

# Crop Profile for Cherries (Tart) in Pennsylvania

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## General Production Information



- Pennsylvania ranks fifth or sixth in the U.S. in the production of tart cherry, producing from 2.3 to 3.1% of the total U.S. crop in 1995-1997 (1).
- Production was 6.5 million pounds of tart cherries on 1500 acres during the 1997 crop year, down from 9.5 and 7.5 million pounds in 1995 and 1996, respectively (1).
- Tart cherry production value in Pennsylvania was \$866,000 in 1997, down from \$1,012,000 and \$1,699,000 in 1995 and 1996, respectively. The season-average price was \$0.107, \$0.227, and \$0.133 per pound in 1995, 1996, and 1997, respectively (2).
- In the last decade, acreage has decreased by 29%, while production has varied between 3.5 and 11.5 million pounds (1, 2).
- The Pennsylvania tart cherry crop is concentrated in Region I, or the south central district of the state, which has 82% of the state's 130,951 trees. In this region, Adams County has 94,424 trees or 71% of the state's trees. The second and third counties for numbers of tart cherry trees are York (2903 trees) and Cumberland Counties (2060 trees), also both in Region I (2).
- The information below is adopted from the 1998-1999 Pennsylvania Tree Fruit Production Guide (Penn State University College of Agricultural Sciences, University Park, Pa.), which is also available at <http://tfgp.cas.psu.edu>

## Cultural Practices

Growers select deep, silt loam soils with good internal drainage for tart cherry production. Cherries are self-fruitful and planted in solid blocks. Growers establish sod row middles in the orchards to facilitate

use of equipment, reduce erosion, and to prevent pest build up and maintain a bare area under the tree rows with herbicides. Growers harvest tart cherries from late June through July using mechanical harvesters to shake the cherries from the trees. They transport the cherries to the processing plants in bins of ice water. Growth regulators are used in tart cherry production. Gibberellic acid (ProGibb) is used to delay flowering in first year trees and increase fruiting capacity and reducing blind wood. Ethephon (Ethrel) is used to loosen fruit for mechanical harvesting.

## **Insect Pests**

Several insect and mite pests must be managed in order to produce tart cherry in Pennsylvania. These include those that damage the trees and those that infest the fruit. An insecticide program is maintained through much of the season because processors have a zero-tolerance for insects in the cherries. Most growers utilize integrated pest management to combine chemical and non-chemical tactics to manage these pests.

### **American Plum Borer**

American plum borer contributes to the decline of tart cherry orchards. It has become a major indirect pest of tart cherries after widespread use of mechanical cherry harvesters causing shaker wounds that allow this pest to penetrate bark to feed on the underlying cambium.

American plum borer has two generations per year. Nearly full grown larvae overwinter within silken hibernaculae near the cambium feeding sites or on the underside of overlying dead bark. Most larvae pupate within the hibernacula as soon as the cherry buds begin to open, and first adult emergence occurs by the white bud stage about 2 weeks later. Peak adult emergence of the first generation occurs just after full bloom. The majority of eggs of the first generation are laid by petal fall, although adult emergence often continues for another 3 weeks. Adult emergence of the second generation begins in June, peaks in mid July, and continues into August or September. Peak emergence and egg laying coincides with the mechanical harvesting of cherries when there is an abundance of fresh cracks and wounds suitable for oviposition and chemical control is impossible because of residue problems on the harvested fruit.

Growers have two methods to monitor for control and timing of sprays for the borers. First, growers peel away overlying dead bark near the wound in the early spring before white bud or in midsummer just before harvest to check for the white hibernacula and reddish frass around shaker wounds. A threshold is more than two to three larvae in fresh hibernacula in each of several visibly wounded trees from previous years. The second method is pheromone trapping. This species is likely causing economic damage if the average catch exceeds six moths per trap per week during the adult flight of either

generation.

**Non-chemical controls:**

Because this insect has increased with mechanical harvesting, growers can modify this process to minimize shaker injury.

