather Chess, Grape Grower, Chautauqua County, NY.)

1 Pesticide Information

1.1 Pesticide Classification and Certification

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

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

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

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

1.2 Use Pesticides Safely

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

1.2.1 Plan Ahead

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

1.2.2 Move Pesticides Safely

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

1.2.3 Personal Protective Equipment and Engineering Controls

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

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

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

1.2.4 Avoid Drift, Runoff, and Spills

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

2 Introduction

2.1 Overview

How do you decide which pest management strategy is right for you? The variety of choices can be daunting: integrated pest management, sustainable, integrated crop management, organic, best management practices, biodynamics, or traditional, just to name a few. However, what it boils down to is that it doesn't really matter what you call your pest management strategy. Consider which practices work best for you in a particular vineyard. Take the best tools from each of the different programs to provide you with the management strategy that fits your needs and pocketbook.

The one component that every successful pest management strategy shares is information. By gathering and compiling the right information, you will be able to make the best choices in putting together your vineyard pest management strategy.

2.2 Specific Fungicide, Insecticide, and Herbicide Information

The following materials have been registered for the control of certain insects, diseases, and weeds affecting grapes. The trade name and (common) name are given, as well as selected uses for each material. The signal word associated with each pesticide indicates its relative level of toxicity. High toxicity indicates that small quantities of the chemical may cause serious illness or death.

2.2.1 Pesticide Toxicity

The toxicity of a chemical typically is measured with a Lethal Dose 50 (LD50) value. This value is the dosage necessary to kill 50 percent of a laboratory population of test animals (rats, mice, or rabbits). These toxicity values may be expressed in terms of a single dosage in milligrams per kilogram of body weight. LD50 values are useful in comparing different pesticides, as the degree of hazard to a person handling a pesticide is directly related to toxicity.

The following classification was established to aid users of pesticide chemicals:

High toxicity: Acute oral LD50 from a trace to 50 mg/kg. From 4 to 100 drops (1 teaspoon) of technical pesticide may be lethal to a 150-pound person. Label must carry signal word DANGER. A skull and crossbones on the label indicates poison.

Moderate toxicity: Acute oral LD50 from 50 to 500 mg/kg. From 1 teaspoon to 1 ounce of technical pesticide may be lethal to a 150-pound person. Label must carry signal word WARNING.

Low toxicity: Acute oral LD50 greater than 500 mg/kg. From 1 ounce to 1 pint of technical pesticide may be lethal to a 150-pound person. Label must carry signal word CAUTION.

2.2.2 Pesticide Compatibility

Some pesticides are unstable or incompatible under alkaline conditions. Well or pond water used to fill sprayers can be alkaline, and pH should be tested and adjusted if over 7.0. Do not apply tank-mix combinations unless your previous experience indicates the mixture is effective and will not result in application problems or plant injury. If tank-mix compatibilities are unknown, the mixture should be combined in the proper proportions using a jar test. CAUTION: Fixed copper formulations and lime should not be used with Captan, Imidan, or Sevin.

2.2.3 Adjuvants with Fungicides and Insecticides

The addition of adjuvants (spreader-stickers, penetrants, etc.) to spray mixtures of fungicides and insecticides is not recommended unless suggested on the pesticide label or supported by reliable data. Many fungicide and insecticide formulations already include an adjuvant; thus, addition of another adjuvant is often counterproductive or a waste of money.

2.2.4 Restricted-Use Pesticides

Restricted-use pesticides mentioned in this publication are identified by an asterisk (*). They may be purchased and used only by certified applicators or used by someone under the direct supervision of a certified applicator.

2.2.5 Pesticide Resistance Management

The ability of various fungicides, insecticides, and herbicides to control specific grape pests has been reduced (and, in some cases, eliminated) because pests developed resistance to these materials. Resistance occurs when some individual pests survive treatment with the pesticide. They multiply and pass this resistance on to their young. Because individuals that are controlled by the chemical die, or reproduce poorly, over time the population becomes dominated by individuals that are resistant to it. This process is favored by a number of factors, the most common of which are:

1. Multiple applications of a single product or class of compounds (strobilurin fungicides, organophosphate insecticides, etc.);
2. An exclusive reliance on a single product (or class) to manage the pest;

3 Vineyard Disease Management

3.1 Pest Information – Diseases

Several important insects and diseases that occur in New York and Pennsylvania vineyards are described below to help growers manage these pests with practices and pesticides appropriate for their production systems.

ANGULAR LEAF SCORCH was first described in 1985. Symptoms of this fungal disease are similar to those of rotbrenner, a disease of grapevines found in the cool grape-growing regions of Europe, which is caused by a very closely related fungus. Angular leaf scorch occurs sporadically and is most likely to become a problem in years when high rainfall occurs between bud break and early summer, especially if this should happen in consecutive years. Riesling appears to be a particularly susceptible cultivar.

Disease symptoms occur mainly on the leaves and first appear as faint chlorotic spots. As these lesions grow larger, they change from yellow to reddish-brown and the margin often becomes sharply defined (depending on the cultivar, the margin may be yellow, red, or absent). Lesions are confined by major veins, becoming "angular" or wedge-shaped. They eventually kill the infected tissue, sometimes crossing the major veins in the process and often causing diseased leaves to fall prematurely.

The fungus survives winter in infected leaves on the vineyard floor. Mature spores are ready for discharge in spring when grape buds begin to grow. During rainfall, spores are released into the air from fruiting structures, and susceptible tissue is infected.

Cultural practices that increase air circulation through the canopy can shorten periods of leaf wetness that favor disease development. Destruction of leaf litter by cultivation, before bud break, can also reduce disease pressure. Where needed, effective fungicides applied from the 3-inch stage and continuing through fruit set will provide significant control. Although there are no specific labels for the control of this disease, mancozeb products (e.g., Dithane, Penncozeb) applied according to label directions to control Phomopsis, black rot, and downy mildew also have provided good control of angular leaf scorch in commercial experience. In Europe, the strobilurin fungicides (Abound, Flint, Pristine, *[NY]Sovran) have provided good control of the closely related disease, rotbrenner. However, experience with angular leaf scorch is lacking. The DMI fungicide, difenoconazole (Revus Top, Quadris Top; CAUTION: Quadris Top causes injury to Concord and some other cultivars) is labeled for control of rotbrenner and should provide significant post-infection control of this disease in addition to moderate protective activity (excellent protective activity for Quadris Top). See Table 3.1.1 for varietal susceptibility to this disease.

