Crop Profile for Cherries in New York

Prepared June, 2000

General Production Information

- **State Rank:** Tart Cherries: 4
- **Sweet Cherries:** 8
- **U.S. Production:** 7.4%
- **Acres Planted:**
  -2600 (Tart Cherries)
  -750 (Sweet Cherries)
- **Pounds Harvested:**
  -14 million (Tart Cherries)
  -1.4 million (Sweet Cherries)
- **Cash Value:**
  -$2.2 million (Tart Cherries)
  -$1.35 million (Sweet Cherries)
- **Yearly Production Costs:** NA
- **Production Regions:** Tart Cherries -- Western NY (Wayne, Niagara, Orleans, and Monroe counties). Sweet Cherries -- Western NY (Niagara, Wayne, Monroe, Orleans and Chautauqua counties), Central NY (Schyler county), and Hudson Valley (Ulster county).

Cultural Practices

Cherries grow best on deep, silt loam soils with good internal drainage for 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. Sweet cherries for fresh market are still harvested by hand, usually by migrant labor or as pick-your-own.

Commodity Destination(s):

Fresh Market: 91%
Processing: 9%

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Insect Pests

Key to Pests:

APB = American plum borer; BCA = black cherry aphid; BCFF = black cherry fruit fly; CFF= cherry fruit fly; ERM = European red mite; OBLR = obliquebanded leafroller; PC = plum curculio.

American Plum Borer

Type of Pest: Insect

Frequency of Occurrence: Most orchards eventually become infested.

Damage Caused: APB larvae feed on cambium. They can only enter the cambium layer through openings created by mechanical damage, diseases, sunscald, winter injury, etc. Entry is most commonly gained through splits in the bark of tart cherries caused by mechanical harvesters, and black knot cankers in tart cherries and plums. In western New York, most tart cherry orchards damaged by mechanical harvesting shelter APB larvae, with an average of 8- 9 larvae per tree. Trees may harbor 40 or more larvae. The number of larvae per tree is correlated with the severity of bark damage. Mechanically harvested tart cherry trees tend to have more APB larvae because of the severity of the damage done by shakers.

Because APB larvae feed horizontally, they may eventually girdle the trunk or scaffolds. However, damage may go unnoticed because the outer bark usually remains intact. The negative effect of borer feeding on tree vigor can be greater under drought conditions. Young trees may be destroyed by APB that gain entry at the graft union.

APB can also spread plant pathogens. Larvae may contribute to the enlargement of Cytospora cankers and ovipositing females can carry spores from one tree to another.

% Acres Affected: 90%

Pest Life Cycles: Adults: Male and female APB are identical. Wingspread ranges from 17-28 mm (2/3-1 inch). The forewing is narrow and somewhat triangular; the hind wing is broad and fringed on the trailing edge. The overall color of the moth is a light grayish brown. The forewing is generally reddish brown, marked by wavy black and brown vertical bands about 2/3 of the distance from its base. Those markings may vary considerably in color and intensity. The hind wing is pale brownish gray with a darkened margin at the base of the fringe. Some veins of the hind wing may be darker than the wing.

There are two moth flights per year in New York State. In the western part of the state, the first begins in mid-May and peaks about 2 weeks later. The second flight peaks near the end of July. APB adults are active at night and seldom seen. However, male activity can be monitored using wing traps baited with a commercially available APB pheromone lure. The female is attracted to gum exuded from wounds in the bark of stone fruit trees. It lays 20-50 eggs in a couple of days on or near this gum.

Eggs: Eggs are oval and covered with a network of triangular facets. They are dirty white when first laid but darken to pink, then deep red, as they mature. They are small and are laid singly or in small masses in or near the gummosis caused by bark wounds. Eggs hatch in 8-9 days at a constant temperature of 68°F in the laboratory, and twice as long at 56°F. The first generation egg hatch, in the field, takes a couple of weeks because of cool spring temperatures; the second generation egg hatch, in late July, takes about a week.

Larvae: APB larvae range in color from grayish green to grayish purple; the head capsule, cervical shield, and anal plate are yellow to brown. The cervical shield has dark markings on either side. In contrast, larvae of the peachtree borer and lesser peachtree borer, which may be found along with APB larvae, are creamy white with a yellowish-brown to dark brown head capsule. In addition, APB larvae have two rows of crochets (hook-like spines) at the tips of the abdominal prolegs, while sesiid larvae have only one row. Long primary setae are apparent on APB larvae, but not on the sesiids.

APB larvae pass through seven instars. First generation eggs hatch in late May or early June and larval development is completed 4-5 weeks later. Second generation larvae begin to hatch in late July or early August and develop until sometime in mid-October when they enter diapause. The 1st instar larva is minute (about 0.25 mm or1/100 inch long), while the last is 18-25 mm (3/4-1 inch) long. After hatching, larvae move into frass from earlier larval feeding or to the edge of the cambium. They feed along this edge throughout their development. Most APB larvae are found within four feet of the ground, although in trees infected with black knot or Cytospora canker they may be found in cankers higher in the tree. APB frass is loosely cemented together by a small amount of sap, while sesiid larval feeding is evidenced by frass mixed throughout large amounts of gum. Larvae spin silken cocoons in which they pupate. The cocoon also serves as a hibernaculum for the overwintering larva. In heavily infested trees, seemingly live bark can be pulled away to reveal many of these cocoons. Larvae from the 3rd through the 7th instar can overwinter.

Pupae: APB pupae are found under the bark, within the silken cocoons described above. The pupa itself is 11-12 mm long (slightly less than 1/2 inch), tan to dark brown, with black eyes. The cocoon may be found among its frass, but the frass is not used in its construction, as with the sesiids. Pupation takes about 4 weeks in the spring. The empty pupal skin is found inside the cocoon (sesiid pupal skins are found protruding from exit holes on the outside of the bark). Because larvae can overwinter between their 3rd and 7th instars and must complete development in the spring, pupae of the overwintering generation may be found from early April to early June. This results in an extended emergence of first flight adults. Summer generation pupae are present from late June through early August. Pupation at this time takes about two weeks.

Timing of Control: Against newly emerging adults shortly after petal fall.

Yield Losses: Nothing directly, but contributes to tree decline.

Regional Differences:

Cultural Control Practices:

Biological Control Practices: Natural enemies may play an important role in reducing APB larval populations. Birds, especially woodpeckers, feed on larvae throughout the year. A number of species of parasitic wasps, predatory insects, and spiders also feed on APB.

Fungi of the Hirsutella spp. may be especially important pathogens, attacking larvae of APB and other lepidopterous borers. Cadavers of larvae killed by these fungi appear wooden and often possess hornlike hyphal structures from which spores are released. In trees where borer larvae are heavily infected with the fungus, white hyphal horns may be seen growing through cracks in the bark. Hirsutella has been observed to infect up to 50% of the APB larvae present in some tart cherry orchards.

Post-Harvest Control Practices:

Other Issues:

Chemical Controls for American Plum Borer:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
chlorpyrifos *(Lorsban 4E)*	100		1.5-3 qt/100 gal.	Against newly emerging adults, shortly after petal fall	2	6	24

Black Cherry Aphid

Type of Pest: Insect

Frequency of Occurrence: Occassional

Damage Caused: Except when present in very high densities, the colonies are found on the underside of the leaves of growing shoots. The adults and nymphs feed by sucking the sap out of the leafs and tender shoots. Feeding causes a curling and stunting of the leaves and growth distortions in the stem. Heavy infestations may kill young trees and reduce the quantity and quality of the crop on mature trees by stunting tree growth and vigor. High aphid populations have been known to limit fruit set in the following year and the sticky waste products (called "honeydew") secreted by the aphids spots the foliage and fruit and promotes the growth of a black, sooty fungus.

