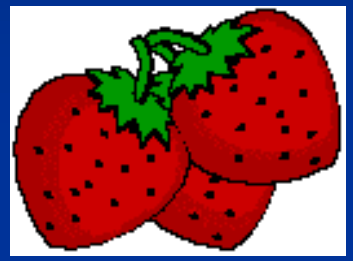
Fruit Diseases in the Home Garden



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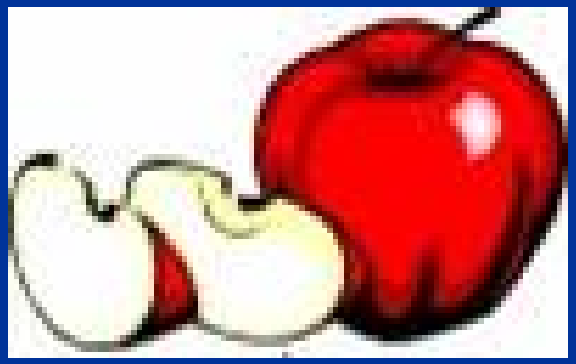
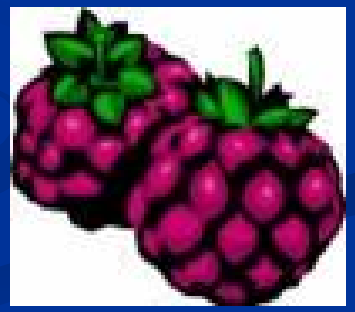




February 2005

Fruits commonly grown in the home garden in Wisconsin

- Apple
- Stone Fruits
- Strawberry
- Raspberry
- Grape

Apple Diseases

- Scab
- Rust
- Powdery mildew
- Fire blight
- Phytophthora root and crown rot
- Canker diseases

Apple Disease Management: General Recommendations

- Plant scab-resistant varieties; some of these are also resistant to other diseases.
- Plant in a well-drained site, preferably with light, sandy soil.
- Prune out diseased branches at least once per year; late winter is a good time to prune.
- Do not over fertilize with nitrogen.

Diseases of Apple: Scab

- Cause: a fungus, *Venturia inaequalis*.
- By far the most common disease of apple and crabapple.
- Favored by wet weather, especially during early to middle spring.
- Can cause early defoliation which weakens tree, makes it less winter-hardy.

Apple Scab: Symptoms

At first, spots are velvety and olive green with indefinite margins.

Can occur on upper or lower leaf surface.

Apple Scab: Symptoms

Later, spots turn brown to black; margins become more definite.

Leaves turn yellow or brown; trees can defoliate prematurely.

Apple Scab: Symptoms

At first, spots on fruit similar to spots on leaves.

Later, spots turn corky and brown. Spots are superficial, but can cause fruit cracking.

Apple Scab: Management

- Plant scab-resistant varieties.
- Remove fallen leaves in the fall and early spring *before* any new growth.
- Spray fungicides on susceptible varieties:
  - start when leaves show 1/2 inch new growth.
  - most garden store fungicides are protectants and must be applied before infection.
  - if spring weather is wet, reapply fungicide every 10-14 days.

Scab Fungicides

- Protectant
  - captan
  - ferbam
  - mancozeb, maneb
  - copper (e.g., Bordeaux)
  - sulfur
- Systemic
  - triforine
  - myclobutanil
  - fenarimol
  - thiophanate-methyl
  - benomyl
  - dodine

Always check the product label for permitted uses!

Diseases of Apple: Rust

- Cause: fungi, *Gymnosporangium* species.
- Cedar-apple rust, hawthorn rust, and quince rust are similar but caused by different fungi.
- Various types of junipers ("cedars") as alternate host.
- Favored by wet weather, especially around the time of bloom