ANTHRACNOSE is a disease that occurs most commonly in years that are wet during the first half of the growing season, with damage typically limited to a few highly susceptible cultivars. In NY/PA, most outbreaks historically occurred on Vidal Blanc and a few seedless table grape varieties, especially Reliance. In recent years, however, there have been regular outbreaks on some of the newer cold-hardy cultivars that are gaining in popularity and expanding the geographical range of grape production. Marquette appears to be particularly susceptible, although Frontenac and La Crescent also have been affected. Some older cold-hardy cultivars (Edelweiss, Esprit, Brianna, St. Pepin, and Swenson White) also can be problematic. In some Midwestern states, Concord, Catawba, and Leon Millot have been reported as encountering problems, although such occurrences are rare in NY and PA. Symptoms occur on leaves, green shoots, and clusters. On leaves, numerous small, circular brown spots appear which later turn gray in the center and develop dark brown to black margins. In severe attacks, lesions may coalesce and cause large dead zones, distortion of the leaf blade, and eventually death of the entire leaf. Infected shoots develop dark, noticeably sunken lesions, typically on the first several internodes near the base of the new shoot. These lesions resemble the internode lesions typical of Phomopsis cane and leaf spot but they usually are more aggressive, expanding farther along the shoot and deeper into its center than those caused by Phomopsis. On berries, spots approximately 0.25-in in diameter develop, with whitish-gray centers surrounded by reddish brown to black margins, sometimes producing an appearance that superficially resembles a bird’s eye. Severely affected berries may shrivel and dry into mummies.

The fungus overwinters primarily on infected canes, although the previous year's berries can also be a source. In spring, spores are produced from the fungal structures on these sources and are dispersed by splashing raindrops to young, susceptible tissues, where they cause infection if wetness persists for a sufficient length of time. Temperatures in the mid-70s to mid-80s Fahrenheit (25-30°C) are optimal and require only 3 to 4 hours of leaf wetness for infection to occur. However, infection can also occur across a much wider range of temperatures, including those that typically prevail during the early growing season in upstate NY, if it remains wet for long enough. Additional spores, which also are splash dispersed, are produced from new infections, and these can rapidly spread the disease through multiple repeating cycles of new infection and additional spore production. Hence, outbreaks occur most frequently in years with multiple rain events early and mid-season. Young tissues are most susceptible, becoming resistant as they are mature; for example, berries become relatively resistant by about 7 weeks post-bloom.

BOTECTOR (*Aureobasidium pullulans* strains DSM 14940, 14941) – read the label

Signal word: CAUTION

Chemical/fungicide family: biopesticide

Resistance Group Number: N/A

Resistance risk: low

Physical mode of action: protectant

Selected use: Botrytis bunch rot

Comments: Botector is a preparation of a living yeast-like organism that competes with the Botrytis fungus for colonization sites on the grape flowers and berries. As such, it provides protective activity only (must be present and growing before the Botrytis fungus tries to infect), and this beneficial organism can be killed by some broad-spectrum fungicides if they are applied to manage other diseases (see company website for a current list of incompatible materials). Botector has provided fair to good control in a limited number of NY trials under moderate disease pressure conditions, and provided poor control under heavy and moderate pressure in a limited number of PA trials. It has a 4-hr REI and up to day of harvest PHI.

^CAPTAN 50WP, ^CAPTAN 80WDG, ^CAPTEC 4L (captan) – read the label

Signal word: DANGER

Medical emergency: (800) 858-7378; (800) 424-9300 (^Captan), (866) 303-6952 (Captec); others (consult the label)

Chemical/fungicide family: phthalimides

***Resistance Group Number*:** N/A

Resistance risk: low

Physical mode of action: protectant

Selected uses: Phomopsis cane and leaf spot, downy mildew, anthracnose, bitter rot, ripe rot

Comments: There are a number of different captan products on the market, and REIs vary among them (often 48 hr for 50WP and 4L formulations, 72 hr for 80WDG formulations, depending on the age of the label). Consult and follow the label of the particular formulation you're using. Do not apply more than 24 lb/A/season of ^Captan 50WP or more than 15 lb/A/season of ^Captan 80WDG. It is illegal to apply ^Captan "during, with, or following" a spray of JMS Stylet Oil (danger of plant injury). There is also a danger if the oil is applied within 10 days after a ^Captan spray. ^Captan may similarly cause plant injury if applied with or near other oils or products that cause its uptake into the leaves and fruit (e.g., some liquid insecticides and surfactants). Lime should not be used with ^Captan, or fungicide activity may be reduced. The use of ^Captan is restricted or not permitted by certain processors and export markets. Check with your processor before applying ^Captan.

***[NY]†CEVYA 3.3 SC** (mefentrifluconazole) – RESTRICTED-USE PESTICIDE IN NY – read the label

Signal word: CAUTION

Medical emergency: (800) 832-4357

Chemical/fungicide family: sterol inhibitor [DMI subgroup]

Resistance Group Numbers: 3

Resistance risk: moderate

Physical mode of action: post-infection, antisporulant, limited protectant

Selected uses: black rot, powdery mildew

Comments: *[NY]†Cevya is a relatively new DMI fungicide that is registered for use on grapes. In NY and PA trials, *[NY]†Cevya has been very effective at controlling powdery mildew. Though this product is labeled for black rot and does have efficacy against that disease, data in the Eastern US are limited. Nevertheless, in two years of trials at Penn State University, *[NY]†Cevya was highly effective against black rot when used at label rates of 4 and 5 fl oz/A, providing complete control of the disease under moderate to heavy pressure. Note that recent label expansion for 2022 product has removed the varietal restriction on *[NY]†Cevya**.** Also note the following label restrictions for Table/Raisin and Wine Grapes according to the label:

Grapes, Table & Raisin

- Rate/A /Application - 4 fl ozs
- Rate/A /Maximum/year - 8 fl ozs
- PHI – 14
- Spray Interval - Apply before the onset of disease and on a minimum interval of 10 days.

Use Restrictions for Grapes, Table & Raisin

- DO NOT apply more than 4 fl ozs (0.10 lb mefentrifluconazole) per acre per application.
- DO NOT make more than 2 applications per year.
- DO NOT apply more than 8 fl ozs (0.20 lb mefentrifluconazole) per acre per year.
- DO NOT apply more than a cumulative total of 0.20 lb ai/acre/year of mefentrifluconazole-containing products.
- Mixing *[NY]†Cevya fungicide with other products may infrequently cause leaf injury on *Vitus labrusca* and *V. labrusca* hybrid grape varieties. This foliar injury is cosmetic, occurs only on leaves and does not affect fruit quality or yield. Not all varieties have been thoroughly tested. Consult a BASF representative for more information concerning *Vitus labrusca* and related variety sensitivity.

