



2019 Cornell Pest Management Guidelines for Berry Crops

Cornell Cooperative 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

Aacre	EC emulsifiable concentrate	SP soluble powder
AIactive ingredient	F flowable	ULV ultra-low volume
Ddust	G..... granular	W wetttable
DFdry flowable	Lliquid	WDG... water-dispersible granules
DGdispersible granule	Ppellets	WP wetttable powder
Eemulsion, emulsifiable	Ssoluble	WSP water soluble packet

*Restricted-use pesticide; may be purchased and used only by certified applicators

†Not for use in Nassau and Suffolk Counties

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 2018). Changes in pesticide registrations, regulations, and guidelines occurring after publication are available in county Cornell Cooperative Extension offices or from the Pesticide Management Education Program web site (pmep.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.

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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: Transplanting day neutral strawberries into plastic mulch. (Photo by: Laura McDermott, Cornell Cooperative Extension Eastern NY Commercial Horticulture Program)

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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 divided 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 Pesticide Management Education Program (PMEP) at Cornell University (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 you begin to use 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 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 the label requires.

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 General Information

2.1 Introduction

Cornell's 2018 Pest Management Guidelines for Berry Crops is intended to provide growers with general nutrient guidelines and information to aid with insect, mite, disease, and weed management decisions. Cultural, biological, and chemical management tools are identified whenever available.

In-depth information on commercial berry crop production may be found in the resources listed in Table 2.15.

Guidelines provided in this guide are consistent with label guidelines formulated for large-scale operations. Smaller scale producers may use the same guidelines by converting them to the appropriate unit (Table 2.1.1).

2.2 Site Selection and Preparation

Preparations for a berry planting must begin one to two years in advance. Select a site with good air and water drainage and have a preplant soil and a nematode analysis performed on representative soil samples. *Growers may wish to select a more broad-spectrum approach to preplant soil analysis at this time by opting for a comprehensive Cornell soil health assessment.*

2.2.1 Basic Soil Test

Agro-One provides soil and nutrient testing services previously available through the Cornell Nutrient Analysis Laboratory along with additional analytical services. Key input regarding analytical methods and quality control is provided by Cornell, and Cornell nutrient management guidelines are provided by Cornell through Agro-One.

Table 2.1.1. Conversion factors to convert from one unit to another.

To convert from	To	Multiply by
lb/A	lb/100 sq ft	0.0023
tn/A	lb/100 sq ft	4.6
lb/A	kg/ha	1.12
kg/ha	lb/A	0.893
lb	oz	16
qt of fruit	lb of fruit	1.5
qt	pt	2.0
pt	qt	0.5
gal of liquid	lb of liquid	8.3
Strawberries		
lb/A	lb/100 ft of row	0.008
Yield in lb/100 ft of row	lb/A	125
Yield in qt/100 ft of row	lb/A	188
Raspberries and Blackberries		
lb/A	lb/100 ft of row	0.0184
lb/A	oz/plant	0.009
Yield in lb/100 ft of row	lb/A	55
Yield in pt/100 ft of row	lb/A	73
Blueberries		
lb/A	oz/plant	0.015
Yield in lb/100 ft of row	lb/A	44
Yield in pt/100 ft of row	lb/A	58
Currants and Gooseberries		
lb/A	oz/plant	0.012
lb/A	lb/100 ft of row	0.0184
Yield in lb/100 ft of row	lb/A	55
Yield in pt/100 ft of row	lb/A	73

Table 2.5.3. Nitrogen guidelines for berry crops.

