3 Blueberries

Numerous pests affect 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 at: http://www.nraes.org/publications/nraes55.html.

For assistance with diagnosing blueberry problems, use the Berry Diagnostic Tool at http://www. hort.cornell.edu/diagnostic 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, 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, www.entomology.cornell.edu/Extension/DiagnosticLab

The following information is provided for management of blueberry pests. If a pesticide is used, it must be registered with the state and federal governments. Use Table 9 to determine legal pesticides, their brand names, and any restrictions that may apply. Unless otherwise noted, use 100 gal water per acre.

Table 8. Blueberry pests and the associated stage of plant development.

Stage of development	Scout for:
Dormant	Insect stem gall, pg. 19 Botrytis blossom and twig blight, pg. 19 Cankers (Fusicoccum and Phomopsis), pg. 20 Scale insects, pg. 21
Green tip	Mummyberry, pg. 21 Botrytis blossom and twig blight, pg. 22 Phomopsis canker, pg. 22
Pink bud	Mummyberry, pg. 22 Botrytis blossom and twig blight, pg. 23
Bloom	Mummyberry, pg. 23 Botrytis blossom and twig blight, pg. 23 Anthracnose fruit rot, pg. 24
Petal fall/Post bloom	Cranberry fruitworm, pg. 24 Cherry fruitworm, pg. 25 Leafrollers, pg. 26 Blueberry tip borer, pg. 26 Plum curculio, pg. 26
Summer preharvest	Blueberry maggot, pg. 27 Japanese beetle, pg. 28 Anthracnose fruit rot, pg. 28 Blueberry stem borer, pg. 28
Special pests	Blueberry leaf rust, pg. 29 Witches' broom, pg. 29 Powdery mildew, pg. 30

Table 9. Chemical and brand names of labeled fungicides, insecticides, miticides and pesticides for blueberries.

(DTH= days to harvest; REI= Restricted Entry Interval)

Chemical Name	Brand Name/Formulation	EPA Reg. Number	Restrictions
***azinphos-methyl**	*Guthion 50WP	264-733	DTH = 7, REI = 7 days
azoxystrobin	Abound 2.08F	100-1098	DTH = 0, REI = 4 hr
Bacillus thuringiensis (B.t.)	Javelin WG Deliver Dipel ES	70051-66 70051-69 73049-17	DTH = 0, REI = 4 hr
captan	Captan 50WP Captan 80WP Captec 4L Many others	51036-166 51036-168 51036-181	DTH = 0, REI = 96 hr
captan/fenhexamid	Captevate 68WDG	66330-48	DTH = 0, REI = 72 hr
carbaryl	Sevin 4F Sevin 80WSP Sevin XLR Carbaryl 80S Carbaryl 4L Carbaryl 4L	264-349 264-526 264-333 19713-50 19713-49 34704-447	DTH = 7, REI = 12 hr DTH = 7, REI = 12 hr
chlorothalonil	Bravo Ultrex (82.5WDG) Bravo WeatherStik (Bravo 720) Echo 720	50534-201-100 50534-188-100 60063-7	DTH = 42, REI = 12 hr DTH = 42, REI = 12 hr
copper hydroxide	Kocide 101 (50WP) Kocide DF (40DF) Kocide 4.5LF Kocide 2000 (35DF)	1812-288 1812-334 1812-303 1812-358	(††) DTH = B, PH; REI = 24h
cyprodinil/fludioxonil	Switch (62.5WG)	100-953	DTH = 0, REI = 12h
dichlobenil	Casoron 4G	400-168	REI = 12 hr
fenhexamid	Elevate (50WDG)	66330-35	DTH = 0, REI = 12hr
fluazifop-butyl	Fusilade DX	100-1070	DTH = 365, REI = 12 hr
glyphosate	Glyphosate Original	352-607	DTH = 14, REI = 12 hr
imidacloprid	Admire 2F Admire Pro Provado 1.6F	264-758 264-763 264-763	DTH = 7, REI = 12 hr DTH = 7, REI = 12 hr DTH = 7, REI = 12 hr
iprodione	Iprodione 4 L AG Iprodione 50 WP AG Rovral (50WP)	51036-340 51036-341 264-453	DTH = 0, REI = 24 hr DTH=0, REI = 24hr
lime sulfur	Miller's Lime Sulfur Solution 29%	72-19	REI = 24 hr
malathion	Malathion 57EC Malathion 5EC	34704-108 51036-104	DTH = 12 hr, REI = 12 hr
methyl anthranilate	Fruit Shield	66550-1-8708	
mefanoxam	Ridomil Gold EC	100-801	REI = 48 hr.
napropamide	Devrinol 50DF Devrinol 10G	70506-36 70506-34	DTH = 42, REI = 12 hr

Table 9. Chemical and brand names of labeled fungicides, insecticides, miticides and pesticides for blueberries.

