

11 SMALL-FRUIT PEST MANAGEMENT

The following list of IPM strategies is an example of good horticultural practices for small fruits. A similar list could be applied to any of the small fruits you grow. Note the summary of ideas at the end of the list.

IPM FOR RASPBERRY DISEASE CONTROL

The following outline reviews available techniques that raspberry growers can use to minimize or eliminate the need to spray fungicides to control specific diseases.

Cane diseases (anthracnose, cane blight, spur blight)

1. Prune dead or diseased canes before new primocanes emerge; burn, bury, or remove them from garden.

2. Promote air circulation to increase drying of young primocanes:
 - a. Regulate cane densities.
 - b. Regulate row width.
 - c. Use trellising systems.
3. Apply a single, delayed dormant spray of lime sulfur to reduce overwintering inoculum levels.
4. Minimize cane injuries (for cane blight).
5. Avoid summer tipping of canes if rain is expected within two to three days (for cane blight).

Gray mold

1. Promote air circulation to reduce humidity and improve drying in the fruiting zone.
 - a. Use same techniques as for cane diseases.

Phytophthora root rot

1. Plant on soils with good internal and surface drainage or plant on raised beds; plant highly suscep-

tible cultivars only on soils that have excellent drainage.

2. If possible, establish new plantings from nursery material not previously exposed to garden or field soil (i.e., greenhouse-propagated plants).
3. Avoid contaminating new planting sites with soil, water, or plants from sites in which the disease has occurred.

Leaf spot

1. Promote air circulation to reduce humidity and improve drying of new leaves.
 - a. Use same techniques as for cane diseases.
2. Apply a single, delayed dormant spray of lime sulfur to reduce overwintering inoculum levels.

Viral diseases

1. Use only planting stock derived from virus-indexed sources.
2. If possible, avoid establishing new plantings adjacent to wooded areas or older raspberry plantings.
3. Eradicate wild brambles in nearby hedgerows.

Verticillium wilt

1. Avoid planting in locations where susceptible crops (such as potatoes or tomatoes) have been grown recently.

Summary

Four primary themes run throughout the preceding list:

1. Plant resistant or only moderately susceptible cultivars.
2. Exclude specific pathogens from the planting if possible.
3. Reduce inoculum levels for indigenous or established pathogens.
4. Choose or modify the crop environment to make it less conducive to growth and development of plant-pathogenic fungi.

Small-fruit cultural pest management guidelines follow in Table 13. Pesticide guidelines are found in Part II, Table 15.



