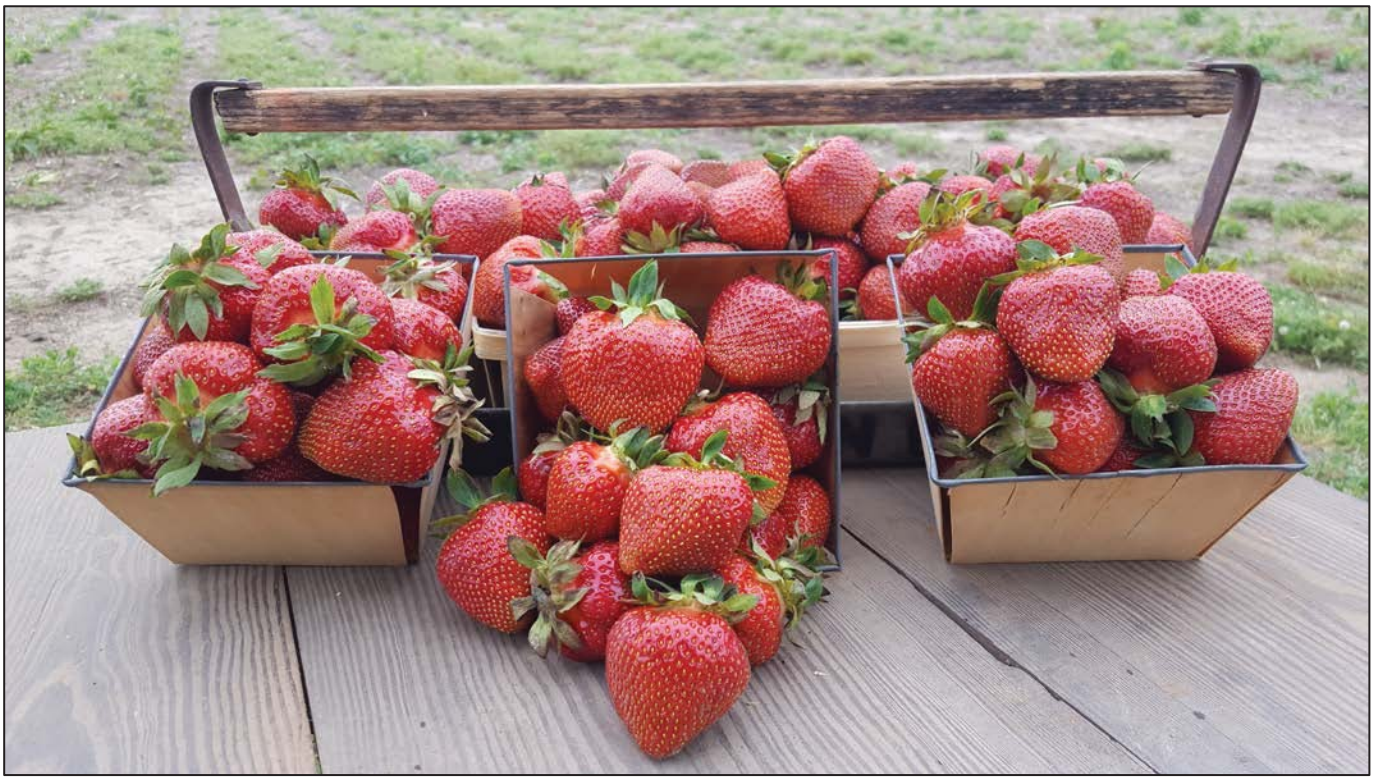

2017
Cornell Pest Management Guidelines for Berry Crops

Cornell University
Cooperative Extension

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

3. SPRAYER TECHNOLOGY *(continued)*

6 BRAMBLES (RASPBERRIES AND BLACKBERRIES) *(continued)*

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 be 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.