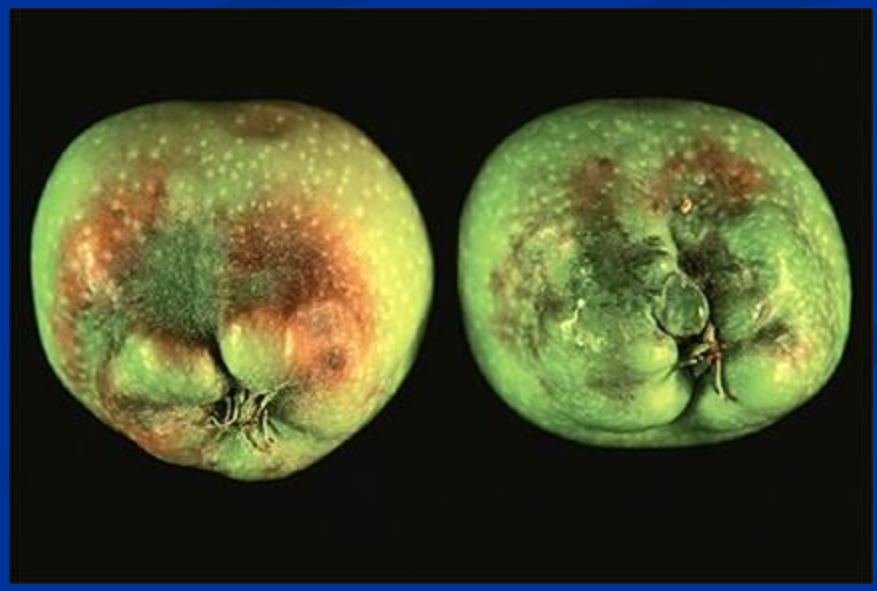
Rust Symptoms on Apple or Hawthorn

In the spring, spots on upper leaf surface are roughly circular and pale yellow; by mid-summer, spots are orange, sometimes with dark centers.

By late summer, grayish tubes protrude from lower leaf surface.

Rust Symptoms on Apple or Hawthorn

Fruit spots similar to leaf spots; usually near bottom of fruit.



Rust Symptoms on Juniper

Brown to reddish leaf galls (up to 2 inches in diameter) which exude gelatinous, orange tendrils in the spring.

Rust Symptoms on Juniper

Quince rust forms elongated masses of short, knobby spore masses.

Spores produced from same lesion year after year.

Rust: Management

- Plant resistant varieties.
- Break the disease cycle by removing junipers that are an alternate host (not always practical!)
- Apply fungicides, especially during bloom.
- Captan and sulfur do not control rust; ferbam and mancozeb are better choices.

Juniper ("cedar") Hosts

- Cedar apple rust
  - eastern red cedar, southern red cedar, Rocky Mt. Juniper, some varieties of prostrate junipers and Chinese juniper
- Hawthorn rust
  - eastern red cedar, southern red cedar, Rocky Mt. Juniper, common juniper and some varieties of prostrate junipers
- Quince rust
  - eastern red cedar, Rocky Mt. Juniper, common juniper, prostrate juniper, savin juniper

Diseases of Apple: Powdery Mildew

- Cause: a fungus, *Podosphaera leucotricha*.
- Usually severe only on highly susceptible varieties (Jonathan, Rome Beauty, Cortland, Ida Red, Stayman, Baldwin).
- Spores do not need free water to germinate; need only high humidity at 60-80°F.
- Overwinters in buds; mildew infected buds more susceptible to winter kill.

Powdery Mildew: Symptoms

Leaves covered with white, powdery fungal growth.

Later, leaves curl inward, turn brown, and die.

Powdery Mildew: Management

- Avoid highly susceptible varieties.
- If fungicides are used, start when flower bud clusters are still tightly closed; continue until terminal growth stops.
- Sulfur is excellent against mildew.

Apple Diseases: Fire Blight

- Cause: a bacterium, *Erwinia amylovora*.
- Pathogen can become systemic in plant, affecting all parts.
- Flower symptoms favored by warm, wet weather during bloom.
- Young, succulent shoot tips especially susceptible.
- Shoot symptoms often appear about 1 to 2 weeks after a wind/rain storm.

Fire Blight: Symptoms

In winter, bark is darker than normal. Cankers sunken and cracked.

Ooze is sometimes visible in spring.

Fire Blight: Symptoms

Flowers appear water-soaked, limp, and dark green to brown.

After bloom, clusters remain attached and turn hard and brown to black.

Fire Blight: Symptoms

In early summer, shoot tips wilt, sometimes exude ooze.

Later, shoots turn brown to black and bend back to form a "shepherd's crook."

Fire Blight: Symptoms

Fruit are usually brown and soft; sometimes covered with sticky ooze.

