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An IPM Scouting Guide for Common Problems of Peach in Kentucky

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An IPM Scouting Guide for Common Problems of Peach in Kentucky

This manual is the result of efforts of the University of Kentucky Fruit Integrated Pest Management team.

Long before the term “sustainable” became a household word, farmers were implementing sustainable practices in the form of Integrated Pest Management (IPM) strategies. IPM uses a combination of biological, cultural, physical, and chemical methods to reduce and/or manage pathogen and pest populations. These strategies are used to minimize environmental risks, economic costs, and health hazards. Pathogens and pests are managed (although rarely eliminated entirely) to reduce their negative impact on the crop.

Scouting and monitoring for diseases, insects, weeds, and abiotic disorders helps identify potential problems before serious losses result. This is essential to the IPM approach. The key to effective monitoring is accurate identification. The images included in this guide represent the more common abiotic and biotic problems that occur in Kentucky peach plantings.

This manual is not all-inclusive, and growers may encounter problems not included here. Growers should contact a local Cooperative Extension Service office for further assistance. Additional information on pathogen and pest identification and management, as well as peach production, can be found in the resources listed below, available online or at county Extension offices.

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National Institute of Food and Agriculture

Sponsored by Kentucky IPM

Cover:
Brown rot fruit infection
John Strang, University of Kentucky

Diseases

1. Anthracnose fruit rot (*Colletotrichum* spp.) is a fungal disease that causes rot of a wide range of fruits. It is common on stone fruit in the Southeast, but is uncommon in Kentucky. Initially, small round sunken spots resemble brown rot symptoms; however, unlike brown rot, sunken spots of anthracnose remain firm to the touch as they expand. Salmon-colored spores arranged in concentric rings ooze from lesions during wet or humid conditions; this is distinctive for anthracnose. Infection occurs soon after bloom, but symptoms do not appear until fruit is ripe or nearly ripe. The fungus overwinters on diseased fruit and infected twigs. **Management**— Use proper sanitation (remove infected fruit, remove diseased twigs; discard debris away from orchard). Increase air circulation to encourage drying of plant tissues (pruning, thinning, spacing). Use fungicides to suppress disease development; fungicides do not cure disease.

Anthracnose fruit rot (a) and close-up of lesions with exuding spore masses (b).

2. Bacterial canker (*Pseudomonas syringae* pv *syringae*) results in canker development and twig blight symptoms, more commonly on cherry and less frequently on peach. Dark, sunken lesions (cankers) develop on stems, and gum exudes from the site (gummosis). Tissue underneath the bark appears reddish brown. Gummosis becomes more severe and a sour odor (also called sour sap) may develop. Cankers enlarge and girdle branches; sudden branch death occurs during summer months. Bacterial cells ooze from cankers in early spring (2 to 3 weeks after bud break) or when weather is cool and wet. Infection occurs through buds and shoots or through injured bark tissue. Pruning wounds and freeze injury enhance infection of the trunk and scaffold limbs. Secondary fungal diseases may develop at canker site (e.g. perennial canker; see #10). Bacterial canker and freeze injury are the direct causes of peach tree death associated with Peach Tree Short Life (PTSL) syndrome.
Management—Avoid injury and wounds (freeze, insect, pruning, nematodes); consider planting cold-tolerant cultivars. Prune in late winter or early spring for more rapid callus formation. Maintain plant health; reduce plant stress. Sandy soils and drought stress increase susceptibility to infection. Practice proper sanitation (remove diseased wood before spring growth begins; discard debris away from orchard).

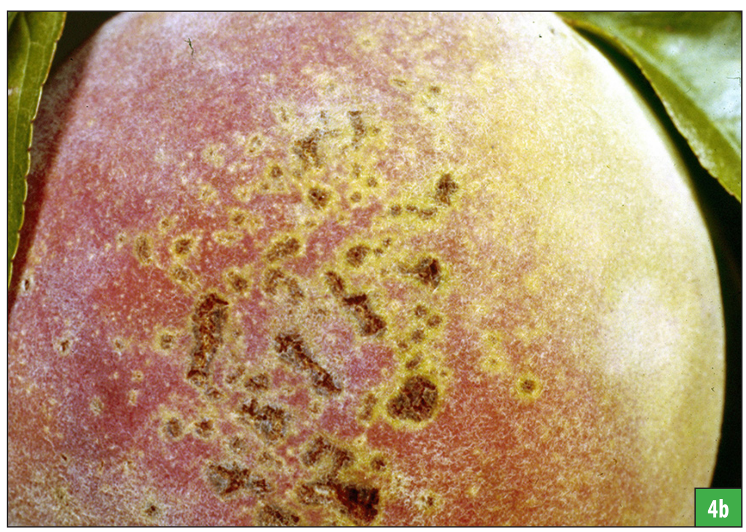
Bacterial canker on branch (a) and gums (gummosis) exuding from infection site (b).

3. Bacterial leaf spot (*Xanthomonas campestris* pv *pruni*) affects all stone fruits, but it occurs most frequently in peach. The bacterium can infect fruit, leaves, and shoots, particularly if conditions are warm and wet from petal fall until 3 to 4 weeks after petal fall. Red to purple leaf spots are small and angular with a yellow halo. Spots are usually concentrated on tips of leaves and along midribs; diseased leaves rapidly turn yellow and drop from trees, even with minimal spotting. Spots expand and centers of spots drop out, causing shot-hole symptoms. Infection may spread to fruit (see #4). Twig infections occur on current season's wood and serve as sites for overwintering. Twig dieback is more common in apricot and plum than peach. **Management**—Space plants to improve air circulation. Apply copper products as a dormant spray and antibiotics during the growing season. Consider resistant cultivars. Avoid planting new trees near infected trees. Practice proper sanitation (remove diseased wood before spring growth begins; discard debris away from orchard). Plant windbreaks to reduce damage/abrasions by driving rain, wind, and blowing sand.

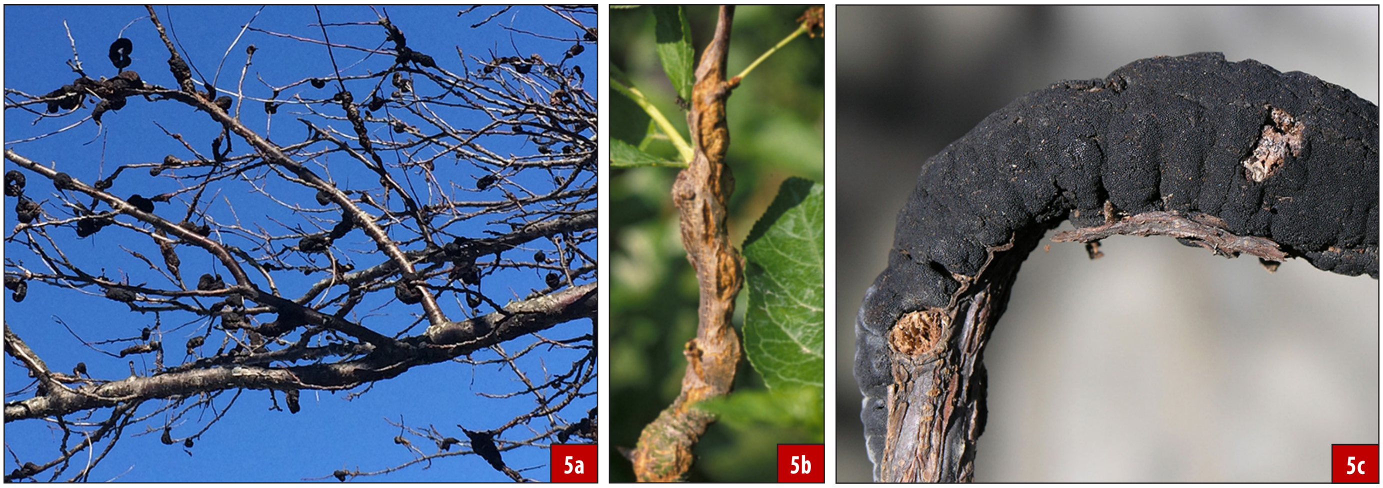
Bacterial leaf spot lesions (a) and shot-hole symptoms (b).