Crop	Age of planting	Amount/timings (actual N)	N source	Comments
Strawberries (day neutral) (continued)				
	1	5 lb/A weekly <i>beginning at green fruit through the end of harvest</i>	potassium nitrate	Water soluble product applied through drip irrigation system.
Raspberries and Blackberries (summer-bearing)				
	0	25-35 lb/A, <i>4 weeks after planting</i>	calcium nitrate	Avoid touching plants with fertilizers after planting.
	1	35-55 lb/A, <i>in May or split between May and June</i>	urea or ammonium nitrate	Use higher amount on sandier soils or if irrigation is used.
	2+	40-80 lb/A, <i>in May or split between May and June</i>	urea or ammonium nitrate	Use higher amount on sandier soils or if irrigation is used.
Raspberries (fall-bearing)				
	0	25 lb/A, <i>4 weeks after planting</i>	calcium nitrate	Avoid touching plants with fertilizers after planting.
	1	50-80 lb/A, <i>split between May and June</i>	urea or ammonium nitrate	Use higher amount on sandier soils or if irrigation is used.
	2+	70-100 lb/A, <i>split between May and June</i>	urea or ammonium nitrate	Use higher amount on sandier soils or if irrigation is used. Adjust with leaf analysis.
Blueberries				
	0	Do not fertilize newly planted blueberries	–	Soil should be adjusted to pH 4.5 prior to planting.
	1	15 lb/A, <i>split between May and June</i>	ammonium sulfate or urea	Use ammonium sulfate where soil pH is >5.0.
	2	20 lb/A, <i>split between May and June</i>	ammonium sulfate or urea	Use ammonium sulfate where soil pH is >5.0.
	3	25 lb/A, <i>split between May and June</i>	ammonium sulfate or urea	Use ammonium sulfate where soil pH is >5.0.
	4	35 lb/A, <i>split between May and June</i>	ammonium sulfate or urea	Use ammonium sulfate where soil pH is >5.0.
	5	45 lb/A <i>split between May and June</i>	ammonium sulfate or urea	Use ammonium sulfate where soil pH is >5.0.
	6	55 lb/A <i>split between May and June</i>	ammonium sulfate or urea	Use ammonium sulfate where soil pH is >5.0.
	7+	65 lb/A <i>split between May and June</i>	ammonium sulfate or urea	Use ammonium sulfate where soil pH is >5.0.
Currants and Gooseberries				
	0	25 lb/A, <i>4 weeks after planting</i>	calcium nitrate	
	1	50-80 lb/A, <i>split between May, June, August</i>	calcium nitrate	
	2+	70-100 lb/A, <i>split between May and early August</i>	calcium nitrate	
Elderberries				
	0	Do not fertilize newly planted elderberries.	–	

Table continues on next page.

2.17 Herbicide Active Ingredients and Weeds Controlled

Effectiveness may vary with method of application, rate, addition of adjuvant, size of weed, and soil and climatic factors. Consult the berry crop herbicide table of interest to see if products are labeled for use in that crop and to determine whether control is pre- or post-emergent.

Active ingredient (Trade name)	HRAC code	Alfalfa <i>Medicago sativus</i>	Amaranth, Palmer <i>Amaranthus palmeri</i>	Amaranth, Powell <i>Amaranthus powellii</i>	Amaranth, spiny <i>Amaranthus spinosus</i>	Aster <i>Aster spp.</i>	Barley, volunteer; wild <i>Hordeum spp.</i>	Barnyardgrass <i>Echinochloa crus-galli</i>	Bedstraw, catchweed <i>Galium aparine</i>	Beggarticks <i>Bidens spp.</i>	Bentgrass <i>Agrostis spp.</i>
Weed type		BL	BL	BL	BL	BL	G	G	BL	BL	G
Weed habit		P	A	A	A	P	A	A	A	A	P
Control Efficacy											
2, 4-D (Amine 4, Formula 40 etc.)	4	C								C	
ammonium nonanoate (Axxe)	M										C
carfentrazone-ethyl (Aim EC)	14		C		C				C		
clethodim (*Arrow EC, *Select Max)	1						C	C			
clopyralid (*†Stinger)	4	C									
DCPA (*†Dacthal W75,F)	3							C			
dichlobenil (Casoron 4G, CS)						C	C	C	C	C	C
diuron (Karmex)	7							C			
fluzifop-butyl (†Fusilade DX)	1						C	C			
flumioxazin (Chateau SW, Tuscany)	14		C		C			S			
glufosinate-ammonium (†Rely 200, †280, †Cheetah)	10							C			
glyphosate (Roundup WeatherMax, Touchdown, etc.)	9		C				C	C			
halosulfuron-methyl (Sandeia)	2				C			C			
hexazone (Velpar DF, L)	5					C		C			C
mesotrione (Callisto)	27		C	C	C						
napropamide (Devrinol 50DF, DF-XT)	15						C	C			
norflurazon (*†Solicam DF)	3						C	C			
orzalin (Surflan AS, XL, Flex)	3				P			C			
oxyfluorfen (Goal 2XL)	14				C			C	C		
paraquat (*Gramoxone Inteon, *Firestorm)	22	Control or suppression of a broad spectrum of annual broadleaf and grass weeds. Suppression of perennial weeds.									
pelargonic acid (Scythe)	27	Contact non-selective broad-spectrum herbicide; provides burndown of both annual and perennial broadleaf and grass weeds, most mosses and cryptogams (“spore plants” – algae, lichens, mosses, ferns).									
pendimethalin (Prowl H2O)	3		C					C			
pronamide (Kerb)	3						C	C			C
sethoxydim (Poast)	1						C	C			
s-metolachlor (*†Dual Magnum)	15		C	C				C			
simazine (*†Princep Caliber 90,4L)	5							C			
terbacil (*Sinbar)	5						C	C			