% Acres Affected: 30%

Pest Life Cycles: The adults and nymphs are readily identified by their shiny black coloration, since no other aphid of this color attacks cherry. The adults are soft-bodied insects that measure about 1/8 inch (3.2 mm) in length and exist in both winged and wingless forms. The nymphs are smaller in size, but are otherwise identical in appearance to the wingless adults. The shining black, oval eggs are extremely small, less than 4/100 inch (1mm) in length.

The BCA overwinters as an egg on the bark of small branches. The eggs start to hatch as soon as the buds begin to open (April) with the young female aphids moving into the buds to feed on any exposed foliage. Within three to four weeks, the wingless female aphids called "stem mothers" rapidly establish colonies on the new growth by giving live birth parthenogenetically (without mating with males) to more wingless females. Two or three generations are usually produced on cherry during the season. By mid-summer (early July), winged females develop and migrate to alternate hosts, mainly of the mustard family, but a few aphids will remain on cherry during the entire season. Several generations are produced on the alternate hosts. In the fall, usually in September and October, winged males and females fly back to the cherry orchards to mate and lay the overwintering eggs.

Timing of Control: Between the white bud and shuck fall stages.

Yield Losses: 0%

Regional Differences:

Cultural Control Practices:

Biological Control Practices:

Post-Harvest Control Practices:

Other Issues: NA

Chemical Controls for Black Cherry Aphid:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
endosulfan *(Thiodan 3EC)*	5		2/3 qt/100 gal	White bud	1	21	24

endosulfan *(Thiodan 50WP)*	60		1 lb/100 gal	White bud	1	21	24
malathion *(Cythion 5EC)*	5		1.5 pt/100 gal	White bud	1	3	12
carbaryl *(Sevin 50WP)*	30		2 lb/100 gal	Shuck fall	1	1	48-72

Cherry Fruit Fly and Black Cherry Fruit Fly

Type of Pest: Insect

Frequency of Occurrence: Most orchards are at risk every year.

Damage Caused: Little damage results from the egg puncture itself, and the egg-laying scar can be inconspicuous. If the fruit is stung while still green such as with late varieties and before it has fully sized, a small dimple will form around the egg puncture. Infested fruit may initially appear sound and will not drop prematurely. Larval feeding in the fruit will separate the pit from the pulp and cause the pulp to turn brown. Sometimes the skin shrivels over the injured area. Brown rot (Monilinia sp.) can start in wormy fruit and spread to other cherries. Late cherry varieties are usually more heavily infested than early varieties.

% Acres Affected:

Pest Life Cycles: Adults: The adults of the CFF are somewhat smaller than the common house fly. The head and legs are yellowish brown. The male has three white crossbands on the abdomen; the female has four crossbands. The wings are clear with dark bands and a characteristic dark spot at the tip. The adult BCFF is slightly larger than the CFF, and its abdomen is entirely black; the bands on the wings are darker and wider than those of the CFF, with a characteristic "doughnut-hole" marking near the posterior (back) edge of the wing.

Emergence begins in late May or early June when early sour cherry varieties begin to turn red or when 950 degree-days above 4.4˚ C (40˚ F) have accumulated after March 1. As a rule of thumb, the BCFF emerges at Mcintosh apple petal fall and the CFF emerges seven days later. Flies continue to emerge for about one month, into early July. Peak emergence occurs in mid (BCFF) to late (CFF) June.

Freshly emerged flies move actively about the foliage and feed on honeydew produced by aphids or other insects. After about one week, flies are sexually mature. Mating takes place on the fruit and egg-laying begins.

Eggs: The female fly pierces the fruit with her sharp ovipositor and inserts a single egg just below the skin, leaving a small scar on the surface. The egg is creamy white, about 0.6 mm (.02 in.) long, and slightly curved. Hatch occurs after five or more days, depending on the temperature.

Larvae: The larvae (maggots) of both cherry fruit fly species look very similar. Mature larvae are 5 to 6 mm (about .2 in.) long, cream-colored, and have no legs or visible head. The posterior end is blunt; the anterior or "front" end tapers to a point with two dark mouth hooks. The young larva feeds next to the pit and matures in two to three weeks. When the fruit is ripe or overripe, the fullgrown larva bores through the skin and drops to the ground to pupate.

Pupae: After the larva drops to the ground, it bores into the soil, where it forms a puparium. Although most larvae pupate in the top 5 cm (2 in.) of soil, some puparia can be found up to 12 cm (4.8 in.) deep. The straw-colored puparium is 4 mm (.16 in.) long, and resembles a grain of wheat. Both species overwinter in this stage and spend about ten months in the soil.

Some individuals may stay in the ground for two or more years before they emerge.

Timing of Control: After flies emerge in mid to late June, until fruit is picked in July.

Yield Losses:

Regional Differences:

Cultural Control Practices: Both species of cherry fruit flies build up in unsprayed, abandoned cherry trees or in wild hosts, and migrate from there to commercial orchards. The removal of such sources of infestation will reduce considerably the cherry fruit fly threat in an area.

Biological Control Practices: The CFF is attacked by several natural predators, of which a braconid wasp is the most important. The BCFF is parasitized by an ichneumonid wasp. Neither wasp provides acceptable control in commercial orchards.

Post-Harvest Control Practices:

Other Issues:

Chemical Controls for Cherry Fruit Flies:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
azinphos-methyl *(Guthion 50WP)*	40		0.5 lb/100 gal.	One week after first flies emerge until harvest	2-3	15	48-72
carbaryl *(Sevin 50WP)*	40		2 lb/100 gal.		2-3	1	48-72
esfenvalerate *(Asana XL 0.66EC)*	5		2-5.8 oz/100 gal.		2-3	14	12
phosmet *(Imidan 70WP)*	10		0.75 lb/100 gal.		2-3	7 (tart only)	24
permethrin *(Ambush 25WP)*	5		1.6-3.2 oz/100 gal.		2-3	3	12
diazinon *(D.Z.N. 50WP)*	0		1 lb/100 gal.			21	24

European Red Mite

Type of Pest: Mite

Frequency of Occurrence: Established in most deciduous fruit growing areas. Considered the most important mite species attacking tree fruits in North America.

Damage Caused: Injury is caused by the feeding of all stages on the foliage. The lower leaf surface is preferred. Under high populations both surfaces are fed upon. The injury is caused by the piercing of the cell walls by the bristle-like mouth parts and the ingestion of their contents, including the chlorophyll. The injury results in off-color foliage which in severe cases becomes bronzed. The leaf efficiency and productivity is directly affected. Heavy mite feeding early in the season (late June and early July) not only can reduce tree growth and yield but also drastically affect fruit bud formation, and thereby reduce yields the following year. Additionally, mite-injured leaves will not respond to growth regulators applied to delay harvest drop.

% Acres Affected: 10%

Pest Life Cycles: Adults: There are 4-9 generations of the ERM a year, depending on the locality and the length of the growing season. The sexes of the adults are readily differentiated. The female has a globular body which ranges in length from 0.38-0.40 mm, is velvety brown to brick red, and has 4 rows of dorsal setae or spines borne on raised white tubercles. The body color and setal pattern distinguish this species from all other plant feeding mites. The male is smaller, 0.26-0.28 mm in length, lighter in color and has a pointed abdomen and proportionately longer legs. The rate of development is temperature dependent, being slower in the spring and fall, and more rapid during the hot summer months. The first generation generally requires about 3 weeks to develop, while summer generations may develop in 10 to 14 days. Reproduction can be both sexual and parthenogenetic. Unfertilized eggs give rise to males only, while mated females produce both sexes. The average preoviposition period of females is about 2 1/2 days. Although some females in insectary studies have lived 39 days, the average life span is 18 days. The oviposition period averages 12.5 days with 18.8 eggs produced per female.