Fire Blight: Management

- Plant resistant varieties/rootstocks.
- Prune out affected shoots:
  - during summer, make cuts at least 12 inches below visible symptoms; disinfest tools in solution of 1 part bleach + 9 parts water.
  - during winter, make cuts at least 6 inches below visible symptoms; don't need to disinfest tools.
- Do not fertilize with nitrogen after July 1.

Apple Diseases: Phytophthora Root and Crown Rot

- Cause: various species of the water mold, *Phytophthora*.
- Crown is the base of the trunk, just above where roots emerge.
- Only a problem if soil drainage is poor or crowns remain wet for prolonged periods.

Phytophthora Root and Crown Rot: Symptoms

Bark and wood at crown is orange to brown and water-soaked; margin between diseased and healthy tissue is usually distinct.

Leaves are small, yellowish, and sparse; fruit are small; often turn red prematurely.

Phytophthora Root and Crown Rot: Management

- Plant in well-drained sites.
- Avoid heavy soils high in clay content.
- Do not let water pool at crown.
- To enhance drying at crown:
  - control weeds and grass.
  - do not use air-tight trunk guards.

Apple Diseases: Canker Diseases

- Cause: various fungi, including *Botryosphaeria* and *Leucostoma* species.
- Weak trees and trees under drought stress are more susceptible.
- Fungi often enter through pruning wounds.
- Apple canker pathogens are common on other woody plants.

Canker Diseases: Symptoms

Bark becomes dark or discolored; sometimes sunken, sometimes cracked.

Cankers can girdle and kill limbs, trunks, and entire trees.

Canker Diseases: Management

- Irrigate during hot, dry periods.
- Prune out diseased limbs.
- Prune properly so that wounds heal over.
- Avoid trunk injury from mowers.
- Apply white latex paint to the southwestern side of trunks to reflect sunlight; this will prevent cracking due to expansion and contraction of bark.

Calcium Deficiency in Pome Fruit

Common on large fruit on small trees, especially if tree is under drought stress. No pathogen involved.

Stone Fruit Diseases

Stone fruits include apricot, cherry, peach, and plum; some important diseases:

- Brown Rot
- Cherry Leaf Spot
- Perennial Canker
- Black Knot
- Virus Diseases

Stone Fruit Diseases: General Comments

- Wisconsin is at the northern limit for many stone fruit trees; disease makes them even more susceptible to winter injury.
- Cultural practices, including good soil drainage, irrigation, and pruning will improve tree health.
- Disease symptoms vary on different stone fruits.

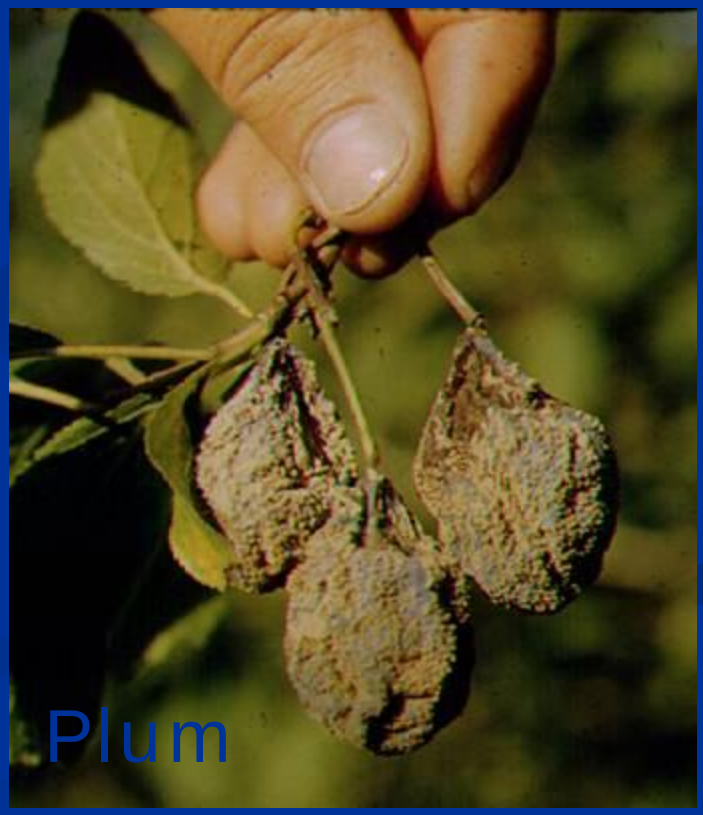
Stone Fruit Diseases: Brown Rot

- Cause: a fungus, *Monilinia fructicola*.
- All stone fruits susceptible.
- Favored by humid weather at the time that fruit are ripening.
- Entire crop can be lost within a few days.
- Disease can develop on harvested fruit.