Key: Weed type: BL = broadleaf, G = grass. Weed habit: A = annual, B = biennial, P = perennial. Efficacy: C = control; P = partial control; S = suppression; blank box = weed not listed on label.

3. Sprayer Technology

3.1 Introduction

The average berry planting in New York State is less than 5 acres. Selecting sprayers for small-size plantings can be challenging because it may not be possible to justify the expense of a full-sized sprayer. Larger growers may also use their sprayer for multiple crops, thereby justifying the expense. Sprayers for the small berry crop planting are discussed in sections 3.2 and 3.3.

Sprayers for larger plantings or multiple crops are discussed in sections 3.8 through 3.11.

Regardless of sprayer size, information presented on nozzles (sections 3.5, 3.6 and 3.9), drift reduction (sections 3.3 and 3.7), and solutions for safer spraying (section 3.13) is relevant for all types of sprayers.

3.2 Selecting a Small Sprayer for the Small Berry Crop Planting

There are many important points to consider before purchasing a sprayer, not the least of which is the area to spray, the proximity of the local supplier, standard of manufacture, etc. There are many growers with small plantings who need spraying equipment ranging from backpack sprayers to small truck- or ATV-mounted machines.

3.2.1 Canopy Sprayers

3.2.1.1 Backpack Sprayers

Small capacity (4-5 gallon) sprayers will produce up to approximately 100 psi pressure. Weight is an important consideration and growers should select a sprayer with good, wide, padded straps to ease the load on your shoulders. Correct nozzle selection according to the target is very important to ensure even coverage. A good-sized filling hole at the top is also important.

There are three factors affecting application rate – forward speed, pressure, and nozzle tip size. Unfortunately, most inexpensive backpack sprayers have no pressure gauge. Pay more money and purchase a backpack sprayer with a pressure gauge or, better still, purchase a spray management valve as standard or as an option. Normally output increases or decreases according to the pressure in the system, (which is dependent upon how vigorous you are in pumping the handle up and down). A spray management valve, such as a CF valve, will ensure a constant output irrespective of hand pump action. The CF valve evens out fluctuations in pressure, e.g. will only allow a maximum and minimum pressure thus ensuring even flow. The Fountainhead Group (www.thefountainheadgroup.com) sells a backpack sprayer with a simple valve which ensures the correct pressure is not exceeded.

An alternative to the hand-operated backpack sprayer is an electrically-operated backpack sprayer, which utilizes a small rechargeable battery. Maximum pressure is relatively low and it is easier than using a traditional hand pump system, particularly if you have many rows of plants to spray. Similarly a small back pack sprayer fitted with a small gas engine is available. The electric version is quieter to use, but you must remember to recharge the batteries otherwise spraying will be delayed.

