GROWING SOUR CHERRIES

Agriculture Handbook No. 451

Agricultural Research Service
UNITED STATES DEPARTMENT OF AGRICULTURE

PRECAUTIONS

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the Federal Environmental Protection Agency, consult your county agricultural agent or State Extension specialist to be sure the intended use is still registered.

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Washington, D.C. Issued March 1974

For sale by the Superintendent of Documents, U.S. Government Printing Office,
Washington, D.C. 20402 – Price 40 cents
Stock Number 0100–02892

GROWING SOUR CHERRIES

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The sour cherry (*Prunus cerasus* L.) also is referred to as the tart, pie, or red cherry. Like the sweet cherry (*P. avium* L.) it is a drupe or stone fruit belonging to the family Rosaceae. It is a tetraploid species ($4n=32$), which apparently is native to the Caspian-Black Sea region and perhaps to northern India (*22, 47, 61, 66*).[2] It is considered a natural cross of *P. fruticosa* Pall., also tetraploid, with unreduced pollen of *P. avium,* a diploid species (*63*). Occasionally the sour cherry hybridizes with unreduced pollen of sweet cherry to produce Duke cherries (*P. gondouinii* (Poit. & Turp.) Rehd.) (*19, 46*). Duke cherries are tetraploid and intermediate between the parent species. Some of these are very similar to sour cherries in fruit characteristics but have upright growth habit.

Approximately 6 million sour cherry trees of bearing age and another million trees not of bearing age were grown throughout the United States according to the 1964 census. They were distributed in every State. Michigan had about 4.2 million trees, or 62 percent of the total. Wisconsin had about 825,000 trees, New York about 750,000 trees, and Pennsylvania about 340,000 trees. The remainder were distributed primarily in States bordering the Great Lakes and in the Northwestern and Rocky Mountain States.

In the 1969 census about 4.8 million bearing trees and 0.9 million nonbearing trees were reported, reflecting a continued decline in total acreage.

The most important commercial sour cherry orchards are located in western Michigan, western New York and the Hudson Valley, southern and northwestern Pennsylvania, Door County

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The authors acknowledge the generous use of text and illustrations from Farmers' Bulletin 2185, "Growing Cherries East of the Rocky Mountains," prepared by the late Leon Havis. This bulletin is out of print. Figure 2 was furnished by T. K. Toyama, Irrigated Agriculture Research and Extension Center, Prosser, Wash., figures 3, 7, 8, and 12 by Cornell University, Ithaca, N.Y., and figure 16 by Friday Tractor Co., Hartford, Mich.

[2] Italic numbers in parentheses refer to Literature Cited, p. 31.

of Wisconsin, Oregon, Utah, Arkansas River Valley of Colorado, and northern Ohio. Large quantities of sour cherries are produced in some other States, but usually the individual orchards are small and do not represent important community interests. Sour cherries often produce well in the central and southern Great Plains regions, where more tender fruits usually fail.

U.S. production of sour cherries varies from about 90,000 to over 175,000 tons annually (table 1). Michigan produces from 50 to over 70 percent of this tonnage, and combined with New York, Pennsylvania, and Wisconsin up to 90 percent.

The bulk of the sour cherry crop is frozen (about 55 percent) or canned (about 40 percent) for use in pastries, primarily pies. Small quantities are used for juice, jam, or jelly and for brining. Some of these uses are included in the total for canning. Only about 3 percent of the crop is sold fresh, and this is declining (*35*).

Annual sale value of sour cherries in the United States is about $20 million.

Production is relatively stable (*24*) and is predicted to remain so (*79*); however, acreage has declined in States where mechanical harvesting has not been adopted.

CLIMATIC REQUIREMENTS

Climate, chiefly temperature, is the most important factor affecting the geographic distribution of sour cherry trees (*32*). Generally the trees do not thrive where summers are long and hot or where winter temperatures are high for short periods. Primarily because of this, few sour cherries are grown in the South; however, some are grown at higher altitudes. Young sour cherry trees respond to longer day length directly by increased shoot growth but less so as they become older (*71*).

Winter injury to trunks is a serious problem in some central and southern parts of the country. A sudden freeze after a mild period sometimes causes dormant trunks to split. Often these splits close tightly and little damage ensues. However, sometimes bark and cambial tissues are injured and repair of the large wounds requires several years. (Fig. 1.)

Sour cherry trees usually are less hardy than 'McIntosh' and 'Northern Spy' apple trees, but are more hardy when fully dormant than other stone fruit trees of commercial importance except the European plum (*Prunus domestica* L.). Early fall freezes before the trees become fully hardened may damage trunks and crotches in northern produc-

TABLE 1.—*Sour cherry production in the United States, 1960–71* [1]

State	1960–64	1965	1966	1967	1968	1969	1970	1971
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Michigan	102,700	120,000	55,500	44,000	100,000	106,000	79,000	80,000
New York	22,840	25,100	6,000	22,100	14,300	15,300	18,200	22,000
Pennsylvania	11,220	12,500	8,700	1,000	7,500	11,000	8,090	7,600
Wisconsin	13,460	8,000	7,000	6,800	6,000	2,740	3,490	8,000
Oregon	4,460	2,350	7,300	3,900	1,100	6,200	2,000	5,000
Utah	3,000	3,700	2,800	7,100	4,700	6,180	4,900	5,200
Colorado	1,286	1,700	700	690	1,800	1,760	1,010	1,350
Ohio	1,570	1,400	900	500	1,300	800	1,000	500
Idaho	1,066	1,400	600	1,100	384	950	500	--
Washington	848	580	750	1,100	320	700	450	--
Montana	270	140	200	--	--	--	--	--
Total	162,720	176,870	90,450	88,290	137,404	151,630	118,640	129,650

[1] From Crop Production, 1970 annual summary, "Fruits—Part I Non-Citrus by States, 1969–70," summaries for preceding years; and release of July 9, 1971; prepared by Crop Reporting Board, Statistical Reporting Service, U.S. Department of Agriculture, Washington, D.C.