Brown Rot: Symptoms

Small, soft, brown spots expand to cover entire fruit; fungal spores appear in fluffy brown masses, especially on ripe fruit.


Tart cherry


Plum

Brown Rot: Symptoms

Diseased fruit shrivel and harden to form mummies in which the fungus overwinters.

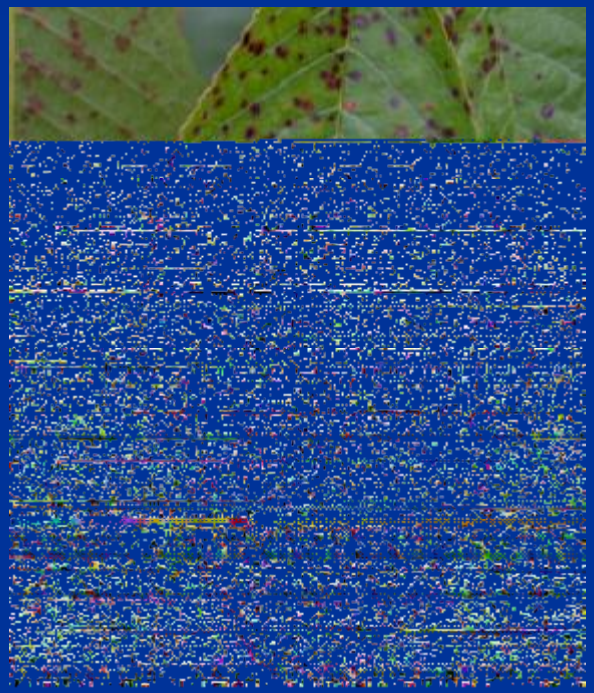
Brown Rot: Management

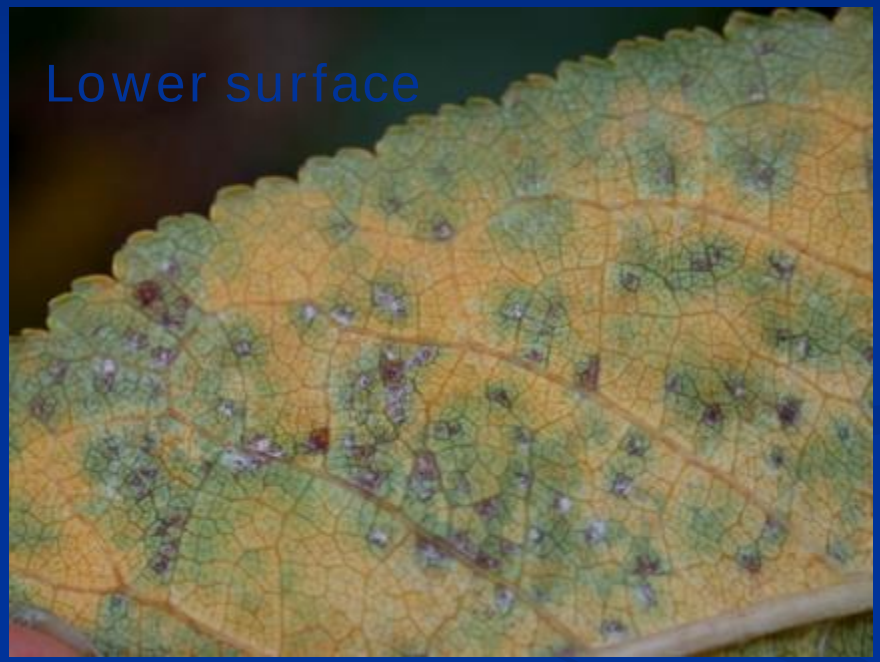
- Remove mummies after harvest and in the spring before budbreak.
- Fungicides (captan, triforine, myclobutanil) should be applied during bloom and again as fruit are ripening if rainy weather prevails.
- Refrigerate fruit after harvest.