**Chemical controls:**

Growers may apply a dilute handgun application of a long residual insecticide at petal fall if treatment thresholds are exceeded. Chlorpyrifos 4EC applied at 3 quarts per 100 gallons to the trunk and lower scaffold limbs at petal fall controls hatching larvae of both generations. Endosulfan at varying rates gives good control for a single generation, but under heavy pest pressure its shorter residual activity does not control of the second generation.

**Black Cherry Aphid**

The black cherry aphid is the most common aphid attacking sweet cherries and to a lesser extent tart cherries in Pennsylvania. Feeding causes curling and stunting of leaves and stems. Heavy infestations may kill young trees and reduce crop quality and quantity and return bloom on mature trees. Honeydew from these aphids also causes the growth of black sooty fungus. The aphids are readily identified by their shiny black coloration. The adults are 1/8 inch long and have both winged and wingless forms.

The black cherry aphid overwinters as an egg on the bark of small branches. The eggs begin to hatch as soon as cherry buds break, with young aphids moving to new green tissue. After 3 to 4 weeks wingless, stem mother females have established large colonies on growing shoots. Two to three generations occur on cherry trees by early July when most of the aphids move to summer hosts including water cress, peppergrass, and members of the mustard family. In September or October winged males and females return to cherry trees, mate, and lay eggs.

Growers scout trees in early spring to detect the presence of stem mothers on actively growing shoots. While no thresholds have been established for mature trees, young trees cannot tolerate even low numbers of aphids.

**Non-chemical controls:**

Aphid natural enemies including syrphid flies, lacewings, and lady beetles are often abundant enough to control this species.

**Chemical controls:**

Delayed dormant applications of oil and insecticides applied to control other cherry pests generally control the black cherry aphid.

## Cherry Fruit Fly and Black Cherry Fruit Fly

Cherry fruit fly and black cherry fruit fly are found on cherry, pear, plum, and wild cherry trees. These insects are common in alternate hosts, but can be effectively managed in commercial orchards with organophosphate insecticides.

These flies are slightly smaller than the common house fly and have wings are marked with distinctive black bands. The cherry fruit fly female has four white bands crossing the abdomen lacking in the black cherry fruit fly. Maggots are creamy white, legless, tapered at the head end, and blunt in the rear, and reach 5/16 inch at maturity.

Both species have one generation per year. Adults emerge from the soil in June and July. The black cherry fruit fly emerges about a week before the cherry fruit fly. Females lay eggs in cherries over a 3- to 4-week period. Newly hatched maggots burrow into the fruit as they feed on the flesh. There are three larval instars lasting a total of 10 to 21 days. The last instar emerges from the fruit, falls to the ground, and burrows down 3 inches where it pupates.

Maggot-infested fruit is often shrunken and misshapened, ripens earlier than surrounding fruit, and is unmarketable.

Adults can be monitored using adhesive-covered yellow panel traps baited with an ammonium-carbonate lure. Traps should be placed in the fruiting canopy of the tree, with fruit and foliage removed from around it for 12 to 18 inches. Traps are used to detect the beginning of fly emergence, but they are not good indicators of the level of infestation.

### **Chemical controls:**

Management is directed against the adults because once the maggot burrows into the fruit it is protected from insecticides. Insecticide treatments are begun about one week after the first fly emerges, or about second cover. Growers apply long-residual insecticides every 10 to 21 days until after harvest to kill adults before they can lay eggs. The two most common insecticides used are azinphos-methyl on 57% of the acreage in 3.2 applications at 0.68 pounds active ingredient (a.i.) per acre per crop-year and phosmet on 52% of the acreage in 1.7 applications at 0.88 pounds a.i. per acre per crop-year (2).

## Leafrollers

Growers must contend with several species of leafrollers that feed on ripening tart cherries. Obliquebanded and redbanded leafrollers are widespread, but generally uncommon. The tufted apple bud moth is currently the most common species in the primary production regions of the south central and the southeastern districts. This leafroller possesses some level of resistance to the organophosphate

insecticides.