PN-2946

FIGURE 1.—Trunk of 'Montmorency' cherry, showing winter injury. This type of injury is often caused by rapid changes in temperature. The injury to this tree occurred several years before the photograph was taken, and considerable healing had taken place, as indicated by new bark along the right side of the wound.

ing areas (*3*, *37*, *42*). Extremely low winter temperatures may kill flowerbuds and damage terminal wood and spurs (fig. 2). The blossoms and young fruits of sour

PN-2947

FIGURE 2.—Browning of tissues in fruit spur and fruit buds of cherry in Yakima Valley of Washington State after −11° F. in November 1964.

cherries are very susceptible to injury by low temperatures. Protection against temperatures below 28° F. is advisable after the buds reach the green tip or so-called water bud stage (Dennis, F. G., et al., unpublished). Often more blossoms and fruits are killed by spring frosts on sour cherry than on peach trees in the same area.

SOIL REQUIREMENTS

Sour cherry trees will grow on a wide range of soil types provided the soils are well drained. Perhaps no other fruit tree is more sensitive to the ill effects of a poorly drained soil (fig. 3). In many important cherry-growing areas the prevailing soils are sandy loams or other sandy soils that usually are underlain by clay subsoil. Such soils occur in districts bordering the Great Lakes, where the most important commercial cherry areas

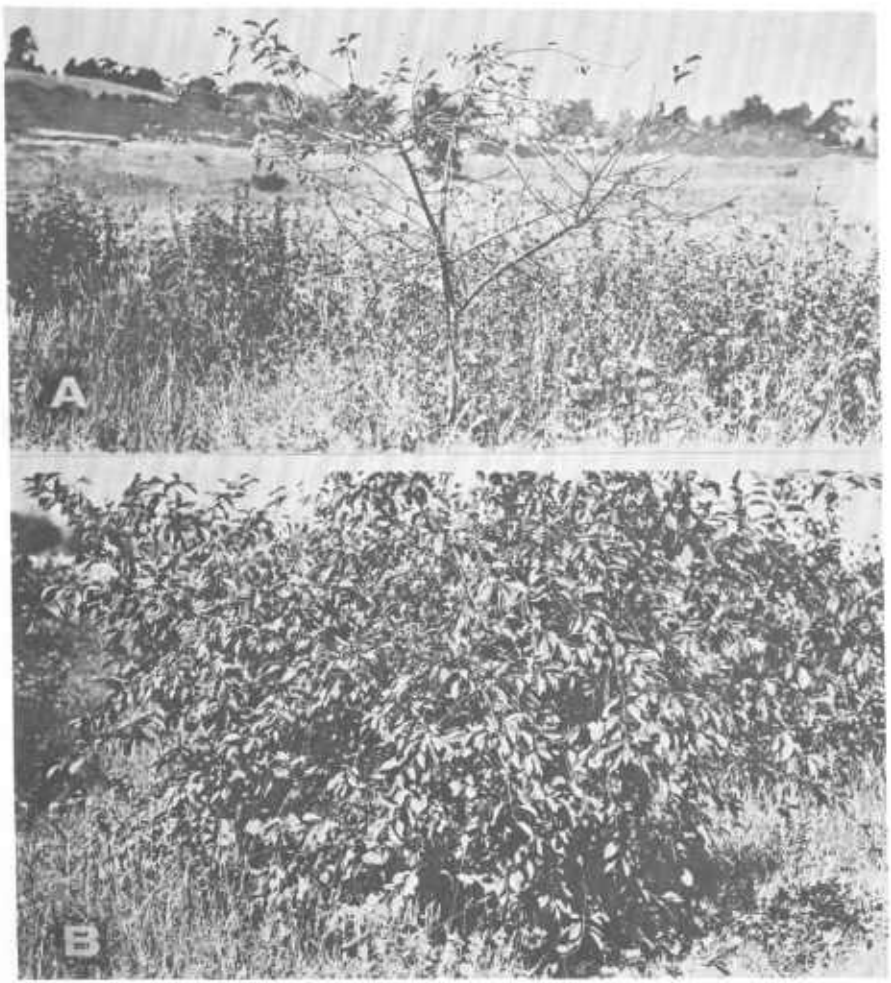

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FIGURE 3.—'English Morello' trees 6 years old, showing effect of soil drainage: *A*, On poorly drained soil; *B*, on well-drained soil. These trees were within 33 feet of each other, and the camera was at the same distance from each.

east of the Rocky Mountains are located. However, the industry has developed in these districts because of the tempering effect of large bodies of water instead of the existence of particular soil types.

Many of the better orchards in western New York are on Dunkirk clay loam, which is fairly heavy but well drained. Since the heavier clay soils often are insufficiently drained, the lighter soils are preferred for cherries.

Soils that are droughty and that dry out excessively are unsatisfactory for cherry trees. Moderately fertile soils give better results than those having either extreme in fertility.

CULTIVARS

Sour cherries are separated into two distinct groups based on the color of the fruit juice—the Amarelle or Kentish group with colorless juice and the Morello or Griotte group with reddish juice and usually dark-red fruit (*34, 47*). In addition, a subspecies classification is sometimes given to the Marasca group, which is used for distilled or brined products (*61*). Further classification into Montmorency, Morello, Brusseler, and Vladimir groups has been suggested (*66*).

About 270 named cultivars (varieties) of sour cherries were described by Hedrick in 1914 (*47*). Only 12 had been added by 1950 and an additional five by 1970. Ten of these 17 were mutations of 'Montmorency' (*9*).

Numerous mutations or strains of 'Montmorency' have been selected for productiveness, season of fruit maturity, or disease resistance (*13, 39, 41*). The fruits of these are similar to those of 'Montmorency'. These mutations in order of their introduction are 'McClain Montmorency' (1925), 'Montearly' and 'Montlate' (1932), 'Musselman Montmorency' (1934), 'Gilbert Montmorency' and 'Jordan' (1937), 'Richmorency' (1938), 'Bell Montmorency' (1940), 'Montmorency, Dayton strain' (1941), and 'Fernwood Montmorency' (1956). 'Black Flame', introduced in 1940, is an open-pollinated seedling of 'Montmorency' (*9*).

A 1961 survey showed that 70 distinct cultivars and numerous selections or mutations of 'Montmorency' were growing in North American fruit collections (*33*). Only three cultivars are of economic importance—'Montmorency', 'English Morello', and 'Early Richmond'. 'Montmorency' is by far the leading cultivar. These cultivars are described in order of fruit ripening as follows:

'Early Richmond' (Kentish) apparently originated in the Montmorency Valley of France

and was introduced into America via either England or Holland (*47*). Fruits are light red, small to medium sized, white fleshed, of fair quality, and ripen 7 to 10 days before 'Montmorency'. Trees are medium sized, moderately productive, and relatively hardy. Early strains of 'Montmorency' are supplanting this cultivar.