3.2.1.2 Portable Mist and Air Blower Backpacks

These are ideal for plantings where canopy penetration is required, e.g. denser, vigorous plantings. A small gas engine drives a fan blower which creates an airstream which passes along a hand-held tube (similar to a leaf blower). The tube has a nozzle situated at the end so that liquid spray can be squirted into the airstream. The operator directs the spray cloud towards the canopy by pointing the hand-held tube. It is preferable to point the tube backwards to avoid walking into the spray cloud. Engine speed can be reduced which enables a slower airspeed to match a smaller canopy in early season. They are very good at rustling the canopy and getting good penetration and deposition. They are heavy! Noise is a problem, so ear protection must be worn.

3.2.1.3 Portable Gas Engine-driven Sprayers

If weight is a problem, and ground conditions are relatively smooth, a number of manufacturers offer a sprayer with a small gas engine and a 10 to 12 gallon tank. Larger capacity tanks (14 to 100 gallons) are often trailed and can be pulled by a lawn tractor, ATV, Gator, or small tractor.

3.2.1.4 Small, Mounted Sprayers

Ideal for mounting onto the carrier rack of an ATV, 15 to 25 gallons, they use a small electric pump to provide up to 70 psi. When used with a hand wand and a hose, they can be used to spray short length rows. The same system is ideal for weed control and spot spraying of weeds.

3.2.1.5 Large, Skid Mounted Sprayers

Ideal for fitting into the back of a pick-up truck, these sprayers have a tank capacity of 35 to 200 gallons, and an electric-start gas engine.

3.2.1.6 Small, Trailed Airblast Sprayers

Very small airblast sprayers, with tank capacities up to 110 gallons and a 5.5 to 20 hp gas engine, can be towed by an ATV or a small tractor. Larger tank capacities up to 300 gallons are also available but require larger tractors with weights and brakes for safe operation. Remember, the

Air induction nozzles (AI): These nozzles, when used properly, can reduce drift by at least 50 percent. The principle behind these nozzles is to create a larger droplet that won't drift as far but still maintain good leaf and fruit coverage. Note, not all AI nozzles are the same. Remember, it is critical to orientate the nozzles as in step 1 above. Wilger and Lechler manufacture air-assist units to enable AI and hollow cone nozzles to be switched on/off from the tractor.

End plates: In situations where only one side of the sprayer is required, a shroud can be used to block any air on the opposite side of the sprayer. On the last couple of rows in the berry planting you can spray inwards. This way you can reduce drift by 50 percent.

Axial fan size and speed: Using an axial fan producing 20,000m³/hr. and in conjunction with AI nozzles will result in a 75 percent reduction of drift. In order to accommodate varying crop canopies, e.g. as the season progresses, many modern sprayers are fitted with adjustable pitch propellers to provide a variable airflow.

Cornell doughnuts: These attachments restricts air intake to reduce air flow through the sprayer. For early season, the 1/2 air intake doughnut can be used to only allow enough air to penetrate just the target row. A 2/3rd air intake hole can be used for early/mid-season to allow more air. Finally in full canopy, no doughnut is required.

Hydraulic drive: Using a hydraulic motor to drive the sprayer fan will allow you to regulate wind velocity.

Tower sprayers are better at targeting the spray into the canopy than a conventional airblast. The conventional air blast sprayer sends droplets in an air blast from a central fan upwards into the canopy whereas the tower sprayer uses a horizontal air curtain.

Foliage sensors: These sensors tell whether or not the sprayer is next to a berry plant, automatically shutting the spray off if no berry plant is present. There are ultrasonic or infrared sensor types and if used properly reduce your overspray and drift by 50 percent.

Tunnel sprayers: Tunnel sprayers are the best way to reduce drift. Very little spray gets out of the tunnel spraying system allowing for a 90 percent reduction in drift. If A.I nozzles are used with the tunnel sprayer 99 percent of drift can be reduced.

Drift reducing additive: A number of manufacturers supply drift reducing agents, most work via increasing droplet size. Beware not all of them can withstand the higher pressures associated with fruit sprayers and need independent verification.

Calibrate and check that the sprayer is functioning correctly.