Tufted apple bud moth has two generations in Pennsylvania. Larvae overwinter in the orchard groundcover, where they complete their development in the spring. Adults lay their eggs in the trees. Eggs of the two generations hatch in June and August. The second generation feeds after harvest and does not damage the crop.

**Chemical controls:**

Organophosphate insecticides generally control leafrollers in Pennsylvania. Optimal timing for control with insecticides is during hatch of the first and second generations. Growers determine when hatch occurs by degree-day calculations. These calculations are based on temperatures and calculated by the growers or by weather companies (e.g., Skybit, Inc., Boalsburg, PA) for specific farms.

**Lesser Peachtree Borer**

Lesser peachtree borer can be found damaging tart cherry trees throughout the state. It has two generations per year. Eggs hatch in June and August. Larvae invade wounds in the above-ground portions of the trees and can girdle limbs.

Growers are encouraged to scout to determine whether the borers are above threshold densities. Most growers rely on annual applications of chlorpyrifos (Lorsban 4E) or a pyrethroid to prevent infestations. Growers generally use one application of Lorsban 4E at 1.5 quarts per 100 gallons applied with a handgun in the late summer to the trunk and scaffold limbs to control this species. At least two Endosulfan or pyrethroid applications are needed to provide the similar results. Growers who use PennCap-M during cover sprays achieve some control of adults.

**Plum Curculio**

Plum curculio is a pest of most tree fruits in Pennsylvania. This beetle generally has one generation per year. Adults lay eggs in fruitlets soon after bloom. Larvae often survive best in pome fruits that drop prematurely, but in stone fruits can develop in growing fruit.

**Chemical controls:**

Plum curculio in tart cherries is maintained at low levels with organophosphate insecticide applications at petal fall and first two or three cover sprays. The two most common insecticides used are azinphos-methyl on 57% of the acreage in 3.2 applications at 0.68 pounds active ingredient (a.i.) per acre per crop-year and phosmet on 52% of the acreage in 1.7 applications at 0.88 pounds a.i. per acre per crop-year (2). The same products are used for fruit flies at second cover and afterwards. Loss of the organophosphate insecticides would lead to a resurgence of these two pests throughout the state.

## San Jose Scale

San Jose scale is a potentially destructive scale pest of tart cherry in Pennsylvania. The scales are protected by a shell-like cover as they feed on limbs, twigs, and fruit. Crawlers emerge from beneath the shell to new feeding sites. High populations may seriously weaken or kill fruiting branches and main limbs, thus causing permanent injury to mature trees.

### **Chemical controls:**

Scales are controlled by narrow range oil applications or methidathion (Supracide) during the dormant season coupled with insecticides targeted at adults or crawlers during the season. However, insecticides applied for other pests prevent establishment of the scales in most commercial orchards. Methyl parathion is an effective scale material.

## Spider Mites

European red mites and two-spotted spider mites are the most common pest mites in Pennsylvania tree fruits. These two species of spider mites have different life histories. European red mites over-winter as eggs and spend their whole life in the trees. The two-spotted spider mites over-winter as adult females in protected places on the tree or in the litter, trash and weeds on the orchard floor and move from weeds into the trees during the season. Both species are favored by hot, dry conditions. Mite feeding causes a mottling of the leaves, and under severe conditions can cause heavy leaf drop.

### **Non-chemical controls:**

Cultural practices and biological control are generally relied upon for mite management. Proper pruning and adequate amounts of fertilizer to maintain tree vigor will also minimize the impact of two-spotted and European red mites.

The ladybird beetle, *Stethorus punctum*, is the major mite predator in Pennsylvania. The beetles have a relatively high degree of resistance to the low rates of organophosphate insecticides used against key pests such as fruit flies. However, because they are susceptible to pyrethroids, growers often limit use of these products to specific periods during the season to conserve the beetles.

