



# 2018 Cornell Pest Management Guidelines for Berry Crops

Cornell Cooperative Extension

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

<b>1 PESTICIDE INFORMATION.....</b>	<b>1</b>
1.1 Pesticide Classification and Certification.....	1
1.2 Use Pesticides Safely .....	1
1.2.1 Plan Ahead.....	1
1.2.2 Move Pesticides Safely .....	1
1.2.3 Personal Protective Equipment and Engineering Controls.....	1
1.2.4 Avoid Drift, Runoff, and Spills.....	1
1.2.5 Avoid Equipment Accidents .....	2
1.2.6 Pesticide Storage.....	2
1.3 Pollinator Protection.....	2
1.4 New York State Pesticide Use Restrictions.....	2
1.4.1 Restricted-Use Pesticides .....	2
1.4.2 Additional Use Restrictions .....	3
1.5 Verifying Pesticide Registration and Restricted-Use Status .....	3
1.6 Check Label for Site and Pest .....	3
1.7 Pesticide Recordkeeping/Reporting .....	3
1.7.1 New York State Requirements.....	3
1.7.2 Federal Private Applicator Recordkeeping Requirements .....	4
1.8 EPA Worker Protection Standard (WPS) for Agricultural Pesticides.....	4
1.9 Reduced-risk Pesticides, Minimum-risk Pesticides, and Biopesticides .....	4
1.9.1 Reduced-risk Pesticides .....	4
1.9.2 Minimum-risk Pesticides .....	4
1.9.3 Biopesticides.....	5
1.10 FIFRA 2(ec) Recommendations.....	5
<b>2 GENERAL INFORMATION.....</b>	<b>6</b>
2.1 Introduction.....	6
2.2 Site Selection and Preparation.....	6
2.2.1 Basic Soil Test .....	6
2.2.2 Cornell Soil Health Test.....	7
2.2.3 Nematodes.....	7
2.2.4 Nematode Testing .....	8
2.2.5 Garden Symphylans .....	8
2.3 Fumigation .....	8
2.3.1 Soil Fumigant Management Plans.....	8
2.3.2 Soil Fumigant Buffer Zones.....	9
2.4 Cover Crops .....	9
2.5 Nutrient Guidelines .....	10
2.5.1 Nitrogen .....	10
2.5.2 Potassium, Phosphorus, Magnesium and Boron .....	12
2.5.3 Leaf Analysis .....	13
2.6 Principles of Weed Management .....	13
2.6.1 Managing Herbicide Applications .....	13
2.7 Principles of Insect and Disease Management .....	14
2.8 Wildlife Damage Management .....	15
2.8.1 Bird Management.....	15
2.8.2 Rodent Management .....	15
2.8.3 Deer Management .....	15
2.9 Berry Crop Harvesting and Handling Guidelines.....	15
2.10 Postharvest Considerations .....	16
2.11 Transporting Berries to Market.....	16
2.12 Food Safety and Berry Crops.....	17
2.13 Useful Web Sites.....	18
2.14 Extension Specialists.....	18
2.15 Extension Faculty and Statewide Specialists .....	19
2.16 Related Resources .....	21
2.17 Herbicide Active Ingredients and Weeds Controlled.....	22