Grapes, Wine - Black Rot, Phomopsis, Powdery Mildew –

- Rate/A /Application - 4 to 5 fl ozs
- Rate/A /Maximum/year - 15 fl ozs
- PHI – 14

Table 3.2.1 Physical modes of action of and resistance risk of fungicides used in management of grape diseases[1].

Fungicide	Protectant[a]	Post-infection[b]	Anti-sporulant[c]	Eradicant[d]	Resistance risk	Resistance group
spray oil (JMS Stylet, PureSpray)[h]	+/-	+	+	+	L	N/A[j]
sulfur (several formulations) [f]	+	+	+	+/-	L	N/A[j]
tebuconazole (various formulations)[e]	+/-	+	+	-	M	3
tetraconazole (Mettle)	+/-	+	+	-	M	3
trifloxystrobin (Flint Extra)[e]	+	+/-[f]	+	-	H	11
triflumizole (*[NY]Viticure, *[NY]Procure, *[NY]Trionic)[e, f]	+/-	+	+	-	M	3
ziram	+	-	-	-	L	N/A[j]
zoxamide + mancozeb (*[NY]Gavel)	+	+	+?	-	M	22

[1]These ratings apply only to the diseases against which the products are labeled for control, and assume recommended rates and timings, and good spray coverage.

Key:

+ significant activity
+/- limited activity, or only active against some target pathogens in this mode
- not active in this mode
H = high, M = moderate, L = low

Notes:

a. Active when present before the pathogen begins to infect.
b. Active when applied after infection has begun, but before symptoms appear.
c. Significantly reduces spore production when applied after infection has occurred, although symptoms may develop or persist.
d. Kills all or most of the fungal colony when applied after symptoms appear.
e. Activities diminished or absent against pathogens resistant to the material.
f. Significant post-infection activity against powdery mildew only.
g. Significant post-infection activity against powdery mildew and Botrytis only.
h. Significant activity against powdery mildew only.
i. Modest post-infection activity likely against powdery mildew.
j. N/A = No resistance group designated since resistance is unknown and unlikely; resistance management not required.
* Federal restricted-use pesticide.
*[NY] Restricted-use pesticide in New York State.
† Not for use in Nassau/Suffolk Counties in New York
^ Not registered for use in New York State at press time

Table 3.2.2 Effectiveness of fungicides for management of grape diseases[1].

Fungicide	Phomopsis cane and leaf spot	Black rot	Downy mildew	Powdery mildew	Botrytis bunch rot
ametoctradin + dimethomorph (*[NY]†Zampro)	0	0	++++	0	0
Aureobasidium pullulans strains DSM 14940 and 14941 (Botector)	0	0	0	0	++/+++
azoxystrobin (Abound, ^Azaka)	++	++++	++++[a]	++++[a]	+
Bacillus amyloliquefaciens strain D747 (Double Nickel)	?	0	0	++	++
Bacillus pumilis strain QST 2808 (Sonata)	?	?	+	++	+
Bacillus mycoides isolate J (LifegardWG)	?	?	+++	+++	?
Banda de Lupinus albus doce (BLAD) polypeptides (Fracture/ProBlad Verde)	?	0	0	+/++	++/+++
benzovindiflupyr (*[NY]Aprovia)	?	++	0	++++	+
benzovindiflupyr + difenoconazole (*[NY]Aprovia Top)	?/?	++++	0	++++	+
boscalid (Endura)	0	0	0	++++	++/++++[b]
boscalid + pyraclostrobin (Pristine)	++	++++	++++[a]	++++[a]	++/++++[b]
captan (^Captan, Captec)	++++	+	+++	0	+

4 Vineyard Insect & Mite Management

4.1 Pest Information – Insects

BANDED GRAPE BUG is a sporadic pest of grapes in the Finger Lakes and Lake Erie regions and does not require treatment in most years. Nymphs of this insect emerge in the spring and feed on flowers and young berries, using their sucking and piercing mouth parts. The nymphs range in size from 1/8- to 1/2-inch in length, depending on the stage. Injury by small nymphs, occurring between 3- to 5-inch shoot growth (around May 15) and early June, results in floret drop, reduced berry set, and fewer clusters. Subsequent feeding by larger nymphs and adults does not affect cluster development. Economic injury can occur when more than 1 nymph per 10 shoots are present. This injury only occurs in the prebloom stages. Subsequent feeding by nymphs does not reduce berry set. Adults appear to be predaceous and do not cause injury to berries. Look for nymphs on grape clusters and shoot tips prior to the bloom period. They can be recognized by their long, banded antennae.

BROWN MARMORATED STINK BUG (BMSB) is a new invasive species in New York that may present problems for grapes. This stink bug, originally from Asia, was first observed in PA and has spread to many regions and has become particularly abundant in the mid-Atlantic states. It is present in NY and PA grape-growing regions, although at this time at relatively low numbers. BMSB uses its sucking mouthparts to feed on reproductive structures of many different crop plants, including grapes. At high densities, damage can be extensive. BMSB also produces strong odors that have the potential of tainting grape juice. Recent research indicates the offending compounds are not very stable and break down during fermentation. Even without fermentation, odors are relatively unstable and may not be of significant concern except when consumed close to harvest.

CLIMBING CUTWORMS are known to feed on grapes. Larvae hide in the soil litter below the grape trellis and climb onto vines on warm nights to feed on developing primary buds. Only during bud swell are cutworms able to inflict serious damage to a vineyard. To examine vines for cutworms, search under the bark and in the soil litter beneath a vine with damaged buds, or search the vine with a flashlight after dark.

EUROPEAN CORN BORER is an important lepidopteran pest of corn, but it is also known to feed on over 200 other plant species, including grapes. Corn borer problems are rare, but under some circumstances, may require management. They are usually found in *Vinifera* varieties, especially vines with excessive foliage or where vineyards are weedy or surrounded by corn, sorghum, Sudan grass, or related crops. Young vineyards or nursery stock may be more seriously affected by borer injury than mature vines. The larvae vary in color, ranging from creamy to light gray to faint pink, with very small, round, dark brown spots on each segment and a dark-colored head capsule. After initially feeding on young leaves, larvae bore into canes. This weakens or kills shoots, especially when the larvae enter the middle or lower sections. Adult moths are a creamy yellowish-brown and approximately one inch long. Eggs are white and laid in masses resembling overlapping fish scales on the underside of leaves. Egg laying can occur in late May, late June to early July, or early August, depending on the genetic race of corn borer present. See the section on pest management schedules for minor insects (4.3) for pesticide recommendations and other comments.