4. Bacterial spot of fruit (*Xanthomonas campestris* pv *pruni*) is caused by the same bacterium that causes bacterial leaf spot (see #3); it infects fruit, leaves, and shoots of stone fruit, but it occurs most frequently in peach. Fruit lesions begin as tiny, water-soaked spots with yellow halos. As fruit enlarge, spots become pitted, increasingly sunken, and crack; gummosis may occur. Lesions are limited to fruit surfaces and do not affect flesh, but cracks may allow entry for fungal pathogens (e.g. the brown rot fungus; see #6). Bacteria overwinter in twig cankers and become active at petal fall if conditions are wet and warm. Infection occurs through wounds, especially those caused by driving rains and blowing sand.

Management—Space plants to improve air circulation. Apply antibacterial products in early spring; use antibiotics during the growing season if orchard has a history of disease. Consider resistant cultivars. Avoid planting new trees near infected trees. Practice proper sanitation (remove diseased wood before spring growth begins; discard debris away from orchard). Plant windbreaks to reduce damage/abrasions by driving rain, wind, and blowing sand.



Bacterial spot early symptoms on fruit (a) and later damage (b).



Tree heavily infected with black knot (a); early black knot symptoms (b); and advanced symptoms later in the season (c, d); on a major limb (e).

5. Black knot (*Apiosporina morbosa,* formerly *Dibotryon morbosum*) results in knotty growths on branches of fruiting and ornamental cherry and plum; it rarely affects peach. Infected twigs and branches develop abnormal growths that enlarge each year to reach 12 inches or more in length. In late spring, knots expose olive-green colored fungal growth and sporulation. Later in the season, knots become hard, brittle, and black. Eventually, girdling occurs and branch death results. The pathogen overwinters in knots. **Management**—Practice proper sanitation (remove diseased wood 6 to 8 inches below knot before spring growth begins; discard debris away from orchard). Remove nearby wild *Prunus* species. Use fungicides to prevent new infections; fungicides are only effective if knots are removed.

6. Brown rot (*Monilinia fructicola*) can result in fruit rot, blossom blight, and twig blight in peach and other stone fruit. Blossom blight phase occurs as the fungus infects open blooms; flower parts turn brown and blossoms die. Infection moves downward from blooms into spurs and twigs; cankers develop. Fruit infections begin as small, round, dark spots, which enlarge rapidly. In as little as 2 days, masses of light-colored tan-to-gray spores rapidly consume large portions of fruit. Fruit eventually become hard and shriveled (mummify) and remain attached to trees or drop. Damaged fruit and ripening fruit are most susceptible to infection; fallen fruit are also susceptible. Twig lesions may cause blighting,

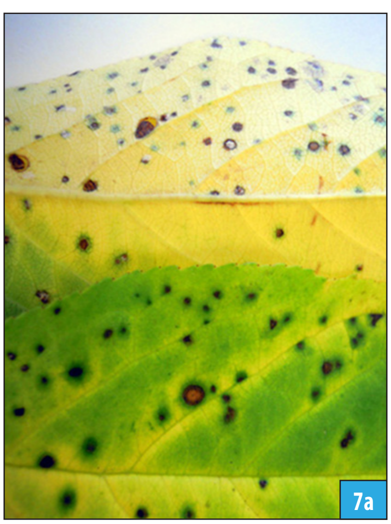
Brown rot blossom blight (a) and twig blight (b) resulting from blossom infection.

resulting in death of twigs; gummosis is common in affected twigs. Infection is more severe during rainy spring weather. The fungus overwinters in mummies and twig cankers. **Management**—Practice proper sanitation (remove infected fruit, mummies, and fallen fruit; discard debris away from orchard). Avoid fruit injury and wounding (insects, birds, mechanical). Use fungicides beginning at bloom; fungicides do not cure disease. Refrigerate fruit immediately after harvest.

Brown rot blossom blight fruit infections (c) expand rapidly to encompass entire fruit (d); and infected fruit become covered with fungal sporulation (e). Diseased fruit eventually mummify (f).

7. Cherry leaf spot (*Blumeriella jaapi,* formerly *Coccomyces hiemalis*), sometimes called shot-hole disease, is a fungal disease that affects leaves of sour cherry and sometimes sweet cherry; it rarely affects peach. Small reddish-purple spots develop on leaves and enlarge to ¼ inch. Velvety spore masses may develop on undersides of leaf spots if weather is wet or humid. During summer, centers of spots drop out, causing shot-hole symptoms. Leaves eventually become bright yellow as infection progresses, while halos around spots remain green (green island effect); leaves drop prematurely. The fungus overwinters on fallen leaves. Symptoms resemble bacterial leaf spot (see #3).

Management—Use proper sanitation (remove infected fruit, remove diseased twigs; discard debris away from orchard). Increase air circulation to encourage drying of plant tissues (pruning, thinning, spacing). Fungicides used to manage brown rot often manage cherry leaf spot.



Cherry leaf spot lesions (a, b) and shot-hole symptoms (c).

Crown gall.

Peach leaf curl (a) and close-up of infected leaves (b).

8. Crown Gall (*Rhizobium radiobacter,* formerly *Agrobacterium tumefaciens*) is a bacterial disease that affects a wide range of host plants, including stone fruits. Tumor-like galls girdle infected young trees at the soil line or on the lower trunk, causing stunting, poor vigor, and eventually tree death. Early symptoms include small, wart-like round galls that develop in late spring; galls expand through the growing season, turning rough and brownish-black. Bacteria enter trunks and roots through wounds (pruning cuts, insect punctures, freeze damage, equipment damage). The soilborne bacterium survives for several years in soil and is moved through infected plant material and through soil (drainage water, cultivation equipment).
Management—Begin with disease-free stock plants. Avoid injury and wounds (freeze, insect, pruning); consider planting cold-tolerant cultivars. Rotate crops if site has a history of disease; avoid susceptible plants, such as apple and brambles. Avoid movement of infested soil.