'Montmorency' originated in the Montmorency Valley of France before the 17th century (*47*). Fruits ripen in midseason and are relatively large, bright red, white fleshed, and of good quality. Trees are vigorous, hardy, and very productive on good soil. The firm flesh and long harvest season make this cultivar the best suited for processing uses. Mutations in this cultivar have made available a succession of similar types that permits a prolonged harvest season and more efficient use of harvesting machinery and labor. Usually this is the only sour cherry cultivar grown by the most successful orchardists.

'English Morello' is thought to have originated in Holland or Germany and then was introduced into England and France (*47*). Fruits ripen 10 to 14 days after 'Montmorency', and are medium sized, very dark red, and very tart, but of good quality. The flesh is dark red and the juice is red. Trees are spreading and sometimes drooping. Annual terminal growth often is short and trees become unproductive. They are particularly susceptible to the leaf spot fungus (*Coccomyces hiemalis* Higgins).

'Meteor', introduced in 1952, was derived from a cross of 'Montmorency' and a seedling derived from 'Vladimir' and 'Shubianka' at the University of Minnesota Fruit Breeding Farm (*9*). This cultivar combines improved winter hardiness with relatively small Montmorency-type fruit.

'Coronation', introduced in 1937 by the Dominion Experimental Station, Morden, Manitoba, and 'Dwarfrich', introduced in 1952 by the U.S. Horticultural Field Station at Cheyenne, Wyo., are open-pollinated seedlings of 'Vladimir' (*9*). Both have bush-type, dwarfish growth.

'Northstar', introduced in 1950, was derived from a cross of 'English Morello' and 'Serbian Pie No. 1' at the University of Minnesota Fruit Breeding Farm (*9*). It has Morello-type fruit and usually a very dwarfed, hardy tree. This cultivar has potential as a dwarfing interstock for sweet cherries.

Other cultivars generally have a limited availability. Detailed descriptions of those originating before 1920 are given by Hedrick (*47*) and later ones by Brooks and Olmo (*9*).

POLLINATION REQUIREMENTS

All commercially important sour cherry cultivars are considered self-fertile and pollinizers usually are not planted (*31, 84*). Under favorable conditions, i.e., weather warm enough for bee activity and for pollen tube growth, and adequate nutrition, pollen from an individual tree will fertilize the pistils of the flowers on the same tree and cause fruit set. Low light intensity does not appear to hamper fruit set (*44*). However, bees or other insects apparently are necessary for transporting the pollen, regardless of the compatibility factors.

A few minor cultivars, viz 'Chase', 'Ostheim', 'Kentish Red', 'Homer', and a few mutations of 'Montmorency' give higher fruit sets from cross-pollination than from self-pollination (*17, 31*). Factors may be involved, such as those that make all commercial sweet cherry cultivars self-incompatible (*16*).

Prolonged periods of cool wet weather during blossoming may prevent fruit set because of inadequate pollination. However, relatively short periods of warm temperatures and intense bee activity may insure a good crop if the anthers are shedding pollen.

PROPAGATION AND ROOTSTOCKS

Most growers buy trees from a reputable nurseryman. Trees are propagated by budding on seedling stocks in the nursery row and sold for transplanting to the field when they are 1 or 2 years old. It is essential that nurserymen use budwood only from trees that are free of known viruslike diseases. Likewise, trees producing seeds for rootstock should be free of known viruses.

Two kinds of seedling rootstock are in general use—the mahaleb and the mazzard (*1, 4, 8, 14, 15, 21, 45, 48, 70, 78*). The mahaleb is used more extensively than the mazzard for sour cherry stocks (*70*). Despite occasional incompatible unions, mahaleb rootstocks are usually satisfactory. Trees on this stock in good soil are more productive than those on mazzard (*4*). However, the mazzard rootstock is more desirable for heavy soils. 'Stockton Morello' rootstock sometimes is used in areas with inadequate drainage (*21*).

Trees on mahaleb rootstock appear more spreading than those on mazzard in the early bearing years, probably because those on mahaleb grow more slowly and bear fruit when they are younger.

SELECTING AND HANDLING NURSERY TREES

Either 1- or 2-year-old nursery trees may be used. Medium-sized trees, 4 to 5 feet high and nine-sixteenths to eleven-sixteenths inch in diameter, seem preferable, but smaller trees often are satisfactory (fig. 4). Unpack trees immediately after delivery and keep the roots moist. The trees should be heeled in (fig. 5)