Eggs: The ERM overwinters as fertilized eggs. The environmental factors triggering winter egg production are diminishing food supply, temperature and photoperiod. The bulk of winter egg deposition occurs from mid to late August, but may continue until late September. Overwintering eggs are deposited in groups, on roughened bark areas, especially around the base of buds and fruit spurs. These eggs may be so numerous that the infested areas take on a reddish cast. Egg hatch is closely correlated with bud development and first occurs when buds are in the tight cluster stage; hatch is better than 50% complete at the pink stage, and virtually 100% complete by the end of bloom. The first summer eggs as a rule can be found at petal fall or at latest by fruit set. The summer eggs are globular and somewhat flattened (onion shaped). They are bright red to dark orange, and average 0.13 mm in diameter. The overwintering egg is deeper red and slightly larger, averaging 0.14 mm. The egg surface is ridged with the grooves running toward the top center from which a slender tapering stalk (0.1 mm) arises. The average incubation period of the summer eggs for each generation varies from 6.7 to 14.4 days, the shortest period being in mid-summer.

Larvae and nymphs: The ERM passes through 3 stages between egg hatch and adulthood. They are called the larva, protonymph and deutonymph. A resting period precedes each molt to the following stage. The hatching larva is about 0.2 mm in length, light orange in color and six-legged. All subsequent stages have 8 legs. With the exceptions of an increase in size and the ability to differentiate sexes in the deutonymphal stage, there are no conspicuous changes in structure or color between the nymphal instars. The average developmental time from eclosion to adulthood ranges from 5.5-15 days, depending on the generation.

Timing of Control: The most effective treatments are those applied after new growth has appeared but ahead of bloom.

Yield Losses: 0%

Regional Differences:

Cultural Control Practices:

Biological Control Practices: Mite predators are generally distributed in commercial plantings and contribute to the control of the ERM.

Post-Harvest Control Practices:

Other Issues:

Chemical Controls for European Red Mite:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
oil	80	Dormant	2 gal/100 gal.	As soon as first eggs are laid	1-2	PB	12
clofentezine *(Apollo 4SC)*	10	Cover	2-8 oz/A	As needed	1-2	21	12
fenbutatin-oxide *(Vendex 50WP)*	10	Cover	4-8 oz/100 gal.	When mites first appear	2	14	48

Lesser Peachtree Borer

Type of Pest: Insect

Frequency of Occurrence: Most orchards are at risk every year.

Damage Caused: Injury is caused by the larvae feeding on the cambium and inner bark of the trunk close to the soil level. Occasionally larger roots are also attacked. Areas attacked often have masses of gum, mixed with frass, exuding from the bark. All ages of trees are injured. Young trees are at times completely girdled and subsequently die. Older trees are often so severely injured that their vitality is lowered and they are rendered especially susceptible to attack by other insects or by diseases.

% Acres Affected:

Pest Life Cycles: Adults: The adults are clear-winged, day-flying moths which, to the casual observer, are often mistaken for wasps. The sexes are strikingly distinct. The female is steel blue with an orange band on the fourth and sometimes also fifth abdominal segment. The forewings are opaque, covered with blue scales; the hind wings are transparent. The wingspread is 35-38 mm. The male is smaller (wingspread 27-30 mm) with both pairs of wings clear except for the margins and a line across the forewing. The blue abdomen is marked with 3 or 4 narrow yellow stripes.

Adult emergence commences early in July, peaks in August, and may extend into October. Mating occurs soon after emergence. Several hours later, egg laying begins. A female may produce up to 800 eggs, the average being about 400. Ovipositing females seem to be attracted to trees previously infested by PTB or to trees on which mechanical injury has occurred. The moths die a few days after the short period of egg deposition ends.

Eggs: The oval (0.5 by 0.7 mm), reddish-brown eggs are deposited singly or in small groups on the trunk, lower scaffold limbs, or on debris or soil near the base of the tree, and are difficult to find. The incubation period varies with the temperature and averages about 10 days. First egg hatch occurs in mid-July.

Larvae: Upon hatching, the larvae immediately start burrowing into the bark, usually entering at a crack or wound near the soil surface. The larvae feed on the cambium or growing tissues and tunnel between the inner bark and the sapwood.

PTB larvae are white or cream colored with a yellowish-brown to dark brown head. When half to full grown, the prothoracic and anal

shields become yellow to dark brown in color. Like other lepidopterous larvae, they have 3 pairs of jointed thoracic legs plus prolegs on the 3rd, 4th, 5th, 6th, and last abdominal segment. There are 7 larval instars, varying in size from 1.6 mm to 38 mm.

The larvae normally attack the tree trunk between 76 mm (3 in) below ground to 254 mm (10 in) above ground. Some of the earlier hatching borers are nearly mature by fall, but most are only half-grown. The larger larvae hibernate in their burrows beneath the bark, while the smaller larvae usually pass the winter on the bark under a thin silken covering or hibernaculum. With the advent of warm weather in April and May, feeding is again resumed.

Prior to pupation, the mature larvae normally enter the soil. There they construct silken cocoons containing particles of

chewed-up bark, frass and soil particles. The cocoons are elongate, brownish to sand colored capsules averaging about

22 mm long. They are usually situated in an upright position just beneath the soil surface.

Pupae: Within the cocoons, the larvae pupate into dark brown to black pupae measuring about 14 mm long. The pupae possess stiff spines on their backs which assist them in working themselves out of the cocoons. The combined period of cocooning and pupation averages about 28 days.

Timing of Control: After adults emerge in July until the end of the flight in August.

Yield Losses: Nothing directly, but contributes to tree decline.

Regional Differences:

Cultural Control Practices:

Biological Control Practices:

Post-Harvest Control Practices:

Other Issues:

Chemical Controls for Lesser Peachtree Borer:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
esfenvalerate *(Asana XL 0.66EC)*	10	Cover	2-5.8 oz/100 gal.	After moths emerge until the end of the flight in August	2-3	14	12
permethrin *(Ambush 2EC/25WP)*	0	Cover	1.6-3.2 oz/100 gal.		0	3	12
permethrin *(Pounce 3.2EC)*	0	Cover	1-2 oz/100 gal.		0	3	12

chlorpyrifos *(Lorsban 4EC)*	80	Cover	1.5-3 qt/100 gal.	After moths emerge until the end of the flight in August	2-3	6	24
endosulfan *(Thiodan 50WP/3EC)*	10	Cover	1.5 lb/100 gal. 1 qt/100 gal.	Post-harvest	1	21	24

Obliquebanded Leafroller

Type of Pest: Insect

Frequency of Occurrence: Annually in problem orchards

Damage Caused: The most serious injury from overwintering OBLR larvae occurs just prior to and shortly after petal fall, when the developing fruit is damaged. Many of these damaged fruits drop prematurely, but a small percentage remain on the tree, exhibiting deep corky scars and indentations at harvest. Leaf injury by all broods is characterized by the larvae rolling leaves and feeding on surrounding foliage. The first summer brood larvae feed on the surface of developing fruit in late July and early August. This injury is similar to that caused by several other species of leafrollers. Fruit damage caused by first summer brood OBLR larvae is usually more serious than spring feeding by overwintered larvae because more of the fruit injured later in the season remains on the tree at harvest.

% Acres Affected: 20%

Pest Life Cycles: Adults: The spring flight of OBLR adults begins about 3-4 weeks after petal fall, and continues for 3-4 weeks. In areas where the OBLR has 2 generations, a second flight occurs from early August through early September. OBLR adults are 9-12 mm in length and have a wingspan of 20-27 mm. The forewings are reddish- brown and crossed by 3 oblique, chocolate-brown bands. The hind wings, which are not visible when the moth is at rest, are pale yellow. After emergence, females have a 24 hr preoviposition period. They then begin laying egg masses that gradually diminish in size with each succeeding egg mass laid. A female is capable of laying up to 900 eggs during her 7-8 day oviposition period.