9. Peach leaf curl (*Taphrina deformans*) is caused by a yeast-like fungus. Disease is most severe if weather is cool and wet during bud swell and shoot emergence. New foliage becomes thickened, puckered, and deformed. Leaves become bright yellow to reddish, later darkening to a purplish color. Dusty white spores develop on leaves. Leaves drop, causing decrease in fruit production. Mature leaves are not susceptible to infection. Fungal spores overwinter on bark, in infected buds, and on affected leaves.
Management—Apply fungicides before bud break. Consider resistant cultivars. Apply fungicides in early spring or late autumn.

10. Perennial canker, **Cytospora canker**, **Leucostoma canker**, **Valsa canker** (*Leucostoma* spp., formerly *Cytospora* spp.) results in cankers on branches of all stone fruit and flowering *Prunus* species. Initial symptoms include amber-colored oozing sap (gummosis) at the canker site. Callus tissue develops around canker edges during late summer, and decay resumes the next spring. This annual series of callus production eventually expands, and visible rings develop. Gummosis becomes more severe as cankers enlarge. Cankers surround (girdle) branches and branch death occurs. Causal fungi are weak pathogens that target wounded and stressed trees; they overwinter in cankers and in dead wood. Perennial canker may be confused with bacterial canker (see #2) or with injury by boring insects (see # 17 and #19), which also result in gummosis. Perennial canker damage is limited to cambium tissue, but other wood decay fungi often enter through canker sites.
Management—Avoid wounding (pruning, insects, sunscald, winter injury). Maintain vigor and reduce plant stress; consider planting cold-tolerant cultivars. Practice proper sanitation (remove infected wood; discard debris away from orchard; remove diseased wood before spring). Fungicides are ineffective.

Early development of perennial canker (sunken lesion) with gummosis (a) and advanced symptoms (b).

11. Phytophthora root rot and **crown rot** (*Phytophthora* spp.) is a water mold disease that affects roots and crowns of stone fruit and many other hosts. The first visible symptoms include wilt or death of entire trees in late spring or summer. In less severe situations, slow symptom development occurs with gradual chlorosis, wilting, and dieback; scorch along leaf margins can occur. Water-soaked, black, sunken cankers are often visible at bases of trunks. Scraping off the bark reveals a characteristic red coloration and necrotic (dead) cortical (inner) tissue. Necrosis sometimes expands upward. This pathogen favors soils with high moisture content, especially when soil is clay, poorly drained, or rain/irrigation keeps soil saturated for extended periods. Symptoms first appear on plants in low-lying areas and then spreads to nearby plants. High soil moisture accelerates pathogen reproduction and rate of infection. Some *Phytophthora* species have broad host ranges and may be present in soils prior to planting; other species may have more restricted host ranges and are likely introduced into planting sites via infected plant material. Once *Phytophthora* is established in soils, it persists for many years, even after host plants are removed. **Management**—Select a growing site with good soil drainage or plant on raised beds. Rotate with non-susceptible crops. Consider resistant rootstocks. Fungicides may suppress disease on less symptomatic plants, as long as fungicides are applied regularly.

Tree decline due to Phytophthora root and crown rot (a) and typical discoloration of root tissues (b).

12. Scab, also known as **peach scab** (*Cladosporium carpophilum*), results in superficial lesions on skins of peaches and other stone fruit. Small, velvety, olive-green spots form on young fruit, usually near the stem end. Fruit can become infected anytime during the season, especially if conditions remain wet. Spots become darker, expand to ¼-inch diameter, and may crack. Lesions may run together if disease is severe, and fruit may drop in extreme cases. A corky layer underneath the skin develops but does not expand into the flesh. Twig infections cause raised lesions on current season's wood; they resemble bacterial spot lesions (see #3). The fungus overwinters in twig lesions. Leaf infections are uncommon. Infection is more severe when conditions are wet after petal fall. Symptoms develop 6 to 12 weeks after infection occurs.
Management—Increase air circulation to encourage drying of plant tissues (pruning, thinning, spacing). Use proper sanitation (remove infected fruit; remove diseased twigs; discard debris away from orchard). Use fungicides either at petal fall or at shuck split. Peel fruit to remove diseased skins.

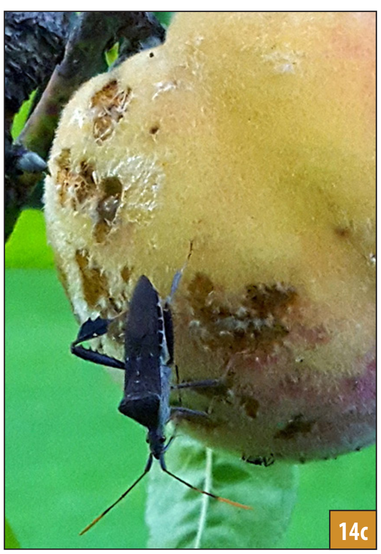
Peach scab lesions on small branches (a) and on fruit (b).

Insect Pests

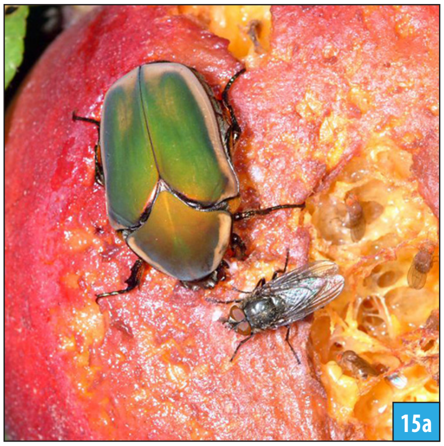
13. Brown marmorated stink bug (*Halyomorpha halys*) adults have ¾-inch long shield-shaped bodies that are mottled brown in color. Bodies have a smooth edge between eye and corner of the thorax (middle section of the body). Alternating white and brown spots are present on abdomen edge beyond wings. Each antenna has two light bands. Nymphs have white bands on their tibia (leg segments). Fruit damage includes distortion, catfacing (see #14), oozing (gummosis), and corky flesh.
Management—Scout border rows to monitor populations. Apply insecticide as needed.

14. Cat-facing is caused by various insects (plant bugs, stink bugs, leaf-footed bugs) that feed on fruit with piercing-sucking mouthparts. As they feed, saliva is injected into fruit, which results in wounds to the skin. Callus tissue forms over these wounds as fruit expands in size, resulting in sunken areas on the fruit.
Management—Eliminate winter annual weeds in orchard. Apply insecticides as needed.

Brown marmorated stink bug nymph (a); adult (b); and damage to fruit (c).



Tarnished plant bug (a); leaf-footed bug (b); and leaf-footed bug feeding on peach (c). Catfacing damage: note gummosis (d) and damaged skin with callus tissue (e).



Green June bug adult with damage to fruit (a) and larva (b).

Japanese beetle adults and damage (a); large numbers of beetles (b); and grub (c).

15. Green June beetle (*Cotinis nitida*) adults are about 1 inch long with dull metallic green wings and bronze-to-yellow margins on head and sides. Undersides are shiny green. Larvae are cream-colored, up to 2 inches long, crescent-shaped, and project legs upward when moving. Adults feed on ripe and overripe fruit, causing extensive surface damage; they are often present in large numbers.
Management—Apply insecticides with short pre-harvest interval (PHI) just before and during harvest.