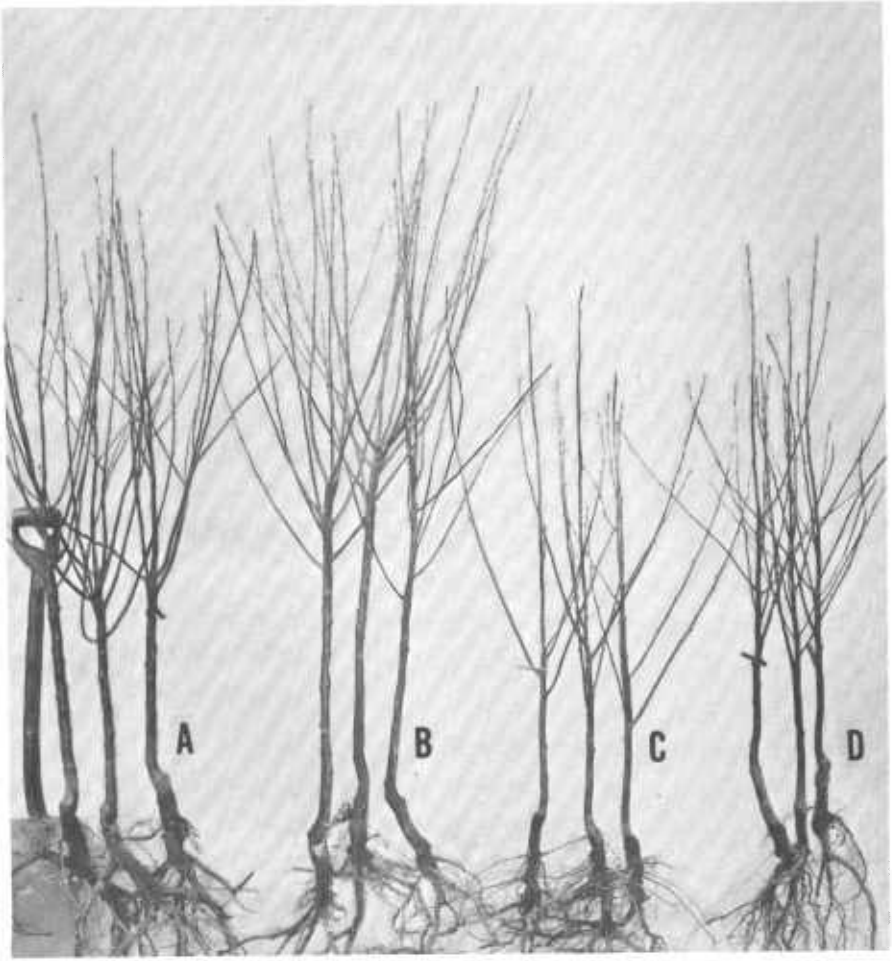

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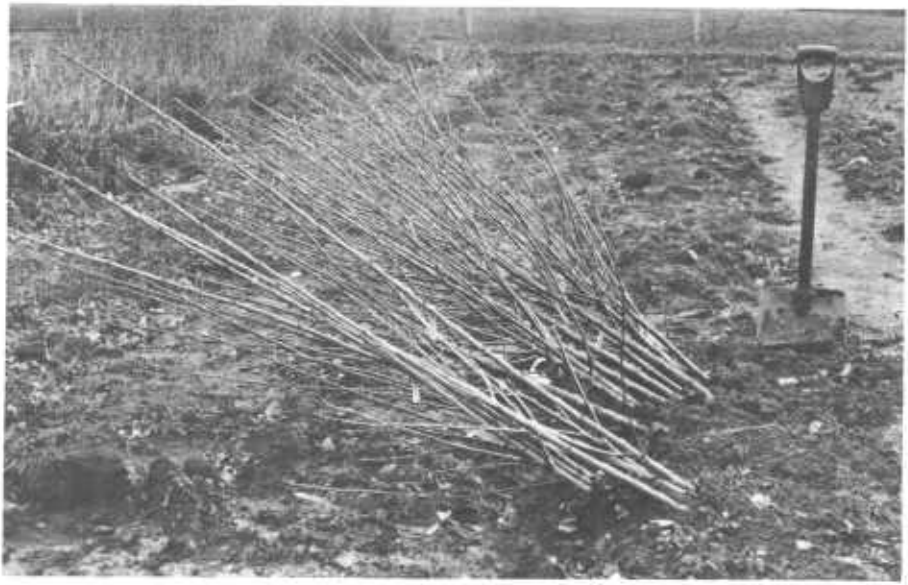
FIGURE 4.—Sour cherry trees representing different grades of nursery trees as follows: *A*, 2-year-old 'Montmorency' on mazzard rootstock, three-fourths inch or more in diameter, 5 to 7 feet high; *B*, same as *A* except on mahaleb rootstock; *C*, 1-year-old 'Montmorency' on mazzard rootstock, five-eighths to eleven-sixteenths inch in diameter, 3 to 4 feet high; *D*, 1-year-old 'Montmorency' on mahaleb rootstock, five-eighths to eleven-sixteenths inch in diameter, 3 to 4 feet high.



PN-2950

FIGURE 5.—Cherry trees heeled in.

if they cannot be planted immediately.

A place where the soil is friable, deep, and well drained should be used for heeling-in the trees. Make a trench sufficiently wide and deep for the roots and lay the trees at an angle. Then distribute moist sawdust, bark dust, or soil among the roots to fill all the spaces between them. If many trees are to be heeled-in, they usually are placed in parallel rows. When this is done, the roots in one row may be covered with the soil that is removed in opening the adjacent trench. Trees that are tied in bundles when received must be separated before they are heeled-in. If this is not done, it is difficult to distribute the soil among the roots sufficiently to protect them from drying.

ORCHARD PLANTING

Site

The area of land occupied by the trees is called the "site." The most essential site considerations are soil and local climatic conditions. Cherries blossom comparatively early in the spring. Avoid sites subject to spring frosts during blossoming. Heating of sour cherry orchards usually is not profitable. Because cold air settles to lower levels, orchards occupying sites slightly higher than the surrounding areas are usually less likely to be injured by frost than those at comparatively low elevation. Also, the soil on higher

levels is likely to be better drained.

Replanting favorable sites with sour cherries may lead to unthrifty growth. Preplant fumigation of a problem site in Michigan increased trunk growth, even of diseased trees (*55*). Root lesion (*Pratylenchus* sp.) and dagger nematodes (*Xiphinema* sp.) were present in the orchard.

Avoid soils in which tomatoes, potatoes, or other solanaceous crops have been grown during the previous 5 years because of the verticillium wilt hazard.

Turning under a green manure crop is a good way to prepare a site.

Time of Planting

Cherry trees should be planted as soon as possible after they are dug to prevent losses of young orchard trees. If feasible, obtain and plant trees in the fall. In areas where winters are extremely severe, spring planting is advisable. In the middle latitudes and where winters are comparatively mild, fall planting usually is preferable and it is becoming more common in areas where the climate is moderate.

The trees should be completely dormant prior to planting to prevent bud growth. Extensive bud growth prior to planting usually increases tree losses.

Prepare a good seedbed for the trees. Plowing or deep disking usually is necessary. Where erosion is a potential problem, only a 6-foot-wide strip in the tree row need be prepared. Since soil preparation will vary with the location and soil type, follow local recommendations.

Tree Spacing

Cherry trees are planted at various spacings depending on the topography of the land, soil depth, rootstock, varietal characteristics of the trees, and preference of the individual grower. Sometimes smaller trees, such as 'English Morello', are planted 16 to 18 feet apart each way. The minimum spacing of permanent trees for most sour cherry cultivars is 20 feet apart. The spacing may be increased up to 24 feet if the soil is favorable for tree growth, particularly for vigorous cultivars such as 'Montmorency'.

The square system is generally used in planting cherry trees. However, a contour system should be considered on sites where there is danger of soil erosion. Contour planting means planting each row of trees at the same level or on a contoured line with a slight grade along which water moves slowly. Sometimes terraces are desirable. In contour planting, there should be a minimum distance of about 18 feet between rows.

