

## 5 Strawberries

For information on the culture of strawberries, obtain a copy of Strawberry Production Guide (NRAES-88) from your Cornell Cooperative Extension Office. Obtain a copy of the Cornell Cooperative Extension publication "Dayneutral Strawberry Production Guide" (IB-215) for information specifically on late summer and fall strawberry production.

For assistance with diagnosing strawberry 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](http://www.entomology.cornell.edu/Extension/DiagnosticLab)

Pesticides used for strawberry production must be registered with the state and federal governments. Consult Table 14 to determine legal pesticides, their brand names, and any restrictions that may apply. Unless otherwise noted, use 100 gal of water per acre.

**Table 13. Strawberry pests and the associated stage of plant development.**

<b>Stage of development:</b>	<b>Scout for:</b>
FIRST GROWING SEASON	
<b>Summer months after planting</b>	Greenhouse whitefly, pg. 53 Twospotted spider mite, pg. 53
DURING FRUITING YEARS	
<b>Early Spring</b>	Twospotted spider mite, pg. 54 Bud weevil (clipper), pg. 54 Leaf spot, pg. 55 Leaf scorch, pg. 56 Leaf blight, pg. 57
<b>Prebloom</b>	Bud weevil (clipper), pg. 56 Tarnished plant bug, pg. 56 Spittlebug, pg. 57
<b>Early bloom</b> (10-20% of flower buds open)	Botrytis fruit rot (Gray mold), pg. 58 Leaf spot, Leaf scorch, Leaf blight, pg. 59
<b>Full Bloom</b> (Do not apply insecticides during bloom)	Botrytis fruit rot (Gray mold), pg. 59
<b>Fruit set through harvest</b>	Anthraco-nose, pg. 59 Leather rot, pg. 60 Tarnished plant bug, pg. 60 Sap beetle, pg. 61
<b>Postharvest</b>	Leaf spot, Leaf scorch, Leaf blight, pg. 61
<b>Special Pests</b>	Strawberry rootworm, pg. 62 Root weevils, pg. 63 Cyclamen mite, pg. 64 Garden slugs, pg. 64 Leafrollers, pg. 65 Aphids, pg. 65 Red stele, pg. 65 Verticillium wilt, pg. 66 Powdery mildew, pg. 66 Black root rot, pg. 67 Potato leafhopper, pg. 67

**Table 14. Chemical and brand names of labeled pesticides for strawberries.***(DTH = days to harvest; REI = Restricted Entry Interval)*

<b>Chemical name</b>	<b>Brand name /formulation</b>	<b>EPA Reg. Number</b>	<b>Restrictions</b>
<b>2,4-D</b>	Clean Crop Amine 4 Weed Killer	34704-120	REI = 48 hr
<b>abamectin</b>	Agri-Mek 0.15EC ABBA 0.15EC	100-898 72167-43-73220	DTH = 3, REI = 12 hr DTH = 3, REI = 12 hr
<b>*azinphos-methyl</b>	*Guthion 50WP	264-733	DTH = 5, REI = 96 hr
<b>azoxystrobin</b>	Abound 2.08F	100-1098	DTH = 0, REI = 4hr
<b>Bacillus thuringiensis (Bt)</b>	Javelin WG	70051-66	DTH = 0, REI = 4 hr
<b>bifenazate</b>	Acramite 50WS	400-503	DTH = 1, REI = 12 hr
<b>bifenthrin</b>	Brigade WSB	279-3108	DTH = 0, REI = 24 hr
<b>captan</b>	Captan 50WP Captan 80WP Captan 80WDG Captec 4L Many others	51036-166 51036-168 66330-29 51036-181	DTH = 0, REI = 24 hr
<b>captan/fenhexamid</b>	Captevate 68WDG	66330-48	DTH = 0, REI = 24 hr
<b>carbaryl</b>	Sevin 80WSP Sevin XLR Carbaryl 80S Carbaryl 4L Carbaryl 4L	264-526 264-333 19713-50 19713-49 34704-447	DTH = 7, REI = 12 hr
<b>chlorpyrifos</b>	Lorsban 4EC	62719-220	DTH = 21, REI = 24 hr
<b>clethodim</b>	Select 2EC	59639-00003	DTH = 4, REI = 24 hr
<b>copper hydroxide</b>	Agri Star Nu-Cop 50DF Agri Star Nu-Cop 50WP Champ Formula 2 Champ Dry Prill Champion WP (50WP) Kocide 101 (50WP) Kocide DF (40DF) Kocide 4.5 LF Kocide 2000 (35DF) Kop-Hydroxide 50W	45002-4 45002-7 55146-64 55146-57 55146-1 1812-288 1812-334 1812-303 1812-358 19713-321	DTH = B, PH, REI = 24 hr     DTH = See label, REI = 24 hr DTH = B, PH, REI = 24 hr
<b>copper oxychloride/ copper sulfate</b>	C-O-C-S WDG	34704-326	(††)DTH = B, PH; REI=24 hr
<b>copper salts</b>	Tenn-Cop 5E	1812-381	DTH = 0, REI = 12 hr
<b>basic copper sulfate</b>	Cuprofix Disperss (20DF)	4581-396	(††)DTH = B, PH; REI=24 hr
<b>cyprodinil/fludioxonil</b>	Switch (62.5WG)	100-953	DTH = 0, REI = 12 hr
<b>(†)DCPA</b>	†Dacthal W75	5481-490	DTH = 30, REI = 12 hr
<b>dicofol</b>	Kelthane 50WP	707-229	DTH = 3, REI = 48 hr

**Table 14. Chemical and brand names of labeled pesticides for strawberries.***(DTH = days to harvest; REI = Restricted Entry Interval)*