16. Japanese beetle (*Popillia japonica*) adults are ⅜-inch long metallic green beetles with copper-brown wing covers. Five small white tufts of hair project from underneath wing covers at the tip of the abdomen. Mature larvae are crescent-shaped grubs about 1 inch long with a brown head and grayish-black end; hairs on the last body segment (raster) form a V-shaped pattern near the anal opening. Adults feed on ripening fruit as it ripens and softens; they do not feed on leaves. Japanese beetles feed in groups and can be present in large numbers.
Management—Avoid use of Japanese beetle traps. Apply foliar insecticides. Grub management does not usually manage adults.

17. Lesser peachtree borer (*Synanthedon pictipes*) moths resemble wasps; adults are slender and dark blue with thin, pale yellow bands on the second and fourth abdominal segments. Both pairs of wings are clear, except for the edges and veins, which have bluish-black scales. Antennae of males are finely tufted. Lesser peachtree borers resemble male peachtree borers but have fewer yellow bands on the abdomen (lesser peachtree borers have two bands and peachtree borers have three or more complete bands). Mature larvae are about 1 inch long, cream-to-pink in color, and have light brown heads. Eggs are small, reddish-brown, and laid in groups in bark cracks. Lesser peachtree borer attacks older trees and can be found on any part of the tree (scaffold limbs, branches, and trunk). Symptoms include clear, oozing gum (gummosis) with frass inside the gum. Outer bark damage can include scarring and peeling in extreme infestations. Decline and tree death may occur.
Management— Monitor populations with pheromone traps. Apply insecticide sprays to trunk and scaffold limbs after peak flights.

Adult lesser peachtree borer (a); larva (b); damage to tree (c); and gummosis associated with damage (d).

18. Oriental fruit moth (*Grapholita molesta*) is a ¼-inch, charcoal-colored moth. Fine alternating bands of light and dark lines give it a mottled appearance. Eggs are flat and oval, initially opaque and white in color but turn brownish-red as they mature. Larvae are pinkish-white with brown heads and are ½ inch long when full-grown. Oriental fruit moth (OFM) larvae and codling moth larvae are very similar, but OFM have a small four-prong comb hidden underneath a flap near the end of their abdomen. Early generation larvae feed on leaf shoots, causing flagging and tip dieback. Later generation larvae tunnel through fruit and feed around the pit. Fruit drop is common; fruit remaining on trees is distorted.
Management—Monitor populations with pheromone traps. Time insecticide applications based on weather monitoring and degree-day models. Mating disruption products are effective as an alternative technique.

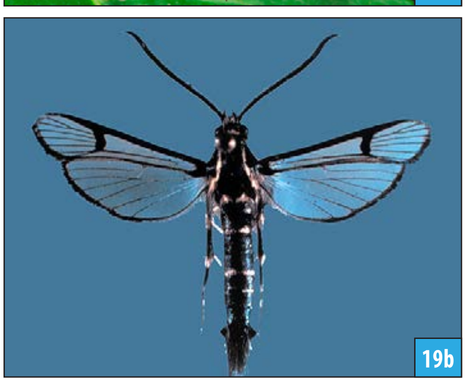

18b


18a

Oriental fruit moth adult (a) and damage to developing shoot (b).

19. Peachtree borer (*Synanthedon exitiosa*). Females are dark, steel blue moths with two wide orange bands around their abdomen; front wings are opaque while hind legs are clear. While males are also steel blue, they have three or four narrow-yellow bands around their abdomen and both pairs of wings are clear. Male moths are smaller and more slender than females. Mature larvae are 1 ¼ inches long and cream colored with a dark brown head. Larvae attack near the base of trunks and often burrow beneath the soil line. Frass often protrudes from bark wounds. Gummosis and ooze is typically clear with visible frass inside the gum. Severely infested trees show signs of decline, dieback, and reduced crop load. Young trees are most susceptible.
Management—Monitor populations with pheromone traps. Apply insecticide sprays to trunks after peak flights.


19a


19b

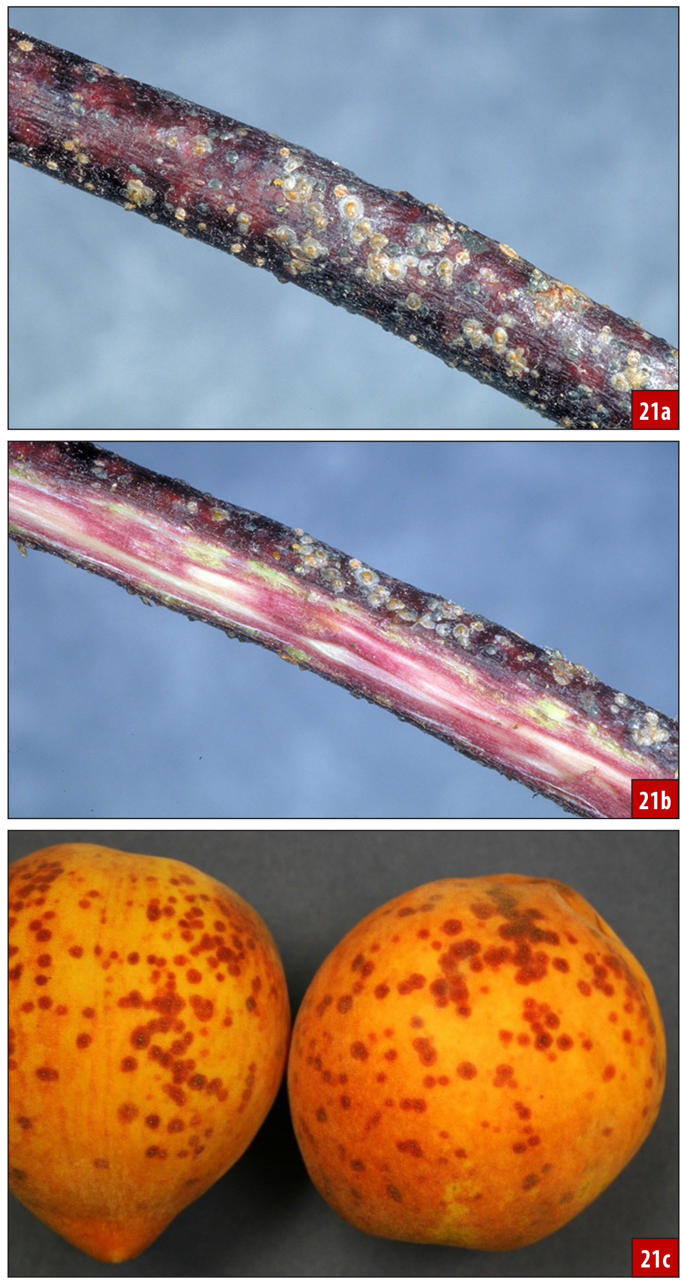

19c

Peachtree borer adult female (a); adult male (b); and damage at base of trunk (c).

Plum curculio adult (a); larva (b); and egg-laying scar (c), shown here on apple, but similar on peach.

20. Plum curculio (*Conotrachelus nenuphar*) adults are ¼ inch long snout beetles with dark brown with patches of white or gray. Four prominent humps are present on wing covers. Larvae are legless, grayish-white grubs with brown heads, and are ⅓ inch long when full-grown. Injury will appear as ⅛-inch crescent-shaped cuts on fruit surfaces.
Management—Apply insecticides when damage is first observed or at first-cover.