More information about pesticide certification and classification is available from your Cornell Cooperative Extension office (cce.cornell.edu/learnAbout/Pages/Local_Offices.aspx), regional NYSDEC pesticide specialist (www.dec.ny.gov/about/558.html), the Pesticide Applicator Training Manuals (store.cornell.edu/c-876-manuals.aspx), 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 be a good steward of their health and that of others. Keep in mind that 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 preparation of a container for disposal. All of 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.** These requirements are based on the pesticide's toxicity, route(s) of exposure, and formulation. Label PPE requirements are the minimum that must be worn during the pesticide's use. Pesticide users can always wear more protection than the label requires.

The choice of protective equipment depends on the activity, environment, and handler. The type and duration of the activity, where pesticides are being used, and exposure of the handler influences the equipment you should use. Mixing/loading procedures often require extra precautions. Studies show you are at a greater risk of accidental poisoning when handling pesticide concentrates. Pouring concentrated pesticide from one container to another is the most hazardous activity. More information on personal protective equipment can be found online at umes.edu/NC170/Default.aspx?id= 7184.

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. More information on engineering controls can be found online at umes.edu/NC170/Default.aspx?id=7196.

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

2 General Information

2.1 Introduction

Cornell's 2017 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**

2.5 Nutrient Guidelines

Maintaining healthy plants is an essential component of pest management. Furthermore, avoiding excessive chemical inputs into the agroecosystem should be an objective of the conscientious grower. The first step in nutrient management is to adjust the soil pH to 6.5 before planting (4.5 for blueberries). Use the soil test results to determine the appropriate amount of lime, sulfur, potash, and phosphorus.

Contact Agro-One (www.dairyone.com/AgroOne) for detailed instructions, submission forms, and fees for basic soil analysis.

The lime requirement will depend on soil texture, current pH, and organic matter content. Follow the recommendations of the soil test and apply and incorporate sufficient lime prior to planting.

Sulfur is useful for lowering the soil pH for blueberry production. The amount of sulfur required depends on soil type, cation exchange capacity, and current pH. See Table 2.5.1. Apply sulfur to the entire field intended for blueberry production. It is not recommended to acidify only the strips into which blueberries will be planted. In established plantings on a high pH soil. Sulfur may be used to lower pH; apply no more than 400 lb/acre in any one year, preferably split between fall and spring, until pH 4.5 is achieved.

Table 2.5.1. Approximate amounts of sulfur (lb/A) required to lower soil pH to 4.5.

	Soil type		
Current pH	**Sand**	**Loam**	**Clay**
5.0	175	530	800
5.5	350	1000	1600
6.0	660	1880	3030
6.5	1250	3560	5730

2.5.1 Nitrogen

Table 2.5.3 contains typical nitrogen guidelines for berry crops planted in sites where preplant soil nutrient guidelines were followed.

Use leaf analysis for determination of nutrient status in established plantings, and adjust nitrogen fertilization accordingly. Apply N in a 3-ft band in the row for all berry crops except strawberries, where fertilizer should be concentrated in a 1-ft band over the row.

To calculate the actual amount of fertilizer to apply, divide the desired amount of actual N by the percent N in the fertilizer and then multiply the result by 100. Apply the total amount of fertilizer in a 3-foot band in the row (1 foot band over the row for strawberries).

Example: Calculation nitrate, actual N 30 lbs/A on strawberries

Calculation:

$$\frac{\text{30 lbs/A actual N}}{\text{15 percent N in calcium nitrate}} \times 100 = \text{200 lbs/A calcium nitrate}$$

Table 2.5.2. Nitrogen sources and calculation of actual N.

Fertilizer	% actual N in fertilizer
Ammonium nitrate	34.0
Ammonium sulfate	20.5
Calcium nitrate	15.0
Diammonium phosphate	17.0
Potassium nitrate	13.0
Urea	46.0

Table 2.5.3. Nitrogen guidelines for berry crops.

Crop	Age of planting	Amount/*timings* (actual N)	N source	Comments
Strawberries (June-bearing)				
	0	30 lb/A, *early June* 30 lb/A, *early September*	ammonium nitrate or calcium nitrate	Be sure plants are growing well prior to application.
	1+	70 lb/A, *at renovation* 30 lb/A, *early September*	ammonium nitrate, urea, calcium nitrate	Adjust fall amount based on leaf analysis.
Strawberries (day neutral)				
	0	3 lb/A weekly, *beginning 4-6 weeks after planting*	calcium nitrate	Water soluble product applied through drip irrigation system. Be sure plants are growing well prior to first application.