EUROPEAN RED MITES are spider mites. Adult mites are small, dark red, and have eight legs. When viewed with a hand lens, the mites appear hairy because they have white spines called “setae.” Nymphs range in color from pale to dark orange. Both adults and nymphs pierce the leaf cells and extract plant juices. This leads to the characteristic bronze coloration, which impairs the photosynthetic capacity of the leaf. Two-spotted spider mites are often found in mixed populations with European red mites. Two-spotted spider mites are light in color with two black spots on their backs. *Vinifera* and French hybrid varieties appear to be the most susceptible to infestations, although native varieties can also develop large densities under some conditions. Mites may be found on the upper or lower leaf surface. Four to nine generations occur in a season. Susceptible vineyards in production areas prone to damaging infestations should be monitored, starting at the bud break stage, for presence of this pest. Although problems can develop at any time after bud break, pay particular attention to the 1- to 4-inch growth stage and the postbloom period, especially after early July. Given a head start, the vine can tolerate a fair amount of feeding damage on lower leaves. Heavy mite infestations early in the season can cause stunted, chlorotic shoots with small leaves and pinpoint necrotic areas on leaves. Later in the season, as shoot growth rate declines and the vine allocates more resources to fruit, mites may also have an increased capacity to cause damage. Infestations can be severe on Long Island and in southeastern Pennsylvania vineyards. Serious infestations in the Finger Lakes region have occurred more frequently in recent years. Problems with spider mites in the Lake Erie region are uncommon. Predatory mites, when present in the vineyard at sufficient densities, can provide excellent biological control of spider mites. Recent research indicates that frequent use of mancozeb fungicides reduces predatory mite populations, although mancozeb use does not necessarily lead to mite problems.

regions as in the southeastern areas. Aurore and Rougeon appear to be particularly susceptible.

4.2 Insecticide Information

ACRAMITE (bifenazate) – read the label

Signal word: CAUTION

Medical emergency: (866) 673-6671

Selected use: spider mites

Comments: Do not apply within 14 days of harvest. REI is 5 days for tying, turning, and girdling of table grapes and 12 hrs for all other activities. Both European red mite and two-spotted mite are listed for grapes on the current label. Acramite limited to one application per season.

***NY†ACTARA** (thiamethoxam) – RESTRICTED-USE PESTICIDE IN NY – read the label

Signal word: CAUTION

Medical emergency: (800) 888-8372

Selected use: leafhoppers, mealybugs, Japanese beetle

Comments: REI = 12 hrs, DTH = 5 days. Maximum *NY†Actara allowed per growing season is 7 oz/A with a minimum interval between applications of 14 days. Not registered for use in Nassau and Suffolk Counties in New York State.

***NY ADMIRE PRO** (imidacloprid) – RESTRICTED-USE PESTICIDE IN NY – read the label

Signal word: CAUTION

Medical emergency: (800) 334-7577

Selected use: mealybugs, leafhoppers, grape phylloxera

Comments: REI = 12 hrs, DTH = 30 days (**soil**) & 0 days (**foliar**) *NYAdmire Pro can now be applied both to soil, where it is systemic throughout the vine, and on foliage, where it shows translaminar activity. When applied to soil, *NYAdmire Pro works best when applied through a drip system, although it can be applied as a subsurface side-dress. Maximum allowed per season is 14.0 fluid ounces per acre for **soil treatment** and 2.8 fluid ounces per acre for **foliar treatment**. [*NYAlias 4F is a generic of soil applied imidacloprid that is also labeled for foliar application.]

***AGRI-MEK** (abamectin) – RESTRICTED-USE PESTICIDE – read the label

Signal word: WARNING

Medical emergency: (800) 888-8372

Selected use: two-spotted spider mite

Comments: REI = 12 hrs, DTH = 28 days. Product must be applied in combination with nonionic surfactant. Do not make more than two applications per season. Amount of product per growing season cannot exceed 32 fl oz/A of ^*Agri-Mek 0.15EC or 7.0 fl oz *Agri-Mek SC. Ground application only. Currently, European red mite is not on the label. [^*ABBA 0.15 EC, and ^*Epi-mek 0.15 EC are generic miticides that have abamectin as active ingredient].

***NY†ALTUS** (flupyradifurone) – RESTRICTED-USE PESTICIDE IN NY – read the label

Signal word: CAUTION

Medical emergency: (800) 334-7577

Selected uses: Leafhoppers, some other sucking insects.

Comments REI = 4 hrs; DTH = 0 days. This insecticide belongs to a new class of chemicals known as butenolides. Use of *NY†Altus is for nursery and landscape grapes only. See *NY†Sivanto Prime for use in vineyards. It has the same active ingredient. *NY†Altus has relatively wide spectrum of activity. It has systemic properties, the extent to which depends on method of application (foliar verses via soil). See label for more information.

***NY†ALTACOR** (chlorantraniliprole) – RESTRICTED-USE PESTICIDE IN NY – read the label

Signal word: None

Medical emergency: (800) 441-3637

Selected use: Grape berry moth, climbing cutworm and Japanese beetle adults (use high rate)

Comments: Not registered for use in Nassau, Suffolk, Kings and Queens Counties of New York State. Also in NY, this product cannot be used within 100 feet of water body and aerial application is prohibited. Chlorantraniliprole is in the anthranilic diamide class of insecticides with a new mode of action that is selective against Lepidoptera and some other insect groups.

ASSAIL (acetamiprid) – read the label

Signal word: CAUTION

Medical emergency: (866) 673-9300

Selected uses: leafhoppers, plant bugs, grape phylloxera, mealybug, Japanese beetle and rose chafer

Comments: The active ingredient is in the same chemical class as ^Provado (neonicotinoid) and is particularly effective against sucking insects such as leafhopper, but also has activity against some beetles such as Japanese beetle and rose chafer.

AVAUNT (indoxacarb) – read the label

Signal word: CAUTION

Medical emergency: (800) 441-3637

Selected use: Japanese beetle, grape berry moth

Comments: REI = 12 hrs, DTH = 7 days. Avaunt has activity against a number of chewing insects including Japanese beetle and grape berry moth. It will help suppress leafhoppers. Conserves some beneficial arthropods. Two applications per season with minimum of 21 days between applications. A new formulation of Avaunt, called Avaunt eVo (WDG), has recently been

Table 4.2.1 Effectiveness of insecticides for management of grape insects and mites. *(continued)*

	Pests												
Material	*BGB*	*GBM*	*LH*	*GP*	*GCGL, JB*	*GCGR*	*GFB, CW*	*GE, RBLR*	*SB*	*SF*	*M*	*GR*	*RC*
spinosad (Entrust)		++	0	0	0	0	0	+	0	+	0	0	0
spirotetramat (Movento)	0	0	0	+++	0	0	0	0	0	0	+	0	0
thiamethoxam, chlorantraniliprole (*[NY]†Voliam Flexi)	?	+++	+++	++	++	?	++?	++?	?	++?	0	?	?
zeta-cypermethrin (*Mustang Maxx)	+++	+++	+++	?	+++	?	?	++	++	?	?	?	?