<b>3. SPRAYER TECHNOLOGY .....</b>	<b>36</b>
3.1 Introduction.....	36
3.2 Selecting a Small Sprayer for the Small Berry Crop Planting .....	36
3.2.1 Canopy Sprayers.....	36
3.2.1.1 Backpack Sprayers.....	36
3.2.1.2 Portable Mist and Air Blower Backpacks.....	36
3.2.1.3 Portable Gas Engine-driven Sprayers .....	36
3.2.1.4 Small, Mounted Sprayers.....	36
3.2.1.5 Large, Skid Mounted Sprayers .....	36
3.2.1.6 Small, Trailed Airblast Sprayers.....	36
3.2.1.7 Small, Mounted Airblast Sprayers.....	37
3.2.2 Herbicide or Ground Application Sprayers .....	37
3.2.2.1 Backpack, Small ATV-Mounted Tank, and Hand-Lance Sprayers .....	37
3.2.2.2 Controlled Droplet Applicators (CDA) .....	37
3.2.2.3 Wick Wipers .....	37
3.3 Spraying Small-Scale Berry Crop Plantings .....	37
3.3.1 Prior to Spraying – Calibrating Sprayers .....	37
3.3.1.1 Calibration of Backpack Sprayers – For Canopy Spraying .....	37
3.3.1.2 Calibration of Backpack Sprayers – In General.....	37
3.3.2 Calculating the Amount of Pesticide to Use .....	37
3.3.3 Measuring Small Amounts of Pesticide.....	38
3.3.3.1 Measuring Equipment.....	38
3.3.3.2 Safety.....	38
3.3.3.3 Powders and Granules .....	38
3.3.3.4 Liquids.....	38
3.4 Equipment for Weed Control in Berry Crops .....	38
3.4.1 Boom Applicators .....	38
3.4.2 Sensor-Controlled Applicators.....	39
3.4.3 Controlled Droplet Applicators (CDA).....	39
3.4.4 Flame Applicators.....	39
3.5 Selecting the Correct Nozzle to Reduce Drift.....	40
3.6 Selecting Nozzles from the Nozzle Catalogue –Boom Sprayers .....	41
3.7 Boom Sprayer Calibration .....	41
3.8 Preparing the Airblast Sprayer for Work .....	42
3.8.1 Checking the Sprayer.....	42
3.8.2 Fitting the Sprayer to the Tractor.....	42
3.8.3 Checking the Operation of the Sprayer.....	42
3.8.4 Pre-Season Maintenance.....	42
3.8.5 Nozzles on the Net.....	43
3.9 Selecting Nozzles from the Nozzle Catalogue – Airblast Sprayers .....	44
3.10 Reducing Drift from Airblast Sprayers in Berry Crops .....	46
3.11 Sprayer Calibration .....	47
3.11.1 Travel Speed Calibration .....	47
3.11.2 Airblast Sprayer Calibration .....	48
3.11.3 Calibrating an AgTec Sprayer .....	48
3.12 Management Strategies to Reduce Drift .....	48
3.13 Solutions for Safer Spraying.....	49
3.13.1 Why use Engineering Controls? .....	49
3.13.2 Loading the Sprayer.....	49
3.13.3 Reducing Contamination at the Boom .....	49
3.13.4 Drift and Contaminated Clothing in Cabs.....	50
3.13.5 Cleaning the Sprayer.....	50
3.14 Decontaminating and Storing Crop Sprayers.....	54
3.14.1 Sprayer Decontamination and Maintenance .....	54
3.14.2 Cleaning when Similar Products are to be Used.....	54
3.14.3 Cleaning when Product Type is Changed .....	54
3.14.4 Disposal of Pesticide Waste.....	55
3.14.5 Storage of Sprayers.....	55

**3 SPRAYER TECHNOLOGY** *(continued)*

3.15 Distance Learning .....	55
3.16 Further Sprayer Information.....	56

**4 EMERGING PESTS**..... 57

4.1 Introduction.....	57
4.2 Spotted Wing Drosophila.....	57
4.3 Brown Marmorated Stink Bug.....	59
4.4 Blueberry Scorch Virus.....	59
4.5 Blueberry Shock Ilarvirus.....	60
4.6 Currant Cane Blight.....	61
4.7 White Pine Blister Rust.....	61
4.8 Wild Parsnip.....	62
4.9 Giant Hogweed.....	63
4.10 Herbicide-Resistant Weeds in NY.....	63