Stone Fruit Diseases: Cherry Leaf Spot

- Cause: a fungus, *Blumeriella jaapii*.
- Affects sweet and sour cherry and plum.
- Favored by rainy weather starting at late bloom.
- Severe disease results in premature defoliation which makes trees less winter hardy.

Cherry Leaf Spot: Symptoms





Reddish spots on green leaves; spots appear green, red, or brown on yellow leaves; fungal spores appear as white flecks on undersides of leaves.

Cherry Leaf Spot: Symptoms

Severe disease results in early defoliation, reduced yield, and reduced tree vigor.

Cherry Leaf Spot: Management

- In the fall or in the spring before bloom, remove fallen leaves where the fungus overwinters.
- If weather is rainy at late bloom and later, apply a fungicide (captan, copper) at 10- to 14-day intervals.

Peach Leaf Curl

- Common on peach and nectarine.
- Similar disease (plum pockets) on plum.
- Can cause premature defoliation which in turn reduces tree vigor, winter hardiness.

Peach Leaf Curl: Symptoms

Leaves are thickened, curled, blistered, often reddish. Shoots are stunted.

Fruit are puckered, pillow-like, reddish.

Peach Leaf Curl: Management

- Time to use fungicides is in fall or spring, BEFORE leaves emerge.
- Effective fungicides: chlorothalonil, copper (e.g., Bordeaux), ferbam, ziram.
- Where leaf curl is severe, irrigation and additional nitrogen will help maintain tree vigor.

Stone Fruit Diseases: Perennial Canker

- Also called Valsa canker, Cytospora canker, Leucostoma canker.
- Cause: a fungus, *Leucostoma cincta* or *Leucostoma persoonii.*
- Most severe on peach but affects other stone fruits too.
- Fungus enters through wounds.
- Can kill limbs and entire trees.

Perennial Canker: Symptoms

Cankers form on branches, scaffold limbs, branch crotches and trunks; start out as sunken, off-color zones.

Later, bark cracks and peels; gumming may occur, but this is not diagnostic.

Perennial Canker: Management

- Prune out diseased limbs; prune properly so that wounds heal over.
- Avoid trunk injury from mowers.
- Apply white latex paint to the southwestern side of trunks to reflect sunlight; this will prevent cracking due to expansion and contraction of bark.
- Delay extensive pruning until spring when warm, dry weather is forecast.

Stone Fruit Diseases: Black Knot

- Cause: a fungus, *Apiosporina morbosa*.
- Common on plum and cherry, including ornamental and wild trees.
- Knots develop slowly, but can girdle and kill branches.

Black Knot: Symptoms

Spongy and corky knots form on branches and trunk.

Knots older than 1 year are black and sometimes covered by white or pink fungus.

Black Knot: Management

- Remove wild plum and cherry trees that may be a source of inoculum.
- Inspect trees several times per year for knots and prune them out making cuts 3 to 4 inches below visible knots.
- Fungicides applied for leaf spot or brown rot might help protect from black knot, but fungicides alone are not effective.

Stone Fruit Diseases: Viruses

- Several viruses infect stone fruit trees.
- Wild and ornamental stone fruit trees are a reservoir.
- Symptoms not always visible.
- Leafhoppers, aphids, pollen, and dagger nematodes spread viruses.
- Most viruses spread through budding and grafting; some are seed-borne.
- Reputable nurseries screen for viruses.

Virus Diseases: Symptoms

Sour cherry yellows (shot hole) caused by prune dwarf virus; leads to early defoliation and reduced tree vigor.

Green mottle virus occurs on many stone fruits but symptoms only on sour cherry.

Virus Diseases: Management

- Purchase certified virus-free trees from a reputable source.
- Destroy symptomatic trees and nearby wild stone fruit trees, even if they don't show symptoms.
- Control leafhoppers and aphids.
- No chemical controls for virus diseases.

Strawberry Diseases

- Gray mold
- Anthracnose
- Leaf spot, Leaf scorch, and Leaf blight
- Black root rot
- Verticillium wilt

Strawberry Diseases: General Recommendations

- Pathogens and diseases build up over time; renew plantings and rotate into sites where strawberries haven't been grown.
- Purchase plants from a reputable source.
- Plant in well-drained, light soils.
- Irrigate early in the day to promote drying of foliage.
- Where possible, choose varieties resistant to the major diseases.