Key to pests:

BGB = banded grape bug; CW = cutworms; GBM = grape berry moth; GCGL = grape cane gallmaker; GCGR = grape cane girdler; GE = grapevine epimenis; GFB = grape flea beetle; GP = grape phylloxera; GR = grape rootworm; JB = Japanese beetle; LH = leafhoppers; M = mites; RBLR = redbanded leafroller; RC = rose chafer; SB = steely beetle; SF = 8 spotted forester

Key to ratings:

+++ = highly effective; ++ =moderately effective; + =slightly effective effective or not labeled; 0 =not; ? =effectiveness not known

* Federal restricted-use pesticide; may be purchased and used only by certified applicators or used by someone under the direct supervision of a certified applicator.

*[NY] Restricted-use pesticide in New York State

† Not for use in Nassau/Suffolk Counties

^ Not registered for use in New York State at press time

Table 4.2.2 Insecticides for use in New York and Pennsylvania vineyards

Insecticide	IRAC Number[1]	Control method	Longevity	GBM	Leafhopper	Japanese Beetle	Toxic to Natural Enemies
Delegate	5	C, I	**	+++	+	+	Moderate
Spintor/Entrust	5	C, I	**	++	+	0	Moderate
Biobit, Dipel, Deliver, Javelin	11	I	*	++	0	0	Safe
*[NY]†Intrepid	18	I	****	+++	0	0	Safe
Movento	23	S, C, I	***	Phylloxera, mealybug, and tumid gall midge control only			Moderate
*[NY]†Altacor	28	C, I	***	+++	0	+++	Moderate
*[NY]†Voliam Flexi	28 + 4A	S, C, I	****	+++	+++	+++	Moderate
*[NY]†Cyclaniliprole	28	C,I	***	+++	0	+++	Moderate
*[NY]†Verdepryn	28	C,I	***	+++	0	+++	Moderate
Sevin	1A	C	**	++	+++	+++	Toxic
*[NY]Imidan	1B	C	***	+++	++	+++	Moderate
Avaunt	22A	C, I	**	++	+	++	Moderate
Evergreen	27A + 3A	C	*	+	+	+++	Moderate
*Baythroid	3A	C	***	+++	++++	+++	Toxic
*Brigade	3A	C	***	+++	++++	+++	Toxic
*Danitol	3A	C	***	+++	++++	+++	Toxic
*Mustang Maxx	3A	C	***	+++	++++	+++	Toxic
*Hero	3A	C	***	+++	+++	+++	Toxic
Pyganic	3A	C	*	+	+	++	Moderate
*[NY]†Actara	4A	S, C, I	****	++	+++	+++	Moderate

5 Pest Management Schedules for Diseases and Major and Minor Insects

5.1 Introduction

This section provides guidelines pertaining to management programs for control of diseases and major insects in vineyards of New York and Pennsylvania. Although this section is organized along a phenological schedule to reflect important events during the growing season, there is no implication that every spray listed will be necessary. Rather, this is a schedule of the various times when individual diseases and insects might require that sprays be integrated into a management program; refer to the notes to help determine which sprays are generally necessary and which ones apply only to certain conditions. Refer to the pictures in the front of this publication for help in identifying critical growth stages during the season. Note comments in right-hand column address precautions or considerations necessary for use of particular methods or materials. Be especially alert to the notations that certain chemicals may not be approved for your state or for certain growing areas within a state.

5.2 Pest Management Schedules for Diseases and Major Insects

Pest(s)		Materials	Rate per Acre	Comments
5.2.1 DORMANT				
Canker diseases (Eutypa, Botryosphaeria)		Mettle 1ME	5 fl oz	Mettle is labeled in all states for spray application in 25 to 50 gpa within 24 hr after pruning, with a 12-hr REI. Consult the label for further use directions. No trials have been conducted in NY or PA to evaluate the efficacy of Mettle for this purpose.
5.2.2 DELAYED DORMANT				
Soft scale insects and mealybugs		petroleum oil	2.5%	**Apply early in the spring at bud swell but before any leaf tissue is exposed.** Apply in 250 to 300 gallons of water. Thorough coverage is essential for good results. Avoid use with captan or sulfur due to phytotoxicity. Also avoid use within 24 hours before or after freezing temperatures. Field data indicate only short-term benefits for reducing mealybug populations. Oil more effective against soft scale.
	OR	Knack	16 fl oz	Only labeled for lecanium scale. Can use oil with Knack at this time (delayed dormant). Not to exceed 32 fl oz/A for season.
Anthracnose, black rot, Phomopsis, powdery mildew		*[NY]Miller Lime Sulfur	1 gal/10 gal water	This spray is most likely to be beneficial on cultivars highly susceptible to anthracnose (e.g., Marquette, Reliance), where it can be important in blocks with a history of the disease, or in blocks where black rot and/or Phomopsis control is regularly problematic and conventional fungicides will not be used during the growing season. Otherwise, it is unlikely to be cost effective. THOROUGH coverage of the vines is essential for acceptable results. If practical, application to individual vines with a handgun or using some other system that minimizes loss of these expensive materials to non-grapevine surfaces (e.g., hooded-boom, recirculating sprayer such as the Lipco) is desirable. The low per-acre rate of *[NY]Sulforix is unlikely to be effective unless loss to non-target surfaces is minimal. Use of more than 15 gal/A of *[NY]Miller Lime Sulfur is prohibitively expensive. For NYS users: note that *[NY]Sulforix is only labeled for use against powdery mildew and Phomopsis and that*[NY]Miller Lime Sulfur is only labeled for control of Phomopsis, powdery mildew and anthracnose.
	OR	*[NY]Sulforix	1-2 gal	

6 Vineyard Weed Management

6.1 Introduction

Weeds are part of the vineyard ecosystem. Weed management decisions are based on balancing the positive and negative aspects of weed growth in the vineyard. Weeds can compete for water and nutrients, reducing vine growth; contaminate mechanically harvested fruit; provide alternate hosts for vineyard pests; and interfere with vineyard operations. Weed growth can also alter the microclimate around vines, leading to higher disease pressure and increasing the risk of spring frost. Managing weed or cover crop growth in row middles can be a powerful tool for managing overly vigorous vines, minimizing erosion, and improving equipment access in wet seasons. Weed management practices can have negative impacts on grapes if those strategies cause direct damage to the vines.