Conclusion:

Drift is impossible to eliminate but can be minimized. Implementing just one of these methods will greatly reduce the effects of drift and improve your efficiency of spray application saving you time, money, and future problems.

3.11 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 at: web.entomology.cornell.edu/landers/pestapp/PATTERNATOR.htm.

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"

3.11.1 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.

$$\text{Formula: } \frac{\text{Feet traveled}}{\text{Seconds traveled}} \times \frac{60}{88} = \text{MPH}$$

Your figures:

Tractor gear _____ Engine revs. _____

$$\frac{\text{ft.}}{\text{sec.}} \times \frac{60}{88} = \text{MPH}$$

5 Highbush Blueberries

5.1 Introduction

Numerous pests affect highbush blueberries, although the pest complex is much narrower than with many other fruit crops. For photographs of these pests and for detailed information on blueberry culture, obtain a copy of the Highbush Blueberry Production Guide (NRAES-55) from your Cornell Cooperative Extension Office or order on line or download a free fair use pdf copy (23.0 MB) of this publication at: palspublishing.cals.cornell.edu.

For assistance with diagnosing highbush blueberry problems, use the online Berry Diagnostic Tool at: <https://blogs.cornell.edu/berrytool/> or contact your Cornell Cooperative Extension Office for assistance.

To submit samples for disease diagnosis, contact Plant Disease Clinic, Cornell University, Plant

Pathology section, SIPS, 334 Plant Science Building, Ithaca, NY 14853-4203, (607) 255-7850, online at: plantclinic.cornell.edu. To submit samples for insect diagnosis or for phone consultations, contact Insect Diagnostic Laboratory, Cornell University, Department of Entomology, 4140 Comstock Hall, Ithaca, NY 14853-2601, (607) 255-3250, online at: idl.entomology.cornell.edu.

The following information is provided for management of highbush blueberry pests. If a pesticide is used, it must be registered with the state and federal governments. Use Tables 5.1.2 (insecticides and miticides), 5.1.3 (fungicides), 5.1.4 (herbicides) and 5.1.5 (other highbush blueberry pest management products) to determine legal pesticides, their brand names, and any restrictions that may apply. Unless otherwise noted, use 100 gal water per acre. Always read the label before applying any pesticide.

Table 5.1.1. Highbush blueberry pests and the associated stage of plant development.

Stage of development	Scout for:	See section:
Dormant	Insect stem gall,	5.2.1.1
	Botrytis blossom and twig blight	5.2.1.2
	Cankers (<i>Fusicoccum</i> and <i>Phomopsis</i>)	5.2.1.3 and 5.2.1.4
	Scale insects	5.2.1.5
Green tip	Mummyberry	5.2.2.1
	Botrytis blossom and twig blight	5.2.2.2
	Phomopsis canker	5.2.2.3
Pink bud	Mummyberry	5.2.3.1
	Botrytis blossom and twig blight	5.2.3.2
Bloom	Mummyberry	5.2.4.1
	Botrytis blossom and twig blight	5.2.4.2
	Anthracnose fruit rot/blossom blight	5.2.4.3
	Blueberry leaf rust	5.2.4.4
	Powdery mildew	5.2.4.5
Petal fall/Post bloom	Cranberry fruitworm	5.2.5.1 and 5.2.6.1
	Cherry fruitworm	5.2.5.2 and 5.3.6.2
	Leafrollers	5.2.5.3 and 5.3.6.3
	Blueberry tip borer	5.2.5.4 and 5.2.6.4
	Plum curculio	5.2.5.5
Summer preharvest	Blueberry maggot	5.2.7.1
	Japanese beetle	5.2.7.2
	Anthracnose fruit rot	5.2.7.3
	Blueberry stem borer	5.2.7.4
	Spotted wing drosophila	5.2.7.5
Harvest	Spotted wing drosophila	5.2.8.1
Special pests	Brown marmorated stink bug	5.2.9.1 and 4.3
	Ants	5.2.9.2
	Witches' broom	5.2.9.3
	Crown gall	5.2.9.4
	Blueberry viruses	5.2.9.5 and 4.4, 4.5

Table 6.1.1. Bramble pests and the associated stage of plant development.