<b>Chemical name</b>	<b>Brand name /formulation</b>	<b>EPA Reg. Number</b>	<b>Restrictions</b>
<b>*endosulfan</b>	*Thionex 50W *Thionex 3EC *Endosulfan 50WP *Endosulfan 3EC	66222-62 66222-63 51036-91 19713-399	DTH = 4, REI = 24 hr
<b>etoxazole</b>	Zeal WP	59639-123	DTH = 1, REI = 12 hr
<b>fenhexamid</b>	Elevate (50WDG)	66330-35	DTH = 0, REI = 12 hr
<b>fenpropathin</b>	Danitol 2.4EC	59639-35	DTH = 2, REI = 24 hr
<b>fluazifop-butyl</b>	Fusilade DX	100-1070	DTH = 365, REI = 12 hr
<b>fosetyl-al</b>	Aliette WDG (80 WDG)	264-516	DTH = 0.5, REI = 12 hr
<b>glyphosate</b>	Glyphosate Original	352-607	DTH = 14, REI = 12 hr
<b>hexakis</b>	Vendex 50WP	1812-413	DTH = 1, REI = 48 hr
<b>hexythiazox</b>	Savey 50DF	10163-250	DTH = 3, REI = 12 hr
<b>imidacloprid</b>	Provado 1.6F	264-763	DTH = 7, REI = 12 hr
<b>iprodione</b>	Rovral (50WP) Rovral 4F Iprodione 4 L AG Iprodione 50WP AG	264-453 264-482 51036-340 51036-341	DTH = do not apply after first fruiting flower, REI = 24 hr
<b>iron phosphate</b>	Sluggo AG	67702-3-54705	REI = 0 hr
<b>malathion</b>	Malathion 57EC Malathion 5EC	34704-108 51036-104	DTH = 3, REI = 24 hr
<b>mefanoxam</b>	Ridomil Gold EC (4EC)	100-801	DTH = Before fruit set, REI=12 hr
<b>metaldehyde</b>	Deadline M-PS Deadline M-PS Prozap Agribrand Snail and Slug AG Trail's End LG (3.5% Amvac)	5481-511 64864-38 61282-11 5481-91	REI = 12 hr Do not apply to edible portions of plant.
<b>mineral oil</b>	JMS Stylet Oil	65564-1	DTH = 0, REI = 4 hr
<b>myclobutanil</b>	Nova 40W (WSP) Nova 40W (WSP)	707-221 62719-411	DTH = 0, REI = 24 hr
<b>naled</b>	Dibrom 8EC	5481-479	DTH = 1, REI = 24 hr
<b>napropamide</b>	Devrinol 50DF Devrinol 10G Devrinol 2E	10182-258-705 10182-253-705 10182-219-705	DTH = 42, REI = 12 hr
<b>*paraquat</b>	*Gramoxone Max	100-1074	DTH = 21, REI = 12 hr Only 3 applications per season
<b>parasitic nematodes</b>	<i>Heterorhabditis bacteriophora</i> <i>Heterorhabditis marelatus</i>	NA	NA

**Table 14. Chemical and brand names of labeled pesticides for strawberries.***(DTH = days to harvest; REI = Restricted Entry Interval)*

<b>Chemical name</b>	<b>Brand name /formulation</b>	<b>EPA Reg. Number</b>	<b>Restrictions</b>
<b>pelargonic acid</b>	Scythe	53219-7	
<b>phosphorous acid</b>	Phostrol	55146-83	REI = 4
<b>pyraclostrobin</b>	Cabrio EG	7969-187	DTH = 0, REI = 12 hr
<b>pyraclostrobin/boscalid</b>	Pristine WG	7969-199	DTH = 0, REI = 12 hr
<b>pyrethrin</b>	Pyrenone Crop Spray 0.5EC	432-1033	DTH = 0, REI = 12 hr
<b>sethoxydim</b>	Poast 1.5EC	7969-58	DTH = 7, REI = 12 hr
<b>pyrimethanil</b>	Scala	264-788	DTH = 1, REI = 12 hr
<b>spinosad</b>	Spintor 2 SC Entrust	62719-294 62719-282	DTH = 3, REI = 4 hr DTH = 3, REI = 4 hr
<b>sulfur</b>	Kumulus DF (80DF) Microthiol Dispress (80WP) Thiolux Dry Flowable (80DF) Thiolux Jet Dry Flowable (80DF)	51036-352 4581-373 100-835 100-1138	REI = 24 hr
<b>terbacil</b>	Sinbar 80WP	352-317	DTH = 70, REI = 12 hr
<b>thiophanate-methyl</b>	Topsin-M 70WP Topsin M 4.5FL	4581-322 4581-405	DTH = 1, REI = 12 hr
<b>thiram</b>	Thiram 65WSB	45728-24	DTH = 3, REI = 24 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. Some pesticides have specific reentry intervals. Read the label.

## 5.1 Insects and Diseases: Time For Concern

### First Growing Season

#### SUMMER MONTHS AFTER PLANTING

#### Greenhouse Whitefly

**Symptoms-** Small, white flies feed on young plants, causing stunting.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	None known.
Cultural management	None established.
Chemical treatment	<ol style="list-style-type: none"> <li><b>malathion-</b> Malathion 57EC (1.5-3 pt/A) OR</li> <li><b>*endosulfan-</b> Several products (rates vary depending on formulation). Apply as needed to plants in propagating beds, and in the field during the year of setting new plants but not after bloom of the following year. OR</li> <li><b>imidacloprid-</b> Provado (3.75 fl. oz/A) for bearing and bedding plants.</li> </ol>

#### Twospotted Spider Mite

**Symptoms-** In early spring, mites begin feeding on the undersides of new leaves, sometimes resulting in small yellow spots on the upper leaf surfaces. These symptoms do not occur in all cases, however, and are not seen later in the year. Brownish dry areas on the lower leaf surfaces are more characteristic of damage. Later, the entire lower leaf may become dry and brown, giving it a bronzed appearance. Heavily infested plants look dry and stunted, and their sparse new growth is yellowish and distorted. Damage is first seen and is most prevalent in dry areas of a field. Mild growing areas in New York (Hudson Valley and Long Island) experience problems with mites most frequently.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	Five mites/leaf or 15 out of 60 mature (fully expanded) leaflets infested with 1 or more mites Regular leaf monitoring is necessary for assessing population growth.
Resistant cultivars	None known.
Cultural management	<ol style="list-style-type: none"> <li>Ensure plots are not overfertilized.</li> <li>Do not use other insecticides that kill predatory mites.</li> </ol>
Chemical treatment	<p>Chemical control of spider mites is often not completely effective because of their high mobility, reproductive rate, and resistance to some pesticides. Good coverage of the plants, particularly the undersides of the leaves, is critical for adequate protection. Use adequate water (200-300 gal/A) for maximum effectiveness of the miticide. Repeat at 7- to 10-day intervals as necessary unless otherwise noted on label.</p> <ol style="list-style-type: none"> <li><b>dicofol-</b> Kelthane 50WP (0.5-1lb) OR</li> <li><b>hexakis-</b> Vendex 4L (1.5-2pt) Do not exceed 8 lb a.i./A per season. OR</li> <li><b>abamectin-</b> Agri-Mek 0.15 EC (16 fl oz/A, applied twice, 7-10 days apart) <i>or</i> ABBA</li> </ol>

## Twospotted Spider Mite

- 0.15EC (16 fl oz/A) applied twice, 7-10 days apart. OR
- d. **hexythiazox**- Savey 50DF (6 oz/A) OR
  - e. **bifenthrin**- Brigade WSB (16-32 oz/A) OR
  - f. **fenpropathin**- Danitol E.C. (16 to 21 oz/A) OR
  - g. **bifenazate**- Acramite 50WS (0.75-1.0 lbs /A). OR
  - h. **etoxazole**- Zeal WP (2-3 oz/A). Zeal is primarily an ovicide/larvicide and should be used early in the life cycle of mites.

## Fruiting Years

### EARLY SPRING

## Twospotted Spider Mite

Refer to information given under *Summer months after planting* (pg. 53).

## Bud Weevil (Clipper)

**Symptoms**- Adults puncture blossom buds while feeding in the spring, deposit eggs in the nearly mature buds, and then girdle the bud so that it hangs by a mere thread or falls to the ground. Injury is most likely along edges of fields or when strawberries are grown next to woodlots or other sites suitable for adult hibernation.