Strawberry Diseases: Gray Mold

- Cause: a fungus, *Botrytis cinerea*.
- A common fruit rot in the field and after harvest.
- Favored by mild, wet weather during bloom.

Gray Mold: Symptoms

At first, tan to brown rot, often at stem end. Fluffy, gray to white fungal growth takes over entire fruit.

Gray Mold: Management

- Promote rapid drying by:
  - maintaining narrow, widely-spaced rows running parallel to prevailing winds.
  - irrigating in the morning for less than 2 hours at a time.
  - controlling weeds.
  - avoiding excessive nitrogen fertilization which promotes dense growth.
- Apply a fungicide during bloom, and if wet weather persists, as fruit ripen.

Strawberry Diseases: Anthracnose

- Cause: a fungus, *Colletotrichum acutatum*.
- Favored by hot, wet weather as fruit develop and ripen.
- Can develop and spread rapidly, destroying all fruit within a few days.

Anthracnose: Symptoms

At first, lesions are water-soaked indentations; within 2 to 3 days tan-colored rot expands to whole fruit; eventually lesions exude slimy, salmon-colored masses of spores.

Anthracnose: Management

- Keep soil covered with clean straw:
  - spores bounce and spread farther off water and soil than they do off straw.
- Fungicides of little benefit.
- Almost impossible to stop an epidemic after it's started, especially if weather is warm and wet.

Strawberry Diseases: Leaf Spot, Leaf Scorch, and Leaf Blight

- Three distinct diseases, but disease cycles and management are similar.
- Cause: fungi *Mycosphaerella fragariae*, *Diplocarpon earliana*, and *Phomopsis obscurans*.
- All favored by wet weather.
- If severe, reduce plant vigor and winter hardiness.

Strawberry Leaf Diseases: Symptoms

Leaf scorch: reddish-purple spots

Leaf spot: red-purple spots, white centers

Leaf blight:
red-brown spots; often V-shaped at base

Strawberry Leaf Diseases: Angular Leaf Spot

A bacterial disease; symptoms often show on only one half of a leaflet; spots are delimited by small veins.

Leaf Spot, Leaf Scorch, and Leaf Blight: Management

- At harvest, mow with blade set high; rake leaves and remove from the area.
- Irrigate early in the day to promote drying of foliage.
- Purchase plants from a reputable source.
- Where possible, choose varieties resistant to leaf diseases.

Strawberry Root Diseases

- Black root rot (complex of factors) and red stele (*Phytophthora fragariae*).
- BRR and RS common in Wisconsin, especially where soils are heavy.
- No chemical control or resistant varieties for BRR; resistant varieties for RS.

Black Root Rot Symptoms

Root system smaller than in healthy plant.

Main roots have dark lesions.

Small feeder roots dark and brittle or absent.

Red Stele of Strawberry

Foliage stunted.

Feeder roots lacking.

Central core (stele) of root is brick red rather than white.

Strawberry Root Diseases: Management

- Provide adequate soil drainage.
- Avoid planting in heavy, compacted soil.
- Consider raised plantings in heavier soils.
- Protect plants during winter with adequate straw cover.
- Renew plants and rotate into sites where strawberries have not been grown.

Strawberry Diseases: Verticillium Wilt

- Cause: fungi, *Verticillium* species.
- Favored by alternating cool and warm days.
- *Verticillium* infects many fruit, vegetable, and ornamental plants and remains in the soil for many years.
- *Verticillium* invades water-conducting tissue.
- Diseased plants generally die.

Verticillium Wilt: Symptoms

In new plantings, dieback appears when runners form.

In older plantings, outer leaves wilt, turn yellow to brown at margins and between veins.

Verticillium Wilt: Management

- Purchase plants from a reliable source.
- Choose resistant varieties.
- Allow 3 or more years after growing tomatoes, peppers, eggplant, potatoes, strawberries, or raspberries before rotating to strawberries again.

Raspberry Diseases

- Anthracnose
- Spur Blight
- Verticillium Wilt
- Phytophthora Root Rot
- Virus Diseases

Raspberry Diseases: General Recommendations

- Purchase certified virus-free plants from a reputable source.
- Destroy wild or abandoned bramble plants in the area.
- After harvest, remove canes that have fruited and any diseased canes.
- Improve air circulation by pruning and controlling weeds.