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** *Medicago sativus*	**Amaranth, Palmer** *Amaranthus palmeri*	**Amaranth, Powell** *Amaranthus powellii*	**Amaranth, spiny** *Amaranth spinosus*	**Aster** *Aster spp.*	**Barley, volunteer; wild** *Hordeum spp.*	**Barnyardgrass** *Echinochloa crus-galli*	**Bedstraw, catchweed** *Galium aparine*	**Beggarticks** Bidens spp.	**Bentgrass** Agrostis spp.
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**
fluazifop-butyl (Fusilade DX)	**1**						**C**	**C**			
flumioxazin (Chateau SW)	**14**		**C**		**C**			**S**			
†glufosinate-ammonium (Rely 200, 280, Cheetah)	**10**							**C**			
glyphosate (Roundup WeatherMax, Touchdown, etc.)	**9**		**C**				**C**	**C**			
halysulfuron-methyl (Sandea)	**2**				**C**			**C**			
hexazione (Velpar DF, L)	**5**					**C**		**C**			**C**
mesotrione (Callisto)	**27**		**C**	**C**	**C**						
napropamide (Devrinol 50DF, DF-XT)	**15**						**C**	**C**			
†norfulrazon (Solicam 80DF)	**3**						**C**	**C**			
orzalin (Surflan AS, XL 2G)	**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 cryptomgams (“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 WDG, 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 20,000m^3/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.

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

Your figures:

Tractor gear_____ Engine revs._____

$\dfrac{\text{ft.}}{\text{sec.}} \times \dfrac{60}{88} =$ ____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 www.fruit.cornell.edu/berrytool or contact your Cornell Cooperative Extension Office for assistance.

To submit samples for disease diagnosis, contact Plant Disease Clinic, Cornell University, Department of Plant Pathology, 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 (Fusicoccum and Phomopsis)	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 5.1.2. Selected insecticides and miticides registered for use on highbush blueberries.

(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
azadirachtin	Aza-Direct	**OMRI**	71908-1-10163	0	4 hr	UN
	AzaSol		81899-4		4 hr	
	Molt-X		68539-11	0	4 hr	
***Bacillus thuringiensis* (B.t.)**	Javelin WG	**OMRI**	70051-66	0	4 hr	11
	Deliver	**OMRI**	70051-69	0	4 hr	11
	Dipel DF	**OMRI**	73049-39			
Beauvaria bassiana	Mycotrol ESO	**OMRI**	82074-1	0	4 hr	
bifenthrin	*Brigade WSB		279-3108	1	12 hr	3A
	*Bifenture 10DF		70506-227	1	12 hr	3A
	*Fanfare 2 EC		66222-99	1	12 hr	3A
bifenthrin + zeta-cypermethrin + imidacloprid	*Triple Crown		279-3440	3	12 hr	3A, 4A
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
Chromobacterium subtsugae	Grandevo		84059-17	0	4 hr	
cyantraniliprole	*†Exirel		352-859	3	12 hr	28
fenpropathrin	*Danitol 2.4 EC		59639-35	3	24 hr	3A
imidacloprid	*Admire Pro		264-827	7 (soil); 3 (foliar)	12 hr	4A
	*Alias 2F		66222-203	7	12 hr	
	*MANA Alias 4F		66222-156	7 (soil); 3 (foliar)	12 hr	
	*Provado 1.6F		264-763	3	12 hr	
indoxacarb	Avaunt		352-597	7	12 hr	22A
malathion	Malathion 57EC		67760-40-53883	1	12 hr	1B
	Malathion 5EC		19713-217	1	12 hr	
	Malathion 8 Aquamul		34704-474	1	12 hr	
methomyl	*Lannate LV		352-384	3	48 hr	1A
	*Lannate SP		352-342	3	48 hr	
neem extract/derivatives	Trilogy	**OMRI**	70051-2	–	4 hr	
phosmet	*Imidan 70W		10163-169	3	24 hr	1B
pyrethrin[2]	Pyrenone Crop Spray 0.5EC		432-1033	0	12 hr	3A
	PyGanic 1.4 EC_{II}	**OMRI**	1021-1771	0	12 hr	
	PyGanic 5.0 EC_{II}	**OMRI**	1021-1772	0	12 hr	
pyriproxyfen	Esteem 35WP		59639-115	7	12 hr	7C
	Esteem Ant Bait		59639-114	24	12 hr	
	Esteem 0.86 EC		59639-95	7	12 hr	
spinetoram	Delegate WG		62719-541	3	4 hr	23
spinosad	Entrust Naturalyte	**OMRI**	62719-282	3	4 hr	5
	Entrust SC	**OMRI**	62719-621	1	4 hr	
	GF-120 NF Naturalyte Fruit Fly Bait	**OMRI**	62719-498	0	4 hr	
tebufenoxzide	*†Confirm 2F		8033-111-10163	14	4 hr	18
thiamethoxam	*†Actara		100-938	3	12 hr	4A
	*†Platinum		100-939	75	12 hr	