Soil and moisture conservation are essential for best production. The extra time required to plan and lay out a good conservation system is well spent.

The undesirable effect of planting too closely is illustrated in figure 6. The 21-year-old 'Montmorency' trees are spaced 14 by 14 feet since the filler trees were not removed. The long, slender, upright branches interlock, causing spraying and harvesting problems.

On well-drained, fertile soil, 'Montmorency' trees may become crowded even when spaced more than 20 feet apart, and some of the trees may need to be removed for best orchard operation. The trees in figure 7 are too close; those in figure 8 are well spaced.

Transplanting

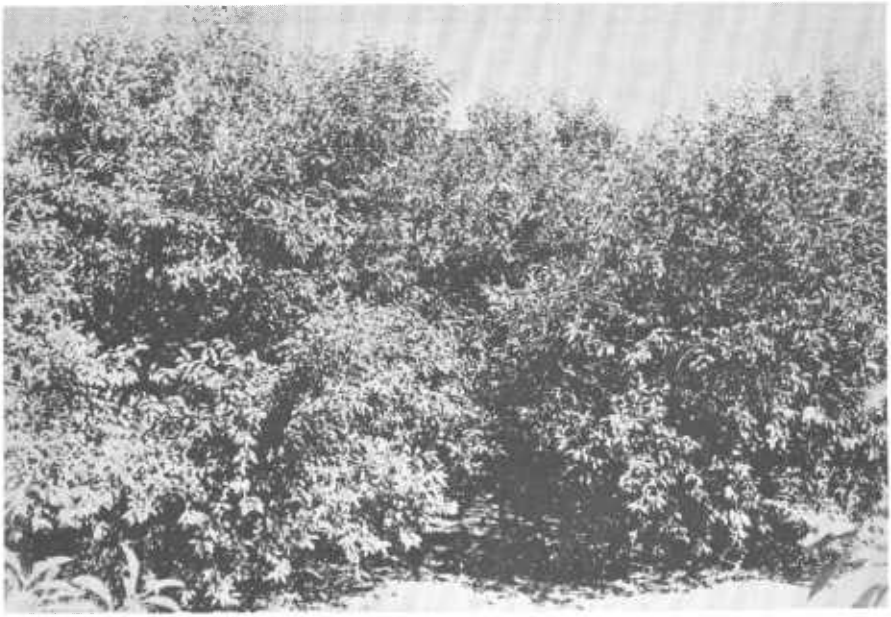
The details of planting are similar to those usually followed for apples, peaches, or other fruit trees commonly planted in sections where cherries are grown.

When a tree is being prepared for planting, remove all mutilated or injured parts of the roots. Cut long, slender roots to match the length of the main roots.

Take every precaution to prevent the roots from becoming dry. The tree roots will be injured if they are unduly exposed to cold or to drying-out during

PN–2951

FIGURE 6.—This 'Montmorency' cherry orchard in New York is about 21 years old and the trees are 14 feet apart each way. They are tall with long slender branches as a result of being planted too closely.



PN-2952

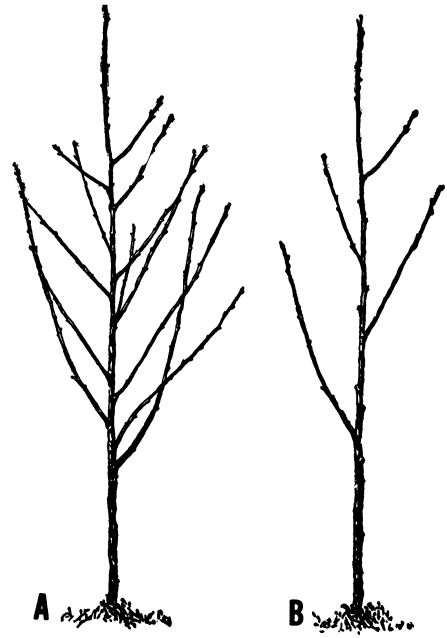
FIGURE 7.—Twelve-year-old 'Montmorency' trees. The permanent trees are planted 24 by 24 feet on a square system, and a semipermanent tree is in the center of the square. These trees on mazzard stocks and in good soil are too close together.

PN-2953

FIGURE 8.—Well-spaced trees in a 'Montmorency' cherry orchard. The semipermanent trees were removed when 12 years old.

trimming and planting. Many poor stands of cherry trees have resulted from injury to roots exposed prior to planting.

Use only pulverized topsoil around the roots in filling the hole after a tree has been put into position and alined. Work the soil in closely around the roots. Moving the tree up and down slightly as the hole is being filled helps settle the soil among the roots. As the filling progresses, firmly tamp the soil around the roots and fill the hole to the surface. If water is available, fill the hole with water when it is about two-thirds filled with soil and completely fill it with soil several hours later.



PN-2954

FIGURE 9.—One-year-old 'Montmorency' cherry tree, about 3 feet high, showing method of pruning at time of planting: *A*, Before pruning; *B*, after pruning.

Tree Heading and Training

Sour cherry trees have a spreading habit of growth. The modified-leader system of training is preferable for all types.

Both well-grown 1-year-old and 2-year-old trees should be branched when received from the nursery. Select about four branches for main or scaffold limbs of the tree (figs. 9 and 10). The lowest scaffold limb should start at least 14 to 16 inches from the ground. The others should be well spaced around the trunk up and down so that none are directly over a lower one. For mechanical shaking, the lowest branch should be at least 18 and preferably 24 to 30 inches from ground level. Where possible, the scaffolds should be at least 4 to 6 inches apart up and down the trunk. If all are allowed to develop from the same height, a weak tree is likely to result (figs. 11 and 12).

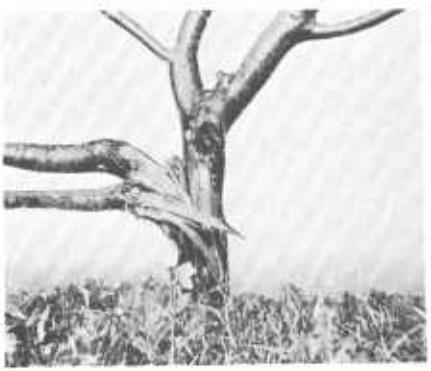
For these scaffold limbs, retain only branches with the widest angles. Select the more vigorous branches and cut back to about the length of weaker ones so that all may develop to approximately equal length. Do not cut back the main stem or trunk when it is planted; it should be left higher than any of the scaffold branches (figs. 9 and 10).