(DTH= days to harvest; REI= Restricted Entry Interval)

Chemical Name	Brand Name/Formulation	EPA Reg. Number	Restrictions
(†)**norflurazon**	(†)Solicam 80D F	100-849	REI = 12 hr
oryzalin	Surflan A.S.	62719-112	REI = 12 hr
***paraquat**	*Gramoxone Max	100-1074	REI = 12 hr
pelargonic acid	Scythe	53219-7	
***phosmet**	Imidan 70WP	10163-169	DTH = 3, REI = 24 hr
***pronamide**	*Kerb 50W	707-159	REI = 12 hr
pyraclostrobin	Cabrio EG	7969-187	DTH = 0, REI = 72 hr
pyraclostrobin/boscalid	Pristine WG	7969-199	DTH = 0, REI = 72 hr
pyrethrin	Pyrenone Crop Spray 0.5EC	432-1033	DTH = 0
sethoxydim	Poast 1.5EC	7969-58	DTH = 30, REI = 12 hr
simazine	Princep 90WDG Princep 4L	100-603 100-526	REI = 12 hr
spinosad	Spintor 2 SC Entrust	62719-294 62719-282	DTH = 3, REI = 4 hr DTH = 3, REI = 4 hr
(†)**tebufenoxzide**	(†)Confirm 2F	62719-420	DTH = 14, REI = 4
terbacil	Sinbar 80WP	352-317	DTH = 70, REI = 12 hr
ziram	Ziram Granuflo 6WDG Ziram 76DF	45728-12 4581-140	DTH = Do not use past 3 weeks after bloom, REI = 48 hr

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

† Not for use in Nassau and Suffolk Counties. Pesticide labels that indicate 'Not for use on Long Island, NY' mean that use is prohibited in Nassau and Suffolk Counties only.

(††)B=do not apply after bloom, PH=post-harvest sprays permitted.

NOTE: With most pesticides, reentry is not allowed until spray material has dried. Read the label.

3.1 Insects and Diseases: Time For Concern

DORMANT

Insect Stem Gall

Symptoms- Large bulbous galls form on the stems, often near the terminals. Larvae of a tiny flightless wasp cause these galls. This is a periodically important blueberry pest, particularly in young plantings still being trained. The adults overwinter in the galls, emerge in early June, and crawl or hop to other stems to deposit eggs. Galls form around egg deposition sites. Infestations are usually localized, but may be extensive (50 to 70 galls per plant).

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	None known.
Cultural management	a. Hand picking (pruning) and burning the galls when the leaves fall after harvest is the most advisable course of action. b. Prune and burn all insect-infested or galled wood. c. Repeat during the growing season as blighted tips appear.
Chemical treatment	Wasp emergence is so protracted it is difficult to predict; chemical measures are of little use.

Botrytis Blossom and Twig Blight

Symptoms- After several days of rainy or foggy weather, blossoms and/or young shoots die, turn brown, and become covered with a dusty gray mass of fungus spores. Not common in New York State, but develops occasionally.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	The disease is usually a concern only when rainy, foggy weather prevails during the prebloom and bloom period.
Resistant cultivars	None known.
Cultural management	Avoid high rates of nitrogen, which lead to excessively succulent shoot growth and encourage disease development.
Chemical treatment	a. **captan**- Captan 50WP (5lbs/A) *or* 80WP (31/8 lbs/A) *or* Captec 4L (0.75-1.0qts/100 gal) as buds swell or have loose scales *OR* b. **ziram**- Ziram 76 DF (3lbs/A). Ziram aids in control and should not be relied on as a stand-alone product for control of this disease.

Fusicoccum Canker

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 diseased canes as they appear.
Chemical treatment	**NOTE**: Cultural practices designed to avoid winter injury and pruning out dead wood are more important than sprays. a. **sulfur**- Lime sulfur (5 gal/A). A single spray of lime sulfur as leaf buds begin to break (delayed dormant) can help reduce inoculum of canker in problem locations. Because of phytotoxicity danger, do not apply within 2 weeks of an oil spray or when temperatures are above 75°F.*OR* b. **ziram**- Ziram 76DF (3lbs/A) *OR* c. **copper hydroxide**- Kocide 101 (3-5lbs/A) *or* DF (3-5 lbs/A) *or* 4.5LF (4pt./A) *or* 2000 (2-4lbs/A)

Phomopsis Canker

Symptoms- New shoots wilt and die back from the tips toward the crown. Pith and wood become discolored. Infected mature canes suddenly wilt and collapse in the summer. Suspect this disease if single canes suddenly die while the rest of the plant remains healthy. Injured or weakened plants are most susceptible to infection by this fungus.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	No known resistant cultivars; 'Coville' and 'Jersey' are moderately susceptible cultivars. 'Weymouth', 'Earliblue', and 'Berkeley' are particularly susceptible cultivars.
Cultural management	a. Management is best accomplished by maintaining plants in a vigorous condition with proper pruning and management and by taking all possible precautions to minimize winter injury and early spring frost damage. b. To reduce spread, prune, and burn diseased twigs and canes as they appear, ensuring that all infected (brown) tissue below the canker is removed.
Chemical treatment	Same as for Fusicoccum canker above.