### MANAGEMENT OPTIONS

### GUIDELINE

#### Scouting/thresholds

Frequent scouting for bud cutting is important in areas where weevil pressure is expected to be high. In the past, a treatment threshold of 1 cut bud per linear foot has been recommended. Research conducted in the last few years, however, suggests that plants can sustain many times this pressure without a measurable reduction in yield if clipping occurs on tertiary flower buds. The new threshold is more than one primary or secondary flower bud or more than two tertiary flower buds per truss, or more than one injured truss per foot of row.

#### Resistant cultivars

None known, although ‘Seneca’ and ‘Jewel’ strongly compensate for insect injury.

#### Cultural management

- a. Mulches and full-canopy beds may encourage newly emerged adults to remain in the planting so that damage increases in succeeding years.
- b. Using cropping systems shorter than 3 years, plowing under all old beds immediately after final harvest, and removing foliage and mulch to reduce the suitability of overwintering sites help lessen the chances of clipper injury.

#### Chemical treatment

The timing of pesticide applications is extremely critical. Treatment must take place when blossom buds first become visible in the crown and the temperature approaches 65° F. Since clipper weevils move into the fields from the wooded edges, border sprays may be effective for control in new plantings, or in older plantings without previous infestations. Do not treat outside of the strawberry fields as this use is not labeled.

- a. **chlorpyrifos**- Lorsban 4EC (2 pt). OR
- b. **bifenthrin**- Brigade WSB (6.4-32 oz/A) OR
- c. **fenpropathin**- Danitol E.C. (10 2/3 fl . oz/A).

## Leaf Spot

**Symptoms-** Initial lesions on leaves begin as small, irregularly shaped purple spots. Lesions develop to approximately 1/8 to 1/4 inch in diameter, remain relatively circular to elliptical, and the center of lesions turns from purplish to brown to finally a characteristic white. The pathogen primarily infects young, expanding leaves and petioles, although a serious disease of strawberry, known as black seed, occasionally occurs when this pathogen infects the fruit. Heavy leaf infections can inhibit the production of flower buds for the following year, predispose a plant to winter injury, and provide inoculum for infection of the fruit caps.

MANAGEMENT OPTIONS	GUIDELINE
<b>Scouting/thresholds</b>	None established.
<b>Resistant cultivars</b>	None known. Fungicide sprays, as recommended, are likely to be necessary only on more susceptible varieties such as ‘Raritan’, ‘Honeoye’, ‘Sparkle’, ‘Veestar’, and Tribute’. ‘Kent’ and ‘Idea’ are particularly susceptible.
<b>Cultural management</b>	<ol style="list-style-type: none"> <li>Destruction of infected leaves at renovation (e.g., mowing and burying) will reduce the amount of disease carry-over.</li> <li>Promote good air circulation (plant spacing, weed control) to speed drying time and limit infection periods.</li> </ol>
<b>Chemical treatment</b>	<p>This early spray is recommended primarily when disease carry-over from the previous year is high or conditions are favorable for disease development.</p> <ol style="list-style-type: none"> <li><b>captan-</b> Captan 50WP (3 - 6 lb/A) <i>or</i> Captec 4L (1.5 - 3 qt/100gal water) <i>or</i> other captan. OR</li> <li><b>myclobutanil-</b> Nova 40W (2.5 - 5.0 oz/A). Do not exceed 30 oz/A of Nova 40W per growing season. OR</li> <li><b>pyraclostrobin-</b> Cabrio EG (12-14 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 five applications of Cabrio per season. OR</li> <li><b>pyraclostrobin/boscalid-</b> 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 five applications of Pristine per season. OR</li> </ol> <p><b>copper-</b> several formulations, follow labeled rates.</p>

## Leaf Scorch

**Symptoms-** Dark purple spots about 1/8- to 1/4-inch in diameter are scattered over the upper leaf surfaces or petioles. These spots differ from those of leaf spot in that they are purple throughout (no light centers). Numerous infections can cause a leaf to appear red or light purple and eventually to dry up and appear scorched. Heavy leaf infections can inhibit the production of flower buds for the following year, predispose a plant to winter injury, and provide inoculum for infection of the fruit caps.

MANAGEMENT OPTIONS	GUIDELINE
<b>Scouting/thresholds</b>	None established.
<b>Resistant cultivars</b>	None known. Fungicide sprays, as recommended, are likely to be necessary only on more susceptible varieties including ‘Raritan’ and ‘Sparkle’.
<b>Cultural management</b>	<ol style="list-style-type: none"> <li>Destruction of infected leaves at renovation (e.g., mowing and burying) will reduce the amount of disease carry-over.</li> <li>Promote good air circulation (plant spacing, weed control) to speed drying time and limit infection periods.</li> </ol>

**Chemical treatment**

This early spray is recommended primarily when disease carry-over from the previous year is high or conditions are favorable for disease development.

- a. **thiophanate-methyl**- Topsin-M 4.5FL (15 - 20 fl oz/A) *or* Topsin-M 70WP (0.75-1 lb/A). If using Topsin-M tank mix with a copper fungicide for resistance management. OR
- b. **copper**- several formulations, follow labeled rates.

**Leaf Blight**

**Symptoms**- Lesions begin as small, circular to irregular, reddish, or purplish spots. As they expand, lesion centers become necrotic and turn light brown and dark purple halo surrounds the necrotic centers. Older lesions along major leaf veins develop into large V-shaped lesions that eventually kill the leaf. Heavy leaf infections can inhibit the production of flower buds for the following year, predispose a plant to winter injury, and provide inoculum for infection of the fruit caps.

**MANAGEMENT OPTIONS****GUIDELINE****Scouting/thresholds**

None established.

**Resistant cultivars**

None known. Fungicide sprays, as recommended, are likely to be necessary only on more susceptible varieties including 'Raritan' and 'Sparkle'.

**Cultural management**

- a. Destruction of infected leaves at renovation (e.g., mowing and burying) will reduce the amount of disease carry-over.
- b. Promote good air circulation (plant spacing, weed control) to speed drying time and limit infection periods.

**Chemical treatment**

This early spray is recommended primarily when disease carry-over from the previous year is high or conditions are favorable for disease development.

- a. **thiophanate-methyl**- Topsin-M 4.5FL (15 - 20 fl oz/A) *or* Topsin-M 70WP (0.75-1 lb/A). If using Topsin-M tank mix with a copper fungicide for resistance management. OR
- b. **copper**- Several formulations, follow labeled rates.

**PREBLOOM****Bud Weevil (Clipper)**

Refer to information given under *Early spring* (pg. 54).

**Tarnished Plant Bug**

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

**MANAGEMENT OPTIONS****GUIDELINE****Scouting/thresholds**

Anytime from just before the blossoms open until harvest, check for tarnished plant bug nymphs by striking the plant over a flat, low-sided, light-colored dish. Suggested action threshold: 0.5 nymphs per cluster, or 4 out of 15 clusters with 1 or more nymphs.