Eggs: OBLR eggs are laid on the upper surface of leaves. They appear as greenish yellow masses measuring about 5 x 9 mm and may contain 200 or more eggs. The black head capsules of embryonic larvae become visible prior to hatching which usually occurs in 10-12 days.

Larvae: OBLR larvae are indiscriminate feeders that pass through 6 instars. Newly hatched larvae have a yellowish green body and a black head and thoracic shield. Mature larvae are 20-25 mm in length and the head and thoracic shield may be either black or various shades of brown. The first summer brood of larvae emerge in early July and complete their development in late July or early August. Second brood larvae begin to emerge in mid-August, and feed until they reach the third instar in the fall, when they construct hibernation sites on twigs or bark and enter winter diapause. These overwintering larvae resume activity the following spring when the tree breaks dormancy and complete their development about 3 weeks after the blossom period. Overwintered OBLR larvae (spring brood) first feed on water sprouts and then move throughout the tree. Those feeding on developing flower buds do so before bloom and continue to consume floral parts throughout the blossom period. After petal fall, these larvae continue feeding on the developing fruit. Newly hatched larvae of the first summer brood move to and feed on tender growing terminals, water sprouts, or developing fruit. As these larvae reach the third instar they display an increasing propensity to damage fruit. The second brood larvae, which develop in late summer and fall, feed primarily on leaves until they enter diapause, although they may occasionally damage fruit.

Pupae: OBLR pupae are dark brown, about 11 mm in length, and are usually found in rolled leaves on the tree.

Timing of Control: Insecticides must be applied at petal fall. If necessary, another spray is applied in the summer. An alternative strategy is to control overwintering larvae at petal fall as previously described, and apply sprays during June to kill the first summer brood adults and newly hatching larvae. Conventional organophosphate insecticides can be used in this program. The flight of adults can be monitored with pheromone traps. The first spray is applied about 7 days after the first male moth is captured and subsequent sprays are applied at 14-day intervals as long as the flight continues.

Yield Losses: 2%

Regional Differences: Mostly in Western NY

Cultural Control Practices: Use trap catch and DD model to time sprays

Biological Control Practices: Several parasites attack OBLR larvae but do not adequately control the pest.

Post-Harvest Control Practices: NA

Other Issues: Resistant to most organophosphates; can develop resistance to other classes.

Chemical Controls for OBLR:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
B.t. *(Biobit 1.6FC)*	10	Cover	2-7 pts/A	Petal fall and starting 360 DD (base 43˚ F) after 1st moth catch	2-4	0	4
B.t. *(Dipel 2X 6.4WP)*	90	Cover	0.5-2 lbs/A	Petal fall and starting 360 DD (base 43˚ F) after 1st moth catch	2-4	0	4

Plum Curculio

Type of Pest: Insect

Frequency of Occurrence: Most commercial orchards are free of resident populations and are infested by adults moving in from hedgerows and woodlands. Injury is therefore heaviest close to these sites.

Damage Caused: The adults can injure the fruit in two ways during the early season: 1) feeding injury and 2) egg laying (oviposition) injury. Feeding punctures consist of small, round holes extending 1/8 inch (3 mm) into the fruit; egg punctures are distinguished by a characteristic crescent-shaped cut that partly surrounds the sunken egg. As the fruit matures both types of injury become corky in appearance. Slight feeding may occur on petals, buds, and blossoms, but there is little injury until the fruit is available. Early-blooming varieties are the first to provide suitable locations for feeding and egg laying. During the egg laying period, the female PC initially eats a small hole in the fruit, deposits an egg, and then makes a crescent-shaped slit just below the site with her snout. It is believed that the slit relieves pressure from the rapidly growing fruit and helps the hatching larva to become established. Egg laying scars appear on fruit at harvest as crescent-shaped corky areas resembling the letter "D." Adults which successfully emerge in mid-summer can again feed on fruit. This injury appears as small, soft, irregular holes, usually near the calyx of the fruit. The injury usually occurs in orchards that have high amounts of egg laying injury. Adults can average over 100 feeding and/or egg punctures during their normal life.

% Acres Affected: 50%

Pest Life Cycles: The biology of PC is similar for most deciduous fruits, although the timing may be slightly different. The adults overwinter in the top few inches of leaf litter in nearby hedgerows, trashy fields and woods (especially on the south edge of an orchard). The adults initially appear in orchards during bloom. Most beetle activity occurs during the first warm period after petal fall, when the maximum temperature is 70°F or higher. Periods of cool, rainy weather with maximum temperatures below 70°F are not suitable for adult activity. Adults can be found in orchards for 5 to 7 weeks. Egg laying activity starts once the fruit begins to form, with egg hatch occurring after 7 days. In successfully attacked hosts, the hatching larva burrows into the fruit's center, where it makes large irregular cavities. Fruit that are successfully attacked by larvae are prone to drop prematurely. After 14-16 days within the fruit the larvae exit and enter the soil where they form a pupation chamber for an additional 10-12 days before transforming into adults. New adults can appear in the orchards in mid- to late- July with emergence continuing until early September. In September and October adults begin seeking overwintering quarters.

Timing of Control: In the spring, control can be obtained with 1-3 insecticide applications, depending on the spray timing and severity of the problem. The first spray is applied at about petal fall.

Yield Losses: 2%

Regional Differences: None

Cultural Control Practices: None

Biological Control Practices: None

Post-Harvest Control Practices: NA

Other Issues: NA

Chemical Controls for Plum Curculio:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
azinphos-methyl *(Guthion 50WP)*	70	Postbloom and Cover	0.5 lb/100 gal	Petal fall and 10-14 days later	2	15	48-72
carbaryl *(Sevin 50WP)*	5	Postbloom and Cover	0.5 lb/100 gal	Petal fall and 10-14 days later	2	1	48-72
esfenvalerate *(Asana XL 0.66EC)*	2	Postbloom and Cover	2-5.8 oz/100 gal	Petal fall and 10-14 days later	2	14	12

permethrin *(Ambush 25WP)*	2	Postbloom and Cover	1.6-3.2 oz/100 gal	Petal fall and 10-14 days later	2	3	12
permethrin *(Ambush 2EC)*	2	Postbloom and Cover	1.6-3.2 oz/100 gal	Petal fall and 10-14 days later	2	3	12
permethrin *(Pounce 3.2EC)*	2	Postbloom and Cover	1-2 oz/100 gal	Petal fall and 10-14 days later	2	3	12
permethrin *(Pounce 25WP)*	2	Postbloom and Cover	1.6-3.2 oz/100 gal	Petal fall and 10-14 days later	2	3	12
phosmet *(Imidan 70WP)*	15	Postbloom and Cover	0.75 lb/ 100 gal	Petal fall and 10-14 days later	2	7 (tart only)	24

Diseases

Bacterial Canker

Type of Pest: Bacterial

Frequency of Occurrence: Persistant in sweet cherries

Damage Caused: The disease attacks most parts of the tree. Cankers on trunks, limbs and branches exude gum during late spring and summer. Leaves on the terminal portions of cankered limbs and branches may wilt and die in summer or early autumn if girdled by a canker. Occasionally, large scaffold limbs are killed. Leaf and fruit infections occur sporadically, but they can be of economic significance in years with prolonged wet, cold weather during or shortly after bloom. Leaf spots are dark brown, circular to angular, and sometimes surrounded with yellow halos. The spots may coalesce to form large patches of dead tissue, especially at margins of leaves, or the centers of the necrotic spots may drop out, resulting in tattered leaves. Infected leaves may abscise during midseason. Lesions on green cherry fruit are brown with a margin of wet or water-soaked tissue. The affected tissues collapse, leaving deep, black depressions in the flesh, with margins becoming yellow to red as lesions and fruit age. On fruit stems, lesions are elliptical and brown with watersoaked margins.