Table 13. Small-fruit pest management

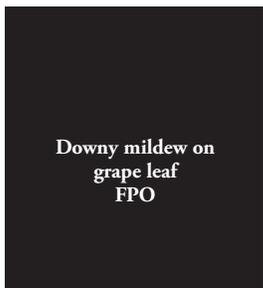
<i>Plant</i>	<i>Pest/Disease</i>	<i>Description/Cultural Management</i>
Blueberry	Blossom and twig blight (<i>Botrytis</i>)	Improve air circulation. Practice plant sanitation. Avoid high rate of nitrogen.
	Cane cankers (<i>Phomopsis</i> and <i>Fusicoccum</i>)	Prune out dead or dying canes in early spring or as they appear. Promote vigor by weeding and fertilizing properly in spring. To promote winter hardiness, do not fertilize after late spring; allow weeds to grow after harvest. Jersey, Earliblue, and Bluecrop are very susceptible to <i>Fusicoccum</i> ; Rancocas is resistant.
	Mummy berry	Clean up mummified (pumpkin-shaped) berries in autumn. Before budbreak cultivate to bury remaining mummies or add 2 in. of sawdust mulch. Resistant varieties include Burlington, Collins, Jersey, Darrow, Rubel, Bluetta, and Dixi. Earliblue and Blueray are most susceptible.
	Blueberry maggot	Small white maggot feeds inside fruit, devouring flesh. Use visual (yellow board) traps for monitoring starting in late June. For small plantings it may be possible to reduce populations of adults by using a large number of baited sticky traps.
	Blueberry stem borer	Larvae hollow out tender growing terminals of plants for 1 to 2 in. Cut off and discard all affected tips below insect infestation before fall.
	Cranberry fruitworm, cherry fruitworm	Larvae enter fruit, feeding on flesh; as they develop they move from one berry to another within fruit cluster. Remove by hand when seen.
	Leaf tiers and leafrollers	Leaves may be tied together or rolled. Larvae usually feed inside, skeletonizing heads. Remove by hand and destroy larvae. Natural enemies often help keep populations at low level.
	Scales	Feed by sucking sap from plants, reducing vigor and causing dieback. Good pruning practices will reduce likelihood of scale problems.
Currant and gooseberry	<i>Botrytis</i> rot (Gray mold)	Prune in early spring to thin plants or plantings; allow air to circulate and fruit and leaves to dry off quickly after rains. Eliminate weeds around plants to improve air circulation. Remove and dispose of rotten or severely damaged fruit throughout season. In autumn, or as leaves of fruit drop in summer, rake and destroy or discard all fallen leaves and fruit.
	Powdery mildew (Gooseberry)	Plant resistant varieties and promote good air circulation.
	Currant aphid	Feeding causes distorted and discolored foliage. Yellowish-green aphids are on undersides of leaves. Damage often is not noticed until aphids are gone and it is too late to treat.
	Currant stem girdler	This sawfly deposits eggs in a cane, girdles tip, and causes it to wilt, die, and drop off. In May or June, cut off injured shoots about 3 to 4 in. below girdle and destroy. If left until later in season, remove about 8 in. and bury or burn.

Table 13. Small-fruit pest management *(continued)*

<i>Plant</i>	<i>Pest/Disease</i>	<i>Description/Cultural Management</i>
Currant and gooseberry <i>(continued)</i>	Gooseberry fruitworm	Greenish caterpillar feeds in fruit and causes it to color early, dry up, and drop to ground. Moves from one fruit to next, often webbing them together. If numerous, can destroy crop. Remove infested berries and destroy before larvae move into adjacent ones.
	San Jose Scale	Feeds by sucking sap from branches and twigs; when numerous may be encrusted on twigs. Good pruning practices will reduce likelihood of scale problems.
	Twospotted spider mite	Feeding may cause stippling and bronzing of foliage. Wash off with water occasionally as needed. A strong stream of water will dislodge many mites. Avoid overuse of nitrogen fertilizers.
Grape	Black rot	In autumn, or as leaves or fruit drop in summer, rake and destroy or discard all fallen leaves and fruit. Practice plant sanitation to remove mummified grapes and infected canes. In early spring, cultivate to bury mummies. Susceptible varieties include Aurore, Baco Noir, Canadice, Cabernet Sauvignon, Catawba, Concord, Dutchess, Gewürtztraminer, Niagara, Pinot Noir, Riesling, and Seyval.
	Downy mildew	In autumn, or as leaves or fruit drop in summer, rake and destroy or discard all fallen leaves and fruit. Remove from vine and destroy diseased berries or clusters as they appear in summer. Particularly susceptible varieties include Cabernet Sauvignon, Catawba, Chancellor, Chardonnay, Delaware, Fredonia, Gewürtztraminer, Ives, Niagara, Pinot Noir, Riesling, and Rougeon.
	Phomopsis cane and	Prune out all dead wood and cane stubs before budbreak. Susceptible varieties include Catawba, Concord, Delaware, Niagara, and Rougeon.
	Grape berry moth	Caterpillars destroy developing grapes; silken webbing often present. Wormy grapes result in some crop loss. Vines adjacent to wood edges containing wild grape plantings especially susceptible to damage. Two to three generations occur during season. Individual larvae cause more damage later in year because berries are larger and closer together and larvae can move more easily from berry to berry. Destroy nearby wild and abandoned vines. Sample vineyard third week of July to see if August treatment needed. Visually inspect five groups of 20 clusters. For table grapes, if one cluster per group is infested in July, treatment is warranted. For processing grapes, anything below 6 percent infestation should not require August treatment. Remove by hand and dispose of infested grapes for