<b>Resistant cultivars</b>	‘Honeoye’ is less susceptible to feeding injury than other cultivars.
<b>Cultural management</b>	<ol style="list-style-type: none"> <li>Row covers accelerate development and help avoid injury.</li> <li>Note that tarnished plant bug pressure is often highest in weedy fields or in fields bordered by woody shrubs.</li> </ol>
<b>Chemical treatment</b>	<ol style="list-style-type: none"> <li><b>malathion</b>- Malathion 57 EC (1.5-3 pt/A). Malathion may be used up to 3 days before harvest. OR</li> <li><b>naled</b>- Dibrom 8EC (1 pt/A) OR</li> <li><b>pyrethrin</b>- Pyrenone crop spray 0.5EC (2-12 oz/A) OR</li> <li><b>bifenthrin</b>- Brigade WSB (16-32 oz/A) OR</li> <li><b>fenpropathin</b>- Danitol EC (10.67 fl oz/A).</li> </ol>

## Spittlebug

**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.

MANAGEMENT OPTIONS	GUIDELINE
<b>Scouting/thresholds</b>	One mass per square ft of row.
<b>Resistant cultivars</b>	None known.
<b>Cultural management</b>	<ol style="list-style-type: none"> <li>Good weed control may help to reduce numbers. Populations are usually largest in weedy fields.</li> <li>Only one generation is produced per year. The leaves recover after the insects leave.</li> </ol>
<b>Chemical treatment</b>	<ol style="list-style-type: none"> <li>*<b>endosulfan</b>- several products; rates depend on formulation. OR</li> <li><b>bifenthrin</b>- Brigade WSB (16-32 oz/A) OR</li> <li><b>fenpropathin</b>- Danitol EC (10.67 fl. oz/A) <i>or</i> Danitol 3EC (1 qt/A) OR</li> <li><b>imidacloprid</b>- Provado 1.6F (3.75 fl oz/A).</li> </ol>

## EARLY BLOOM (10-20% of flower buds open)

### Botrytis Fruit Rot (Gray Mold)

**Symptoms-** Rot usually begins at the blossom end or where the berry is touching another rotten berry. The infected portion is firm and brown while the berry is still green, but it expands and softens as the fruit ripens. A powdery gray mass of spores covers infected berries if the weather remains humid and/or air circulation is poor.

MANAGEMENT OPTIONS	GUIDELINE
<b>Scouting/thresholds</b>	None established.
<b>Resistant cultivars</b>	None known. Less susceptible cultivars are ‘Earliglow’ and ‘Jewel’. ‘Allstar’ is very susceptible.
<b>Cultural management</b>	<ol style="list-style-type: none"> <li>Disease control is greatly aided by controlling weeds and regulating plant density and by using other practices that promote good air circulation and rapid drying of the fruit.</li> <li>Spring applications of nitrogen increase disease potential dramatically.</li> </ol>
<b>Chemical treatment</b>	<p>Protection of newly opened and aging blossoms is critical in gray mold management. Research in New York has consistently shown that excellent gray mold control can be obtained with just two fungicide sprays applied at early bloom and 10 days later. Continued protection of fruit prior to harvest may be necessary during prolonged periods of wet, foggy, or humid weather, although other diseases are usually more of a concern during the fruit period. Broad-spectrum fungicides will likely be most useful during fruiting. This strategy reduces the risk of developing resistance to fenhexamid, iprodione, or pyrimethanil and can provide activity against multiple diseases. All fungicides listed except Elevate, Captevate, and Scala, provide control of leaf spot.</p> <ol style="list-style-type: none"> <li><b>fenhexamid-</b> Elevate (1.5 lb/A). Elevate is the most effective bloom spray. Do not apply more than two consecutive sprays of Elevate. OR</li> <li><b>captan/fenhexamid-</b> Captevate 68WDG (3.5-5.25 lb/A). Do not apply more than 21 lb/A Captevate per season. When plastic mulch is used, do not apply Captevate within 16 feet of natural vegetation or aquatic areas.</li> <li><b>captan-</b> Captan 50WP (3-6 lb/A) <i>or</i> Captan 80WP (1.875–3.75 lb/A) <i>or</i> Captec 4L (1.5-2 qt/A) <i>or</i> Captec 4L (1.5-3qt/100 gal water) OR</li> <li><b>thiram-</b> Thiram 65WSB (5 lb/A) OR</li> <li><b>thiophanate-methyl-</b> Topsin-M 4.5FL (15-20 fl oz/A) <i>or</i> Topsin-M 70WP (1 lb/A). If using Topsin-M and leaf spot protection is needed, tank mix with captan or thiram. OR</li> <li><b>iprodione-</b> Rovral 50 WP (1.5-2.0 lb/A) <i>or</i> Iprodione 4L (1.5-2.0 pt/A). Do not apply more than one spray of iprodione per season. OR</li> <li><b>cyprodinil/fludioxonil-</b> Switch (11-14 oz/A). OR</li> <li><b>pyrimethanil-</b> Scala (18 fl oz/A; 9 fl oz/A when mixed with another botryticide). Do not apply more than 54 fl oz/A Scala per season. OR</li> <li><b>pyraclostrobin/boscalid-</b> 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 five applications of Pristine per season.</li> </ol>

### Leaf Spot, Leaf Scorch, Leaf Blight

Refer to information given under *Early spring* (pg. 55-56).

## FULL BLOOM (Do not apply insecticides during bloom)

### Botrytis Fruit Rot (Gray Mold)

Refer to information given under *Early bloom* (pg. 58).

## FRUIT SET

### Anthracnose

**Symptoms-** One or more circular spots occur on the fruit; spots originally are tan or light brown but soon become darker brown, or black and sunken. Sunken spots are usually about one eighth to one quarter inches in diameter and may be covered with a pink slime during wet or very humid periods. The disease may occur on both green and ripe fruit, but is most common following periods of warm, wet weather. In New York, anthracnose occurs only sporadically and is a more common problem on day-neutral varieties in the summer than it is on June-bearers; however, it can be serious on June-bearers if warm, wet conditions occur between fruit set and harvest.

MANAGEMENT OPTIONS	GUIDELINE
<b>Scouting/thresholds</b>	None established.
<b>Resistant cultivars</b>	None known.
<b>Cultural management</b>	<ol style="list-style-type: none"> <li>Provide good air circulation by controlling weeds and plant densities.</li> <li>The anthracnose fungus is spread throughout a planting by splashing raindrops or sprinkler irrigation. Thus, straw mulch may significantly reduce the rate of disease spread relative to bare ground (less splash), whereas black plastic promotes disease spread.</li> </ol>
<b>Chemical treatment</b>	<ol style="list-style-type: none"> <li><b>azoxystrobin-</b> Abound 2.08F (6.2-15.4 fl oz/A). Abound will not stop an epidemic once it has begun. Therefore, it is important to monitor fields for the presence of anthracnose, particularly if the weather has been warm and wet, and quickly begin a control program once the disease is detected. If the field has a history of anthracnose, a preventative schedule is recommended. 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 four 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 use spray equipment that has been previously used to spray Abound to spray apple trees. OR</li> <li><b>captan-</b> Captan 80WDG (3.75 lb/A). OR</li> <li><b>captan/fenhexamid-</b> Captevate WDG (5.25 lb/A). Do not apply more than 21 lb/A Captevate per season. When plastic mulch is used, do not apply Captevate within 16 feet of natural vegetation or aquatic areas. OR</li> <li><b>pyraclostrobin-</b> 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 five applications of Cabrio per season. OR</li> <li><b>pyraclostrobin/boscalid-</b> 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 five applications of Pristine per season.</li> </ol>

## Leather Rot

**Symptoms-** Affected fruits appear dull and lifeless. Infected areas on immature fruit are brown, whereas those on maturing fruit appear bleached out. Infected areas are tough, leathery, and discolored on the inside as well as the outside of the fruit. Diseased fruits have a pungent smell and a bitter, unpleasant taste.