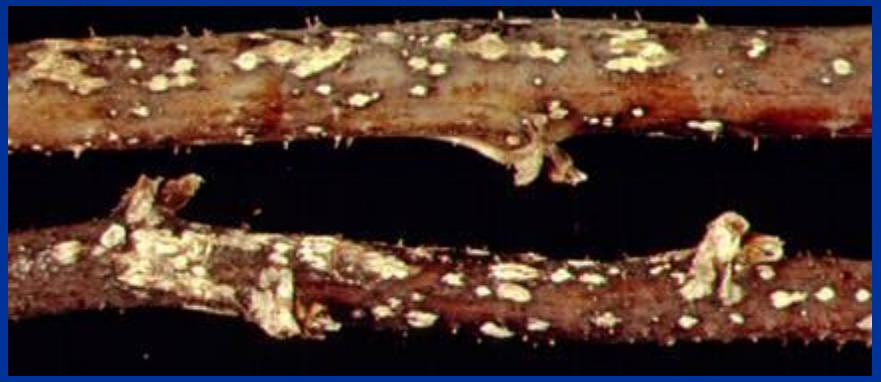
Raspberry Diseases: Anthracnose

- Cause: a fungus, *Elsinoe veneta*.
- Black and purple varieties more susceptible than red varieties.
- Severe disease makes canes less winter hardy.

Anthracnose: Symptoms

Spots start out with purple borders and gray or tan centers.

Anthracnose: Symptoms



By late summer, spots are large, more tan than purple, coalesce to form “gray bark.”

Raspberry Diseases: Spur Blight

- Cause: a fungus, *Didymella applanata*.
- Common on red and purple varieties but not black varieties.
- Severe disease makes canes less winter hardy.

Spur Blight: Symptoms

Bluish-brown or purplish-brown cankers develop at spur where a leaf is attached.

Symptoms usually on lower portion of cane; worse in dense plantings.

Anthracnose and Spur Blight: Management

- After harvest, remove canes that have fruited and any diseased canes.
- Improve air circulation by pruning and controlling weeds.
- Delayed dormant application of lime-sulfur helps reduce inoculum.

Raspberry Diseases: Verticillium Wilt

- Cause: fungi, *Verticillium* species.
- Favored by cool spring weather; symptoms arise during hot, dry weather.
- Usually worse in black and purple varieties than red varieties.
- *Verticillium* infects many fruit, vegetable, and ornamental plants and remains in the soil for many years.
- *Verticillium* invades water-conducting tissue.

Verticillium Wilt: Symptoms

- Lower leaves are dull rather than bright green.
- Higher up on stem, older leaves turn yellow, shoot tip wilts, and cane may collapse.
- Blue streaks on the surface of canes; red to brown streaks in the vascular tissue.

Verticillium Wilt: Management

- Purchase plants from a reliable source.
- Allow 3 or more years after growing tomatoes, peppers, eggplant, potatoes, strawberries, or raspberries before rotating to raspberries again.
- Remove symptomatic plants, including roots, as soon as they are noticed.

Raspberry Diseases: Phytophthora Root Rot

- Cause: various species of the water mold, *Phytophthora*.
- Only a problem if soil drainage is poor or crowns remain wet for prolonged periods.
- Diseased plants are susceptible to winter injury.

Phytophthora Root Rot: Symptoms

Plants are generally unthrifty and lack vigor; leaves are small and yellowish.

Crown/root tissue soft and reddish instead of green-white; sharp margin between healthy and diseased tissue.

Phytophthora Root Rot: Management

- Plant in well-drained sites with light soil.
- If drainage is a problem, plant in raised beds.
- Fungicides only marginally effective; will not restore vigor to declining plants.

Raspberry Diseases: Viruses

- Cause: various viruses which are carried by aphids or nematodes.
- Viruses more common in raspberry than other fruit plants.
- Wild brambles are a reservoir for viruses.
- Can significantly reduce yields.
- Symptoms can be confused with injury from herbicides or insects.

Tomato Ringspot Virus Symptoms on Raspberry

Symptoms vary depending on variety and time of year. Can be general stunting and bronzing. Can be vein chlorosis, ringspot on leaves, and crumbly berries.

Raspberry Leaf Curl Virus Symptoms

Small leaves that are cupped downward and inward; fruit can be small, plants stunted.