**5 Highbush Blueberries**..... 65

5.1 Introduction.....	65
5.2 Insects and Diseases: Time for Concern.....	70
5.2.1 DORMANT.....	70
5.2.1.1 Insect Stem Gall ( <i>Hemadas nubilipennis</i> ).....	70
5.2.1.2 Botrytis Blossom and Twig Blight ( <i>Botrytis cinerea</i> ).....	71
5.2.1.3 Fusicoccum Canker ( <i>Fusicoccum putrefaciens</i> ).....	71
5.2.1.4 Phomopsis Canker and Twig Blight ( <i>Phomopsis vaccinii</i> ).....	72
5.2.1.5 Scale Insects (various species).....	73
5.2.2 GREEN TIP.....	73
5.2.2.1 Mummyberry ( <i>Monilinia vaccinii-corymbosi</i> ).....	73
5.2.2.2 Botrytis Blossom and Twig Blight ( <i>Botrytis cinerea</i> ).....	74
5.2.2.3 Phomopsis Canker and Twig Blight ( <i>Phomopsis vaccinii</i> ).....	75
5.2.3 PINK BUD.....	75
5.2.3.1 Mummyberry ( <i>Monilinia vaccinii-corymbosi</i> ).....	75
5.2.3.2 Botrytis Blossom and Twig Blight ( <i>Botrytis cinerea</i> ).....	75
5.2.4 BLOOM.....	76
5.2.4.1 Mummyberry ( <i>Monilinia vaccinii-corymbosi</i> ).....	76
5.2.4.2 Botrytis Blossom and Twig Blight ( <i>Botrytis cinerea</i> ).....	76
5.2.4.3 Anthracnose Fruit Rot and Blossom Blight ( <i>Colletotrichum acutatum</i> ).....	76
5.2.4.4 Blueberry Leaf Rust ( <i>Naohidemyces vaccinii</i> or <i>Pucciniastrum vaccinii</i> ).....	78
5.2.4.5 Powdery Mildew ( <i>Microsphaera vaccinii</i> ).....	78
5.2.5 PETAL FALL.....	80
5.2.5.1 Cranberry Fruitworm ( <i>Acrobasis vaccinii</i> ).....	80
5.2.5.2 Cherry Fruitworm ( <i>Grapholita packardi</i> ).....	80
5.2.5.3 Leafrollers (various species).....	81
5.2.5.4 Blueberry Tip Borer ( <i>Hendecaneura shawiana</i> ).....	82
5.2.5.5 Plum Curculio ( <i>Conotrachelus nenuphar</i> ).....	82
5.2.6 POST BLOOM.....	83
5.2.6.1 Cranberry Fruitworm ( <i>Acrobasis vaccinii</i> ).....	83
5.2.6.2 Cherry Fruitworm ( <i>Grapholita packardi</i> ).....	83
5.2.6.3 Leafrollers (various species).....	83
5.2.6.4 Blueberry Tip Borer ( <i>Hendecaneura shawiana</i> ).....	83
5.2.7 SUMMER PREHARVEST.....	83
5.2.7.1 Blueberry Maggot ( <i>Rhagoletis mendax</i> ).....	83
5.2.7.2 Japanese Beetle ( <i>Popillia japonica</i> ).....	84
5.2.7.3 Anthracnose Fruit Rot ( <i>Colletotrichum acutatum</i> ).....	85
5.2.7.4 Blueberry Stem Borer ( <i>Oberea myops</i> ).....	85
5.2.7.5 Spotted Wing Drosophila ( <i>Drosophila suzukii</i> ).....	85
5.2.8 HARVEST.....	87
5.2.8.1 Spotted Wing Drosophila ( <i>Drosophila suzukii</i> ).....	87



**5 Highbush Blueberries (continued)**

5.2 Insects and Diseases: Time for Concern (continued)	
5.2.9 SPECIAL PESTS.....	87
5.2.9.1 Brown Marmorated Stink Bug ( <i>Halymorpha halys</i> ).....	87
5.2.9.2 Ants (various species).....	87
5.2.9.3 Witches' Broom ( <i>Pucciniastrum goeppertianum</i> ).....	88
5.2.9.4 Crown Gall ( <i>Agrobacterium tumefaciens</i> ).....	88
5.2.9.5 Blueberry Viruses (various types).....	88
5.3 Blueberry Weed Management.....	89