Scale Insects

Symptoms- A number of species of scale insects, including Oystershell and European lecanium scale, feed on the twigs and can greatly reduce plant vigor. Look for the hard-covered female scale insects on small branches early in the spring.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	None known.
Cultural management	Good pruning practices should reduce the likelihood of scale problems.
Chemical treatment	a. **oil**- (6 gal/A). Apply a delayed dormant spray consisting of 2-2.5 percent oil, early in the spring during bud swell (after the bud scales start to expand, but before the first leaf stands out from the clusters). Thorough coverage is essential for good results. Apply in 250-300 gal of water/A, at a pressure of 300-400 psi.

GREEN TIP

Mummyberry

Symptoms- Young shoots and leaves wilt, turn brown, and die (similar in appearance to frost damage). Tissue at the base of infected flower clusters may appear water-soaked or brown. As harvest approaches, berries that develop from infested blossoms become tan or cream colored, shrivel into hard mummies, and shatter easily off bushes.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	'Burlington', 'Collins', 'Jersey', 'Darrow', 'Rubel', 'Bluetta', and 'Dixi' are most resistant to this disease. 'Rancocas', 'Weymouth', 'Berkeley', 'Bluecrop', 'Herbert', and 'Coville' are less resistant. The most susceptible cultivars are 'Earliblue' and 'Blueray'.
Cultural management	Control is greatly aided by raking or disking the soil beneath the blueberry bushes just prior to bud break to disturb production of the mummyberry fungus spores.
Chemical treatment[1]	a. **chlorothalonil**- Bravo Ultrex (2.7-3.6 lb/A) *or* Bravo WeatherStik (3-4 pt/A) or Echo 720 (3-4 pt/A) at 7 day intervals at the low rate or 10 day intervals at the higher rate beginning at green tip. Do not apply chlorothalonil after full bloom or within 42 days of harvest. Chlorothanil is considered to have moderate activity against primary infections, but is not effective against secondary infections that typically occur after bloom. The actual number of applications needed depends on the severity of the disease the previous year (inoculum density) and the degree of wetness during the early spring season. OR b. **ziram**- Ziram 76DF *or* Ziram Granuflo (3 lb/A) at green tip and 7 days later. Do not apply later than 3 weeks after full bloom. Ziram is only moderately effective against the shoot blight phase of mummyberry (it has been shown to be very effective against Phomopsis canker in trials in Michigan).OR c. **azoxystrobin**- Abound (6.2-15.4 fl oz/A). Do not make more than two sequential applications of Abound before alternating with another product with a different mode of action. Apply no more than four applications of Abound per season. Abound is extremely phytotoxic to certain apple varieties. DO NOT spray Abound where spray drift may reach apple trees. DO NOT spray when conditions favor drift beyond intended area of application. DO NOT spray apple trees with equipment that has been previously used to spray Abound. OR

Mummyberry

d. **captan**- Captan 50WP (5lb/A) *or* Captan 80WP (3.125 lb/A) *or* Captec 4L (0.75-1.0 qts/100 gal) OR
e. **cyprodinil/fludioxonil**- Switch (11-14 oz/A). OR
f. **captan/fenhexamid**- Captevate 68WDG (4.7 lb/A). Do not apply more than 21lb/A Captevate per season. OR
g. **pyraclostrobin/boscalid**- Pristine WG (18.5-23 oz/A). Do not make more than two sequential applications of Pristine before alternating with another product with a different mode of action. Apply no more than four applications of Pristine per season.

[1] Mummyberry disease is not present in all blueberry plantings; however, management measures are usually necessary in plantings where the disease has occurred previously. Fungicide sprays may also be required if the weather is wet between bud break and bloom- the critical period for control of the disease.

Note: A Section 18 request has been made to the NYS DEC for use of Indar to control mummyberry. Check with an Extension educator before applying.

Botrytis Blossom and Twig Blight

Refer to information given under *Dormant* (pg. 19), but note additional chemical option.