Raspberry Virus Diseases: Management

- Purchase certified virus-free plants from a reputable source.
- Remove diseased plants and wild brambles.
- Control aphids.
- No chemical controls for viruses.

Grape Diseases

- Black Rot
- Downy Mildew
- Powdery Mildew
- Phomopsis Cane and Leaf Spot

Grape Diseases: General Recommendations

- Relatively few important diseases, but these can cause severe losses.
- *Vitis labrusca* (American) much more disease resistant that *Vitis vinifera* (European).
- Purchase certified virus-free plants from a reputable source.
- Improve air circulation by pruning and controlling weeds.

Grape Diseases: Black Rot

- Cause: a fungus, *Guignardia bidwellii*.
- Most economically important grape disease in the Midwest.
- Can cause total crop loss if wet weather prevails.
- All succulent new growth--leaves, stems, tendrils, and fruit--is susceptible.

Black Rot Symptoms

Leaf spots are tan and irregular in shape, have dark borders, and develop black fungal fruiting bodies.

Black Rot Symptoms

Fruit spots are small and white with tan margins; later they expand, turn brown,and whole berries shrivel, turn hard, and become spotted with fungal fruiting bodies.

Black Rot: Management

- Remove mummies (dried-up diseased fruit) in the fall or spring before budbreak.
- American grape varieties more resistant than French hybrids.
- Prune well to open canopy and improve air circulation.
- If fungicides are used, early spring applications are most important.

Grape Diseases: Downy Mildew

- Cause: a water mold, *Plasmopora viticola*.
- Favored by cool, rainy weather.
- Symptoms usually not visible until middle or late summer.
- Direct losses due to rotting of flowers and fruit.
- Early defoliation can make vines less winter hardy.

Downy Mildew: Symptoms

Early symptoms

Late symptoms

Leaf spots are yellowish on upper surface, white and downy on lower surface.

Late-season infection results in a mosaic of yellow, red, and brown angular spots.

Downy Mildew: Symptoms

Diseased fruit are off-color, shrivel and become covered with white, downy fungal growth.

Downy Mildew: Management

- American varieties more resistant than French hybrids and vinifera varieties.
- In the spring before budbreak, remove dead leaves from the previous season.
- Prune well to open canopy and improve air circulation.

Grape Diseases: Powdery Mildew

- Cause: a fungus, *Uncinula necator*.
- Favored by warm, humid weather (but not heavy rains).
- Reduces vine growth, fruit quality, and winter hardiness.
- Many plants get powdery mildew, but in general, each plant species has a unique mildew species.

Powdery Mildew: Symptoms

White, dusty fungal growth appears on upper and lower leaf surfaces.

Young leaves become distorted and stunted.

Fruit skins are dry, tough and cracked.

Powdery Mildew: Management

- American varieties more resistant than French hybrids.
- Prune well to improve air circulation within the canopy.
- Sulfur is an effective mildewcide, but certain varieties (e.g., Chancellor, Concord, and Foch) are sensitive to sulfur, especially at temperatures >85^{o} F.

Grape Diseases: Phomopsis Cane and Leaf Spot

- Cause: a fungus, *Phomopsis viticola*.
- Formerly known as "dead arm."
- Fruit usually not affected directly.
- Canes with severe lesions more prone to wind damage.
- Disease most active in the spring and fall during rainy weather.

Phomopsis Cane and Leaf Spot: Symptoms

Canes, shoots, and petioles (especially lower portions) have brown to black blotches that coalesce; leaf symptoms include small, chlorotic spots with dark centers, leaf puckering, and necrosis along veins.

Phompsis Cane and Leaf Spot: Management

- Prune out and remove any diseased canes.
- Fungicides most effective in the spring when new shoots are 1 to 3 inches long; if wet weather prevails, apply again when shoots are 4 to 6 inches long.

Further Information

- Your county Extension office has several bulletins in stock and a catalog of the entire inventory.
- American Phytopathological Society (APS) Press produces a “Disease Compendium” for apple, stone fruits, strawberry, raspberry, grape, and several other crops and ornamental plants. These are approximately $40 each. Call 1-800-328-7560. Internet: www.scisoc.org/apspress.

Further Information

Some good web sites:

- http://cecommerce.uwex.edu/
- www.caf.wvu.edu/kearneysville/wvufarm1.html
- www.nysaes.cornell.edu/pp/extension/tfabp/