MANAGEMENT OPTIONS	GUIDELINE
<b>Scouting/thresholds</b>	None established.
<b>Resistant cultivars</b>	None known.
<b>Cultural management</b>	<p>Leather rot is promoted by abundant warm rains during the fruiting period and flooded or puddled soil conditions. The most effective control procedures are:</p> <ol style="list-style-type: none"> <li>Minimize soil puddling through appropriate cultural practices (site selection, avoid ruts and soil compaction, etc.).</li> <li>Provide a supplemental layer of straw mulch between rows throughout the fruiting season (the mulch provides a physical barrier between the soilborne leather rot fungus and the susceptible fruit).</li> </ol>
<b>Chemical treatment</b>	<p>Mefanoxam and fosetyl-al fungicides provide significant control, but are most effective when used in combination with straw mulch.</p> <ol style="list-style-type: none"> <li><b>mefanoxam-</b> Ridomil Gold EC (1 pt/treated acre). One soil application of Ridomil Gold is allowed during the fruiting season for control of leather rot, in addition to the red stele applications. Broadcast applications are preferred for leather rot control. OR</li> <li><b>fosetyl-al-</b> Aliette 80WDG (2.5-5 lb/A). Fosetyl-al may be applied at 7-14 day intervals after early bloom, but should be targeted primarily to provide protection during periods of warm (70's and 80's), very wet weather. OR</li> <li><b>phosphorous acid-</b> Phostrol (2.5-5 pt/A). Phosphorous acid may be applied at 7-14 day intervals after early bloom, but should be targeted primarily to provide protection during periods of warm (70's and 80's), very wet weather.</li> </ol>






## Tarnished Plant Bug

Refer to information given under *Prebloom* (pg. 56).

## Sap Beetle

**Symptoms-** Sap beetle adults make cavities in ripe and overripe fruit as well as spreading spores of decay organisms. The larvae also feed on ripe and overripe fruit and are a source of contamination in harvested fruit. Until a few years ago, sap beetles were uncommon in strawberries. Now, sap beetles are occasionally found in later ripening strawberry plantings throughout the state. Two species feed on strawberry fruits: the common picnic beetle, one quarter inch long with four yellow spots on the back, and the smaller, brown strawberry sap beetle without distinctive markings. Strawberry sap beetle is the more serious pest because it does not limit its activity to over-ripe fruit. Beetles overwinter at the edge of woodlots and possibly in strawberry fields. As strawberries ripen, beetles move into the field and begin feeding and laying eggs. Fruit touching the ground or straw mulch appears particularly vulnerable.

MANAGEMENT OPTIONS	GUIDELINE
<b>Scouting/thresholds</b>	One mass per square ft of row.
<b>Resistant cultivars</b>	None known.
<b>Cultural management</b>	a. Keep the field free of ripe and over-ripe fruit. b. Early renovation will reduce populations for the following year.
<b>Chemical treatment</b>	a. <b>bifenthrin-</b> Brigade WSB (6.4-32 oz/A). Do not apply Brigade within 100 feet (using ground equipment) or 300 feet (aerial) of coastal marshes or streams that drain into coastal marshes. b. <b>fenpropathrin-</b> Danitol 2.4EC (16 to 21 oz/A)

**Note:** Bifenthrin and fenpropathrin are broad-spectrum pyrethroid insecticides that also kill beneficial arthropods, so use with caution. Frequent use may disrupt biological control of spider mites resulting in mite outbreaks. Use sufficient water (100-300 gal) to ensure uniform coverage since sap beetles stay close to the ground and are quick to seek hiding places when disturbed. Avoid use when bees are active.

## POST HARVEST

### Leaf Spot, Leaf Scorch, Leaf Blight

Refer to information given under *Early spring* (pg. 55-56).

### Twospotted Spider Mite

Refer to information given under *Summer months after planting* (pg. 53). See additional cultural note below

<b>Cultural management</b>	c. Mow and incorporate leaves at renovation.
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## SPECIAL PESTS

### Strawberry Root Worm

**Symptoms-** Grubs feed on roots in late spring to early summer. Adults feed on leaves in May and again in late July, at night.

MANAGEMENT OPTIONS	GUIDELINE
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<b>Scouting/thresholds</b>	None established.
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<b>Resistant cultivars</b>	None known.
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<b>Cultural management</b>	None known.
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<b>Chemical treatment</b>	a. <b>carbaryl-</b> Sevin 80WSP (2-2.25 lb/A). Apply postharvest; apply early to mid-August when foliar damage is observed.
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### Root Weevils

**Symptoms-** Different species, but most commonly the strawberry root weevil, the black vine weevil, and the rough strawberry root weevil. These pests attack the roots or crowns of plants while in the grub stage. All have a one-year life cycle, although some are known to live two seasons. Adults emerge about late June. Beds with heavy infestations show distinct patches or spots that appear stunted and have substantially reduced yields. The roots of injured plants are badly eaten away, and continued infestation may destroy infested plants.

MANAGEMENT OPTIONS	GUIDELINE
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<b>Scouting/thresholds</b>	None established.
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<b>Resistant cultivars</b>	None known.
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<b>Cultural management</b>	Rotating crop out of strawberries for a least 1 year will reduce root weevil densities.
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<b>Chemical treatment</b>	a. <b>Steinernema carpocapsae-</b> Exhibit (2.5-5 gal/1000 sq ft) 100-200 gal of nematode suspension. This product is a biological larvacide containing parasitic nematodes. It can be spot-applied to problem areas in late September to early October, and again in late April to early May, when the larvae are close to the surface. Irrigate before and after application. OR b. <b>bifenthrin-</b> Brigade WSB (8-32 oz./A). Adult weevils can be targeted with one of the pyrethroid insecticides. Apply Brigade soon after adult emergence in mid to late June. Adult weevils are active at night so their presence is best determined by looking for their characteristic feeding damage on leaves (notching from the edge).
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## Cyclamen Mites

**Symptoms-** This tiny (one one-hundredth-inch) mite is pinkish orange and shiny when mature. Its translucent eggs are often so abundant that they appear as a white mass along the midveins of folded, newly emerging leaves. The mites feed on the young leaves in plant crowns; when the leaves emerge, they are stunted, crinkled, and malformed. Blossom feeding later results in misshapen fruit. The mites are most troublesome in strawberry beds that are kept for long periods. They increase in number during bloom and peak during fruit development.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	None known.
Cultural management	Avoid infested planting stock.
Chemical treatment	a. <b>*endosulfan-</b> *Thionex 3EC (2.67 qt/A) <i>or</i> *Thionex W (2 lb/A). If mites are regularly a problem, apply *endosulfan just before bloom. Alternatively, an application during bed renovation can more easily reach the mites in the crown leaves after the old foliage is cut off. Drench crowns using a minimum of 200 gals dilute spray/A. Do not use *endosulfan more than once during blossom period or within 4 days of picking. This spray also controls tarnished plant bug, spittlebug, and aphid infestations.