**6 BRAMBLES (RASPBERRIES AND BLACKBERRIES).....96**

6.1 Introduction.....	96
6.2 Summer Fruiting Raspberries and Blackberries – Insects and Diseases - Time for Concern.....	101
6.2.1 BUD BREAK (New buds show ¼ to ½” green at tips).....	101
6.2.1.1 Anthracnose ( <i>Elsinoe veneta</i> ).....	101
6.2.1.2 Spur Blight ( <i>Didymella applanata</i> ).....	102
6.2.1.3 Cane Blight or Spot ( <i>Leptosphaeria coniothyrium</i> ).....	103
6.2.2 EARLY PREBLOOM.....	104
6.2.2.1 Anthracnose ( <i>Elsinoe veneta</i> ), Spur Blight ( <i>Didymella applanata</i> ) and Cane Blight ( <i>Leptosphaeria coniothyrium</i> ).....	104
6.2.2.2 Raspberry Fruitworm ( <i>Byturus rubi</i> ), Raspberry Sawfly ( <i>Monophadnoides geniculatus</i> ).....	104
6.2.3 LATE PREBLOOM.....	105
6.2.3.1 Raspberry Fruitworm, Raspberry Sawfly.....	105
6.2.3.2 Tarnished Plant Bug ( <i>Lygus lineolaris</i> ).....	105
6.2.3.3 Japanese Beetle ( <i>Papillia japonica</i> ).....	105
6.2.4 EARLY BLOOM (5-10% of blossoms open).....	106
6.2.4.1 Powdery Mildew ( <i>Sphaerotheca macularis</i> ).....	106
6.2.4.2 Botrytis Fruit Rot/Gray Mold ( <i>Botrytis cinerea</i> ).....	107
6.2.5 FULL BLOOM.....	108
6.2.5.1 Botrytis Fruit Rot/Gray Mold ( <i>Botrytis cinerea</i> ).....	108
6.2.5.2 Powdery Mildew ( <i>Sphaerotheca macularis</i> ).....	108
6.2.6 PETAL FALL TO FRUIT RIPENING.....	109
6.2.6.1 Spotted Wing Drosophila ( <i>Drosophila suzukii</i> ).....	109
6.2.6.2 Strawberry Sap Beetle ( <i>Stelidota geminata</i> ) Picnic Beetle ( <i>Glischrochilus fasciatus</i> ).....	110
6.2.6.3 Tarnished Plant Bug ( <i>Lygus lineolaris</i> ).....	111
6.3 Primocane-Fruiting Raspberries (Fall Bearing) – Insects and Diseases - Time for Concern.....	111
6.3.1 WHEN CANES ARE APPROX. 18” TALL.....	111
6.3.1.1 Japanese Beetle ( <i>Popillia japonica</i> ).....	111
6.3.2 FROM PETAL FALL THROUGH THE BEGINNING OF HARVEST.....	111
6.3.2.1 Spotted Wing Drosophila ( <i>Drosophila suzukii</i> ).....	111
6.3.2.2 Sap Beetle ( <i>Stelidota geminata</i> ).....	113
6.3.2.3 Tarnished Plant Bug ( <i>Lygus lineolaris</i> ).....	113
6.3.2.4 Botrytis Fruit Rot/Gray Mold ( <i>Botrytis cinerea</i> ).....	113
6.3.3 HARVEST.....	113
6.3.3.1 Spotted Wing Drosophila ( <i>Drosophila suzukii</i> ).....	113
6.3.4 SPECIAL PESTS.....	113
6.3.4.1 Mosaic Virus Complex.....	113
6.3.4.2 Crumbly Berry (Tomato Ringspot Virus).....	114
6.3.4.3 Verticillium Wilt ( <i>Verticillium albo-atrum</i> ).....	114
6.3.4.4 Orange Rust ( <i>Arthuriomyces peckianus</i> ).....	115
6.3.4.5 Raspberry Leaf and Cane Spot ( <i>Septoria rubi</i> ).....	115
6.3.4.6 Phytophthora Root Rot ( <i>Phytophthora</i> spp.).....	116
6.3.4.7 Late Leaf Rust ( <i>Pucciniastrum americanum</i> ).....	117
6.3.4.8 Fireblight ( <i>Erwinia amylovora</i> ).....	117
6.3.4.9 Blackberry Psyllid ( <i>Trioza tripunctata</i> ).....	118
6.3.4.10 Brown Marmorated Stink Bug ( <i>Halymorpha halys</i> ).....	118
6.3.4.11 Borers/Cane Girdlers (Various species).....	118
6.3.4.12 Raspberry Crown Borer ( <i>Pennisetia marginata</i> ).....	119

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

## 6.3 Primocane-Fruiting Raspberries (Fall Bearing) – Insects and Diseases - Time for Concern (continued)

## 6.3.4 SPECIAL PESTS (continued)

6.3.4.13 Potato Leafhopper ( <i>Empoasca fabae</i> ) .....	119
6.3.4.14 Tree Cricket ( <i>Oecanthus</i> sp.).....	120
6.3.4.15 Twospotted Spider Mite ( <i>Tetranychus urticae</i> ).....	120
6.3.4.16 Raspberry Aphid (Various species) .....	121
6.3.4.17 Yellow Jackets and Hornets* ( <i>Vespa</i> spp.).....	121