21. San Jose scale (*Quadraspidiotus perniciosus*) are tiny ($\frac{1}{20}$ of an inch) gray sucking insects that reside underneath a waxy covering. Scale coverings are flat, circular in shape, and have concentric rings with a tiny knob in the center. Crawlers (immature stage), which are yellow and resemble spider mites, are $\frac{1}{200}$ inch in size and only visible with a hand lens. Red flecking on fruit at harvest or under bark on new growth is due to toxic saliva injections. San Jose scale can kill limbs or entire trees.
Management— Apply dormant oil. Scout to determine population levels: attach a piece of black tape (sticky side out) on an infested limb to detect crawlers. Apply insecticides to target crawler stage either at pre-bloom or early summer.



San Jose scale on surface of branch (a); bark removed to show damage to wood tissue (b); and damage to ripening fruit (c).

Honeyvine milkweed growth habit (a); in bloom (b); and seed pod (c).

22. Honeyvine milkweed (*Cynanchum laeve* or *Ampelamus albidus*) is a vining perennial with a large taproot, rapid growth rate, and high seed production. Heart-shaped leaves are 4 to 7 inches long and arranged in opposite pairs along a tough, narrow stem. Vine damage results in release of milky sap. Green seedpods are 3 to 6 inches long and resemble other milkweed pods. **Management**—Apply pre-emergent herbicide. Minimal treatable leaf surface area makes post-emergent control difficult. Apply post-emergent herbicide persistently and repeatedly after germination. Once this weed grows upward through trees, it is difficult to manage with herbicides.

23. Horsenettle (*Solanum carolinense*) is an herbaceous perennial with a few branches that can reach a height of 3 feet. Spines are scattered along stems and central veins on leaf undersides. Oval, irregularly lobed leaves are 2 ½ to 4 ½ inches long and alternately arranged on stems. Upper stems end in small clusters of white star-shaped flowers with obvious yellow anthers. Round green-yellow fruits, partially enclosed in a papery cover, are ½ inch in diameter. Plants spread by seed and rhizomes. **Management**—Mow repeatedly to starve root systems. Apply systemic post-emergent herbicides while plants are young. Avoid cultivation, which spreads rhizomes.

Horsenettle growth habit (a); in bloom (b); and flowers (c).

24. Johnsongrass (*Sorghum halepense*) is an aggressive perennial common in agronomic fields, along roadways, and in waterways and areas that are prone to flooding. Mature leaf blades are 5 to 20 inches long with obvious white ribs down the center. Plants reproduce by seed and by perennial rhizomes, making control difficult. Rhizomes are stout compared to other grasses and can begin forming as quickly as 1 month after seed germination.
Management—Apply pre-emergent herbicides to help prevent seedling establishment. Apply post-emergent herbicides selective for grasses when plants are seedlings; herbicides are less effective once rhizomes have formed. Avoid cultivation, which spreads plants.

24a

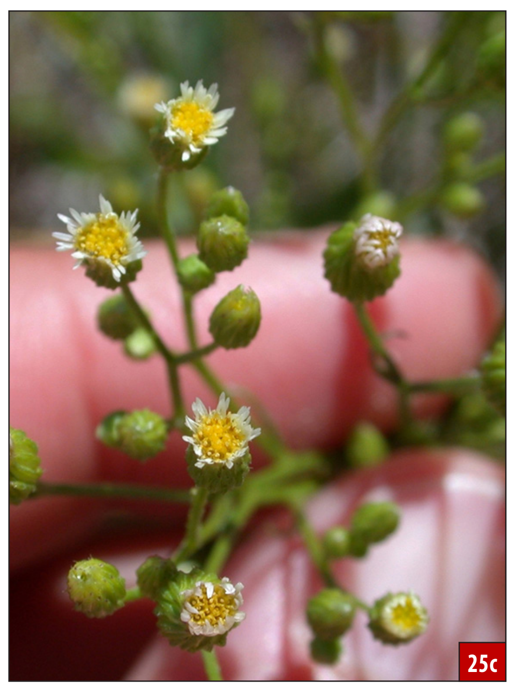
24b

Johnson grass in bloom (a) and closeup of plant (b).

25. Marestail/Horseweed (*Conyza canadensis*) is an annual to biennial weed that can reach a height of 3 to 6 feet. Stems are nearly completely covered with alternate ascending leaves approximately 2 ½ inches long by ½ inch wide. Leaves may appear whorled due to their dense arrangement. Seeds germinate through spring, summer, and autumn; plants mature and set seed the same year. Late-season plants overwinter in the rosette state. One plant may release 20,000 seeds that disperse easily by wind.
Management—Use shallow cultivation to destroy young plants. Apply pre-emergent herbicides to prevent seed germination. Apply burn-down herbicides during seedling or rosette stages to destroy young plants. Glyphosate-resistant marestail is becoming more common; herbicide-resistant populations should be confirmed by a county Extension agent or the Weed Science Society of America.

25a

25b



25c

Marestail growth habit (a, b) and flowers (c).

Palmer amaranth foliage (a) and flowers (b).

26. Palmer amaranth (*Amaranthus palmeri*) is an extremely competitive invasive weed. Simple oval to diamond-shaped leaves are arranged alternately around stems; leaf blades may reach 4 inches in length. Palmar amaranth can be distinguished from other *Amaranthus* species growing in Kentucky by the presence of a small spine at leaf tips; additionally, leaf petioles on older leaves are longer than leaf blades. Some, but not all, Palmer amaranth leaves have a white V-shaped watermark. Plants are dioecious (separate male and female plants). Under ideal conditions, plants can set seed as early as 4 weeks from germination. Some populations have developed resistance to herbicides.
Management—Cultivate very young plants. Apply pre- and post-planting herbicides. Because of this weed's rapid growth rate, herbicide application timing is critical.

27. Trumpet vine (*Campsis radicans*) is a native climbing perennial vine recognized by its trumpet-shaped, red/orange/yellow flowers that can reach up to 3 inches across. Leaves are pinnately compound with 4 to 6 paired leaflets and a single leaflet at the tip; compound leaves may reach a length of 12 inches. Individual leaflets are somewhat oval with coarse teeth on the leaf margin. Occasionally upper surfaces of leaflets are darker than undersides. This weed can spread by seed or spreading root suckers and is very difficult to manage.
Management—Apply systemic herbicides to the cut stems. Prune repeatedly to starve root systems. Avoid cultivation, which spreads vines.

Trumpet vine growth habit (a); close-up of foliage (b); flowers (c); and fruit (d).

Wildlife

Bird damage to fruit.

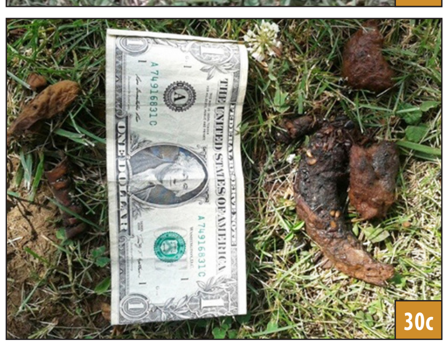
Black bear (a); and bear claw marks on tree (b).