PN-2955

FIGURE 10.—'Montmorency' tree grown 2 years in the nursery. It is about 4 feet high and pruned properly for setting in the field. Note that the original leader was cut back after 1 year in the nursery, but the lateral branch selected as a leader was not cut back.

PN-2956

FIGURE 11.—'Montmorency' cherry tree with no leader and all scaffold limbs arising at the same height. The left limb is very weak at the crotch and is likely to break and leave a large wound on the trunk.



PN-2957

FIGURE 12.—Eight-year-old cherry tree, showing type of scaffold-limb breakage common on cherry trees on which several limbs are allowed to develop at the same height.

Care of Young Trees

In areas of low or poorly distributed rainfall, newly planted trees should receive supplemental irrigation to avoid moisture stress (*53*). Competition for nutrients or moisture from weeds or cover crop should be prevented. If a cover crop is used, maintain a clean-cultivated strip of about 18 inches on each side of the tree row or a 3-foot circle around each tree. In general, do not use chemical weed killers during the first summer of growth. Apply supplemental nitrogen sparingly as the need is indicated by inadequate terminal growth or pale-green foliage. However, fertilizer usually should not be applied after mid-

July to avoid growth late in the fall and subsequent winter injury to unhardened tissues. In some areas, potassium solutions are applied at planting time to prevent potassium deficiency (*60*).

ORCHARD MANAGEMENT

Orchard management practices vary with soil types, drainage, availability of irrigation, and many other factors (*3, 28, 38, 40, 51, 52, 53, 61, 67, 68, 74*). Cost estimates for some of these practices in sour cherries are not available, but some are similar to estimates for sweet cherries (*73*).

Tillage and Cover Crops

Cherry orchards usually are given clean tillage with a disk harrow during the early summer or until about the middle of July. The clean-tillage practices of various growers differ greatly. Some growers cultivate their orchards weekly when the trees are growing rapidly, others cultivate three or four times during the entire season, and some use chemical weed control. The tendency is toward less tillage and even nontillage. The latter combines chemical weed control with mowing.

Cover crops in the early summer, when most tree growth occurs, may compete seriously with the trees. The rapidly growing fruits and shoots require large amounts of moisture and soil nutrients. A more continuous cover crop may be necessary if there is danger of soil and water loss from erosion. Usually a cover crop is seeded at the last cultivation, at about the time the fruit is harvested, and it is disked down early the following spring. Cherry growers sometimes allow weeds to grow as a cover crop during the late summer and fall. However, a planned cover-crop system is often necessary to prevent erosion in sloping orchards.

Mechanical or chemical weed control in a strip 3 to 4 feet wide in the tree rows and periodic mowing or flailing of the sod strips between tree rows overcome the disadvantages of complete cover in orchards requiring continuous cover crops. Usually a low-growing nonlegume such as bluegrass and fescue or a shallow-rooted legume such as subterranean clover (*Trifolium subterraneum* L.) adapts best to this cultural system.

Cover crops have additional advantages. They improve aeration in clay soils, increase water-holding capacity, and aid in retaining the nutrients in sandy soils. They utilize excess nitrogen in late summer and may aid in hardening of trees by preventing late flushes of growth and subsequent winter injury. The type of cover crop used and the method of managing it vary in different districts and sometimes even on dif-

ferent farms in the same area (*51, 52*).

In many localities, one of the best cover crops for cherries is rye, which is sown in late summer at the rate of about 1½ bushels per acre. The cover crop should be disked or mowed well before it matures in the spring to prevent competition with the trees. Some growers prefer a late-summer crop that does not survive the winter, such as oats, millet, or buckwheat.

Sometimes cherry orchards can be maintained satisfactorily in sod if adequate nitrogen is applied. However, the trees may suffer from lack of moisture unless the soil is deep. A mulch of straw, hay, or similar material around the trees reduces evaporation and allows better root development in the surface soil. Trees grow best without competition, and a continuous sod should be considered only when necessary to prevent erosion. Where bluegrass is adapted, it is one of the best sods; in other areas the native grasses, lespedeza, and other legumes may be used.

Fertilization

A soil test may be useful in determining the average initial fertilizer application necessary. Likewise, leaf analysis services may be utilized periodically to monitor the general level of nutrients in an orchard. However, the most economical fertilization system may be to vary the annual applications to individual trees from the average indicated rate according to the amount of terminal growth and the leaf appearance.

The fertilization procedure for cherries is similar to that for other orchard trees (*77*). Adequate but not excessive amounts of the major elements contribute to fruit firmness (*20*). Cherries usually respond well to nitrogenous fertilizers such as sodium nitrate, urea, ammonium sulfate, and ammonium nitrate. Because of differences in the soil, no definite amount to apply can be stated (*67*). In general, one-half pound of sodium nitrate or equivalent amount of other fertilizers, based on actual nitrogen content, for each year of the tree's age may be used. For example, a 6-year-old tree would be given 3 pounds of sodium nitrate or 1½ pounds of ammonium nitrate, since the latter contains twice as much nitrogen as the sodium nitrate. Usually the application of any other element is not necessary, but cherry trees in a few areas have responded to potassium (*60*), and in Oregon some orchards are deficient in boron.

The fertilizer should be spread uniformly under and around the trees to just beyond the dripline of the branches. Apply nitrogen fertilizer in either the fall or the early spring.

Usually it is necessary to apply more fertilizer to trees grown in sod than to those that are clean

cultivated. Application of a complete fertilizer, such as 10-10-10, at the rate of about 250 pounds per acre when the crop is planted, is often valuable in establishing a vigorous cover crop. Trees in bluegrass sod require 50 to 100 pounds per acre more fertilizer than the amount necessary for cultivated trees.

Intercrops

An orchard may endure an interplanted crop without appreciable ill effect, but the crop will be of no benefit to the trees unless the orchard is given better tillage because of it. Beans, peas, and other vegetables of like cultural requirements are the most compatible. Avoid tomatoes, potatoes, and other crops susceptible to verticillium wilt. Crops requiring late-summer cultivation should not be used in the Northern States, where winter injury of cherry is common because of immaturity of the wood. Pesticides and timing of sprays for the two crops usually are not compatible.