## Garden Slugs

**Symptoms-** These soft-bodied mollusks resemble snails without a shell. Slugs feed on ripening fruit, leaving holes in the berries. They are most active at night and during cool, wet weather. Populations are greatest when the weather is damp and the planting is mulched. Translucent silver to whitish slime trails are visible on damaged plant parts.

MANAGEMENT OPTIONS	GUIDELINE
Scouting/thresholds	None established.
Resistant cultivars	None known.
Cultural management	Eliminating mulch will reduce slug populations, but will cause other problems, so this is not recommended. <ol style="list-style-type: none"> <li>Good sanitation and weed control helps to reduce slug populations.</li> <li>In areas where slugs are a problem, avoid perennial legume clovers as cover crops and rotate out of alfalfa or other perennial legumes 1 year prior to planting establishment.</li> <li>Overhead irrigation creates conditions especially favorable to slugs. If overhead irrigation must be used, irrigate during morning hours to allow foliage to dry before evening.</li> </ol>
Chemical treatment	An application in mid-September will reduce egg-laying while an application prior to fruit ripening will reduce the new generation. <ol style="list-style-type: none"> <li><b>metaldehyde bait-</b> is both a slug attractant and a poison, and commercial formulations are available for baiting. The most effective formulations contain additional attractants. <i>Deadline M-Ps</i> (10-40 lb/A). Apply as a soil surface treatment. Use as a band treatment between the rows after formation of edible plant parts. Do not apply or directly contaminate edible portions of the plant. <i>or Prozap Agribrand Snail and Slug AG</i> (1 lb per 1,100-3,600 sq ft soil surface equivalent to 12-39 lb/A). Apply as a soil treatment. Use a band treatment between rows after formation of edible plant parts. Do not contaminate edible portions of the plant. Apply when first plant damage appears or as anticipated and repeat as needed for control; apply any time of day but evening applications are preferred. This product should never be applied to dry soil. Applications should be made following irrigation for best</li> </ol>

## Garden Slugs

results. Do not re-water for 48 hrs after application. DO NOT allow bait to contact parts of the plant that may be used for food or feed purposes or allow drift to adjoining food, fiber or pasture crops. *or Trails End LG* (1 lb per 1,100 to 1,500 sq ft soil surface equivalent to 30-40 lb/A). Use only as a baiting treatment to be applied directly to the soil area beneath plants. Band application in border and around perimeter of crop. Apply when first plant damage appears or as anticipated and repeat as needed for control; apply any time of day but evening applications are preferred. Trail's End LG should never be applied to dry soil. Applications should be made following irrigation for best results. Do not re-water for 48 hrs after application. DO NOT exceed 129 lb/A (4.5 lb a.i.)/A per growing season. DO NOT allow bait to contact parts of the plant that may be used for food or feed purposes or allow drift to adjoining food, fiber or pasture crops. **Note: The above products may be fatal to children and dogs or other pets if eaten. Keep children and pets out of treated areas!**  
OR

- b. **iron phosphate-** Sluggo AG (20-44 lb/A). Spread bait around perimeter to intercept slug migrating towards plots. If slugs are already in plots, carefully spread bait between the furrows near the base of plants. Do not apply over the entire areas but apply selectively. Apply higher rates if the infestation is severe or if the area is heavily watered or after long periods of heavy rain. Reapply as bait is consumed or at least every 2 weeks. Do not place in piles. Soil should be moist with little or no standing water. If the ground is dry, wet before applying bait. **Note:** For terrestrial use only- do not apply directly to water or areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wastes.

## Leafrollers

**Symptoms-** Several species of moth larvae roll or fold strawberry leaves with silk. Leaf injury can be seen throughout the season, but an extremely large population is required before noticeable crop damage occurs.

MANAGEMENT OPTIONS	GUIDELINE
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Scouting/thresholds	None established.
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Resistant cultivars	None known.
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Cultural management	None established.
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Chemical treatment	a. <b>carbaryl-</b> Sevin 80WSP (1.25-2.5 lb/A) <i>or</i> Sevin 4F (1-2 pt/A). OR b. <b>bifenthrin-</b> Brigade WSB (6.4-32 oz./A). OR c. <b>spinosad-</b> Spintor 2SC( 4-6 fl oz/A) or Entrust (1.25-2 oz/A).
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## Aphids

**Symptoms-** These soft-bodied insects usually occur on new shoots and buds in the crown of the plant and along the veins on the undersides of the leaves. When present in large numbers, they weaken the plant. Their honeydew promotes the growth of a black sooty mold, which makes the fruit and leaves sticky, hindering harvest and reducing marketability. More important, aphids are vectors for several serious virus diseases.

MANAGEMENT OPTIONS	GUIDELINE
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Scouting/thresholds	None established.
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Resistant cultivars	None known.
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Cultural management	None established.
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## Aphids

**Chemical treatment** A spray against aphids can be used just before bloom; however, many pesticides that are effective against aphids are also toxic to predators of cyclamen mites and spider mites.

- a. **\*endosulfan-** \*Thionex 3EC (1q/A). OR
- b. **imidacloprid-** Provado 1.6F (3.75 fl oz/A).

**Note:** Aphids may build up where Kelthane (dicofol) was used for spider mite control.

## Red Stele

**Symptoms-** Symptoms of infection often appear just before harvest. Diseased plants appear stunted and off-color and frequently wilt and collapse if the weather becomes warm and dry. Because these same symptoms may be caused by other factors that destroy roots (such as root-feeding insects), the diagnosis depends on an examination of the plant's root system. In a diseased plant, the roots have a "rat-tail" appearance caused by loss of the fine branched feeder roots from the main fleshy roots. The main fleshy roots are rotted from the tips back toward the crown. Cutting or scraping away the white outer portion just above the rotten zone sometimes reveals a reddish root core (stele). Infected plants usually appear in groups and are frequently found in the lowest or wettest parts of a field.