### **Chemical controls:**

Narrow range oil can be applied during the dormant period or fenbutatin oxide (Vendex) or clofentezine (Apollo) can be applied during the growing season. Clofentezine is most effective when mites are first observed. Growers generally restrict usage of this product to no more than once per year to delay the development of resistance.

# Diseases

## Black Knot

Black knot is a fungal disease characterized by black, warty knots it forms on branches of infected trees. Such trees grow poorly and gradually become stunted; occasionally, their limbs may be girdled. The disease is most important on plum trees and, secondarily, on cherry trees.

The disease is present only in the woody parts of trees, occurring most frequently on twigs and branches and sometimes on trunks and scaffold limbs. The warty swellings first become visible in late summer or the following spring on new shoots. At first the knots are somewhat greenish and corky, but with age they become black and hard. They vary in length from an inch to nearly a foot. Many times they do not completely circle the branch. Those a year old or older may become covered with the pinkish white mold of another fungus and may become riddled with insects, especially lesser peachtree borers.

About the time new seasonal growth is 1/2 inch long, spores of the fungus are discharged from tiny sacs in the surface of the knots. These are spread by rain and wind to the new growth, where infection takes place. Spore discharge and infection are greatest during wet periods, at temperatures ranging from 55° to 75° F. Infections continue to occur until terminal growth stops. A few greenish, corky swellings may become visible the fall after infection occurs, but most will not be noticed until the following spring. Generally, the knots produce no spores until the second spring after they become visible. The fungus in woody tissues continues to grow in the spring and fall, increasing the knots' length. Their eventual size depends greatly on the host species and cultivar.

### **Non-chemical controls:**

Growers plant new tart cherry blocks away from infested plum or cherry crops and are advised to remove any wild plum and cherry trees from nearby woods and fence rows for at least 500 feet from the new orchard. Once the disease appears in the trees, they can cut out knots. It is best to remove knots before growth begins in the spring and to take them away from the orchard, as they will continue to produce spores for several weeks after removal.

### **Chemical controls:**

Once the knots have been removed, fungicide sprays such as ferbam (Ferbam) can be applied to control the disease.

## **Brown Rot**

Brown rot is caused by a fungus that infests stone fruits and is one of the major fungal diseases of tart cherry in Pennsylvania. Brown rot occurs in two stages, blossom blight and fruit rot. It first affects blossoms, which wilt and turn brown. The infected blossom parts serve as a source of the fungus for future fruit infections. Fruit decay occurs as the fruit ripens. The infections begin as small brown spots, and the entire fruit can rot within a few hours under favorable conditions. Under wet and humid conditions, ash-gray to brown tufts of fungus develop over the surface of the infected area. If favorable weather conditions persist, the infection can spread from the fruit into small twigs and cause a canker. The canker may girdle the twig, causing it to die. Rotted fruits dry out and become mummified.

### **Non-chemical controls:**

Growers use several cultural methods to reduce the incidence of brown rot. These include sanitation and adequate pruning to increase air circulation and allow faster drying and fewer fruit infections.

### **Chemical controls:**

Growers must apply fungicides during bloom and as fruit ripens to control brown rot in tart cherry. The following fungicides are used for brown rot control: captan (Captan 50 WP, 4 lb), chlorothalonil (Bravo 720, 2-3 pints), tebuconazole (Elite 45 DF, 4-8 oz), fenbuconazole (Indar 75 WSP, 2 fl oz), vinclozolin (Ronilan 50 WP, 1-2 lb), or iprodione (Roveral, 50 WP, 1-2 lb). Captan the most commonly used brown rot fungicide. It is applied to 72% of the acres in 3.6 applications at an average rate of 3.37 pounds active ingredient per crop-year (2).

## **Cherry Leafspot**

Cherry leaf spot is a fungal disease affecting the leaves, leaf stems, fruit, and fruit stems of tart, sweet, and English Morello cherries. The disease is most severe on leaves and may cause them to drop prematurely. When defoliation occurs before harvest, the fruit fails to mature normally, remaining light-colored and low in soluble solids. Buds and wood become susceptible to winter injury, which may show the next season as poor growth, dead spurs, and dead limbs.