Infected leaf and flower buds may fail to open in spring, resulting in a condition referred to as "dead bud." Small cankers often develop at the bases of these buds. Other infected buds open in spring but collapse in early summer, leaving wilted leaves and dried-up fruit. If blossom infection occurs, whole blossom clusters collapse as infection spreads into the fruit-bearing spurs. Blossom blight and spur blast are most likely in years when leaf and fruit infections are common.

On sweet cherries, cankers initiated by bacteria are often enlarged by Leacostoma species that invade the cankers. Together, bacterial canker and Leacostoma canker can kill major scaffold limbs.

% Acres Affected: 100% of sweet cherry; sporadic on tart cherry

Disease Cycle: The bacteria can survive from one season to the next in bark tissue at canker margins, in apparently healthy buds and systemically in the vascular system. Bacteria multiply within these overwintering sites in the spring and are disseminated by rain to blossoms and to young leaves. Bacteria of both pathovars can live in an epiphytic phase on the surface of symptomless blossoms and leaves from bloom through leaf fall in autumn. After leaves abscise in autumn, the bacteria may enter the tree through fresh leaf scars.

Outbreaks of bacterial canker are often associated with prolonged periods of cold, frosty, wet weather late in the spring or with severe storms that injure the emerging blossom and leaf tissues. Freezing can predispose the tissue to infection, but infection depends on the presence of wet weather during the thawing process. Free water on leaf surfaces and high relative humidity are required for at least 24 hours before significant leaf infection can occur following violent storms. Symptoms appear about 5 days later at temperatures between 70 and 80˚ F.

Timing of Control: Copper sprays are recommended at 10% and again at 50% leaf fall in autumn and at bud break in spring.

Yield Losses: unknown; on sweet cherry losses are due to tree decline caused by cankers.

Regional Differences:

Cultural Control Practices: The disease is troublesome on some sweet cherry cultivars but not others. Schmidt and Windsor are susceptible and often severely damaged. Hardy Giant and Royalton are very susceptible and should be avoided. Removal of wild Prunas species in hedgerows adjacent to sweet cherry orchards may help to reduce inoculum.

Biological Control Practices:

Post-Harvest Control Practices: None

Other Issues: Copper-containing compounds may be of limited value for the control of bacterial canker because strains of P. s. syringae resistant to copper are common in orchards with a history of copper usage. Also, copper injures most stone fruit crops if applied to green tissue. Even on the more tolerant crop species, it becomes more injurious as applications are repeated.

Chemical Controls for Bacterial Canker:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
copper hydroxide *(Kocide 40DF/50WP)*	100 (sweet cherry)	Airblast	2-4 lb/100 gal	Dormant in spring; 10% and 50% leaf fall in autumn	2	BL, PH (tart only)	24
Copper oxychloride sulfate *(C-O-C-S 50WP)*		Airblast		Petal fall; 10% and 50% leaf fall in autumn	2	PF, PH (tart only)	

Black Knot

Type of Pest: Fungus

Frequency of Occurrence:

Damage Caused: 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 peach borers.

% Acres Affected:

Disease Cycle: 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.

Timing of Control:

Yield Losses:

Regional Differences:

Cultural Control Practices: New plantings of plums should not be made next to old ones with black knot. Remove any wild plum and cherry trees from nearby woods and fencerows for at least 500 feet from the new orchard. Once the disease appears in the trees, remove the knots. When they occur on twigs and small branches, prune out the infected branches about 4 inches below the knot. On large branches and trunks the knots can be cut out. This is done most successfully during August when the fungus does not extend far beyond the visible swelling. Remove the diseased wood and about 1 inch of clean wood around the knot. 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. Once the knots have been removed, fungicide sprays can be applied to control the disease.

Biological Control Practices:

Post-Harvest Control Practices:

Other Issues: Black knot emerged as a problem when SI fungicides were introduced because they do not suppress black knot.

Chemical Controls for Black Knot:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
ferbam+sulfur *(Ferbam 76WP)*		Airblast		White bud, BL, PF, Shuck split	1	0	24

chlorothalonil *(Bravo 6F)*		Airblast		White bud, BL, PF, Shuck split	2	SS, PH	48

Brown Rot

Type of Pest: Fungus

Frequency of Occurrence: Annually

Damage Caused: Blossom Infections -- Infections during bloom cause blossoms to turn brown, wither, and drop. Under wet conditions, a powdery mass of conidia develop on infected blossoms. The blossoms may also become gummy in appearance. Blossom infections not only reduce fruit set, but increase the inoculum available for fruit infections.

Twig Infections -- Twig infections occur when blossom or fruit infections continue to develop and extend down the stem into the twigs. During wet weather the fungus may sporulate on infected twigs and may also girdle and kill them.

Fruit Infections -- Generally, immature stone fruits are relatively resistant to brown rot infections. Prunes, however, may become infected early in their development. These quiescent infections may remain in a latent state and not become apparent until the fruit matures and then rapidly rots.

All stone fruits become increasingly susceptible to BR as they ripen. Fruit infections appear as soft brown spots which rapidly expand and produce a tan powdery mass of conidia. Fruit infections may spread rapidly, particularly if environmental conditions are favorable and fruits are touching one another. Wet weather with temperatures ranging from 15.5-21° C (60-70° F) favor disease development. Fruit cracking, bird pecks, hail damage and insect feeding increase the potential for BR development.

% Acres Affected:

DiseaseCycle: Dormant -- The BR fungi can overwinter in dried infected fruit called mummies or in infected twigs. In the winter, BR mummies may remain hanging in the trees or be scattered on the orchard floor.

Spread -- The fungus resumes growth in the spring, providing inoculum for blossom infections. Two types of spores may be produced: the sexual ascospores and the asexual conidia. Ascospores are only produced on mummies which have fallen to the ground and are at least partially covered with soil. Conidia are produced in abundance on mummies and infected twigs and may be spread by wind and rain.

Timing of Control: Chemical sprays should be applied just prior to and during bloom to control blossom and twig infections and, as fruit ripen, to control fruit rot.

Yield Losses: 100% in absence of any treatment; sporadic in sprayed orchards.

Regional Differences:

Cultural Control Practices: During wet seasons when favorable temperatures prevail, brown rot can be difficult to control. A grower with a small orchard may wish to remove mummies and infected twigs and either burn them or bury them deep in the soil. Pruning to open canopies for improved air movement and better spray coverage.

Biological Control Practices:

Post-Harvest Control Practices: None

Other Issues:

Chemical Controls for Brown Rot:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
captan *(Captan 50WP)*	50	Airblast	2 lb/100 gal	White bud, Bloom, PF	2	0	48-96
ferbam *(Ferbam 76WP)*	5	Airblast, Cover	1.5 lb/A	PF, 1C	1	0	24
chlorothalonil *(Bravo 6F)*	20	Airblast	1 pt/100 gal	White bud, BL, PF	2	SS, PH	48
sulfur *(Sulfur 95WP)*	10	Airblast	5 lb/100 gal	White bud, BL, PF	2		24
iprodione *(Rovral 50WP, 4F)*	10		8-10 oz/100 gal 8-10 fl oz/100 gal	White bud		0	12
fenbuconazole *(Indar 75WSP)*	70	Airblast	2 oz/A	Preharvest	2	0	
propiconazole *(Orbit 3.6E)*	20	Airblast	4 fl oz/A	Preharvest	2	0	
tebuconazole *(Elite 45DF)*	10	Airblast	2 oz/A	Preharvest	2	0	

Leaf Spot

Type of Pest: Fungus

Frequency of Occurrence:

Damage Caused: This fungus primarily attacks the leaves, although it may also infect leaf stems, fruit, and fruit stems. In the spring, one to three weeks after petal fall, the disease first appears as small, purplish spots on the upper surface of the leaves. These spots eventually turn brown. Most spots are circular; however, when abundant, they often coalesce and form large, irregular dead patches. After six to eight weeks, the spots cease to enlarge, separate from healthy tissue and drop out, leaving a "shot-holed" appearance. Frequently, there are areas around the spots which remain green, giving the leaf a mottled appearance. During wet periods, whitish, felt-like patches appear in the center of the spots on the underside of the leaves. These contain spores of the causal fungus. The spots tend to be somewhat larger on sweet cherry leaves than on tart cherry leaves. After leaves become infected, they turn yellow and fall off. The most conspicuous symptom of leaf spot, especially on tart cherries, is the yellowing of older, infected leaves before they drop. Entire trees can be defoliated by midsummer. This premature defoliation weakens trees and makes them more susceptible to cold injury the following winter. Entire blocks may be killed in years when cold winters follow severe leaf spot infections. If early spring infections are severe, the fruit will fail to mature. Early and repeated defoliation can also result in small, weak fruit buds, death of fruiting spurs, reduction in fruit set and size, and reduced shoot growth. Trees may become stunted or killed if defoliation occurs through successive seasons.