MANAGEMENT OPTIONS	GUIDELINE
<b>Scouting/thresholds</b>	None established.
<b>Resistant cultivars</b>	Resistant varieties include 'Earliglow', 'Northeast', 'Mohawk', 'Lateglow', 'Sunrise', 'Redchief', 'Midway', 'Scott', 'Guardian', 'Allstar', 'Tribute', 'Tristar', 'Surecrop', and 'Sparkle'. These varieties, however, are not resistant to all races of the red stele fungus, so the disease can still occur if a race to which they are not resistant is present.
<b>Cultural management</b>	Because the red stele fungus is particularly active in extremely wet soil, plant only on a well-drained site or provide supplemental drainage if possible. Growing strawberries on a raised bed also reduces disease severity.
<b>Chemical treatment</b>	Red stele is caused by a soilborne fungus that persists for many years even when strawberries are no longer grown. Fungicides labeled for control on red stele have proved effective in reducing the severity of this disease in fields where it occurs. However, they will not provide complete control of susceptible cultivars grown in wet soils. The red stele fungus is not present in every field, thus treatments should be confined to fields where the disease has occurred previously or is suspected. <ol style="list-style-type: none"> <li>a. <b>mefanoxam-</b> Ridomil Gold EC (1 pt/A). Apply Ridomil Gold to the soil in September or early October after soils begin to cool but before [or as] heavy fall rains begin. A second application may be made the following spring after the ground thaws but before bloom; this application may be banded over the row, thus reducing the amount of fungicide applied to the entire planted area (since the between-row aisles are not treated). Banding should provide the same level of red stele control as broadcast applications, although broadcasting may improve leather rot control. OR</li> <li>b. <b>fosetyl-al-</b> Aliette WDG (2.5-5 lb/A). Apply fosetyl-al to the foliage when weather cools and turns wet in the late summer or early fall. Applications may be repeated at 30- to 60-day intervals in the spring after new leaf growth begins, particularly if soils remain wet. OR</li> <li>c. <b>phosphorous acid-</b> Phostrol (2.5-5pt/A). Apply phosphorous acid, to the foliage when weather cools and turns wet in the late summer or early fall. Applications may be repeated at 30- to 60-day intervals in the spring after new leaf growth begins, particularly if soils remain wet.</li> </ol>

## Verticillium Wilt

**Symptoms-** Plants are affected most severely during their first year of growth. Outer leaves turn brown and eventually collapse, but inner leaves remain green until the plant dies. This symptom distinguishes Verticillium wilt from other root and crown disorders. Affected plants may occur uniformly, but more typically, they appear scattered throughout a field.

## Verticillium Wilt

MANAGEMENT OPTIONS	GUIDELINE
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Scouting/thresholds	None established.
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Resistant cultivars	In problem areas, plant only varieties resistant to Verticillium wilt. Resistant varieties include 'Earliglow', 'Guardian', 'Allstar', 'Scott', 'Delite', 'Tribute', and 'Tristar'.
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Cultural management	<ol style="list-style-type: none"> <li>Many weeds are hosts of the Verticillium fungus, particularly nightshade, groundcherry, redroot pigweed, lambsquarters, and horsenettle. These weeds should be strictly controlled in current and future planting sites to keep the Verticillium population low.</li> <li>If fumigation is not practical or desired, plant only resistant strawberry cultivars for at least 3 years after the last crop of tomatoes, potatoes, or eggplant or better still plant an alternative crop.</li> </ol>
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Chemical treatment	If susceptible varieties are to be planted where this disease is likely (especially where potatoes, tomatoes, or eggplants have recently been grown and, to a lesser extent, in recent squash, cucumber, pepper, or melon fields), fumigation (table 2) is recommended. These materials also control nematodes and certain root-rotting organisms and weeds. Fall application is recommended to avoid the delay in planting that is necessary for proper aeration following spring application.
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## Powdery Mildew

**Symptoms-** The edges of infected leaves roll up, sometimes revealing a white powdery growth 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 may appear on infected leaf surfaces in fall.

MANAGEMENT OPTIONS	GUIDELINE
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Scouting/thresholds	None established.
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Resistant cultivars	None known. If possible, <b>avoid</b> varieties commonly affected in New York which include: 'Guardian', 'Earliglow', 'DarSelect', 'Evangeline', 'Annapolis', and to a lesser extent, 'Raritan'.
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Cultural management	Avoid excessive nitrogen and sites with poor air drainage.
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Chemical treatment	<ol style="list-style-type: none"> <li><b>myclobutanil-</b> Nova 40W (2.5-5.0 oz/A). See precautions, restrictions, and guidelines for Nova under <i>Early Spring/Leaf spot</i>. OR</li> <li><b>azoxystrobin-</b> Abound (6.2-15.4 fl oz/A); See precautions, restrictions, and guidelines for Abound under <i>Fruit Set/Anthracnose</i>. OR</li> <li><b>pyraclostrobin-</b> Cabrio EG (12-14 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 five applications of Cabrio per season. OR</li> <li><b>pyraclostrobin/boscalid-</b> Pristine (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 five applications of Pristine per season. OR</li> <li><b>oil-</b> JMS Stylet Oil (3 qt/100 gal water.) When using oil a high volume of water is needed for through coverage. Many common pesticides are phytotoxic when applied with or close to oil sprays (e.g., captan). Check the label for restrictions. OR</li> <li><b>thiophanate-methyl-</b> Topsin-M 4.5FL (15-20 fl oz/A). See precautions, restrictions, and guidelines for Topsin-M under <i>Early Bloom/Botrytis Fruit Rot</i>. OR</li> <li><b>sulfur-</b> Microthiol Dispress <i>or</i> Kumulus DF <i>or</i> Thiolut <i>or</i> Thiolut Jet (see labels for various rates).</li> </ol>
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## Black Root Rot

**Symptoms-** Over time, plant vigor and productivity decline. Feeder rootlets die, and fleshy structural roots deteriorate and become blackened. Blackening frequently starts as patches along the length of the root, rather than from the tip back. This disease is often associated with fields having a long history of strawberry production. Because no single cause of black root rot has been defined, there is no single control.

MANAGEMENT OPTIONS	GUIDELINE
<b>Scouting/thresholds</b>	None established.
<b>Resistant cultivars</b>	None known. A particularly susceptible cultivar is ‘Honeoye’. This cultivar should be avoided in fields without adequate rotation.
<b>Cultural management</b>	<ol style="list-style-type: none"> <li>Cultural practices that reduce soil compaction, improve aeration, and promote good drainage are frequently beneficial.</li> <li>Rotating a field out of strawberries for at least 2-3 years before replanting is strongly recommended to minimize black root rot damage.</li> <li>Damage is greater in fields with a history of Sinbar use.</li> <li>Measures to control <i>Phytophthora</i> (Red Stele, pg. 65) frequently help alleviate black root rot.</li> <li>Cover crops such as brown mustard and indiagrass, provide suppression.</li> </ol>
<b>Chemical treatment</b>	Preplant fumigation (See Table 2) sometimes controls the microorganisms associated with black root rot. Other times, such treatments provide no control or even increase black root rot severity in the next planting.

## Potato Leafhopper

**Symptoms-** Adults migrate into the state in early to mid June, carried by summer weather fronts. The adults and nymphs feed along the veins on the undersides of leaves by sucking plant juices, and in the process, they inject a toxic substance with their saliva. Affected plants have short petioles and small distorted leaves that bend down at right angles. Leaf yellowing is also seen, starting at the margins and progressing toward the midvein.

MANAGEMENT OPTIONS	GUIDELINE
<b>Scouting/thresholds</b>	None established.
<b>Resistant cultivars</b>	None known.
<b>Cultural management</b>	None established
<b>Chemical treatment</b>	<p>A broad-spectrum insecticide applied when the leafhoppers first appear should provide control.</p> <ol style="list-style-type: none"> <li><b>carbaryl-</b> Sevin 80WSP (2 lb/A). OR</li> <li><b>malathion-</b> Malathion 57EC (1.5-3 pt/A). OR</li> <li><b>imidacloprid-</b> Provado 1.6F (3.75 fl oz/A).</li> </ol>

## 5.2 Weed Management

Weed management is a major challenge for strawberry growers. Excellent preplant preparation with the goal of minimizing perennial weeds prior to planting is essential. Some growers fumigate for weed control. Once plants are set, regular hand weeding, hoeing, and cultivation are required throughout the first year.