6.4 Bramble Weed Management.....	121
----------------------------------	-----

**7 STRAWBERRIES..... 127**

7.1 Introduction.....	127
-----------------------	-----

7.2 Insects and Diseases: Time for Concern – First Growing Season.....	133
--	-----

7.2.1 SUMMER MONTHS AFTER PLANTING .....	133
--	-----

7.2.1.1 Greenhouse Whitefly ( <i>Trialeurodes vaporariorum</i> ) .....	133
--	-----

7.2.1.2 Twospotted Spider Mite.....	134
-------------------------------------	-----

7.3 Fruiting Years.....	135
-------------------------	-----

7.3.1 EARLY SPRING.....	135
-------------------------	-----

7.3.1.1 Twospotted Spider Mite ( <i>Tetranychus urticae</i> ).....	135
--	-----

7.3.1.2 Bud Weevil or Clipper ( <i>Anthonomus signatus</i> ).....	135
---	-----

7.3.1.3 Leaf Spot ( <i>Mycosphaerella fragariae</i> ).....	136
--	-----

7.3.1.4 Leaf Scorch ( <i>Diplocarpon earliana</i> ).....	137
--	-----

7.3.1.5 Leaf Blight ( <i>Phomopsis obscurans</i> ) .....	137
--	-----

7.3.1.6 Angular Leaf Spot ( <i>Xanthomonas fragariae</i> ) .....	138
--	-----

7.3.2 PREBLOOM.....	139
---------------------	-----

7.3.2.1 Bud Weevil or Clipper ( <i>Anthonomus signatus</i> ).....	139
---	-----

7.3.2.2 Tarnished Plant Bug ( <i>Lygus lineolaris</i> ) .....	139
---	-----

7.3.2.3 Spittlebug ( <i>Philaenus spumaris</i> ).....	140
---	-----

7.3.2.4 Powdery Mildew ( <i>Podosphaera aphanis</i> syn. <i>Sphaerotheca macularis</i> ).....	140
---	-----

7.3.3 EARLY BLOOM (10-20% of flower buds open).....	142
---	-----

7.3.3.1 Botrytis Fruit Rot or Gray Mold ( <i>Botrytis cinerea</i> ) .....	142
---	-----

7.3.3.2 Leaf Spot, Leaf Scorch, Leaf Blight .....	143
---	-----

7.3.4 FULL BLOOM (Do not apply insecticides during bloom).....	143
--	-----

7.3.4.1 Botrytis Fruit Rot/Gray Mold ( <i>Botrytis cinerea</i> ).....	143
---	-----

7.3.5 FRUIT SET THROUGH HARVEST .....	143
---------------------------------------	-----

7.3.5.1 Anthracnose ( <i>Colletotrichum acutatum</i> ) .....	143
--	-----

7.3.5.2 Leather Rot ( <i>Phytophthora cactorum</i> ).....	144
---	-----

7.3.5.3 Tarnished Plant Bug ( <i>Lygus lineolaris</i> ) .....	145
---	-----

7.3.5.4 Strawberry Sap Beetle ( <i>Stelidota geminata</i> ) Picnic Beetle ( <i>Glischrochilus fasciatus</i> ).....	145
--	-----