5.2.1.2 Botrytis Blossom and Twig Blight (Botrytis cinerea)

Symptoms - After several days of rainy or foggy weather, infected young shoots may die, turn brown, and become covered with a dusty gray mass of fungus spores. Twig blight is not commoly observed n in New York, but develops occasionally. Blossom blight is a concern only when rainy, foggy weather prevails during the prebloom and bloom period.

Management Options	*Guideline*
Scouting/thresholds	None established.
Resistant cultivars	None known.
Cultural management	Avoid high rates of nitrogen fertilization. This leads to excessive succulent shoot growth, which is more susceptible to infection and supports sporulation.
Conventional products	A. **captan**- Captan 50WP (5 lb/A) *or* 80WDG (3-1/8 lb/A) *or* Captec 4L (0.75-1.0qt/100 gal) *or* Captan 4L (1.75-2.5qt/A), *or* Captan Gold 50 WP (5 lb/A), *or* Captan Gold 80 WDG (3-1/8 lb/A) as buds swell or have loose scales. OR B. **captan/fenhexamid** – CaptEvate 68 WDG (3.5 – 4.7 lb/A). Do not make more than 2 consecutive applications of CaptEvate or any product containing the active ingredient fenhexamid before alternating with another product with a different mode of action for 2 applications. Do not apply more than 21.0 lb/A/season (14.3 lb AI/A/season). Do not apply more than 17.5 lb/A/season (11.9 lb AI/A/season). Re-apply every 7 to 10 days or when conditions favor disease development. OR C. **metconazole**- Quash (2.5 oz/A): Do not make more than 2 sequential applications of Quash before alternating with another product with a different mode of action. Apply no more than 3 applications of Quash per season. OR D. **ziram**- Ziram 76 DF (3 lb/A). Ziram only aids in control and should not be relied on as a stand-alone product for control of this disease.
Organic products (*May also be used in conventional production.)*	A. ***Bacillus amyloliquefaciens strain D747***- Double Nickel 55 (0.25-3 lb/A) *or* Double Nickel LC (0.5-6 quarts/A). Re-apply every 3 to 10 days when conditions favor disease development. OR B. ***Bacillus subtilis***- Serenade Max (1–3 lb/A) *or* Serenade Opti (14-20 oz/A) *or* Optiva (24 oz/A). For improved performance add surfactant such as NuFilm to improve coverage. Make the first application prior to disease development and repeat on a 2-10 interval as needed. OR C. **copper octanoate**- Cueva (0.5-2.0 gal/A). Apply when disease occurs and repeat applications every 7-10 days as needed. OR D. **hydrogen peroxide + peroxyacetic acid**- Rendition (3pt/100 gal). Apply at the first sign of disease and repeat every 5-14 days. OR E. ***Streptomyces lydicus* WYEC108**- Actinovate AG (3-12 oz/A). Foliar applications: for best results apply with a spreader/sticker prior to onset of disease. Re-apply at 7 to 14-day intervals depending on disease pressure and environmental conditions.