The disease first emerges on upper sides of leaves as tiny, red to purple, circular spots. These enlarge to 1/8 to 1/4 inch in diameter and become red-brown to brown. By then, spots show brown on the undersides of leaves, and during wet periods tiny, whitish, feltlike patches appear in their centers. These contain the spores (conidia) of the causal fungus. Some may drop out, leaving a shotholed appearance. After the leaves become infected, they turn yellow and fall.

The fungus overwinters in diseased leaves on the ground. Around bloom or shortly afterward, sexual spores (ascospores) mature and are discharged. They are blown to young, expanded leaves where infection takes place through the stomates on the undersides. These first infections are often so few in number that they may be overlooked. However, conidia from the feltlike centers of spots on leaf

undersides mature 10 to 15 days after the first infections. They are spread by rains. Each succeeding wave of infection becomes heavier, and severe defoliation begins.

**Non-chemical controls:**

Rotary mowing the orchard after leaves drop in fall will hasten leaf decay and reduce the numbers in which the fungus can overwinter.

**Chemical controls:**

Fungicide applications are the primary means of control of leafspot. The fungicides are applied from petal fall through postharvest. Growers achieve best control with tebuconazole (Elite), Ferbam, and dodine (Syllit) and good control with Bravo and copper.

### Cytospora canker

Cytospora canker is one of the most destructive diseases of stone fruits in Pennsylvania. The disease may cause trees in young orchards to die. Infected trees in older orchards gradually lose productivity and slowly decline. The fungus attacks the woody parts of stone fruit trees through bark injuries and pruning cuts, and through dead shoots and buds. Visible first is the exudation of gum at the point of infection. The canker forms from a small necrotic center that slowly enlarges with the collapse of the inner bark tissue. Cankers enlarge more along the length than the width of the branch. Outer bark of new cankers usually remains intact, except at points of gumming. Older cankers are surrounded by a roll of callus tissue and the bark in the center becomes torn. The gum turns black from alternate wetting and drying and from the presence of saprophytic fungi. Each year the canker enlarges by repeated invasion of healthy tissue. With renewed growth in the spring, the tree forms a callus ring around the canker as a defense mechanism. This can be a very effective defense except when the lesser peachtree borer breaks the callus ring by burrowing through it into healthy tissue.

The fungi causing the disease overwinter in cankers and dead twigs. Small black fruiting bodies appear on the smooth bark covering diseased areas of dead wood and begin to produce spores once temperatures are above freezing. Wet weather washes the spores from the fruiting structures. Because infections do not usually occur when trees are growing vigorously, most occur during fall, early spring, and winter.

**Non-chemical controls:**

Healthy bark or buds are not attacked by the fungus. Cold-injured buds or wood and pruning cuts are the most important sites of infection. The fungus can also penetrate brown rot cankers, Oriental fruit moth damage, sunscale wounds, hail injury, leaf scars, and mechanical wounds. Once established in the wood, the fungus forms a canker by invading the surrounding healthy tissue.

Cytospora canker involves total orchard management. Because no stone fruit tree is immune, and

fungicide treatments alone are not effective, control efforts must be aimed at reducing tree injuries where infection could begin. The cultural control methods include selecting sites well away from old *Cytospora*-infected trees. The site should have deep, well-drained soil and good air drainage to reduce the possibility of winter injury. Plant only the hardier varieties, especially if *Cytospora* canker has been a major problem in your orchard. Also, painting the trunks and lower scaffold limbs of cold-susceptible cultivars with white latex paint will somewhat moderate temperatures under the bark and reduce cold injury and canker in critical areas of the tree. Plant only disease-free nursery stock. Trees planted when infected with *Cytospora* will probably not live to produce fruit. Plant whips no larger than 9/16 inch in diameter. Large-diameter whips do not heal properly when headed back and may become rapidly infected with *Cytospora*. The infection becomes obvious in the crotch of the tree when it is 3 to 4 years old. Completely remove all branches, leaving no stubs and taking care not to injure the buds at the base of each branch.