7.3.6 POST HARVEST .....	146
--------------------------	-----

7.3.6.1 Leaf Spot, Leaf Scorch, Leaf Blight .....	146
---	-----

7.3.6.2 Twospotted Spider Mite ( <i>Tetranychus urticae</i> ).....	146
--	-----

7.3.7 SPECIAL PESTS.....	146
--------------------------	-----

7.3.7.1 Spotted Wing Drosophila ( <i>Drosophila suzukii</i> ).....	146
--	-----

7.3.7.2 Brown Marmorated Stink Bug ( <i>Halymorpha halys</i> ) .....	147
--	-----

7.3.7.3 Strawberry Rootworm.....	147
----------------------------------	-----

7.3.7.4 Root Weevils (Various species).....	148
---	-----

7.3.7.5 Cyclamen Mite ( <i>Stenotarsonemus pallidus</i> ) .....	148
---	-----

7.3.7.6 Garden Slugs (Various species) .....	149
--	-----

7.3.7.7 Leafrollers (Various species) .....	150
---	-----

7.3.7.8 Aphids (Various species) .....	150
--	-----

7.3.7.9 Yellow Jackets and Hornets* ( <i>Vespa</i> spp.).....	151
---	-----

7.3.7.10 Potato Leafhopper ( <i>Empoasca fabae</i> ) .....	151
--	-----

7.3.7.11 Japanese Beetles ( <i>Popillia japonica</i> ) .....	152
--	-----

7.3.7.12 White grub complex (Various species) .....	152
---	-----

7.3.7.13 Red Stele or Phytophthora Root Rot ( <i>Phytophthora fragariae</i> ).....	153
--	-----

7.3.7.14 Verticillium Wilt ( <i>Verticillium albo-atrum</i> ) .....	154
---	-----

7.3.7.15 Black Root Rot (Various species).....	155
--	-----

<b>7 STRAWBERRIES</b> (continued)	
7.3 Fruiting Years (continued)	
7.3.7 SPECIAL PESTS (continued)	
7.3.7.16 Strawberry mottle virus (SMoV)	155
7.3.7.17 Strawberry mild yellow edge virus (SMYEV)	156
7.4 Strawberry Weed Management	156
<b>8 RIBES (CURRANTS AND GOOSEBERRIES)</b>	<b>161</b>
8.1 Introduction	161
8.2 Insects and Diseases - Time for Concern	165
8.2.1 DORMANT	165
8.2.1.1 San Jose Scale ( <i>Quadraspidiotus perniciosus</i> )	165
8.2.2 BURST TO LEAF	165
8.2.2.1 Powdery Mildew ( <i>Sphaerotheca mors-uvae</i> )	165
8.2.2.2 Currant Aphid ( <i>Cryptomyzus ribis</i> )	167
8.2.2.3 Currant Stem Girdler ( <i>Janus integer</i> )	167
8.2.3 EARLY GRAPE TO BLOOM	167
8.2.3.1 White Pine Blister Rust ( <i>Cronartium ribicola</i> )	167
8.2.3.2 Powdery Mildew ( <i>Sphaerotheca mors-uvae</i> )	168
8.2.3.3 Currant Aphid ( <i>Cryptomyzus ribis</i> )	168
8.2.4 BLOOM TO PETAL FALL	168
8.2.4.1 White Pine Blister Rust ( <i>Cronartium ribicola</i> )	168
8.2.4.2 Powdery Mildew ( <i>Sphaerotheca mors-uvae</i> )	169
8.2.4.3 Leaf Spots: Anthracnose Leaf Spot ( <i>Drepanopezizia ribis</i> ), <i>Septoria</i> Leaf Spot ( <i>Mycosphaerella ribis</i> )	169
8.2.4.4 Currant Aphid ( <i>Cryptomyzus ribis</i> )	169
8.2.4.5 Gooseberry Fruitworm ( <i>Zophodia convolutella</i> )	169
8.2.4.6 Imported Currant Worm ( <i>Nematus ribesii</i> )	170
8.2.5 SUMMER PREHARVEST	170
8.2.5.1 White Pine Blister Rust ( <i>Cronartium ribicola</i> )	170
8.2.5.2 Powdery Mildew ( <i>Sphaerotheca mors-uvae</i> )	170
8.2.5.3 Leaf Spots: Anthracnose Leaf Spot, <i>Septoria</i> Leaf Spot	170
8.2.5.4 Gooseberry Fruitworm ( <i>Zophodia convolutella</i> )	171
8.2.5.5 Currant Borer ( <i>Synanthedon tipuliformis</i> )	171
8.2.5.6 Currant Cane Blight or <i>Botryosphaeria</i> canker ( <i>Botryosphaeria ribis</i> )	171
8.2.5.7 Twospotted Spider Mite ( <i>Tetranychus urticae</i> )	172
8.2.5.8 Imported Currant Worm ( <i>Nebarus ribesii</i> )	172
8.2.5.9 Japanese Beetle ( <i>Popillia japonica</i> )	172
8.2.6 SPECIAL PESTS	173
8.2.6.1 Slugs and Snails (Various species)	173
8.2.6.2 Spotted Wing Drosophila ( <i>Drosophila suzukii</i> )	174
8.3 Ribes Weed Management	174
<b>9 CRANBERRIES</b>	<b>178</b>
9.1 Introduction	178
9.2 Diseases - Time for Concern	181
9.2.1 DORMANT	181
9.2.1.1 Red Leaf Spot and Red Shoot Disease ( <i>Exobasidium rostrupii</i> )	181
9.2.2 BUD BREAK	181
9.2.2.1 Cottonball ( <i>Monilinia oxycocci</i> )	181
9.2.3 BLOOM	182
9.2.3.1 Upright Dieback and Viscid Rot ( <i>Phomopsis vaccinii</i> )	182
9.2.3.2 Early Fruit Rot ( <i>Phyllosticta vaccinii</i> )	182
9.2.4 HARVEST TO POST HARVEST	182
9.2.4.1 End Rot ( <i>Fusicoccum putrefaciens</i> )	182

<b>10 ELDERBERRIES.....</b>	<b>184</b>
10.1 Introduction.....	184
10.2 Diseases - Time for Concern.....	187
10.2.1 BLOOM.....	187
10.2.1.1 Powdery Mildew (Various species).....	187
10.2.2 Fruit Ripening through Harvest.....	187
10.2.2.1 Spotted Wing Drosophila ( <i>Drosophila suzukii</i> ).....	187
10.2.3 SPECIAL PESTS.....	189
10.2.3.1 Verticillium Wilt ( <i>Verticillium albo-atrum</i> ).....	189
10.2.3.2 Elder Shoot Borer Moth ( <i>Achatodes zeae</i> ).....	189
10.2.3.3 Other Insect Damage.....	189
<b>11 JUNE BERRIES/SASKATOONS.....</b>	<b>190</b>
11.1 Introduction.....	190
11.2 Diseases of Juneberries and Management Options.....	193
11.2.1. Entomosporium Leaf and Berry Spot ( <i>Entomosporium mespili</i> ).....	193
11.2.2. Saskatoon – Juniper Rust ( <i>Gymnosporangium nidusavis</i> ).....	194
11.2.3. Powdery Mildew ( <i>Erysiphe polygoni</i> ).....	194
11.2.4. Fireblight ( <i>Erwinia amylovora</i> ).....	195
11.3 Insect Pests of Juneberries and Management Options.....	195
11.3.1. Saskatoon Sawfly ( <i>Holocampa montanicola</i> ).....	195
11.3.2. Woolly Elm Aphid ( <i>Eriosoma Americana</i> ).....	196
11.3.3. Slugs and snails.....	196