MANAGEMENT OPTIONS	GUIDELINE
Chemical treatment	a. **ziram**- Ziram Granuflo (3lb/A) as an aid in control at dormant

Phomopsis Canker

Refer to information given under *Dormant* (pg. 20), but note additional chemical option.

MANAGEMENT OPTIONS	GUIDELINE
Chemical treatment	Cultural practices designed to avoid winter injury and pruning out dead wood are more important than sprays for controlling canker diseases. a. **ziram**- Ziram Granuflo (3lb/A) OR b. **azoxystrobin**- Abound (6.2-15.4 fl oz/A). Do not make more than 2 sequential applications of Abound before rotating to another fungicide with different chemistry. Apply no more than 4 applications of Abound per season. Abound is extremely phytotoxic to certain apple varieties. DO NOT spray Abound where spray drift may reach apple trees. DO NOT spray when conditions favor drift beyond intended area of application. DO NOT spray apple trees with equipment that has been previously used to spray Abound. OR c. **pyraclostrobin**- Cabrio EG (14 oz/A). Do not make more than 2 sequential applications of Cabrio before alternating with another product with a different mode of action. Apply no more than 4 applications of Cabrio per season. OR. d. **pyraclostrobin/boscalid**- Pristine WG (18.5-23 oz/A). Do not make more than 2 sequential applications of Pristine before alternating with another product with a different mode of action. Apply no more than 4 applications of Cabrio per season.

PINK BUD

Mummyberry

Follow guidelines under *Green tip* (pg. 21).

Botrytis Blossom and Twig Blight

Refer to information given under *Dormant* (pg. 19), but note additional chemical option.

MANAGEMENT OPTIONS	GUIDELINE
Chemical treatment	a. **fenhexamid**- Elevate (1.5 lb/A). Do not apply more than 6 lb/A of Elevate per season. OR b. **cyprodinil/fludioxonil**- Switch (11-14 oz/A) beginning at 10% bloom and continue through harvest as needed. Applications should be made at 7-day intervals when conditions favor disease development. Treatment is warranted only if persistently wet weather is expected during bloom. Do not apply more than 56 oz/A of Switch per season. Do not apply more than two sequential sprays of Switch before alternating with another product with a different mode of action. OR c. **captan**- Captan 50WP (5lb/A) *or* Captan 80WP (3.125 lb/A) *or* Captec 4L (0.75-1.0 qts/100 gal) OR d. **iprodione**- Iprodione 4L (1-2 pints/A) *or* Iprodione 50WP (1-2 lb/A) *or* Rovral 50WP (1-2lb/A) OR e. **ziram**- Ziram Granuflo (4lb/A) *or* 76DF (3lb/A). Ziram aids in control and should not be relied on as a stand-alone product. f. **captan/fenhexamid**- Captevate 68WDG (3.5-4.7 lb/A). Do not apply more than 21 lb/A of Captevate per season. OR g. **pyraclostrobin/boscalid**- Pristine WG (18.5-23 oz/A). Do not apply more than two sequential sprays of Pristine before alternating with another product with a different mode of action. Do not make more than four applications of Pristine per season.

BLOOM

Mummyberry

Refer to information given under *Green tip* (pg. 21), and see chemical treatment information below.

MANAGEMENT OPTIONS	GUIDELINE
Chemical treatment	This spray is designed to prevent flower infections. It is necessary only if primary mummyberry (shoot blight) infections were not controlled previously. Substituting captan in the mixture may be preferred if Phomopsis canker is a problem. Mixtures with captan may be repeated at 7-10 day intervals throughout bloom if rain occurs. Discontinue use of Ziram DF or Ziram Granuflo as they are labeled only for the shoot blight phase, not flower infection.

Botrytis Blossom and Twig Blight

Follow guidelines under *Pink bud* (pg. 22).

Anthracnose Fruit Rot

Symptoms- Anthracnose occurs sporadically in New York, primarily in seasons or locations with abundant rainfall and warm temperatures. Berry infections are not usually apparent until fruit become ripe but can occur any time during and after bloom. For instance, many infections occur during flowering, and the green fruit stage but remain "dormant" until harvest. Infections are most common at the blossom end of the fruit. When ripening fruit is turning blue, infected regions will become slightly sunken, giving the surrounding area a puckered appearance. Under very wet or very humid conditions, a layer of pink, slimy spores will develop on the sunken infected regions.