Do not let weeds go to seed, and keep the surrounding area mowed to prevent weed seeds from migrating into the planting. If a first year planting is healthy, dense and weed free prior to winter, then weed problems will be much less in subsequent years. Some growers are planting in late May or early June at a higher density or planting on black plastic at high density to avoid weed pressure.

Mulch matted row plantings with straw (wheat or rye works best) for winter protection, then rake the straw into the alleyways for additional weed suppression.

Herbicides should be selected on the basis of particular weed problems. Not all herbicides are appropriate for all fields (Tables 5 and 14). Weed control in the planting year is especially difficult because few herbicides are labeled for use. †Dacthal and Devrinol at a low rate are the only labeled materials for use at planting. Many growers find that napropamide (Devrinol) in late fall and 2, 4-D at renovation provide reasonable weed control. Others use terbacil (Sinbar) immediately after mowing in July, but this herbicide can injure plants under certain conditions. †Dacthal also can be used in late summer to control winter annuals.

Weed management chemicals for dayneutral strawberries are limited to Devrinol (napropamide) or †DCPA (Dacthal) at planting, and a November application of Sinbar (terbacil) or napropamide if the planting will be overwintered.

**Table 15. Herbicides registered for use on strawberries in New York State.**

<b>Herbicide</b>	<b>Formulation</b>	<b>Amount of product per sprayed acre</b>	<b>lb active ingredient</b>
<b>Preemergent</b>			
(†)DCPA	Dacthal 75W	8-12 lb	6-9
Apply in spring (12 lb/A) after planting but before seedling weeds emerge, or in late summer/early fall in established plantings within 3 days of the last cultivation. Do not apply between first bloom and harvest. Use the lower rate on sandy soils with low organic matter and the higher rate on heavy soils with high organic matter. Not for use on Long Island. Dacthal may be applied through an overhead irrigation system by following labeled instructions.			
<b>napropamide</b>	Devrinol 50DF	8 lb	2, 4
	Devrinol 10G	40 lb	
	Devrinol 2E	2 gal	
Apply in late fall or early spring before seedling weeds emerge or after adequate numbers of runners have rooted. Rainfall is necessary for activation. Apply 2-2.5 lb/A a.i. in newly planted strawberry beds after the soil has settled around roots.			
<b>terbacil</b>	Sinbar 80WP	2-6 oz	0.12–0.38
In the planting year, apply 2 to 3 ounces per acre after transplanting but before new runner plants start to root. With plants established for 6 months or more, apply soon after harvest before new growth begins or in dormant season from mid fall to late winter. If leaves are present when material is applied, the application must be followed immediately by 0.5 to 1 inch of irrigation or rainfall to wash the chemical off the strawberry foliage. Otherwise unacceptable (severe) injury may result. Use no more than 8 oz per year. Do not use on soils with less than 2% organic matter. Not recommended for use on ‘Guardian’, ‘Darrow’, ‘Micmac’, ‘Tribute’, or ‘Tristar’. Some growers have reported sensitivity in ‘Honeoye’.			
<b>Postemergent</b>			
<b>2-4,D</b>	2-4,D	4lb/gal (2-3 pt)	1.0-1.5

For broadleaf weeds in established plantings. Apply soon after last picking or when berry plants are dormant in late fall or early spring. Use 25 to 50 gal/A.

**Table 15. Herbicides registered for use on strawberries in New York State.**

<b>Herbicide</b>	<b>Formulation</b>	<b>Amount of product per sprayed acre</b>	<b>lb active ingredient</b>
<b>*(†)clopyralid</b>	Stinger	3L (0.33-0.67 pt)	0.13
<p>For control of specific broadleaf weeds in the composite, legume and solanaceous families, and some additional weeds such as dock, sorrel and ragweed. Stinger may be applied to first year fields, or established strawberries. Do not make an application directly after planting since strawberry plants are temporarily affected by the herbicide. We recommend waiting until runners have started rooting and plants are well established, so they can tolerate and outgrow leaf cupping that often occurs after application. Be sure the planting is well watered and not under stress at the time application. In established fields, apply after last picking or in early spring, but at least 30 days before harvest.</p> <p>For thistle control in established fields, apply either in early spring or later in the summer after thistles have dispersed their seeds. Applications made to thistles in bud or flower will not be as effective.</p> <p>Do not use with a surfactant, or tank mix with other herbicides. Do not apply within 6 to 8 hours of expected rainfall or irrigation. Apply 0.33-0.67 pt in 20-75 gallons of water per acre uniformly with ground equipment. Make 1-2 applications per year not to exceed 0.67pt/A per year. Apply to actively growing grasses less than 8 inches tall. Do not apply to plants that will have harvestable fruit within one year.</p>			
<b>clethodim</b>	Select 2 EC	6 - 8 oz	0.09-0.125
<p>Apply when grasses are actively growing, greater than 4 inches tall, soil is moist, and the temperature is above 55° F but below 80° F. Repeat applications may be necessary, but apply no more than 32 oz/A per season (16 oz. max. on Long Island). Must be mixed with 1% v/v crop oil concentrate (containing at least 15% emulsifiers) to a finished spray volume of between 10-40 gal/A. Do not cultivate within 7 days of application and do not apply within one hour of rainfall.</p>			
<b>fluazifop-butyl</b>	Fusilade 2L <i>plus</i> 1% crop oil concentrate	16-24 oz	0.25-0.375
<p>Apply when grasses are about 8 inches tall and actively growing. Do not apply to plants that will be harvested within one year of the application.</p>			
<b>glyphosate</b>	Roundup	Varies according to weed problem	
<p>Apply as a preplant broadcast application. Requires 30-day interval between application and planting.</p>			
<b>*paraquat</b>	*Gramoxone Max	1.5 pt	0.5
<p>Use as a postemergent directed spray in 20-60 gal water with nonionic surfactant. Shield to prevent contact with crop. Apply before weed growth is 6 inches high. Apply no more than 3 times per season.</p>			
<b>pelargonic acid</b>	Scythe	3-5% solution for annuals 5-7% solution for perennials 7-10% solution for maximum burn down	2.25-20 gal
<p>Apply between rows to suppress weeds or narrow rows. Do not contact desirable foliage.</p>			
<b>sethoxydim</b>	Poast 1.5EC <i>plus</i> 2 pt oil concentrate	0.75-2.5 pt	0.14-0.47

For perennial grasses, apply higher rates in spring when grasses are 6 inches tall. For annual grasses, apply in spring immediately after harvest, or in late summer. Do not use within 6 weeks of Sinbar application. Do not mix with other chemicals. Do not use more than 2.5 pt 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.

Herbicides are usually not banded in strawberry plantings, except when using \*paraquat (\*Gramoxone Max) or Scythe. Read the label.