# 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](http://cce.cornell.edu/localoffices)), regional NYSDEC pesticide specialist ([www.dec.ny.gov/about/558.html](http://www.dec.ny.gov/about/558.html)), the Pesticide Applicator Training Manuals ([store.cornell.edu/c-876-manuals.aspx](http://store.cornell.edu/c-876-manuals.aspx)), or the Pesticide Management Education Program (PMEP) at Cornell University ([psep.cce.cornell.edu](http://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. More information on personal protective equipment can be found online at [umes.edu/NC170/Default.aspx?id=7184](http://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](http://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 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	<b>0.0023</b>
tn/A	lb/100 sq ft	<b>4.6</b>
lb/A	kg/ha	<b>1.12</b>
kg/ha	lb/A	<b>0.893</b>
lb	oz	<b>16</b>
qt of fruit	lb of fruit	<b>1.5</b>
qt	pt	<b>2.0</b>
pt	qt	<b>0.5</b>
gal of liquid	lb of liquid	<b>8.3</b>
<b>Strawberries</b>		
lb/A	lb/100 ft of row	<b>0.008</b>
Yield in lb/100 ft of row	lb/A	<b>125</b>
Yield in qt/100 ft of row	lb/A	<b>188</b>
<b>Raspberries and Blackberries</b>		
lb/A	lb/100 ft of row	<b>0.0184</b>
lb/A	oz/plant	<b>0.009</b>
Yield in lb/100 ft of row	lb/A	<b>55</b>
Yield in pt/100 ft of row	lb/A	<b>73</b>
<b>Blueberries</b>		
lb/A	oz/plant	<b>0.015</b>
Yield in lb/100 ft of row	lb/A	<b>44</b>
Yield in pt/100 ft of row	lb/A	<b>58</b>
<b>Currants and Gooseberries</b>		
lb/A	oz/plant	<b>0.012</b>
lb/A	lb/100 ft of row	<b>0.0184</b>
Yield in lb/100 ft of row	lb/A	<b>55</b>
Yield in pt/100 ft of row	lb/A	<b>73</b>

## 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](http://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.**

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

**Table 2.5.3. Nitrogen guidelines for berry crops.**

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

### 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:** Calcium nitrate, actual N 30 lbs/A on strawberries

**Calculation:**

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

**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

## 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
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			
halosulfuron-methyl (Sanda)	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 (Sollicam 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 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 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](http://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<sup>3</sup>/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 2/3<sup>rd</sup> 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](http://web.entomology.cornell.edu/landers/pestapp/PATTERNATOR.htm).

Videos showing calibration and nozzle selection may be found on the internet at: [www.youtube.com](http://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](http://palspublishing.cals.cornell.edu).

For assistance with diagnosing highbush blueberry problems, use the online Berry Diagnostic Tool at [www.fruit.cornell.edu/berrytool](http://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](http://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](http://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:
<b>Dormant</b>	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
<b>Green tip</b>	Mummyberry	5.2.2.1
	Botrytis blossom and twig blight	5.2.2.2
	Phomopsis canker	5.2.2.3
<b>Pink bud</b>	Mummyberry	5.2.3.1
	Botrytis blossom and twig blight	5.2.3.2
<b>Bloom</b>	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
<b>Petal fall/Post bloom</b>	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
<b>Summer preharvest</b>	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
<b>Harvest</b>	Spotted wing drosophila	5.2.8.1
<b>Special pests</b>	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> )	Raspberry leaf spot	6.3.4.5
	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 <sup>1</sup>
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
	*Fanfare 2 EC	66222-99	1	12 hr	3A
	*Brigade WSB	279-3108	3	12 hr	
	*Brigade 2EC	279-3313	3	12 hr	
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
<i>Chromobacterium subsugae</i>	Grandevo WDG	84059-27	0	4 hr	
etoxazole	Zeal Miticide1	59639-138	0	12 hr	10B
fenpropathrin	*Danitol 2.4EC	59639-35	3	24 hr	3A
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	

Table continues on next page.