Black rot infections destroying a cluster of grapes



Downy mildew on the underside of a grape leaf

continued

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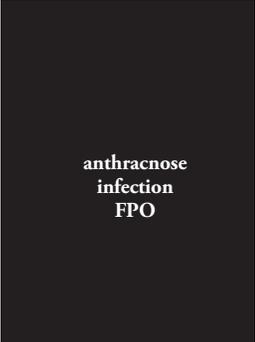
<i>Plant</i>	<i>Pest/Disease</i>	<i>Description/Cultural Management</i>	
Grape <i>(continued)</i>			
	Grape cane girdler	small plantings (do not discard on ground because insects may continue to develop). This very small black snout beetle girdles new grape shoots by chewing two series of holes a few inches apart around shoot. Shoot breaks and broken cane is noticeable. Larva is in portion of cane that remains on twig. Girdles are usually beyond grape cluster and, although unsightly, seldom cause serious damage. Soon after injury occurs, cut off and destroy canes about 4 in. below girdle.	
	Grape flea beetle	Adult is a blue-black, steely-colored beetle that overwinters and feeds on and destroys developing buds in spring; larvae feed on upper surface of leaves. Bud damage usually occurs on vines located near wooded or trashy areas. In late fall cultivate to expose pupae in soil.	
	Grape leafhopper	This small, wedge-shaped sucking insect feeds on undersides of grape leaves, causing them to be discolored or yellowed. Injury may result in reduced vine growth and, if severe, premature leaf drop. No cultural control available.	
Raspberry and blackberry			
 <p>anthracnose infection FPO</p> <p>Recent anthracnose infection on bramble canes</p>	Anthracnose and cane blight	Same as for spur blight. Avoid wounding; make all pruning or tipping cuts during dry weather (at least three to four days before next expected rain). Remove and destroy heavily infected canes.	
	Fruit rots	Harvest regularly. Remove and dispose of rotten or severely damaged fruit throughout season. Prune in early spring to thin plants or plantings; allow air to circulate and fruit and leaves to dry off quickly after rains. Eliminate weeds around plants to improve air circulation.	
	Orange rust (black raspberries and blackberries)	Fungus <i>Gymnoconia peckiana</i> infests black raspberry and blackberry. It is not known to infect red raspberry varieties. Orange rust is one of the more serious diseases of susceptible brambles in the Northeast. It should not be confused with late leaf rust of red raspberries. Rogue infested plants as they appear in spring, and rogue wild brambles nearby. Remove and dispose of entire infected plant, including all roots.	 <p>Orange rust pustules FPO</p> <p>Orange rust pustules on the undersides of black raspberry leaflets</p>
	Phytophthora root rot	Pathogen enters plants through root system, causing root rot and wilting of upper portion of plant. Often black discoloration can be observed under bark near root crown area. On marginally drained soils, establish plants on beds or mounds raised 8–12 in. high. Establish plants on well-drained soil. Plant highly susceptible varieties (Canby, Hilton, Ruby, Titan) only on very well drained soils. Boyne, Killarney, Latham, and Nordic are relatively resistant.	