Stage of development:	Scout for:	See section:
Special pests <i>(continued)</i>	Phytophthora root rot	6.3.4.6
	Late leaf rust	6.3.4.7
	Fireblight	6.3.4.8
	Blackberry psyllid	6.3.4.9
	Brown marmorated stinkbug	6.3.4.10
	Cane borers/girdlers	6.3.4.11
	Raspberry crown borer	6.3.4.12
	Potato leafhopper	6.3.4.13
	Tree cricket	6.3.4.14
	Twospotted spider mite	6.3.4.15
	Raspberry aphid	6.3.4.16
	Yellow jackets and hornets	6.3.4.17

Table 6.1.2. Selected insecticides and miticides registered for use on brambles (raspberries and blackberries).*(DTH = days to harvest; REI = Restricted Entry Interval; OMRI = materials approved by Organic Materials Review Institute)*

Active Ingredient	Trade Name	EPA Reg. Number	DTH	REI	IRAC Code ¹
acetamiprid	Assail 30SG	8033-36-70506	1	12 hr	4A
acequinocyl	Kanemite 15 SC	66330-38	1	12 hr	20B
azadirachtin	*AzaSol	81899-4-74578		4 hr	UN
	Molt-X	68539-11	0	4 hr	11
<i>Bacillus thuringiensis</i> (B.t.)	Javelin WG	OMRI 70051-66	0	4 hr	
	Dipel DF	OMRI 73049-39	0	4 hr	
<i>Beauveria bassiana</i>	Mycotrol ESO	OMRI 82074-1	0	4 hr	
bifenazate	Acramite 50WS	400-503	1	12 hr	UN
bifenthrin	*Bifenture EC	70506-57	3	12 hr	3A
	*Bifenture 10DF	70506-227	3	12 hr	3A
	*Brigade WSB	279-3108	3	12 hr	
	*Brigade 2EC	279-3313	3	12 hr	
carbaryl	Sevin 4F	61842-38	7	12 hr	1A
	Drexel Carbaryl 4L	19713-49	7	12 hr	
	Carbaryl 4L	34704-447	7	12 hr	
	Sevin XLR Plus	61842-37	7	12 hr	1A
<i>Chromobacterium subtsugae</i>	Grandevo WDG	84059-27	0	4 hr	
etoxazole	Zeal MiticideI	59639-138	0	12 hr	10B
fenpropathrin	*Danitol 2.4EC	59639-35	3	24 hr	3A
flupyradifurone	*†Sivanto prime	264-1141	0	4 hr	4D
hexythiazox	Savey 50 DF	10163-250	3	12 hr	10A
imidacloprid	*Admire Pro	264-827	7 (soil); 3 (foliar)	12 hr	4A
	*Provado 1.6F	264-763	3	12 hr	
	*Pasada 1.6F	66222-228	3	12 hr	
malathion	Malathion 57EC	34704-108	1	12 hr	1B
	Malathion 5EC	19713-217	1	12 hr	
	Malathion 8 Aquamul	34704-474	1	12 hr	
neem extract/derivatives	Trilogy	OMRI 70051-2		4 hr	
pyrethrin ²	Pyrenone Crop Spray 0.5EC	432-1033	0	12 hr	3A
	PyGanic 1.4 EC _{II}	OMRI 1021-1771		12 hr	
	PyGanic 5.0 EC _{II}	OMRI 1021-1772		12 hr	

Table continues on next page.

7.3.2.2 Tarnished Plant Bug (*Lygus lineolaris*)

Symptoms- This pest causes “cat faced” or “button” berries. It damages the fruit by feeding on the flower buds; the berries in the immediate area stop developing. Little information is available on cultivar differences in susceptibility to tarnished plant bug, but early maturity is correlated with freedom from injury; later cultivars may suffer more damage.