Black bear track

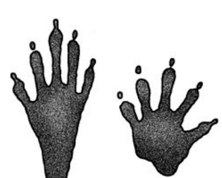
28. Birds (numerous species) damage ripe or near-ripe peaches by pecking at the fruit, resulting in small sections with torn or missing flesh. While external damage can appear minor, birds may remove substantial amounts of flesh under the skin. Secondary issues from birds may include the introduction of weed seeds and subsequent weed establishment in orchards. **Management**—Many birds are protected by Federal law, specifically by the Migratory Bird Act. Management options are limited to deterrents, which should be deployed before fruit becomes ripe. Examples include lasers, auditory distress tapes, and propane cannons. Combinations of deterrents will be more successful than using just one.

29. Black bear (*Ursus americanus*) are attracted to fruit that is ripe or near-ripe, and they eat peaches directly off trees. However, because black bears potentially exceed 300 pounds and are capable climbers, they can also break or damage trees (see #51) during feeding activity. Look for claw marks on trees, tracks or scat around plants, or large numbers of broken/damaged trees close together.
Management—Protect trees using electric fencing (voltage of at least 8,000 volts). Use propane cannons, activated when fruit is almost ripe, to deter bears from the area (begin 2 to 3 weeks before harvest).

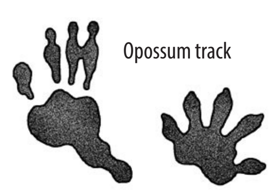
30. Raccoons (*Procyon lotor*) and **opossums** (*Didelphis virginiana*) cause damage when peaches begin to ripen. They generally consume fruit, but leave piles of pits or partially consumed fruit on the ground around trees. Both animals can damage trees while accessing peaches. Damage is usually localized but extreme. Look for tracks or scat in or around orchards to identify species. Because they are nocturnal, these animals generally cause damage at night.
Management—In small-scale operations, install metal fencing to reduce opossum damage; metal fencing is not effective against raccoons. Electric fencing is effective for both opossums and raccoons when a live wire is located at their nose level (about 4 to 6 inches off the ground). Trapping or shooting individuals is also effective. Set cage or dog-proof traps baited with canned tuna or cat food around trees beginning 2 to 3 weeks before harvest.



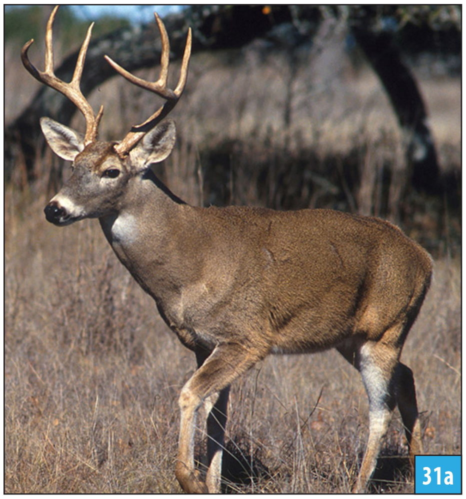
Raccoons (a). Raccoons and opossums leave behind peach pits after consuming fruit (b). Raccoon scat (c). Opossum (d).



Raccoon track



Opossum track



White-tailed deer (a) and track (b). Elk (c). Install small fences to protect deer from rubbing and over-browsing (d); use off-set electric fence (e) to restrict access by deer and elk.

Elk track

31. White-tailed deer (*Odocoileus virginianus*) and **elk** (*Cervus canadensis*) consume new growth and fruit, depending on the time of year. During spring and summer, deer and elk clip leaves and new shoots, leaving behind distinctive angled torn edges on twigs. They also consume ripe fruit, but this is generally minor relative to the damage caused by browsing (branches and buds) and antler rubbing by males during autumn.

Management—Protect plants using 8-foot high metal fencing for deer and elk; where elk are not present, a plastic 8-foot fencing is effective against deer. Protect newly planted trees or saplings using small fences. Off-set (double wire) and overhanging slant electric fence designs are also effective in preventing access to plantings. Reduce the overall deer population on the property through hunting.

32. Rabbits (*Sylvilagus floridanus*) cause damage to young trees and lower trunks of established trees by feeding on bark. Bark removal results in tree decline; when bark is completely removed around trunks, trees are girdled and die. Teeth marks from rabbit gnawing are evident on wood.

Management—Protect young trees with grow tubes. Apply taste-deterrents, such as capsaicin-based products or Thiram, to discourage chewing around trunks. Protect older trees with hardware cloth trunk guards. Remove brushy piles and long grass around orchard to decrease suitable rabbit habitat.

Eastern cottontail rabbit (a). Rabbit feeding on peach trunks is similar to the damage shown here on an apple tree (b).

Prairie vole (a) and vole run with access hole (b). Short grass helps limit available rodent habitat (c).

33. Voles (*Microtus* spp.) and **mice** (*Perymscous* spp.) chew on irrigation lines and bases of trees. Damage to trees may occur a few inches below ground, as well as aboveground. Voles are more problematic during winter months. Teeth marks on trunks or fruit and high concentrations of runs or holes are key characteristics indicating the presence of voles. Mice tend to cause more damage during summer when they feed on fruit.

Management— Use a combination of habitat management and promotion of avian and mammal predators to offset vole or mice populations. Keep grass mowed short between rows to limit cover habitat. To attract natural avian predators, place 12- to 15-foot tall (1-inch diameter) PVC pipes with a 1-foot roost section mounted perpendicular at the top. Collect fruit from the ground after harvest to limit food availability during winter. Scout for high concentrations of runs and holes in autumn to determine if management actions are needed.

Grey squirrel.

34. Squirrels (gray and fox species) cause damage by consuming ripened fruit during daylight hours. They may carry fruit away or eat it on site, leaving seeds and partially consumed fruit behind under trees. **Management**—Monitor activity by scouting for squirrels and partially consumed fruit. Hunt or shoot squirrels using a small caliber rifle (i.e., .22 or 17 hmr) or shotgun to keep populations low and damage to a minimum. Use cage traps when numbers are high and hunting is not an option.

Abiotic Disorders

2,4-D herbicide damage to shoot (a) and scaffold limb (b).

Paraquat herbicide injury.

Glyphosate herbicide resulting in stunting and chlorosis of trees (see arrows).

Herbicide Injury

35. 2,4-D (2,4 dichlorophenoxyacetic acid) injury is evident shortly after exposure. New growth and some older leaves become twisted, malformed, and curled. Symptomatic foliage may also appear chlorotic (yellow). Damage may reappear the following season depending on the dosage received. In severe cases, trees may be killed. Injury results when trees are exposed to the herbicide by sprayer contamination or spray drift. Volatilization and movement from target areas can occur when applications are made under dry, low humidity conditions and at temperatures above 85°F. Ester formulations tend to volatilize more readily than amine formulations.
Management—Use formulations labeled for peaches. Avoid applications beneath peach trees or on surrounding crops when temperatures are above 85°F. Use a coarse spray at a low pressure to avoid volatilization and drift.