The planting of an annual crop in an orchard is a system of double cropping in which the more important crop is the cherry. The tops require only a small part of the space above ground, but the roots occupy a larger volume of the soil. Usually it is better to plant "filler" trees, preferably other sour cherries, than row crops, but these must be removed before the trees become crowded. Substantial crop reduction for 1 or more years will result from delayed removal of "filler" trees.

Irrigation

Irrigation is necessary in many western orchards. Supplemental irrigation is beneficial in areas with sufficient total rainfall but with inadequate moisture during part of the growing season. Usually rill, check, or under-the-tree sprinkler systems are used. Overhead (over-the-tree) sprinkler systems are in experimental use in the Pacific Northwest. These can be adapted also to sprinkling for frost control and reduction of leaf and fruit temperatures on excessively hot days and to applications of certain pesticides, growth regulators, or foliar fertilizers. The hazard of increased diseases has not been serious and it has been outweighed by labor-saving advantages such as movement and storage of irrigation pipes. However, overhead systems should not be installed until their feasibility has been established experimentally in the grower's immediate area.

Sour cherry trees are susceptible to "wet feet" and should not be overirrigated. The need for irrigation can be predicted reasonably well from (1) an evapotranspiration chart for the specific area, (2) moisture tension blocks

at different depths, or (3) a soil-crumbling test. In the last method a ball of soil from the 3-foot depth that is squeezed and jarred slightly will crumble easily if irrigation is necessary. On the other hand, trees should not be permitted to suffer from moisture stress, which may reduce fruit size and restrict vegetative growth.

Pruning

One year after planting, little pruning of a sour cherry tree should be necessary. At this time remove extra scaffold limbs left at planting time. The more vigorous scaffold limbs may be suppressed by (1) removing some of the lateral branches and (2) pruning back the main one to an outward- and upward-branching lateral.

After a tree has been in the orchard for 2 years, cut back its leader to a strong outward and upward lateral arising about 5 feet from the ground. Then select two or three additional scaffold limbs on the upper part of the trunk, so that about six, which are well distributed along about 3 feet of the trunk, finally remain.

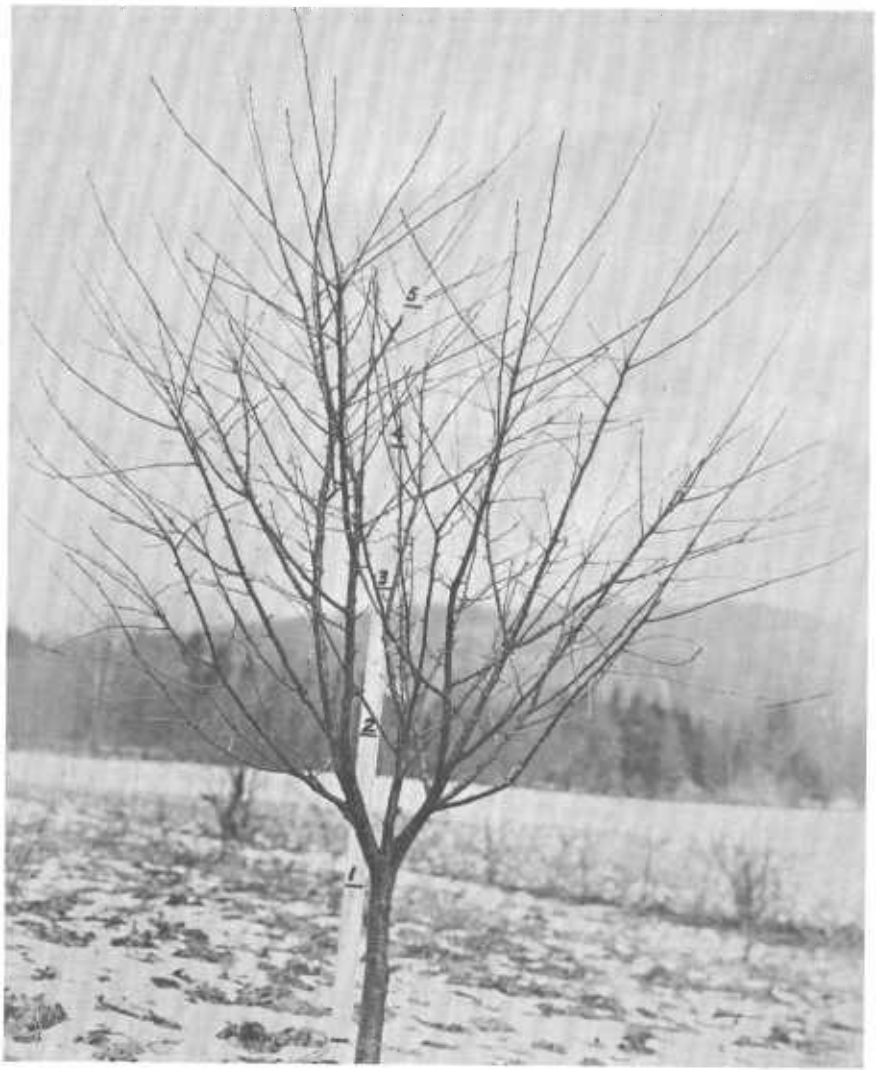
Pruning during the first 4 or 5 years is mainly to train the young trees so as to obtain maximum strength and productivity. Some pruning is necessary each year to maintain a balance between the scaffold limbs. If some scaffolds are allowed to develop more rapidly than others, the leader and the weaker scaffold branches will be choked out (fig. 13). More pruning than necessary, however, will delay bearing and dwarf the tree. Constraint to the minimum pruning that will give a balanced, strong tree will give returns in precocious bearing.

Mature sour cherry trees require little pruning except removal of weak branches, especially on the inside of the trees (fig. 14). If this is not done they become brushy, hard to spray and pick, and bear many small unevenly ripening fruits (fig. 15). It is best to head back the branches of trees that become too tall for convenient harvesting. Moderately light pruning accompanied by adequate nitrogen fertilization helps maintain good terminal growth and vigorous spurs.

Thinning Fruit

Thinning of fruit usually is not practical for sour cherries. This is accomplished to some extent, however, by selective pruning. Thinning out some of the fruiting wood during the dormant season reduces the total number of fruit buds and gives larger fruits. However, care should be taken to avoid reducing the overall production of the orchard.