### 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>
<b>Scouting/thresholds</b>	One mass per square ft of row.
<b>Resistant cultivars</b>	None known.
<b>Cultural management</b>	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.
<b>Conventional products</b>	A. <b>acetamiprid-</b> Assail SG (1.9-4.0 oz/A). OR B. <b>bifenthrin-</b> *Brigade WSB (16-32 oz/A) <i>or</i> *Bifenture 10 DF (6.4-32 oz/A) <i>or</i> *Fanfare (2.56-12.8 fl oz/A). <b>Note that all products have setback requirements when applying near water; see labels for details.</b> OR C. <b>bifenthrin + imidacloprid-</b> *Brigadier (5.1-6.1 fl oz/A). OR D. <b>fenpropathrin-</b> *Danitol 2.4 EC (10.6 fl oz/A). No aerial application allowed in NYS. Do not exceed more than 2 consecutive applications of *Danitol totaling 42.6 fl oz/A (0.8 lb AI/A) to the same planting in 12 consecutive months. 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. <b>imidacloprid-</b> *Provado 1.6F (3.8 fl oz/A) <i>or</i> Admire Pro foliar applied (1.3 fl oz/A) <i>or</i> *Pasada 1.6 (3.75 fl oz/A) <i>or</i> *MANA Alias 4F (1.5 fl oz/A) as a foliar treatment).
<b>Organic products</b>	None known.

### 7.3.2.4 Powdery Mildew (*Podosphaera aphanis* syn. *Sphaerotheca macularis*)

**Symptoms-** The edges of infected leaves roll up, sometimes revealing a white, powdery layer of mycelium and spores on the lower leaf surfaces. Purple to reddish blotches also occur frequently on the lower leaf surfaces. Symptoms are usually not evident until middle or late summer. Numerous pepper-like black flecks (survival structures – cleistothecia) may appear on infected leaf surfaces in fall.

<i>Management Options</i>	<i>Guideline</i>
<b>Scouting/thresholds</b>	None established.
<b>Resistant cultivars</b>	None known. In areas of high incidence (low, humid, foggy areas) <b>avoid</b> varieties commonly affected in New York which include: ‘Guardian’, ‘Earliglow’, ‘Darselect’, ‘Evangeline’, ‘Annapolis’, and to a lesser extent, ‘Raritan’.
<b>Cultural management</b>	A. Manage weeds and regulate planting density to promote air circulation. B. Avoid excessive nitrogen and sites with poor air drainage.
<b>Conventional products</b>	A. <b>azoxystrobin-</b> Abound (6.0-15.4 fl oz/A); See precautions, restrictions, and guidelines for Abound under <i>Fruit Set/Anthracnose</i> . OR B. <b>azoxystrobin/propiconazole-</b> Quilt Xcel (14 fl oz/A). Do not make more than two sequential applications of Quilt Xcel before alternating with another product with a different mode of action (non-group 11 fungicide). Apply no more than four applications of Quilt Xcel or other QoI-containing product per season. OR C. <b>copper-</b> several formulations are labeled. Follow labeled rates. OR D. <b>cyflufenamid-</b> Miltrex 10 SC (1.7 – 3.4 oz/A) <i>or</i> Torino (3.4 oz/A). Begin application at first sign of disease development. Apply in a minimum finished spray volume of 20 gallons per acre by ground. Do not apply more than once every 14 days. Do not exceed a total of 0.044 lb. active ingredient (3.4 oz product/A X 2 applications) per acre per year. 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
<b>ammonium nonanoate</b>	Axxe	6 to 15% v/v. See label for details.	See rate table on label for details
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.			
<b>carfentrazone-ethyl</b>	Aim EC	1-2 fl oz	0.016-0.031
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 COC <sup>2</sup> . Use a minimum of 20 gallons finished spray solution per broadcast acre.			
<b>clethodim</b>	*Select Max	9-16 fl oz	0.07-0.12
	*Intensity One	9-16 fl oz	0.07-0.12
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.			
<b>dichlobenil</b>	Casoron 4G	100-150 lb (annuals)	4-6
		150 lb (perennials)	6
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.			
<b>napropamide</b>	Devrinol 50DF	8 lb	4
	Devrinol DF-XT	8 lb	4
	Devrinol 2XT	2 gal	4
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.			
<b>Note:</b> Devrinol 50 DF for use on currants only; Devrinol DF-XT and 2XT for use on both currants and gooseberries.			
<b>oryzalin</b>	Surflan A.S.	2-6 qt	2-6
	Surflan XL 2G	300 lb	6
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.			
Surflan A.S.: For use in non-bearing and bearing berry crops. Apply directly to the soil surface of the berry planting in a total spray volume of 20-40 gal/A (broadcast basis). To broaden spectrum of weed control Surflan A.S. may be applied in tank mix combination with labeled rates of other herbicides products; see label for details. A single ½ to 1 inch of water is required to activate Surflan A.S.; 1 inch or more of water is needed on fine-textured, high organic matter soils. If weeds begin to emerge, a shallow cultivation to a depth of 1 to 2 inches will destroy existing weeds and place Surflan A.S. in the zone of weed germination. Do not use Surflan A.S. on soils containing more than 5% organic matter. Do not apply more Surflan A.S. than 12 qt/A per year.			