Table 13. Small-fruit pest management *(continued)*

<i>Plant</i>	<i>Pest/Disease</i>	<i>Description/Cultural Management</i>
<p>Raspberry and blackberry <i>(continued)</i></p>  <p>Spur blight on bramble canes</p>	Spur blight (red raspberries)	Prune out and discard fruiting canes after harvest. Prune in early spring to thin plants or plantings and allow air to circulate and fruit and leaves to dry off quickly after rains. Eliminate weeds around plants to improve air circulation.
	Verticillium wilt (mainly black raspberries)	Do not plant raspberries in same site where potatoes, tomatoes, eggplant, strawberry, cherry, squash, or cucumber have been grown in past three years. Weeds such as nightshade, ground cherry, redroot pigweed, and lambsquarters are also hosts for this disease and should be controlled.
	Viral diseases	Leaves may appear deformed and/or smaller than leaves on uninfected plants. Plant only virus-indexed stock from nurseries. Remove and dispose of entire infected plants. Eliminate wild brambles nearby.
	Raspberry cane borer	Causes early- to midsummer wilting of tips of new canes and laterals, which later blacken and drop off. Crush old cane stubs in early spring; as soon as wilted tips appear, cut off several inches below girdled portion, remove and destroy infected crowns, and eradicate wild brambles nearby.
	Raspberry crown borer	Bores into and damages lower canes and crowns. Cane vigor is reduced; canes often break off at ground level. Life cycle requires two years. In spring cut all weakened and infected canes close to crown. In May or June break over and crush old stubs; eradicate all wild brambles nearby.
	Raspberry fruitworm	Adult is a small, 1/8-in., light brown beetle that begins feeding in May on buds and tender leaves and later on blossoms. Leaves appear ragged or torn. Larvae feed on fruit by lying on receptacle and burrowing through berry. No cultural controls available. Fall-bearing varieties not injured. Cultivation around plants may help destroy pupae.
	Raspberry sawfly	Larvae feed on undersurfaces of leaves, causing round holes, and later devouring all but large veins. Larvae mature quickly and then are gone. No cultural controls available.
	Sap beetle	These small (12 mm or less), elongate beetles feed on over-ripe fruit. A common species, the picnic beetle, is dark with two yellow spots on each wing cover. Promptly harvest ripe berries; remove and dispose of rotten or severely damaged fruit throughout season. Do not leave overripe fruit in garden because it attracts the beetles.
	Tarnished plant bug	Sucking injury by this pest results in deformed berries. Keep planting and surrounding areas free of weeds.
	 <p>Tarnished plant bug</p>	Tree cricket

continued

Table 13. Small-fruit pest management *(continued)*

<i>Plant</i>	<i>Pest/Disease</i>	<i>Description/Cultural Management</i>
Raspberry and blackberry <i>(continued)</i>	Two-spotted spider mite	Feeding causes yellow stipple, bronzing, and possibly death of leaves. Mites feed on plant sap. Damage more severe during drought. Insecticides may encourage buildup of mites by killing predators. Wash off with water occasionally as needed. Do not overfertilize.
Strawberry	Black root rot	Infected plants often show overall decline in growth. Main root system has black discoloration with no feeder roots. Set new plants in a part of garden where strawberries have not grown for at least three years. Establish plants on well-drained soil.
	Fungal leaf spot	Renovate planting after harvest (mow off old leaves and incorporate into soil, narrow bed widths, fertilize, control weeds). Improve air circulation as for gray mold.
	Gray mold (<i>Botrytis</i> fruit rot)	Harvest regularly. Remove and dispose of rotten or severely damaged fruit throughout season. Improve air circulation around fruit by (1) narrowing bed widths in early spring, (2) avoiding spring application of nitrogen, which promotes excessive leaf growth (apply nitrogen in summer or early fall), (3) controlling weeds around plants.
	Leather rot (<i>Phytophthora cactorum</i>)	Fungus causes berries to turn brown and leathery. Infection favored by heavy rainfall, poor drainage, and excessive irrigation. Choose planting site and maintain soil structure to prevent water puddles from forming. Maintain thick mulch within and between rows.
	Red stele (<i>Phytophthora fragariae</i>)	Fungus causes all parts of infected plant to wilt and die. Cutting into tissue will reveal red discoloration. Establish plants on well-drained soil. Plant resistant varieties: Earliglow, Sunrise, Redchief, Midway, Scott, Guardian, Allstar, Tribute, Tristar, Surecrop, Sparkle, Stolemaster, Fairland.
	Verticillium wilt	Fungus <i>Verticillium albo-atrum</i> causes plant to lose outer leaves in early spring. New growth appears stunted. Avoid parts of garden where tomatoes, potatoes, eggplant, or peppers have been grown within three years. Plant resistant varieties: Earliglow, Guardian, Scott, Delite, Tribute, and Tristar.
	Bud weevil (blossom clipper)	Small (1/10 in.) red-brown snout beetle. Females puncture bud and deposit egg within, then girdle fruit stalk below injured bud, causing it to droop and fall. Remove foliage and mulch over winter. Monitor for damage and treat if more than two clipped buds per flower stalk per foot of row. Change site after three years if problem is severe. Row covers in weed-free gardens will act as barriers. (In weedy gardens row covers could increase damage because insects get a head start.)
	Cyclamen mite and two-spotted spider mite	This tiny (not visible to naked eye) whitish to caramel-colored mite occurs in groups in crevices of leaves, on stems, and among hairs of plants. Feeding causes severe distortion,