Anthracnose Fruit Rot

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	None known. Particularly susceptible cultivars are 'Berkeley', 'Coville', and 'Bluecrop'.
Cultural management	a. Prune and remove or destroy dead wood in the spring to reduce over wintering inoculum of the anthracnose fungus. b. Avoid excessive nitrogen fertilization, since this encourages disease development. c. Anthracnose is more common and pronounced on overripe fruit, so harvest promptly. Infections can occur during rainy periods anytime between bloom and harvest, but are most serious during warm rains (>70°F).
Chemical treatment	a. **azoxystrobin**- Abound 2.08F (6.2-15.4 fl oz/A) For resistance management, do not apply more than two sequential sprays of Abound before alternating with a fungicide that has a different mode of action; do not make more than 4 applications of Abound per year. Abound is extremely phytotoxic to certain apple varieties. DO NOT spray Abound where spray drift may reach apple trees. DO NOT spray when conditions favor drift beyond intended area of application. DO NOT spray apple trees with equipment that has been previously used to spray Abound. OR b. **chlorothalonil**- Bravo Ultrex (2.7-3.6 lb/A) *or* Echo 720 (3-4 pt/A) In plantings with a history of anthracnose, chlorothalonil sprays can provide significant protection if applied when weather conditions are favorable for infection. Chlorothalonil should not be applied after early bloom (and can not be applied after petal fall) to prevent phytotoxicity on developing fruit. The higher rate will give a longer period of residual protection. Bravo and Echo have a 42 days-to-harvest restriction. OR c. **cyprodinil/fludioxonil**- Switch (11-14oz/A). OR d. **ziram-** Ziram Granuflo (3lb/A) *or* Ziram 76DF (3lb/A). OR e. **pyraclostrobin-** Cabrio EG (14 oz/A). Do not make more than two sequential applications of Cabrio before alternating with another product with a different mode of action.. Apply no more than four applications of Cabrio per season. OR f. **pyraclostrobin/boscalid**- Pristine WG (18.5-23 oz/A). Do not apply more than two sequential sprays of Pristine before alternating with another product with a different mode of action. Do not make more than four applications of Pristine per season. OR g. **captan/fenhexamid-** Captevate 68WDG (4.7 lb/A). Do not apply more than 21 lb/A of Captevate per season.

PETAL FALL

Cranberry Fruitworm

Symptoms- The adults (moths) of the cranberry fruitworm appear during late May and early June and lay their eggs at the base of the newly set fruit. The greenish larvae are up to half an inch long and brownish red on the back. Moths of the cherry fruitworm appear late in the blooming season, when the bloom is nearly off. The larvae are three eights inch long and uniformly reddish orange. Larvae of both species attack the green fruit, webbing the berry clusters together and feeding inside. Just a few worms can do extensive damage.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	A sex pheromone for cranberry fruitworm is commercially available and can be used to monitor male moth flight activity and aid in timing insecticide applications.
Resistant cultivars	None known.

Cranberry Fruitworm

Cultural management

Infested berries culled from the clusters should be promptly burned before the larvae inside have a chance to emerge and pupate.

Chemical treatment

Two sprays are often required to adequately control these pests; the first should be applied at petal fall and the second 10 days later, about 2 weeks before harvest. The sprays against these pests also control leafhoppers, which are vectors for blueberry stunt disease, as well as leafrollers, which are evident at the same time of year.

a. (†)**tebufenoxzide**- (†)Confirm 2F (16 fl oz/A) OR
b. **Bacillus thuringiensis**- Dipel ES (1-4 pt/A). OR
c. **malathion**- Malathion 5EC (1-2 pt/A) *or* Malathion 57EC (1.6 pt/200 gal/A) OR
d. **carbaryl**- Sevin 50WP (3 lb/A) *or* 80 WSP (2-2.25 lb/A) OR
e. ***azinphos-methyl**- *Guthion 50WP (1-1.5 lb/A) There is a 30 REI for public (e.g. Pick your own) access to treated areas. OR
f. **pyrethrin**- Pyrenone Crop Spray 0.5EC (2-12 oz/A) OR
g. **phosmet**- Imidan 70WP (1.3 lb/A) OR
h. **spinosad-** Spintor 2SC (4-6 fl oz/A) *or* Entrust (1.25-2.0 oz/A).