% Acres Affected: 100% in absence of sprays

Disease Cycle: There are two stages in the life cycle of this fungus, described as follows:

Primary cycle -- The fungus overwinters in diseased leaves on the ground. In the spring, fruiting structures called apothecia develop on these leaves. Around bloom or shortly afterwards, ascospores are formed within these fruiting structures. During wet periods, ascospores are forcibly discharged from these leaves and are carried upward by wind and splashing rain to infect newly developing leaves. Sometimes the first sign of infection may be on suckers close to the ground. During this primary cycle, most spores are discharged from bloom to four to six weeks after petal fall. Infection early in the primary cycle is limited, for the new leaves are small and not as susceptible, and also because the stomata of these leaves are still immature. It is through these stomata that the fungus gains entry into the leaf. Another factor that limits infection are the low temperatures that usually occur in the early spring.

Once ascospores are ejected, they attach to the young leaves, germinate in a film of water, and penetrate through stomata on the underside of the leaf surface within a few hours. Small, purplish spots appear on the upper leaf surfaces in about 10 to 14 days after the first infections. The incubation period from the first infection to the appearance of spots varies with temperature and can occur in as little as five days. Temperatures of 60 to 68˚ F (16-20˚ C) are most favorable for disease development.

Secondary cycle -- Eventually, the fungus produces conidia on the underside of the leaf. These conidia are responsible for the extensive spread of the disease. During wet periods, conidia appear as whitish-pink sticky masses of spores and are spread from leaf to leaf by water. If weather conditions for disease development are conducive, infection can become increasingly abundant as the season progresses. New infections can occur throughout the summer and fall due to the rapid increase and spread of the fungus during wet periods by means of repeated generations of conidia.

Timing of Control: Start fungicide applications at petal fall, or after the first leaves have unfolded, and repeat applications every 7 to 10 days until harvest, and conclude with one or two postharvest applications, beginning 2 to 3 weeks after harvest. Spraying alternate sides of trees on a 7-day schedule, rather than spraying both sides on a 10-day schedule, improves efficiency of fungicide use.

Yield Losses:

Regional Differences:

Cultural Control Practices: All commercially acceptable cultivars of cherry are susceptible to the disease.

Biological Control Practices:

Post-Harvest Control Practices:

Other Issues:

Chemical Controls for Leaf Spot:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
captan *(Captan 50WP)*			1-2 lb/100 gal	Petal fall		0	48-96
ferbam *(Ferbam 76WP)*			1 lb/A	Petal fall		0	24
chlorothalonil *(Bravo 6F)*			1.5-2 pt/100 gal	Petal fall		SS, PH	48
sulfur *(Sulfur 95WP)*			3-6 lb/100 gal	Petal fall			24
iprodione *(Rovral 50WP, 4F)*			8-10 oz/100 gal 8-10 fl oz/100 gal	Petal fall		0	12
fenbuconazole *(Indar 75WSP)*			2 oz/A	Petal fall		0	
propiconazole *(Orbit 3.6E)*			4 fl oz/A	Petal fall		0	
tebuconazole *(Elite 45DF)*			2 oz/A	Petal fall		0	
fenarimol *(Rubigan 1E)*			2 fl oz/100 gal	Petal fall		0	12
dodine *(Syllit 65WP)*			4-8 oz/100 gal	Petal fall and Postharvest		0	48
copper oxychloride sulfate *(C-O-C-S)*			1.5 lb/100 gal	Postharvest		PF, PH (tart only)	24
myclobutanil *(Nova 40W)*			1.25-2 oz/100 gal	Postharvest		7	24

Powdery Mildew

Type of Pest: Fungus

Frequency of Occurrence: Powdery mildew of cherry and plum is not normally an economically important disease. On occasion, problems do arise in tart cherry orchards but are rarely encountered in sweet cherry orchards. Powdery mildew is, however, a serious disease in the nursery. Trees can become severely stunted and defoliation on older trees can occur as a result of infection.

Damage Caused: The fungus attacks leaves and twigs, producing symptoms much like powdery mildew on apple. On young leaves, the fungus appears as whitish, feltlike patches. Newly developed leaves on new shoot growth become progressively smaller, are generally pale in color, and somewhat distorted. Severely infected leaves curl upward, become brittle with age, and may drop prematurely. By mid-season, the whitish fungal growth can be seen abundantly growing over the leaves and shoots, sometimes in patches and other times covering most of the new growth. These symptoms are especially common in nurseries

% Acres Affected:

Disease Cycle: The fungus may overwinter on diseased, fallen leaves, but it does so more commonly in infected buds, as in the case of apple powdery mildew. When infected buds expand in the spring the new growth becomes completely colonized by the fungus. Much of the visible white growth consists of masses of conidia, which are spread by wind to other new leaf and shoot growth. Warm temperatures without rain, but with sufficient moisture such as high humidity, morning fogs, dews, or intermittent rains, are ideal for rapid increase of the disease.

Timing of Control: Begin spray applications at petal fall or shuck split and continue at 7- to 10-day intervals until harvest.

Yield Losses:

Regional Differences:

Cultural Control Practices: Cultural practices to reduce mildew include annual tree pruning and removing hedgerows located close to orchards to facilitate drying of fruit and foliage to create a less favorable microclimate for disease development.

Biological Control Practices:

Post-Harvest Control Practices:

Other Issues:

Chemical Controls for Powdery Mildew:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
sulfur *(Sulfur 95WP)*		Cover	3 lb/100 gal				24
fenarimol *(Rubigan 1E)*		Cover	2 fl oz/100 gal			0	12
myclobutanil *(Nova 40W)*		Cover	1.25-2 oz/100 gal			7	24
propiconazole *(Orbit 3.6E)*		Cover	4 fl oz/A			0	
tebuconazole *(Elite 45DF)*		Cover	2 oz/100 gal			0	

copper oxychloride sulfate *(C-O-C-S)*			1.5 lb/100 gal	Postharvest		PF, PH (tart only)	24

Phytophthora Root and Crown Rots

Type of Pest: Fungus

Frequency of Occurrence:

Damage Caused: Diseased trees are most likely to be found in heavy, wet soils or sections of the orchard where water collects or is slow to drain. Symptoms visible above ground vary among tree species and locations but include poor growth with sparse, off-color foliage, wilt, and collapse. Infected trees may decline over more than one season, and gradually declining trees in particular may show a purple discoloration in the autumn. In other cases, previously healthy trees may suddenly collapse and die shortly after resuming growth in the spring, often following an excessively wet autumn; or previously healthy trees may suddenly collapse during the latter part of the growing season, often following an excessively wet spring. A diagnostic reddish-brown discoloration of inner bark can be seen by removing several inches of soil around the base of declining trees and cutting away the outer bark layer on the exposed crowns. The inner bark of infected roots may show a similar discoloration. This symptom distinguishes Phytophthora root and crown rots from other causes of decline and collapse. (Winter-injured bark - common on peach and apricot trees in New York - is usually confined to the aboveground portion of the trunk, particularly on the southwest side of the tree; in contrast, Phytophthora root and crown rots primarily involve below-ground tissues.)