Table 13. Small-fruit pest management (*continued*)

<i>Plant</i>	<i>Pest/Disease</i>	<i>Description/Cultural Management</i>
Strawberry (<i>continued</i>)		
 <p>Slug FPO</p>	Slugs	stunting, and sometimes death of leaves. Blossom feeding causes distortion of fruit. Infested plants usually become unproductive within a season. Cyclamen mite is difficult to control. Rogue infested plants. Damage worse in years with wet spring weather. Slugs feed at night, eating out large, irregular areas in fruit and foliage, hiding during the day in damp refuse. They leave a glistening slime trail that can be seen early in the day. Homemade traps can help; handpick and destroy slugs.
	Spider mites	Feeding on undersides of leaves causes foliage to turn yellow then develop rusty brown blotches. Plants may be stunted and yield reduced. Natural enemies often keep spider mites under control. Do not overfertilize; keep plants watered.
 <p>Tarnished plant bug</p>	Tarnished plant bug	This 1/4-in.-long, brownish bug has yellow and black markings; immatures resemble wingless aphids (greenish) but much more active. Causes hard and nubby fruit and catfacing. Bug first appears just before bloom. Check for insects by striking plants over flat, light-colored dish. Treat when one to two nymphs are found per plant. Adults overwinter in weedy gardens.
 <p>White grubs FPO</p>	White grubs	Larvae of May and June beetles, soft-bodied, C-shaped grubs in soil. Life cycle may be one or two years. Grubs feed on roots and may kill or severely weaken plants. Grubs also feed on roots of grasses. Avoid planting strawberries immediately following sod.

FURTHER READING

Converse, R. H. 1978 (rev.)

Controlling Diseases of Raspberries and Blackberries. Farmers' Bulletin 2208, USDA, Washington, D.C. 18 pp.

Ellis, M. A. 1991. *Compendium of Raspberry and Blackberry Diseases and Insects.* American Phytopathological Society, St. Paul, Minn. 100 pp.

Hoffman, C. J., and T. J. Dennehy. 1987. *Assessing the Risk of Grape*

Berry Moth Attack in New York Vineyards. New York's Food & Life Sciences Bulletin 120, Geneva, N.Y. 4 pp.

Maas, J. L., ed. 1984. *Compendium of Strawberry Diseases.* American Phytopathological Society, St. Paul, Minn. 138 pp.

Maas, J. L. 1978 (rev.). *Strawberry Diseases.* Farmers' Bulletin 2140. USDA, Washington, D.C. 35 pp.

McGrew, J. R., and G. W. Still. 1979. *Control of Grape Diseases and*

Insects in the Eastern United States. Farmers' Bulletin 1893, USDA, Washington, D.C. 35 pp.

Pearson, R. A. 1988. *Compendium of Grape Diseases.* American Phytopathological Society, St. Paul, Minn. 100 pp.

Pritts, M. P., and D. Handley. 1989. *Bramble Production Guide.* NRAES-35, Ithaca, N.Y. 189 pp.

Highbush Blueberry Production Guide. 1992. NRAES-55, Ithaca, N.Y. 200 pp.