Cherry Fruitworm

Symptoms- The adults (moths) of the cranberry fruitworm appear during late May and early June and lay their eggs at the base of the newly set fruit. The greenish larvae are up to ½-inch long and brownish red on the back. Moths of the cherry fruitworm appear late in the blooming season, when the bloom is nearly off. The larvae are 3/8-inch long and uniformly reddish orange. Larvae of both species attack the green fruit, webbing the berry clusters together and feeding inside. Just a few worms can do extensive Symptoms. Small terminal leaves are used to construct a shelter for the insect larvae. Flower and fruit may be tied with silk while constructing a shelter. Leafrollers contaminate harvested fruit.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	A sex pheromone for cranberry fruitworm is commercially available and can be used to monitor male moth flight activity and aid in timing insecticide applications.
Resistant cultivars	None known.
Cultural management	Infested berries culled from the clusters should be promptly burned before the larvae inside have a chance to emerge and pupate.
Chemical treatment	Two sprays are required to adequately control these pests; the first should be applied at petal fall and the second 10 days later, about 2 weeks before harvest. The sprays against these pests also control leafhoppers, which are vectors for blueberry stunt disease, as well as leafrollers, which are evident at the same time of year. a. **Bacillus thuringiensis**- Javelin WG (0.25-1.0 lb/A), *or* Deliver (.25-1.5 lbs/A). OR b. **malathion**- Malathion 5EC (1.6 pt/200 gal/A) *or* Malathion 57EC (1-2 pt/A). OR c. **carbaryl**- Sevin 50WP (3 lb/A) *or* Sevin 80WSP (2-2.25 lb/A). OR d. ***azinphos-methyl**- *Guthion 50WP (1-1.5 lb/A.) OR e. **pyrethrin**- Pyrenone Crop Spray 0.5EC (2-12 oz/A). OR f. **phosmet**- Imidan 70WP (1.3 lb/A). OR g. **spinosad**- Spintor 2SC(4-6 fl oz/A) *or* Entrust (1.25-2.0 oz/A). OR h. (†)**tebufenoxzide**- (†)Confirm 2F (16 fl oz/A).

Leafrollers

Symptoms- Small terminal leaves are used to construct a shelter for the insect larvae. Flower and fruit may be tied with silk while constructing the shelter. Leafrollers contaminate harvested fruit.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	Pheromone traps can be used. Threshold is 1 larva per 100 leaf shoots
Resistant cultivars	None known.
Cultural management	None established.
Chemical treatment	a. **Bacillus thuringiensis**- Javelin WG (0.25-1 lb/A). OR b. **malathion**- Malathion 57EC (1-2 pt/A) OR c. **carbaryl**- Sevin 50WP (3 lb/A) *or* 80WSP (2-2.25 lb/A) OR d. **pyrethrin**- Pyrenone Crop Spray 0.5EC (2-12 oz/A) *or* Deliver (.25-1.5 lbs/A). OR e. **phosmet**- Imidan 70WP (1.3 lb/A). f. **spinosad**- Spintor 2SC(4-6 fl oz/A) *or* Entrust (1.25-2.0 oz/A). OR g. (†)**tebufenoxzide**- (†)Confirm 2F (16 fl oz/A) for obliquebanded and redbanded leafrollers only.

Blueberry Tip Borer

Symptoms- This is a tiny moth that emerges sometime in early June and deposits eggs on the undersides of tip leaves. The larvae bore into the current season's wood, each forming a channel several inches in length; this causes the shoot to wilt and die back.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established
Resistant cultivars	None known.
Cultural management	None established.
Chemical treatment	Two sprays, one applied at petal fall and the other at first cover, control this pest. a. **pyrethrin**- Pyrenone Crop Spray 0.5EC (2-12 oz/A).

Plum Curculio

Symptoms- The plum curculio is better known as a serious pest of tree fruit crops but occasionally can cause significant injury to blueberries. Female weevils lay eggs in very young fruit, leaving a characteristic crescent-shaped scar that persists throughout the season. The larvae or grubs develop during the season and then exits the fruit to pupate in the ground. The pupae become adults later in the summer. Adults overwinter in hedgerows. Plum curculio is of economic importance on occasion; early-ripening varieties are more vulnerable since for late-ripening varieties the damaged berries drop to the ground before harvest.

Plum Curculio

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	After fruit-set fields should be scouted for the characteristic egg-laying scar on young berries. An economic threshold has not been established.
Resistant cultivars	Early-ripening varieties are more at risk of being harvested before damaged berries drop to the ground.
Cultural management	It is reported that clean cultivation will provide some control by killing pupae.
Chemical treatment	a. **phosmet**- Imidan 70W (1.33 lbs/A) OR b. ***azinphos-methyl**- *Guthion 50W (1-1.5 lbs/A). There is a 30 REI for public (e.g. Pick your own) access to treated areas.

POST BLOOM

Cranberry Fruitworm

Follow guidelines under *Petal fall* (pg. X24X).

Cherry Fruitworm

Follow guidelines under *Pink bud* (pg. 25).

Leafrollers

Follow guidelines under *Pink bud* (pg. 26).

Blueberry Tip Borer

Follow guidelines under *Pink bud* (pg. 26).

SUMMER PREHARVEST

Blueberry Maggot

Symptoms- This pest is potentially very destructive, but it generally has not been as serious a problem in New York as in other blueberry-growing regions. Larvae attack the berries (one per fruit) and may cause them to drop, decreasing yield; if they remain on the plant and are harvested, the crop is not acceptable for market.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	Use yellow sticky cards with ammonium acetate. When 1 adult maggot is trapped, consider treatment.
Resistant cultivars	None known.
Cultural management	Sanitation of fields.