36. Gramoxone (e.g. Paraquat) injury results in light tan leaf spots with a light to dark-brown border, which develop where the herbicide has made direct contact. Spots typically occur on lower leaves and are evident shortly after an application. Gramoxone is not translocated within leaves.
Management—Avoid spray contact with peach leaves. Minimize spray drift (shielded sprayers, low pressure spray, apply on calm days).

37. Glyphosate (e.g. Roundup) injury symptoms include leaf chlorosis (yellowing), wilting, browning, and leaf drop. Glyphosate translocates within trees, moving downward to roots in late summer and autumn and then moving upward into foliage the following spring. Tree death may occur following a spring exposure. Symptoms following a late summer exposure may be delayed until the following spring and appear as small chlorotic strap-like leaves. Glyphosate impacts tree winter hardiness development and may lead to trunk cracking and tree death. Peach trees are highly susceptible to injury from drift or inadvertent applications to trunks; bark on young trees is particularly thin and allows for absorption; tree death can occur. Based on research trials, generic formulations of glyphosate can be safer to use in peach orchards because they are absorbed less effectively.
Management—Avoid spray contact with peach trunks and use caution when using formulations with high absorption properties. Minimize spray drift (shielded sprayers, low pressure spray, apply on calm days).

Simazine herbicide injury.

38. Simazine (e.g. Princep) injury causes interveinal and marginal chlorosis (yellowing) of new growth; symptoms can be mistaken for iron deficiency (see #40). Damage becomes evident following a spring application that is too high for the soil type or as the result of repeated applications that have built up in the soil. As the herbicide moves into soil around trees, it is taken up by roots. Young trees are particularly susceptible to injury due to their shallow root systems. Damage is more common in soils with low organic matter and in sandy soils.
Management—Avoid repeated applications of high concentrations of simazine. Apply lower rates to sandy soils.

39. Terbacil (e.g. Sinbar) injury symptoms begin as interveinal chlorosis (yellowing) followed by severe chlorosis of veins and small veinlets. Damage becomes evident on leaves within several days after a spring application, particularly if followed by heavy rainfall that moves the herbicide into tree root zones, where it is absorbed. This herbicide inhibits root growth and moves upward to affect shoot growth. Young trees are more susceptible to injury because they have shallow root systems. Injury can occur when terbacil rates are too high or applications are made in soils with low organic matter.
Management—Avoid repeated applications of high rates of terbacil. Apply lower rates on low organic matter soils and avoid application to soils that contain less than one percent organic matter. Avoid applications if heavy rainfall is predicted.

Nutrient Disorders

40. Iron deficiency results in bright yellow leaves while veins remain green. Symptoms are more severe on the youngest leaves. This deficiency is evident when soil pH is too high (7.3 and above) and iron is chemically bound in the soil, making it unavailable to the tree.
Management—Check soil pH and evaluate tree iron levels through laboratory foliar analysis. For a long term solution, lower soil pH with sulfur before planting. For established orchards, apply iron chelates to foliage or soil.

Terbacil herbicide injury.

Iron deficiency.

41. Nitrogen deficiency is evident as light green to yellow-green, undersized foliage, which occurs uniformly over an entire tree. Annual terminal growth is reduced, and shoots are slender. Lower yields result due to reduced fruit size.

Management—Nitrogen levels change rapidly, making soil testing unreliable. Monitor nitrogen levels through tissue testing and annual tree growth observations. Apply a late winter nitrogen application and a second application after fruit set based on tissue tests, cropping history, and amount of nitrogen applied the previous season.

42. Magnesium deficiency symptoms typically appear as light green blotches between veins of older leaves, progressing toward leaf margins. Blotches become light yellow and then golden yellow in color.

Management—Monitor tree magnesium levels through foliar analysis. Apply dolomitic lime to soil if a pH increase is needed. Apply magnesium sulfate (Epsom salt) to foliage and/or soil, or apply magnesium chelate or magnesium oxide to foliage. Avoid high potassium levels, which inhibit magnesium uptake, leading to deficiency.

Physiological Disorders

43. Frost/freeze injury can affect flowers, seeds, and small, developing fruit. Injury to flower pistils prevents pollination, while injury to flower ovaries kills flowers; damaged flowers drop from trees. Browning of pistils and ovaries is apparent almost as soon as flowers thaw. Seed killed by frost or freeze may result in fruit drop, or fruit may remain on trees but fail to develop to a marketable size. Freezing temperatures may also cause cracking and splitting of fruit skin and the development of sap pockets that are hidden within fruit.

Management—Select a site with good air drainage. Use frost protection equipment, such as wind machines (temperature inversion), overhead irrigation (latent heat), and/or a supplemental heat source.


41

Nitrogen deficiency.


42

Magnesium deficiency.


43a


43b

Freeze injury resulting in cracked fruit (a); lack of seed kernel (right) compared to normal peach seed (left) (b); and small, unmarketable fruit (left) compared to normal-sized fruit (right) (c).


43c

44. Winter injury to flower buds occurs when temperatures drop below the critical survival temperature of dormant flower buds. The critical temperature for flower buds continues to change throughout the winter as trees begin to break dormancy or reach their chilling hour requirement. Trees that did not have a crop the previous season have hardier flower buds the following season. Some peach varieties recommended for more southern regions have low chilling requirements and break dormancy earlier in the season. Thus, southern cultivars are not recommended for Kentucky since they may bloom too early.

Management—Plant cultivars that require higher chilling unit accumulations and cultivars that are known to be very winter hardy. Avoid excessive nitrogen applications, particularly late in the season. In situations where flower bud kill is excessive, prune trees lightly or later in the spring when surviving flower buds can be seen and left to produce fruit.

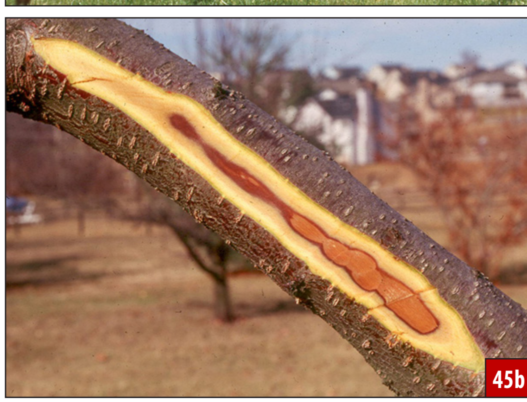

44

Winter injured flower bud (right) and healthy bud (left).

45. Winter injury (blackheart) results from freeze damage to the tree's trunk and limb vascular tissue (xylem); damaged tissue turns dark brown or black. Trees recover readily from light to moderate levels of winter injury, although yields are normally reduced the following season. In severe cases, bark splitting may be visible and tree decline may occur. Scaffold limbs with old blackheart damage are often colonized by wood rot fungi, and limbs break as enlarging fruit puts more stress on limbs. Trees are predisposed to damage when they do not harden-off properly in autumn or during periods of extremely low winter temperatures.

Management—Plant winter hardy cultivars and rootstocks. Avoid late-season nitrogen applications, which delay the development of winter hardiness. Prune trees after coldest winter temperatures have passed (generally March); however, young trees, which are more susceptible to cold injury, should be pruned in late March. If winter injury is suspected, wait until growth begins to evaluate the extent of injury. Lightly prune severely injured trees and apply nitrogen fertilizer to promote shoot growth.