This portion of the guide primarily addresses chemical methods to control weeds in vineyards. We have attempted to include all herbicides labeled for use in grapes even though some are not commonly used in eastern United States vineyards. Not all products or use patterns are labelled for use in each state or in every region of the same state. Registrations may change, so product users should always rely on the most up to date labels for use recommendations. Herbicides are listed in the sections, "preemergence herbicides," "postemergence herbicides," and "herbicides for nonbearing vineyards." Herbicides that are registered for vineyard use and may have applicability under specific circumstances are listed in the section, "specialty use herbicides."

Cultivation is sometimes used as a weed management tool in vineyards. Low vine size restricts productivity of own-rooted *Vitis labruscana* varieties such as 'Concord' that generally have shallow root systems. Effective herbicide use has been shown to increase vine size and subsequent yields as compared with under-the-row cultivation, but this may be less of a concern when deep-rooted rootstocks are used, when vines are overly vigorous, or when maximum yields are not desired. Under trellis mowing and growing cover crops under the row are currently being researched in New York and Virginia. These methods might also be considered where vine growth is overly vigorous.

Cultivation and organic mulches can also be used as tools for row middle management. Excessive cultivation can lead to undesirable consequences such as soil erosion, reduced soil organic matter, and breakdown in soil structure resulting in compaction and reduced permeability. Recently cultivated soil can restrict equipment mobility needed for critical vineyard operations such as timely pesticide applications and mechanical harvest. If cultivation is used for row middle management it is suggested that negative effects be limited by not cultivating more often than necessary to suppress weed growth, to shallow (1-2") depths only, and with the goal of reducing, rather than eliminating, weed or cover crop growth. Fall planting of ryegrass or other cover crops can be used in conjunction with cultivation to provide winter cover. Organic mulches are most effective where soil moisture and fertility are low and where low vine size restricts vineyard productivity.

6.2 Resources

Several resources are available to aid in determining and addressing vineyard weed management goals. The concepts and tools for weed management are covered in the Cornell vineyard weed management fact sheets, listed below and at the back of this guide. They are available online at www.nysipm.cornell.edu/publications/grapeman/index.html (table of contents for Grape IPM in the Northeast), through Cornell Cooperative Extension offices, or directly through the Bulletin Room at the New York State Agricultural Experiment Station, Geneva, NY.

The fact sheets in this series are:

- Choosing a weed management program, which discusses goals and management options, including cultivation, mowing, mulching, and the use of chemical weed control agents (herbicides);
- Chemical control of vineyard weeds, which discusses weed types, herbicide types, and factors to consider in using herbicides effectively;
- Pre-emergence herbicides, which discusses all the available residual herbicide options, including their behavior in soil, persistence, and means of loss from the soil;
- Post-emergence herbicides, which discusses available contact and systemic herbicides and how they affect plants and soil; and
- Managing vineyard floors using no-tillage, which discusses the reasons for avoiding tillage and practical factors to consider in using no-tillage as a weed management tool.

Additionally, ***Weeds of the Northeast*** is an excellent resource covering weed identification and aspects of weed biology and ecology that relate to weed management. ***Weeds of the Northeast*** is available through Cornell University Press and the Lake Erie Regional Grape Program office in Portland, NY. Another valuable resource is the ***Manage Weeds on your Farm*** e-book available at https://www.sare.org/resources/manage-weeds-on-your-farm/.

6.3 Effective Use of Herbicides

Repeated use of the same herbicides, or those with similar chemistry, can lead to a buildup of tolerant weeds, development of resistant biotypes, shifts in microbial

Comments: *[NY]†Solicam provides excellent season-long control of annual grasses and several annual broadleaf species including velvetleaf, and will provide some suppression of yellow nutsedge, plantains, and perennial grasses. *[NY]†Solicam is relatively weak in controlling common annual broadleaf weeds such as pigweed and smartweed species and common lambsquarters. Apply to weed-free soil. Tank mixes with another preemergence herbicide such as Prowl H_2O, simazine, diuron, oxyfluorfen, or oryzalin are needed to attain season-long, broad-spectrum weed control. Note that *[NY]†Solicam is not registered for use in Nassau and Suffolk counties in New York.

SURFLAN A.S., ORYZALIN 4 A.S. (oryzalin) – read the label

Signal word: CAUTION

Medical emergency: (866) 673-6671, (877) 250-9291

Selected uses: Preemergence control of annual grasses and control or suppression of some annual broadleaf weeds in bearing and nonbearing vineyards.

Rate: Apply 2-6 qt per acre surface sprayed. Length of control depends on the rate applied. The total amount allowed per year is 12 qt per acre surface sprayed with a minimum of 2.5 months between applications.

Timing: Apply in the fall or spring prior to weed germination. Do not apply to newly planted vines until soil has settled.

Comments: Oryzalin may be applied safely to coarse-textured, low organic matter soils where other residual herbicide options are limited. It is not recommended for use on soils with an organic matter content of greater than 5 percent. Apply to weed free soil; residues on the soil surface can also reduce its effectiveness. Oryzalin is very weak in controlling some broadleaf weeds including ragweed and mustard species. Tank mix with *[NY]†Solicam, diuron, simazine, or oxyfluorfen for broad-spectrum season-long weed control. Note: the product "Surflan A.S. Specialty Herbicide" is only registered for use in non-bearing vineyards.

NOTE: Oryzalin is also registered for use during vineyard establishment. That use is discussed in the section "Herbicides for nonbearing vineyards."

6.5 Postemergence Herbicides

AIM (carfentrazone-ethyl) – read the label

Signal word: CAUTION

Medical emergency: (800) 331-3148

Selected uses: Postemergence control of certain susceptible broadleaf weeds and burn down of grapevine suckers

Rate: For broadleaf weed control, apply up to 2 fl. oz. per acre surface sprayed. Lower rates can be used to control small seedling weeds at the 2 to 3-leaf stage; higher rates are needed for larger weeds up to the 6-leaf stage. Applications to weeds beyond the six-leaf stage may result in only partial control. For burn down of grapevine suckers, apply at the maximum use rate (2 fl. oz.) per acre surface sprayed. Add a non-ionic surfactant (NIS) containing at least 80% active ingredient at 2 pt. per 100 gallons, or a crop oil concentrate (COC) at one gallon COC per 100 gallons, or methylated seed oil (MSO).