Blueberry Maggot

Chemical treatment

Begin spraying about the time the berries start to turn blue, about July 7-12 upstate and 10 days earlier on Long Island. Because the adults emerge over a long period, three pesticide applications at 10-day intervals are usually required.

a. **malathion**- Malathion 5EC (1 pt/A) *plus* 1.5 qt Staley's Sauce Base No.7 OR
b. **carbaryl**- Sevin 50WP (3 lb/A) OR
c. ***azinphos-methyl**- ***Guthion 50WP (1-1.5 lb/A) Restricted-use pesticide; may be purchased and used only by certified applicators or used by someone under the direct supervision of a certified applicator. Do not apply Guthion more than 3 times per season. There is a 30 REI for public (e.g. Pick your own) access to treated areas. OR
d. **pyrethrin**- Pyrenone Crop Spray 0.5EC (2- 12 oz/A) OR
e. ***phosmet**- Imidan 70WP (1.3 lb/A).

Japanese Beetle

Symptoms- Beetles emerge in early July and feed on leaves and fruit.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	None known.
Cultural management	None.
Chemical treatment	a. **carbaryl**- Sevin 4F (1.5 qt/A) *or* Sevin 80WSP (2-2.25 lb/A). Apply in July as adults appear. b. **imidacloprid**- Admire 2F (16-32 oz/A) *or* Admire Pro (7-14 fl oz/A) *or* Provado 1.6F (6-8 fl oz/A).

Anthracnose Fruit Rot

Follow guidelines under *Bloom* (pg. 23).

Blueberry Stem Borer

Symptoms- This beetle is responsible for two types of injury. In late June and July, the first 3 to 4 inches of the current season's growth may wilt or die; this can occur on large, rapidly growing suckers or on small slow-growing twigs. An examination of the injured twig will show it has been girdled in two places, about half an inch apart, caused by egg deposition. The other injury is the dying out of canes. The leaves first turn from green to yellow or reddish green and drop off, and the cane dies. Close examination may show pinholes at 3-4 inch intervals along the shoot and yellowish strings of castings hanging from them. The cane, when split, contains a yellowish, legless grub, one half to one inch long, at the end of a long tunnel.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	None known.
Cultural management	As wilted tips appear in the summer, cut them off below evidence of insect damage, remove them from the field, and burn them.
Chemical treatment	Chemical control is not effective against this pest.

SPECIAL PESTS

Blueberry Leaf Rust

Symptoms- Reddish brown spots on the upper leaf surface appear mid-season. On the lower leaf surface, these spots (pustules) are yellowish orange and may turn rusty with age. Infected leaves may drop prematurely. Leaf rust is a minor disease of blueberries in New York State. However, local epidemics (epiphytotics) may occur sporadically under favorable weather conditions. The disease generally has little effect on yield unless defoliation is severe. In cases of severe defoliation, yield is reduced the *following* season.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	'Bluecrop', 'Burlington', 'Collins', 'Dixi', 'Earliblue', 'Gem', 'Ivanhoe', 'Olympia', 'Stanley', and 'Weymouth' are resistant. 'Jersey', 'Herbert', 'Berkley', 'Blueray', and 'Pacific' are moderately susceptible. 'Coville', 'Pemberton', 'Washington', and 'Atlantic' are susceptible.
Cultural management	Removal of hemlocks (alternate host), especially those trees upwind within a 0.4 km radius of the planting may be beneficial.
Chemical treatment	No fungicides are currently registered for control of this disease.

Witches' Broom

Symptoms- Unusual numbers of broom-like, swollen, cracked shots arising from lateral buds. Much broom may appear on a single plant. Witches' broom is a relatively minor disease of blueberries in New York State., Generally disease occurrence is so low that crop loss is negligible even though heavily infected plants produce no fruit.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established. Witches' broom is a minor disease in blueberry plantings.
Resistant cultivars	Little is known about resistance to witches' broom. 'Rancocas' appears to be least susceptible.
Cultural management	Elimination of secondary host (fir trees) within several hundred yards of the planting will reduce further infection. The rust fungus causing this disease is systemic; once blueberries are infected, they will always have the disease. Infected bushes and their associated root systems must be killed to eliminate the source of inoculum.
Chemical treatment	Fungicides are not effective for controlling this disease.

Powdery Mildew

Symptoms- On susceptible varieties, leaf surfaces may be covered with white fungal mycelia and spores. Infected leaves may curl or pucker. Either the upper or lower leaf surfaces may be affected. Chlorotic spots with reddish borders are common on the upper leaf surface, similar to symptoms of red ringspot virus. Water-soaked areas on lower leaf surfaces opposite the chlorotic areas distinguish mildew from the virus. Because control measures for the two diseases are very different, it is important to distinguish between them.