45a


45b


45c

Winter injured peach tree with dead branches and weak growth (a); injury to xylem tissue (b); and cross section of branch showing xylem injury (blackheart) (c).


46

Hail injury to fruit.

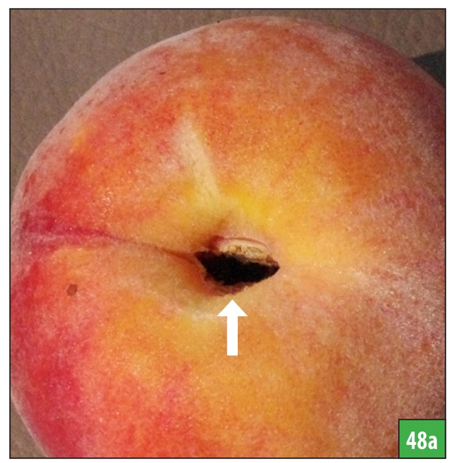
46. Hail injury may affect foliage, fruit, and occasionally bark. Damage includes torn and punctured leaves, as well as scarred and pitted fruit. Hail may damage or strip bark from young branches and trunks, typically on the upwind side of a tree or on upward facing limbs. **Management**—Apply fungicides immediately after a hail event to protect against fungal infections. Hand-thin severely damaged fruit as soon as possible.


47a 47b 47c

Sunscald injury to southwest side of trunk (a); damage to exposed scaffold limb led to decay and breakage (b); and trunk protected with latex paint (c).

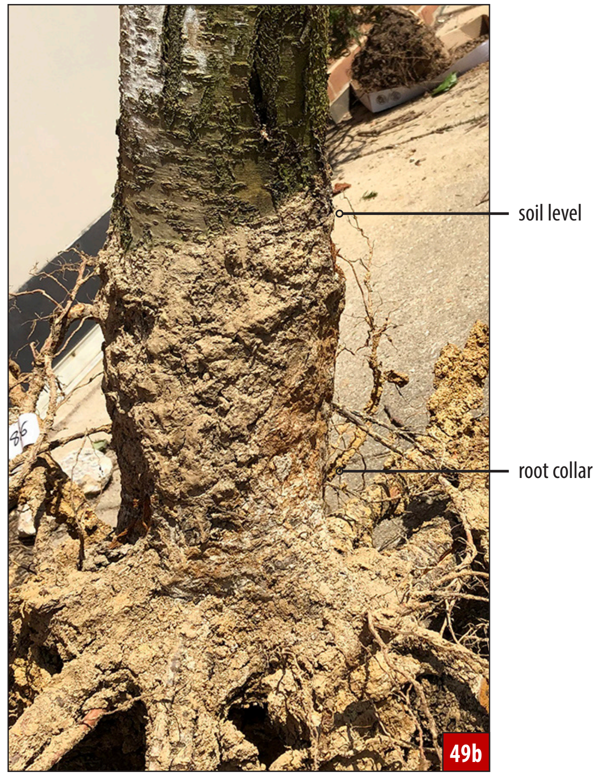
47. Sunscald to lower trunks or scaffold limbs occurs in late winter or spring when growth begins (bark loosens or slips). On a warm, sunny day, a rapid drop in temperature causes bark to contract, split, and separate from the tree. Damage tends to occur in winter on the southwest side of lower trunks and on upward facing scaffold limbs. Resulting wounds are slow to heal and provide a point of entry for insects and diseases; limb breakage can result. **Management**—Protect young tree trunks with white plastic wrap-around tree guards or white exterior latex paint late in autumn. Paint the tops of horizontal exposed scaffold limbs with indoor latex paint.

48. Split pits and **pit shattering** are caused by cold or freeze damage during bloom and/or rapid early fruit expansion. Split pit is often, but not always, evident as an opening at the stem end of fruit, which exposes fruit to internal decay. Rapid expansion of the flesh splits or shatters the pit. Early and very late maturing varieties are much more prone to this problem as fruit expansion may begin before pits harden. Shattered pits, which may be accompanied by internal gumming, are generally not evident until the fruit is cut open. Shattered pits tend to be found closer to the blossom end of fruit. **Management**—Leave slightly heavier crops on early and very late maturing varieties to help reduce fruit size and rapid fruit growth. Avoid excessive nitrogen fertilization.


48a


48b

Split pit external symptoms (arrow) (a) and internal damage (b).



Planting too deeply predisposed this tree to *Phytophthora* infections and led to tree death (a). Note that the soil level on this trunk is well above the root collar (b).

Production Problems

49. Planting too deeply increases soil moisture around roots, decreases oxygen availability, and often predisposes trees to root diseases such as Phytophthora root rot (see #11). These stressed trees generally have reduced growth and fewer, smaller leaves. Foliage may be lighter in color and eventually turn yellow. Tree death follows.
Management—Plant trees at the same depth that they were planted in the nursery.

50. Poor pollination results in flower drop and reduced fruit set. Non-pollinated flowers dry up, and the ovary beneath the shuck turns yellow and shrivels. This can be caused by an insufficient bee population (too few hives) and/or reduced bee activity (cold, windy, wet conditions during bloom).
Management—Provide adequate numbers of pollinators; one strong honey bee hive per acre is more effective than orchard bees and more economical than bumble bees.

Lack of pollination caused flowers to abort.

51. Split trunks and **broken branches** may result when limbs bear excessive weight. This can occur when insufficient thinning results in a heavy crop, from ice build-up on limbs, or large animals causing breakage. Trunk and branch splitting and breaking are often aggravated by heavy winds.
Management—Prune annually. Broken limbs should be removed using good pruning techniques. Thin fruit to avoid an excessively heavy crop. In some cases, the trunk or a split branch may be bolted back together soon after damage occurs and the split sealed with a tree wound dressing; prune heavily to reduce top weight and trunk stress.

Split trunk due to a heavy fruit crop (a) and after repair using bolts and wound dressing (b).

Additional Resources

Additional fruit crop information on identification, production, fertility, and pest management that could be related to protected agriculture can be found in the following publications; University of Kentucky publications are available at county Extension offices and online.

An IPM Scouting Guide for Common Problems of Peach in Kentucky
(for mobile devices)
Scouting Guide for Problems of Peaches (Peach Scout)
https://peachscout.ca.uky.edu

UK Ag Weather Center Prediction Models
Plant Disease and Insect Prediction Models for Kentucky Counties
http://weather.uky.edu/plant_disease.html

Department Extension Publications Websites
Plant Pathology Extension Publications
http://plantpathology.ca.uky.edu/extension/publications

Entomology Extension Publications
https://entomology.ca.uky.edu/entfacts/

Horticulture Extension Publications
http://www.uky.edu/hort/

Wildlife Extension Publications
http://forestry.ca.uky.edu/wildlife-pubs

For Commercial Producers
Commercial Fruit Pest Management Guide (ID-232)
http://www2.ca.uky.edu/agcollege/plantpathology/ext_files/PPFShtml/ID-232.pdf

For Small Scale and Residential Growers
Disease and Insect Control Program for Home Grown Fruit in Kentucky including Organic Alternatives (ID-21)
http://www.ca.uky.edu/agc/pubs/id/id21/id21.pdf

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