% Acres Affected:

Disease Cycle: Phytophthora root and crown rots are caused by a group of related soilborne fungi in the genus Phytophthora. Some of these fungi are common inhabitants of agricultural soils, whereas others are introduced on contaminated planting stock or through the movement of contaminated soil and water. Although the individual Phytophthora species vary somewhat in origin, particular biological characteristics, and destructiveness against different crops and rootstocks, all have one critical trait in common: they are capable of causing significant damage only when soils are extremely wet or saturated.

The Phytophthora fungi persist in the soil mainly as dormant resting spores (oospores, chlamydospores) or in a vegetative growing form within infected plant tissue. When the soil is moist or wet, reproductive structures (sporangia) are produced, either as the result of germinating resting spores or as direct outgrowths of the active fungus within infected roots and crowns. These sporangia are filled with the infective spores of the fungus (zoospores), which are expelled into the soil in significant numbers only when it is completely saturated with water - that is, when water is standing or puddled on the soil surface. The microscopic zoospores then use tail-like structures to swim short distances through the water-filled soil pores and find susceptible plant tissues, to which they are chemically attracted. Zoospores may also swim to the soil surface, where they can be carried relatively long distances by runoff water and contaminate new soils or ponds and canals used for irrigation water.

Whether infection occurs once zoospores reach root or crown tissues depends largely on the inherent susceptibility of the rootstock and its physiological condition. Although many of the physiological factors that influence disease development are unknown, it appears that a tree's ability to resist infection is reduced when saturated soil conditions deprive its roots of oxygen. Therefore, episodes of soil saturation serve as infection periods for Phytophthora root and crown rots because they not only provide the conditions necessary for zoospore activity but also increase the tree's susceptibility to disease during that time. The minimum length of the saturated period necessary to produce an infection can be highly variable, depending on a wide variety of genetic, physiological, and environmental factors; however, the severity of the infection period is roughly proportional to the number of days the soil remains saturated and how quickly it drains thereafter. The number of saturation periods a tree is exposed to is also important because additional zoospores are produced and released by the fungus growing in new infection sites each time conditions become favorable.

Some rootstocks appear to be most susceptible to infection during the spring and autumn, which are also the periods of the year when soil temperatures are most favorable for zoospore production and activity. Rootstock susceptibility and fungus activity are both low in the winter while trees are dormant.

Timing of Control:

Yield Losses:

Regional Differences:

Cultural Control Practices: Soils that are excessively slow to drain or subject to periodic flooding should be avoided. Marginal sites are modified (install drain tiles, create diversion ditches, rip underlying pan layers) to provide the additional drainage recommended for growing tree fruit crops. Planting trees on ridges or berms raises their crowns above the primary zone of zoospore activity and provide an important margin of safety, especially in a wet year.

Tree species and rootstocks are selected to match the soil and drainage characteristics of an orchard. Among stone fruits, Mahaleb is the most susceptible cherry rootstock, whereas Mazzard, Morello, and Colt are somewhat more resistant and would be recommended on the heavier cherry soils. Some of the newer clonal cherry rootstocks may have an additional measure of resistance, but these have not yet been sufficiently evaluated to determine this.

Biological Control Practices:

Post-Harvest Control Practices:

Other Issues: Soil fumigation before planting is ineffective in controlling Phytophthora root and crown rots because the fumigant never completely eradicates existing inoculum from the soil and Phytophthora spp. are easily reintroduced. New fungicides have recently been developed which are effective in controlling these diseases when used preventively, but they are seldom effective in reviving trees once the crown has become infected and moderate symptoms of decline have appeared.

Chemical Controls for Phytophthora Root and Crown Rots:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI	REI
metalaxyl *(Ridomil 2E)*		Dormant	6 fl oz/1000 sq ft treated	Just before growth starts in spring and at 2-3 month intervals thereafter if soil conditions are wet.		0	12

X-Disease

Type of Pest: Mycoplasma-like organism

Frequency of Occurrence: Sporadic and cyclical in 10-15 year cycles

Damage Caused: There are two major types of reaction to X-disease in cherry trees. While there are exceptions in both cases, in general these two types can be described with reasonable safety as totally different reactions. The rootstock is the key.

Trees on mahaleb rootstock generally react differently to the disease than do those on mazzard rootstock. Cherries on Mahaleb rootstock are killed suddenly in midsummer by the disease. Trees on Mazzard rootstock decline slowly. Infected sweet cherry trees on Mazzard rootstocks may not show decline for many years; often the only recognizable symptom is on the fruit. Scattered fruit on trees propagated on Mazzard rootstock are small and pink at harvest and have a bitter flavor. Dieback and decline are often associated with the disease in both sour and sweet cherries.

% Acres Affected: 10% of total state acreage for sweet cherries.

Disease Cycle: X-Disease, once thought to be caused by a virus, is now known to be caused by a mycoplasma-like organism (MLO), a small parasitic organism that lives in phloem cells. The disease affects peach, nectarine, sweet cherry, sour cherry, and Japanese plum. The disease agent also infects wild chokecherry, which serves as a reservoir for the MLO that may then be transmitted to orchard plantings by several species of leafhopper. The most important of these species are Scaphytopius acutus (Say) and Paraphlepsius irroratus (Say); both species have two generations annually. Leafhoppers move into orchards in late summer and are favored by red clover and several rosaceous species, especially strawberry and blackberry.

Timing of Control: No known controls

Yield Losses: Not known

Regional Differences: Primarily a problem in southeastern New York where chokecherry is more common.

Cultural Control Practices: Eradication of choke cherry near stone fruit orchards helps reduce the incidence of X-disease. Remove infected cherry trees, particularly those on Mazzard rootstock. Infected trees in nurseries should be removed and destroyed.

Biological Control Practices:

Post-Harvest Control Practices:

Other Issues:

Chemical Controls for X-Disease:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI	REI
Bromacil liquid *(Hyvar X-L)*		Soil Sterilant	1 tbsp/stump	Early spring		PB	

Weeds

Weeds such as deep-rooted perennials compete for soil moisture and nutrients in newly planted and mature orchard crops, while light can become limiting in newly planted crops. Weeds may host pests including plant viruses and can compete for pollinating bees in spring.

Excessive weedy vegetation in most orchards is controlled by mowing or flailing row middles and application of herbicides within the rows. Repeated use of the same or similar weed control practice results in a weed shift to species that tolerate these practices. Therefore, weeds that survive cultivation, mowing or flailing, specific herbicide treatments or other routine cultural practices must be eliminated before the tolerant species or biotypes become established. A combination of weed control practices or treatments, rotation practices and herbicides are utilized to prevent weed shifts.

Cultural Controls: Native or planted grasses in many orchards often are managed in row middles by mowing or flailing. Sods reduce soil erosion, improve traffic conditions in wet weather, and increase water infiltration and drainage.

Chemical Controls: Persistent, soil active herbicides are applied during the winter dormant season and activated with rain or sprinkler irrigation if dry conditions persist. Existing vegetation is controlled by mixing postemergence contact or translocated herbicide. In New York, ninety percent of growers are using contact herbicides. Ninety percent of those growers using them are tank mixing with residual materials for better control. Twenty percent of growers are using phenoxy acetic herbicides.