Timing: Aim may be applied at any time during the season, but do not allow spray mist to contact desirable fruit, foliage, or green bark. Suckers and other undesirable growth must be treated when the tissue is young (not mature or hardened off). Multiple applications per season are allowed, but do not apply more than 7.9 fl. oz. per season. Do not make applications less than 14 days apart or within 3 days of harvest.

Comments: Aim is very effective in controlling grapevine suckers, and also controls some small broadleaf weeds. Treated suckers turn brown within 1-2 days of application, but multiple applications may be necessary to obtain season-long sucker control. Refer to the label for a list of susceptible broadleaf weeds. Aim may be tank-mixed with other preemergence and postemergence herbicides; observe the other product's label restrictions.

^*GRAMOXONE MAX, *GRAMOXONE SL 2.0 (paraquat) – RESTRICTED-USE PESTICIDE – read the label

Signal word: DANGER

Medical emergency: (800) 888-8372

Selected uses: Postemergence burn down of all weeds in new or established vineyards and burn down of grapevine suckers up to 8 inches long.

Rate: See labels as multiple products are registered. *Gramoxone SL 2.0 contains 2 lb. of the active ingredient, paraquat, per gallon. Apply 2.5-4 pt per acre surface sprayed. ^*Gramoxone Max is a more concentrated formulation that contains 3 lb of the active ingredient, paraquat, per gallon. Apply 1.75-2.7 pt ^*Gramoxone Max per acre surface sprayed. Always add a nonionic surfactant (NIS) or crop oil concentrate (COC). Add NIS at 1 pt per 100 gal (75% or more surface-active agent), or NIS at 2 pt per 100 gal (50-74% surface-active agent), or COC at 1 gal per 100 gal. The label permits applications in as low as 10 gal per treated acre, but spray volume should be increased as necessary to obtain complete coverage of target weeds or suckers without runoff from the target foliage.

Timing: *Gramoxone should be applied to emerged weeds when they are small and succulant. Weeds 1-6 inches tall are easiest to control. Contacted plant foliage wilts and desiccates within hours of application, with complete necrosis in 1-3 days. For burndown of grapevine suckers, treat when sucker growth is no more than 8 inches long. For mature woody weeds, perennial

Table 6.7.1 Herbicides and their basic characteristics for New York and Pennsylvania vineyards. (Read the label for potential tank mixes and specific use, rate and timing of each product.)

Common Name	Herbicide Trade Name	(C)ontact or (S)ystemic	Young Vine Use	Non-bearing Only	Application Timing		Weeds Controlled			Sucker Control
					Pre-emergent	*Post-emergent*	*Broad-leaves*	*Grasses*	*Broad Spectrum*	
sethoxydim	Poast	S	x	–	–	x	–	x	–	–
simazine	*[NY]†Princep	–	–	–	x	–	x	–	–	–
trifluralin	Treflan	–	x[e]	–	x	–	–	x	–	–
trifluralin + isoxaben	^Snapshot	–	x	x	x	–	–	–	x	–

* Federal restricted-use pesticide; may be purchased and used only by certified applicators or used by someone under the direct supervision of a certified applicator.

*[NY] Restricted-use pesticide in New York State.

† Not for use in Nassau/Suffolk Counties

^ Not registered for use in New York State at press time

a Primarily contact, limited systemic activity

b Note maximum annual use rate restriction for Long Island

c Do not apply within 4 weeks of planting

d Do not apply within 6 months of planting

e Usually used pre-plant incorporated

f Vines must be established one full growing season

7 Sprayer Technology

7.1 Preparing the Airblast Sprayer for Work

7.1.1 Checking the Sprayer

Surveys have shown that many farmers are using inaccurate sprayers. Faulty sprayers contribute to increased drift levels and waste money through inefficiency and overuse of chemicals. For example, the cost of replacing a faulty pressure gauge that has been indicating at 15% below the actual pressure is recouped in around two hours' operation. Maintenance measures such as fitting a new set of nozzles at the beginning of each season also save money. Even when overdosing occurs by as little as 5%, the cost of a new set of nozzles would be recovered in less than a day's work. Sprayers must be checked over regularly to ensure that proper maintenance has been carried out and that no outstanding repairs need to be done. Before attempting any work on a machine, make sure that it is fully supported on stands and that all necessary protective clothing is on hand.

7.1.2 Fitting the Sprayer to the Tractor

The selected tractor must always be powerful enough to operate the sprayer efficiently under the working conditions that will be encountered. All its external services - hydraulic, electrical, and pneumatic - must be clean and in working order. Tractors fitting with cabs must have efficient air filtration systems. All protective guards must be in place. Trailed sprayers are often close-coupled to the tractor, so it is essential that the drawbar and the PTO shaft are correctly adjusted for turning. PTO shafts must be disengaged when making very tight turns.

CAUTION

- Take great care when adjusting a sprayer while the tractor engine is running.
- Always ensure that the fan is stationary before approaching the rear of the sprayer.
- Engage the handbrake when leaving tractor seat.

7.1.3 Checking the Operation of the Sprayer

Partially fill the tank with clean water and move the sprayer to uncropped waste ground. Remove the nozzles. Although you are not using any chemical at this point, get into the habit of wearing a coverall, gloves and a face visor when working with the sprayer. Engage the PTO and gently turn the shaft, increasing speed slowly to operating revs. Test the on/off and pressure relief valves, and check the agitation system. Flush through the spray lines, and then switch off the tractor. Refit the nozzles and check the liquid system again for leaks.

It is a valuable exercise to assess the spray deposits at various points in the canopy and on upper and lower leaf surfaces of the vines to be sprayed. This is particularly important if the foliage is dense or if the vines are grown in beds of three or more rows. Water-sensitive papers or fluorescent tracers are available for this purpose. An increase in spray volume or adjustment of the nozzles and their locations may be necessary in order to achieve the correct deposits.

7.1.4 Pre-season Maintenance

Use the following checklists before you begin spraying**:**

Hoses

- ✓ for splits and cracks
- ✓ connections to ensure they are water-tight
- ✓ for hose chafe, particularly in routing clips

Action:
Replace damaged hoses.

Filters

- ✓ for missing filter elements and seals
- ✓ for leakage
- ✓ for blocked or damaged filters

Action:
Replace any damaged or blocked filters.

Tank

- ✓ for fractures and any other damage
- ✓ that the tank sits firmly in its mount
- ✓ that the securing straps are correctly adjusted
- ✓ that the agitation is working
- ✓ that the tank is clean

Action:
See the supplier/manufacturer now about fractures and any other repairs.