Fertilize in late winter or early spring to avoid late, cold-tender growth in the fall. Avoid excessive nitrogen fertilization. Excessively vigorous trees are slow to harden off in the fall and may be injured by cold if early frosts occur. Cold-injured tissue is very susceptible to *Cytospora* infection.

Growers are advised to start training young trees early to prevent broken limbs as a result of poor tree structure, to prune regularly, and not to leave pruning stubs. Growers remove or spread narrow-angled crotches since they tend to split and serve as infection sites, along with all weak and dead wood.

Growers can slow canker development by controlling other pests. Insect pests include lesser peachtree borer, peachtree borer, and Oriental fruit moth. In addition, Control brown rot should be controlled and any brown-rotted fruit removed from trees before cankers form on the twigs.

Growers attempt to eradicate cankers encompassing less than half the branch diameter. Recent research trials have shown that although this procedure is time-consuming (the average treatment time ranges from 1 to 5 minutes per canker), it is nearly 100 percent effective. If the surgery is done improperly, however, the canker is almost never eradicated. When surgery is conducted before too many cankers are evident per tree, cankers can be eliminated from young orchards before extensive infection and tree death occur. The best time of the year for canker surgery is May and June.

### **Powdery Mildew**

The disease is caused by one of the common species of the powdery mildew group of fungi. The fungus attacks leaves and twigs, producing symptoms much like powdery mildew on apples. Infected leaves curl upward. Newly developed leaves on new shoot growth become progressively smaller, are generally pale, and are somewhat distorted. New shoots are shorter in length than normal. By midseason the whitish fungus can be seen growing over the leaves and shoots, sometimes in patches and other times covering most of the new growth. Such symptoms are especially common in nursery trees.

The fungus may overwinter on diseased, fallen leaves, but usually it does so in infected buds, as in apple powdery mildew. As infected buds expand in spring, new growth is overrun by the fungus. Much of the visible white growth consists of conidia, which are spread by wind to other new leaves and shoots. Warm temperatures without rain, but with sufficiently high humidities for morning fog or dews, are ideal for rapid increase of the disease.

### **Non-chemical controls:**

Cultural control, of powdery mildew can be accomplished through the judicious use of nitrogen fertilizers and heavy pruning during the growing season. Both practices cause excessive succulent growth, which is ideal habitat for powdery mildew. Removal of alternate hosts adjacent to peach orchards is suggested as a method to reduce inoculum.

### **Chemical controls:**

Routine fungicides adequately control this disease when made during the first cover through preharvest interval. Sulfur, applied to 67% of the acreage in 2.2 applications at 5.9 pounds a.i. per crop-year (2), provides fair control of powdery mildew.

## **Weeds**

Weed control in orchards can limit competition for nutrients and injury by voles, nematodes, diseases, and insects. Herbicides generally provide the most least expensive and most beneficial control option. Advantages of herbicides are removal of vegetation providing vole habitat around the trunks, prevention of root and trunk injury that can occur with discing, and reduced weed seed germination and erosion. Growers apply herbicide to 52% of the Pennsylvania peach acreage within a year (2).

A grass cover crop established a year before planting reduces erosion and allows earlier access to the field in the spring. 2,4-D is used to reduce perennially weeds in the previous fall.

Weeds in the area under the trees are generally controlled with combinations of pre- and postemergent herbicide applications. Two commonly used preemergent herbicides are simazine (Princep or Simazine) and oxyfluorfen (Goal). The commonly used postemergent herbicides are glyphosate (Roundup) or paraquat (Gramoxone). Glyphosate requires a wick applicator in stone fruits. Paraquat is widely used for broadleaf weed control. It kills most annual weeds and suppresses some perennial weeds. Pennsylvania Extension recommends the addition of a non-ionic surfactant.

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