<i>Management Options</i>	<i>Guideline</i>
Scouting/thresholds	Anytime from just before the blossoms open until harvest, check for tarnished plant bug nymphs by striking the plant over a flat, low-sided, light-colored dish. Suggested action threshold: 0.5 nymphs per cluster, or 4 out of 15 clusters with 1 or more nymphs.
Resistant cultivars	‘Honeoye’ is less susceptible to feeding injury than other cultivars. Late season and day-neutral varieties often experience much higher pest pressure due to high TPB populations.
Cultural management	A. Row covers accelerate development and help avoid injury. B. Tarnished plant bug pressure is often highest in weedy fields or in fields bordered by woody shrubs.
Conventional products	A. acetamiprid- Assail SG (4.0-6.9 oz/A). OR B. bifenthrin- *Brigade WSB (16-32 oz/A) <i>or</i> *Bifenture 10 DF (6.4-32 oz/A). Note that all products have setback requirements when applying near water; see labels for details. OR C. bifenthrin + imidacloprid- *Brigadier (5.1-6.1 fl oz/A). OR D. fenpropathrin- *Danitol EC (10.6 fl oz/A). No aerial application allowed in NYS. Do not make more than 2 applications of *Danitol per season. Do not exceed 2 pts (32 fl oz, 0.6 lb AI) total per acre per season. Do not apply within 100 feet of any freshwater lake, pond, river, stream or wetland. Do not apply within 100 feet of a coastal marsh or any water that drains into a coastal marsh. OR E. malathion- Malathion 57 EC (1.5-3.0 pt/A). Malathion may be used up to 3 days before harvest. OR F. flonicamid- Beleaf 50 SG (2.8 oz/A). OR G. naled- *Dibrom 8EC (1 pt/A). OR H. pyrethrin- Pyrenone crop spray 0.5EC (2-12 oz/A). OR I. thiamethoxam- *†Actara (4 oz/A) (suppression only).
Organic products (<i>May also be used in conventional production.</i>)	A. <i>Beauveria bassiana</i> strain GHA –Mycotrol ESO (0.25 to 1 qt/A). Begin treatment when insects first appear; typically a 7-10 day interval occurs before control is seen. OR B. <i>Chromobacterium substsugae-</i> Grandevo WDG (2-3 lb/A). C. <i>Isaria fumosorosea-</i> PFR-97 20% WDG (1-2 lbs/A). OR D. pyrethrin- PyGanic 1.4 EC _{II} (16 fl oz/A) <i>or</i> PyGanic 5.0 EC _{II} (4.5-15.61 fl oz/A).

7.3.2.3 Spittlebug (*Philaenus spumaris*)

Symptoms- White frothy masses on the stems and leaves around the time of bloom harbor the nymphs, which pierce the stems and suck plant juices. Their feeding, if extensive, can stunt the plants and reduce berry size. Leaves appear crinkled and darker green than undamaged leaves. The spittle masses are a great nuisance to pickers.

<i>Management Options</i>	<i>Guideline</i>
Scouting/thresholds	One mass per square ft of row.
Resistant cultivars	None known.
Cultural management	A. Good weed control may help to reduce numbers. Populations are usually largest in weedy fields. B. Only one generation is produced per year. The leaves recover after the insects leave.
Conventional products	A. acetamiprid- Assail SG (1.9-4.0 oz/A). OR B. bifenthrin- *Brigade WSB (16-32 oz/A) <i>or</i> *Bifenture 10 DF (6.4-32 oz/A). Note that all products have setback requirements when applying near water; see labels for details. OR

Table 8.3.1. Selected herbicides registered for use on Ribes in New York State.