Annual grasses

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates (a.i.)	Timing	# of Appl.	PHI days	REI hour
oxyfluorfen *(Goal 1.6E)*	<1	Foliar	1.2-2.0 lb/A	Dormant. Apply as soon as soil has settled and no cracks are present.	1.5-2	0	24
napropamide *(Devrinol 50WP)*	<1	Surface	4 lb/A	Apply as soon as soil has settled and no cracks are present.	1.5-2	35	12
pendimethalin *(Prowl 4E)*	25	Banded, Foliar	4 lb/A	Apply as soon as soil has settled and no cracks are present. Non-bearing trees only.	1.5-2	365	12
oryzalin *(Surflan AS)*	<1	Banded	3-6 lb/A	Apply as soon as soil has settled and no cracks are present.	1.5-2	0	12
paraquat *(Gromoxone Extra)*	25	Banded, Foliar	0.625-0.9375 lb/A	Apply to emerged weeds as needed	1.5-2	0	48

glyphosate *(Roundup)*	25	Banded, Drench, Foliar, Spot	1-4 lb/A	Apply to emerged weeds as needed	1.5-2	14	12
fluazifop *(Fusilade 2000)*	<1	Banded, Foliar, Spot	0.25-0.375 lb/A	Apply when grass is 2-8 inches tall. Repeat in 2-3 weeks.	1.5-2	365	12
sethoxydim *(Poast)*	<1	Band, Broadcast, Spot	0.28-0.47 lb/A	Apply to actively growing grass before tillering or seedhead formation.	1.5-2	14	12
simazine *(Princep 4L, 80WP)*	25	Banded, Drench, Foliar	1-2 lb/A	Apply early spring before weeds emerge.	1.5-2	0	12
simazine *(Caliber 90WDG)*	25	Banded, Drench, Foliar	1-2 lb/A	Apply early spring before weeds emerge	1.5-2	0	12
norflurazon *(Solicam 80DF)*	<1	Banded	2.0-2.4 lb/A	Apply early spring before weeds emerge.	1.5-2	0	12
diclobenil *(Casoron 4G/50W)*	<1	Broadcast	4-6 lb/A	November to March when soil temp. is below 45˚ F.	1.5-2	0	12

Broadleaf weeds

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates (a.i.)	Timing	# of Appl.	PHI days	REI hour
oxyfluorfen *(Goal 1.6E)*	<1	Foliar	1.2-2.0 lb/A	Dormant. Apply as soon as soil has settled and no cracks are present.	1.5-2	0	24
napropamide *(Devrinol 50WP)*	<1	Surface	4 lb/A	Apply as soon as soil has settled and no cracks are present.	1.5-2	35	12

pendimethalin *(Prowl 4E)*	25	Banded, Foliar	4 lb/A	Apply as soon as soil has settled and no cracks are present. Non-bearing trees only.	1.5-2	365	12
oryzalin *(Surflan AS)*	<1	Banded	3-6 lb/A	Apply as soon as soil has settled and no cracks are present.	1.5-2	0	12
paraquat *(Gromoxone Extra)*	25	Banded, Foliar	0.625-0.9375 lb/A	Apply to emerged weeds as needed.	1.5-2	0	48
glyphosate *(Roundup)*	25	Banded, Drench, Foliar, Spot	1-4 lb/A	Apply to emerged weeds as needed.	1.5-2	14	12
simazine *(Princep 4L, 80WP)*	25	Banded, Drench, Foliar	1-2 lb/A	Apply early spring before weeds emerge.	1.5-2	0	12
simazine *(Caliber 90WDG)*	25	Banded, Drench, Foliar	1-2 lb/A	Apply early spring before weeds emerge.	1.5-2	0	12
norflurazon *(Solicam 80DF)*	<1	Banded	2.0-2.4 lb/A	Apply early spring before weeds emerge.	1.5-2	0	12
dichlobenil *(Casoron 4G/50W)*	<1	Broadcast	4-6 lb/A	November to March when soil temp. is below 45˚ F.	1.5-2	0	12
2,4-D *(Weedar 64, Hi-Dep)*	1	Banded, Foliar, Spot	1.4 lb/A	Treat when weeds are small and actively growing	2	40	48

Perennial grasses

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates (a.i.)	Timing	# of Appl.	PHI days	REI hour

fluazifop *(Fusilade 2000)*	<1	Banded, Foliar, Spot	0.25-0.375 lb/A	Apply when grass is 2-8 inches tall. Repeat in 2-3 weeks.	1.5-2	365	12
sethoxydim *(Poast)*	<1	Band, Broadcast, Spot	0.28-0.47 lb/A	Apply to actively growing grass before tillering or seedhead formation.	1.5-2	14	12
pronamide (Kerb 50WP)	<1	Foliar	2-4 lb/A	Apply late fall before soil freezes.	1.5-2	0	12
glyphosate *(Roundup)*	90	Banded, Drench, Foliar, Spot	1-4 lb/A	Varies with weed type.	1.5-2	14	12
dichlobenil *(Casoron 4G/50W)*	<1	Broadcast	4-6 lb/A	November to March when soil temp. is below 45˚ F.	1.5-2	0	12

Woody brush and vines

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates	Timing	# of Appl.	PHI days	REI hour
glyphosate *(Roundup)*	90	Banded, Drench, Foliar, Spot	1-4 lb/A	Varies with weed type.	1.5-2	14	12

KEY:

BL: Do not apply beyond bloom
GT: Do not apply beyond green tip
HI: Do not apply beyond 1/2-in green
PB: Prebloom applications only
PF: Do not apply beyond petal fall
PH: Postharvest applications allowed
SS: Do not apply beyond shuck split
2C: Do not apply after 2d cover spray

Vertebrates

Two species of voles cause injury to Northeast orchards, the meadow vole and the pine vole. Determining which vole is present is very important since the treatment for each is different. By trapping some voles it is easy to tell the difference between the two. The pine vole has an extremely short tail, about the length of their back foot. Meadow voles have a slightly longer tail about twice the size of the back foot. The meadow vole lives primarily above ground, doing most of its damage in the winter as they chew on bark when snow cover is present. Hardware cloth guards embedded in the ground surrounding the tree trunk, and extending upwards higher than snow level are usually effective. Rodenticide baiting can also be effective. Zinc phosphide pellets are recommended (see table). Broadcast baiting during fall is most effective against meadow voles after mowing and during a stretch of sunny weather, hopefully knocking the population down before winter. Hand baiting established stations is effective for pine voles, as these rodents spend most of their time underground, and feed on bark below the soil line. T-tube bait stations constructed from PVC pipe can serve as a weather-proof dispenser, and reduce non-target hazards.

Commercial rodenticides for vole control in agricultural crops.

<table>
<tr><th>EPA Common Name</th><th>Product Name</th><th>Reg. No.</th><th>Species</th></tr>
<tr><td rowspan="4">Zinc phosphide</td><td>Bonide Orchard Mouse Bait</td><td>4-152</td><td>meadow and pine voles</td></tr>
<tr><td>Hopkins ZP Bait</td><td>2393-185</td><td>meadow and pine voles</td></tr>
<tr><td>Vole-X</td><td>12455-17</td><td>meadow and pine voles</td></tr>
<tr><td>ZP Oat Bait</td><td>61282-14</td><td>meadow and pine voles</td></tr>
<tr><td colspan="4">Baiting: For meadow voles, broadcast 6-10 lb./A *zinc phosphide baits in the drip line of the trees by hand-operated or tractor-mounted fertilizer spreaders after harvest, before leaves and grass mat down. Do not apply baits to areas with bare ground, including vegetation-free herbicide strips or road berms. For pine voles, hand bait 1 teaspoon in each of two to four active burrow entrances or oneto two bait stations per tree.</td></tr>
<tr><td>Clorophacinone</td><td>Rozol Paraffinized Pellets</td><td>7173-151</td><td>meadow and pine voles</td></tr>
<tr><td colspan="4">Hand bait about 1-1.5 oz (10 lb./acre) of bait in each active hole or run at each tree. If populations are high, repeat application in about one month. Apply only after harvest when trees are dormant. This material is not approved for broadcast application.</td></tr>
</table>

IMPORTANT NOTE: *Zinc phosphide and *chlorophacinone are restricted-use pesticides. They may be purchased and used only by certified applicators.

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