5.2.1.3 Fusicoccum Canker (Fusicoccum putrefaciens)

Symptoms- Reddish spots appear on the canes, frequently around a leaf scar near the ground. As the canker enlarges, a bull's-eye pattern develops. Plant parts above the canker may suddenly wilt and die during warm, dry weather, calling attention to the disease. Infection is relatively uncommon except in the colder regions of New York State.

Management Options	*Guideline*
Scouting/thresholds	None established.
Resistant cultivars	'Rancocas' is resistant; moderately susceptible cultivars are 'Coville', 'Berkeley', 'Blueray', 'Burlington', and 'Rubel'; very susceptible cultivars are 'Jersey', 'Earliblue', and 'Bluecrop'.
Cultural management	Prune and burn symptomatic canes as they appear. Take care to avoid winter injury

Management Options	*Guideline*
Cultural management *(continued)*	C. Remove and destroy obviously infected plants as they appear or before bloom in the case of Blueberry Shock Ilarvirus. D. Manage vector populations.
Conventional and Organic products	None known.

5.3 Blueberry Weed Management

A 4-inch layer of bark or sawdust mulch, or a combination of the two, greatly aids in weed management in blueberries. Cultivation should be minimized because the root system is very shallow. Grasses can be planted between rows to minimize weeds within the planting. Consult the Blueberry Production Guide (NRAES-55) for appropriate ground covers for blueberry plantings. Mulches and herbicides are generally applied in a 3-4 foot band under the row. Inventory weeds and consult Tables 2.6.1 and 5.3.1 to determine legal and effective controls.

Table 5.3.1. Selected herbicides registered for use on blueberries in New York State.

Herbicide	Formulation	Amount of product per sprayed acre	lb active ingredient
PREEMERGENT			
carfentrazone-ethyl	Aim EC	1-2 fl oz	0.016-0.031
May be applied as broad cast application during dormant stage of crop; do not apply more than 2 fl oz/A during the dormant season. Use as directed application for both pre-emergent 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 bushberries should only be treated with shielded sprayers or hooded sprayers. Do not exceed 6.1 fl oz/A/season. See label for further details. Requires NIS, MSO, or COC[2]. Use a minimum of 20 gallons finished spray solution per broadcast acre.			
dichlobenil	Casoron 4G	100-150 lb (annuals) 150 lb (perennials)	4-6 6
	Casoron CS	1.4 to 2.8 gal	1.96 –3.92
Casoron 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. Use Casoron CS only around well-established plants; do not apply until 1 year after transplanting. Tank mixing with other pre-and/or post-emergence herbicides registered for use on blueberries may provide a broader spectrum of weed control.			
flumioxazin	Chateau SW	6-12 oz	0.188-0.38
Chateau SW preemergent applications should be made to a weed free soil surface and must be completed prior to weed emergence. Moisture is necessary to activate Chateau SW on soil for residual weed control. Chateau should be tank mixed with a labeled burndown herbicide for postemergence control. Do not apply to bushberries established less than 2 years unless they are protected from spray by non-porous wrap, grow tubes or waxed containers. Do not apply more than 12 oz/A of Chateau SW during a single application or during a 12 month period. Allow 30 days between applications. Note: A maximum rate of 6 oz/A per application should be used on any soil with sand/gravel content over 80% if the bushes are less than 3 years of age; two applications of 6oz/A in a 12-month period can still be made as long as there have been 60 days between applications.			
halosulfuron-methyl	Sandea	0.5 to 0.67 oz 1 to 4-yr old bushes 05. to 1.0 oz > 4yr old bushes	0.023-0.032 0.032-0.047
Preemergence and postemergence directed application for control of labeled weeds: Apply a single or sequential directed application based on weed pressure. If small weeds are present tank-mix with a post-emergence broad-spectrum type herbicide to maximize and enhance the spectrum of broad-leaf and grass control. Preemergence applications of Sandea when ground cover prevents contact with the soil will result in reduced or no residual activity.			