Powdery Mildew

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	'Berkley', 'Earliblue' and 'Ivanhoe' are resistant. 'Bluecrop', 'Rancocas', 'Weymouth', 'Pemberton', and 'Dixi' are moderately susceptible. 'Collins', 'Rubel', 'Blueray', 'Herbert', and 'Jersey' are susceptible.
Cultural management	Reduce humidity in the plantings through planting orientation, plant spacing, pruning practices, limiting overhead irrigation.
Chemical treatment	Since symptoms usually do not appear until after harvest, most growers do not attempt to control the disease. Powdery mildew is not a serious disease of blueberry, but premature defoliation caused by mildew may affect long-term productivity. Fungicide applications are *not* recommended unless the disease is severe. If fungicide applications are used, it is important to make the first application early after petal fall to reduce primary inoculum and applications throughout June, July, and August to reduce secondary infections.

3.2 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 7 and 10 to determine legal and effective controls.

Table 10. Herbicides registered for use on blueberries in New York State.

Herbicide	Formulation	Amount of product per sprayed acre	lb active ingredient
Preemergent			
dichlobenil	Casoron 4G Casoron 2E	100-150 lb 2 gal	4-6
Controls some perennial weeds that survive other preemergent herbicides, and controls later seedlings as well. Apply in late fall or early spring when daily temperatures hold below 45°F. Uniform application is essential. Casoron 4G must use be applied using a device specifically designed for spreading, or applied by hand held shaker			
napropamide	Devrinol 50DF Devrinol 10G	8 lb 40 lb	4
Apply in late fall or early spring before seedling weeds emerge. Incorporate within 24 hours of application with either cultivation or water.			
(†)**norflurazon**	Solicam 80DF	2.5-5 lb	4
Apply as a directed spray from fall to early spring before weeds emerge and when plants are dormant. Make only 1 application per year. Do not use in nurseries or in plantings less than 6 months old. Not for use on Long Island.			
oryzalin	Surflan A. S.	2-6 qt	2-5
Apply late fall or in early spring before weed emergence. Do not apply to newly transplanted bushes until soil has settled and no cracks are present. Not recommended on high-organic soils. Rainfall or irrigation required within 21 days of application. May be tank mixed with Gramoxone, Princep, or Solicam.			

Table 10. Herbicides registered for use on blueberries in New York State.

Herbicide	Formulation	Amount of product per sprayed acre	lb active ingredient
***pronamide**	*Kerb 50W	2-4 lb	1-2
Apply in late fall or winter before ground is frozen. Do not use on high-organic soils or within 3 months of transplanting. Make only 1 application per year.			
simazine	Princep 90WDG Princep 4L	2.2-4.4 lb 0.5 –1 gal	2-4
Apply in early spring before weeds germinate or at a low rate in both spring and fall. Use low rate in first year of growth.			
terbacil	Sinbar 80WP	2-3 lb	1.6–2.4
Use only in plantings 1 or more years old. Apply is spring when weeds are germinating or small, or in fall after harvest. Avoid berry foliage.			
Postemergent			
fluazifop-butyl	Fusilade 2L + 1% crop oil concentrate	16-24 oz	0.25-0.375
Apply to actively growing grasses less than 8 inches tall. Do not apply to plants that will have harvestable fruit within one year			
glyphosate	Roundup 4L	1-3 qt	0.25-0.75
Apply to actively growing weeds when they are between 6 and 8 inches tall. Use for preplant preparation or as a directed spray on wiper application (20% solution). Avoid berry foliage or canes.			
***paraquat**	Gramoxone 2.5L	2-3 pt	0.6-0.9
Spray on weeds in 50-200 gal/A with added nonionic surfactant. Apply in spring after weeds emerge, but before new canes emerge.			
pelargonic acid	Scythe	3-5% solution for annuals 5-7% solution for perennials 7-10% solution for maximum burn down	2.25-20 gal
Apply before new canes emerge in spring or after they become woody. Do not contact desirable foliage			
sethoxydim	Poast 1.5EC + oil concentrate	1.5-2.5 pt +2 pt	0.28-0.47
Apply to actively growing grasses before tillering or seed head formation. Do not cultivate 5 days before or 7 days after application. Limited to 2 applications per year, or 5 pints per season.			

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

† Not for use in Nassau and Suffolk Counties. Pesticide labels that indicate 'Not for use on Long Island, NY' mean that use is prohibited in Nassau and Suffolk Counties only.

NOTE: Herbicides are usually applied in a 3-4 ft band beneath the plants. Read the label.