Herbicide	Formulation	Amount of product per treated acre	lb active ingredient
ammonium nonanoate	Axxe	6 to 15% v/v. See label for details.	See rate table on label for details
<p>Axxe broad spectrum herbicide is a contact non-selective herbicide that provides control and burndown suppression of annual and perennial broadleaf and grass weeds; spore producing plants (cryptogams) such as mosses and liverworts are also controlled. Axxe may be used for the following purposes in berry crops: 1) Vegetative burndown - broadcast spray for weed control for no-till planting or seedbed preparation to control weeds prior to seeding or transplanting. Spot sprays may also be used, 2) Directed and shielded sprays - spray nozzle type or configuration for directed spray or a shield placed around the nozzle to prevent spray contact on the foliage or green stems or bark. Directed/shielded spray applications to area between plastic mulch strips and staked crops for weed control, 3) Preemergence spray before new growth emerges, and 4) Sucker control, pruning and trimming - direct sprays to kill small tender basal suckers in crops such as brambles and fruit trees. Do not allow spray to contact any green plant parts of desirable plants. Do not apply to weeds when wet from dew, rain or irrigation or if rainfall is expected within 2 hours. Do not irrigate within 2 hours after application.</p>			
carfentrazone-ethyl	Aim EC	1-2 fl oz	0.016-0.031
<p>May be applied as broadcast application during dormant stage of crop; do not apply more than 2 fl oz/A during the dormant season. Use as directed application for post-emergence weed control. Use lower rate for control of small weed seedlings (2-3 leaf stage); use higher rate for control of larger weeds (up to 6 leaf stage). Applications beyond 6 leaf stage may result in only partial control. Newly planted bush berries should only be treated with shielded sprayers or hooded sprayers. Do not exceed 6.1 dry oz/A/season. See label for further details. Requires NIS, MSO, or COC². Use a minimum of 20 gallons finished spray solution per broadcast acre.</p>			
clethodim	*Select Max	9-16 fl oz	0.07-0.12
	*Intensity One	9-16 fl oz	0.07-0.12
<p>Apply *Select Max and *Intensity One postemergence to actively growing grasses as a directed spray at the base of plants. Do not apply more than 16 fl oz/A/application; do not apply more than 64 fl oz/A (0.5 lb AI/A) per season. Note special maximum use rate on Long Island of 32 fl oz (0.25 lb AI/acre/season.) There should be a 14 day minimum interval between repeat applications. Supplemental label must be in possession of applicator at time of application.</p>			
dichlobenil	Casoron 4G	100-150 lb (annuals)	4-6
		150 lb (perennials)	6
<p>Dichlobenil controls germinating seeds and seedlings of annual broadleaf weeds, grasses and some perennial weeds that survive other preemergent herbicides. Casoron 4G may be used on bearing, non-bearing and nursery stock. Do not apply until 4 weeks after transplanting. Uniform application is essential – calibration of applicator designed for spreading granules is appropriate. Soil surface treatment: Apply Casoron 4G in late fall from November 15 to February 15. Do not make surface application to areas which have been cultivated during the fall or summer prior to application. Incorporated treatment: Apply Casoron 4G and incorporate immediately after application in late fall or very early spring before May 1.</p>			
mesotrione	Callisto	3-6 fl oz	0.094-0.188
<p>May be applied as a pre-bloom post-directed spray at a rate up to 6 fl oz/A. Split applications (3 fl oz/A each) may also be used at no less than a 14-day interval. No more than 6 fl oz/A may be applied per crop per season. Do not apply after the onset of bloom stage. Do not apply Callisto in a tank mix with emulsifiable concentrate grass herbicides unless specified as injury may occur.</p>			
napropamide	Devrinol 50DF	8 lb	4
	Devrinol DF-XT	8 lb	4
	Devrinol 2XT	2 gal	4
<p>Devrinol is a selective surface-applied or incorporated herbicide for use in newly planted or established crops. See label for weeds controlled. Devrinol does not control established weeds; apply to a weed free soil surface. Devrinol is not recommended for use on soils containing more than 10% organic matter. Do not apply more than 8 lb/A Devrinol 50DF or DF-XT or 2 gal/A Devrinol 2XT per crop cycle.</p>			
<p>Note: Devrinol 50 DF for use on currants only; Devrinol DF-XT and 2XT for use on both currants and gooseberries.</p>			
oryzalin	Surflan A.S.	2-6 qt	2-6
	Surflan XL 2G	300 lb	6
<p>Surflan is a preemergent herbicide for control of certain annual grasses and broadleaf weeds. Apply Surflan prior to germination of target weeds or immediately after cultivation. Do not graze or feed forage from Surflan-treated areas to livestock.</p>			