Controls

- ✓ the control circuitry (electrical, hydraulic or air) for correct operation
- ✓ valves for both internal and external leaks

Action:
Replace leaky valves, which waste money and are potentially dangerous to operators and the environment.

Pump

- ✓ lubrication levels
- ✓ for leaks
- ✓ that the air pressure in the pulsation chamber (if fitted) is at the recommended level
- ✓ that the pump rotates freely without friction or noise. (Do so by rotating manually or starting at low speed, as corrosion may cause seizing up)

Pressure Gauge

- ✓ The pressure gauge is vital for indicating whether the nozzles are delivering the correct amount of chemical

Hardi Air Induction nozzles are similar in construction to Spraying Systems AI nozzles. They are one-piece plastic nozzles.

Albuz nozzles are similar in construction to Spraying Systems AI nozzles. They are one-piece plastic nozzles with a ceramic tip.

Current research

Trials are underway at Cornell University to compare air induction nozzles. Although the nozzles physically reduce drift, we need to see how effective they are at delivering materials used to control disease and insects. They certainly work well at delivering materials used to control weeds.

7.4 Sprayer Calibration

A simple vertical patternator can be constructed in the farm workshop using readily available materials; a build list and photographs can be found online at: www.nysaes.cornell.edu/ent/faculty/landers/pdf/Patternator.pdf.

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"

7.4.1 Travel Speed Calibration

Sprayer travel speed will influence spray deposition and is a critical factor in maintaining accurate application rates. Although results of studies to determine the effect of travel speed on average spray deposition have been inconsistent, all studies have been in agreement that the higher the travel speed, the greater the variability in spray deposit. This variability is an important factor where uniformity of spray coverage throughout the canopy is required. Conclusions from research were drawn using travel speeds of 1-4 mph.

Factors that will affect travel speed include**:**

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

The best way to measure travel speed is to pull a sprayer half full of water over the same type of terrain on which the actual sprayer will be operated.

Using a tape measure, set up a test course at least 100 feet long. Do not pace the distance. The longer the course, the smaller the margin of error.

Run the course in both directions. Use an accurate stopwatch to check the time required to travel the course in each direction. Average the two runs and use the following to calculate the speed in MPH.

Formula $\frac{\text{Ft. traveled}}{\text{Sec. traveled}} \times \frac{60}{88} = \text{MPH}$

Your figures:

Tractor gear_____ Engine revs._____

$\frac{\text{\_\_\_\_ft.}}{\text{\_\_\_\_sec}} \times \frac{60}{88} = \text{\_\_\_\_MPH}$

7.4.2 Airblast 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

Use a flow meter (obtainable from Gemplers, Spraying Systems, etc.) attached to individual nozzles OR

a. Connect hoses to each of the nozzles and measure the flow from each nozzle into a calibrated jug. Record and total your results using Figure 7.4.1.
b. Replace all nozzle tips which are more than 5% inaccurate.
c. Calculate gallons per acre using the following formula.

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

Your figures: $\frac{\text{\_\_\_\_GPM X 495}}{\text{\_\_\_\_mph X \_\_\_\_ft.}} = \text{GPA}$

7.4.3 Calibrating a Kinkelder Sprayer

-use clean water

Rate of spray **Forward speed** **Row spacing**

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

e.g.
50 gals/acre x 3 mph x 9 ft x 60 = 162 gals/hr delivery or index setting

Your figures:

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

This figure should be set on both scales.

8 Pesticides for New York and Pennsylvania Vineyards

8.1 Herbicides

Common Name	Trade Name	Formulation	WSSA Group Number (Resistance Management)	Days to Harvest	Restricted Entry Interval (REI)	EPA Reg. Number
carfentrazone-ethyl	Aim EC	EC	14	3	12	279-3241
clethodim	*NYSelect 2EC[a]	2EC	1	1 year	24 hr	59639-3-1381
	^Volunteer	2 EC	1	1 year	24 hr	59639-3-55467
	*NYSelect Max	0.97 EC	1	1 year	24 hr	59639-132
dichlobenil	Casoron 4G	4G	20	0	12 hr	400-168
	Casoron CS	1.4 L	20	0	12 hr	400-541
diuron	Karmex, Direx, and others	80DF	7	0	12 hr	^1812-362
	Direx, others	4L	7	0	12 hr	^1812-257
	Direx 4L	4L	7	0	12 hr	66222-54
	Karmex DF	80 DF	7	0	12 hr	66222-51
	^Karmex XP	80 DF	7	0	12 hr	352-692
fluazifop-P-butyl	†Fusilade DX	2EC	1	50	12 hr	100-1070
flumioxazin	Chateau SW	51 WDG	14	60	12 hr	59639-99
glufosinate-ammonium	^Rely	1EC	10	14	12 hr	264-652
	†Rely 280	2.34 EC	10	14	12 hr	264-829
glyphosate	^Roundup Ultra	4L	9	14	4 hr	524-475
	^Touchdown Herbicide	3EC	9	14	12 hr	100-1117
	^Touchdown Total, ^Traxion	4.17L	9	14	12 hr	100-1169
	^Touchdown HiTech	5F	9	14	12 hr	100-1182
	^Roundup Ultramax	5L	9	14	4 hr	524-512
indaziflam	*NY†Alion	SC	29	14	12 hr	264-1106
isoxaben	^Gallery	75DF	21	1 year	12 hr	62719-145
napropamide	Devrinol	50DF	15	35	12 or 24 hr (see label)	70506-36
norflurazon	*NY†Solicam	80DF	12	60	12 hr	61842-41
oryzalin	Surflan	4AS	3	0	24 hr	70506-43
	Oryzalin	4AS	3	0	24 hr	66222-138
oxyfluorfen	Goal 2XL	2EC	14	b	24 hr	62719-424
	GoalTender	4 EC	14	b	24 hr	62719-447
paraquat	^*Gramoxone Max	3L	22	0	24 hr	100-1074
	*Gramoxone SL 2.0	2L	22	0	24 hr	100-1431
pelargonic acid	Scythe	4.2EC	unclassified	0	12 hr	10163-325
pendimethalin	^Pendimax	3.3L	3	1 year	24 hr	68156-6-62719
	Prowl	3.3EC	3	1 year	24 hr	241-337
	Prowl H_20	3.8EC	3	21	24 hr	241-418
pronamide	*Kerb	50W	3	c	24 hr	62719-397
rimsulfuron	Matrix FNV	25DF	2	14	4 hr	352-671
sethoxydim	Poast	1.5EC	1	50	12 hr	7969-58