No chemical has been consistently effective in thinning sour cherries.



PN-2958

FIGURE 13.—Three-year-old 'Montmorency' cherry tree with weak crotch that resulted from allowing the scaffold branches to crowd out the leader.

HARVESTING

Sour cherries usually are harvested without stems. Until about 1964 the fruit was harvested by hand into pails harnessed to the picker's body. Temporary picking crews estimated at 45,000 workers were required to harvest the Michigan crop alone (*58, 81*).

PN-2959

FIGURE 14.—Vigorous 'Montmorency' cherry tree, about 7 years old, received little pruning after selection of scaffold branches. When the tree was photographed, only a light thinning out of weak limbs in the center was needed. Note the strong, well-spaced scaffold branches.

Many of them were transients, who become more scarce each year. The grower has been forced to harvest the crop mechanically. In 1964, 1967, and 1968, 3, 50, and 70 percent, respectively, of the Michigan crop was harvested by machine (*7*). In 1970, 600 harvesting machines were used in Michigan (*7*); in 1971, about 85

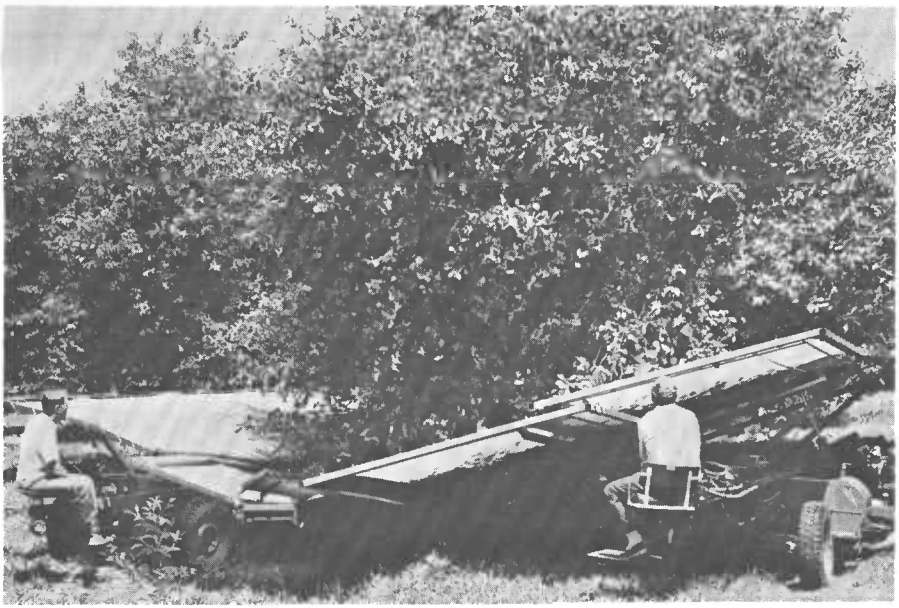
PN-2960

FIGURE 15.—Twelve-year-old 'Montmorency' cherry tree that had not been pruned for 5 years and had received very little pruning before that. When photographed, it was too brushy for uniform ripening of high-quality cherries, for thorough spraying, or for easy harvesting of the fruit. All that it needed, however, was some thinning of weak limbs in the center. Note the strong, well-spaced scaffold branches.

percent of the crop was harvested by over 700 machines.

Reciprocating limb or trunk shakers are used to shake the fruit onto self-propelled or tractor-drawn catching frames. Most advanced harvesters are operated by two men (fig. 16). The frames are inclined to roll the fruit onto conveyor belts and then into pallet tanks of cold water (*62*). The tanks are moved within 30 minutes to cooling stations in the orchard where ice is added. This removes field heat from the fruits in a short time. The cherries are cooled to under 60° F. and remain in the pallet tanks until they are pitted 6 to 8 hours later. Transportation and storage in these tanks minimize bruising and enhance refirming of bruised fruits (*5, 56*).

Water sprays are sometimes applied to the trees by airblast machines 20 to 30 minutes before harvest to reduce fruit temperature at least 10° F. (*26*). Scald, browning of bruised areas, and other sources of loss of quality



PN-2961

FIGURE 16.—Machine harvesting sour cherries in Michigan orchard.

and subsequent reduction in packout are minimized by such treatment (*86*).

A single mechanical harvester and its crew remove at least as much fruit as 33 handpickers (*58*). The newest machines with two men harvest over 60 trees per hour. Cost per pound of fruit removed by mechanical harvesters is comparable to, and often less than, that of handpicking. Michigan researchers estimate that harvesting fruit from 15 acres of sour cherry trees makes one unit economical (*81*). Cherries harvested and handled by machinery are bruised less than those handpicked (*7, 12, 72*). Certain experimental chemical sprays, notably 2-chloroethylphosphonic acid (ethephon) and succinic acid 2,2-dimethylhydrazide (SADH), reduce the force necessary to remove fruits from the tree (*2, 10, 11, 18, 29, 30, 59, 83*) and thereby may reduce bruising. Sprays of the latter chemical 2 weeks after full bloom enhanced anthocyanin development and altered cell wall composition of 'Montmorency' fruits (*23, 83*). Treated fruits had more total anthocyanins and more pectin and hemicellulose, and they were firmer.

In 1970, 60 percent of Michigan cherries were sold by volume rather than by weight (*75*). Fruit scald was reduced by elimination of the rehandling formerly associated with weighing the fruit.

Thus the cherries are handled in water tanks until they reach the processing plant, where they go over a machine that removes stems, usually on 1 to 10 percent of the fruits, and then are conveyed to the pitter.

The shortage of trained pickers and high harvesting labor costs have encouraged pick-your-own-fruit operations. Orchards near population centers often attract families interested in picking fruit for their own use or in buying tree-ripened fruit from roadside markets.

PACKING

Some sour cherries are sold for fresh consumption (*64*). Several methods are used to pack cherries for the fresh-fruit market.

Fruit is occasionally packed directly into baskets of various sizes. Sometimes the picking pails are emptied onto a sorting table or conveyor, from which the cherries are transferred to 1-quart boxes. These are packed into 16- or 24-quart crates for marketing. Also used are the western lug, holding 15 to 20 pounds, and the 4-quart climax basket.

For highest quality and least spoilage, cherries for fresh consumption must be handled with stems attached and kept cool (*57*).

PROCESSING

Processing details are not included in this handbook. However, since about 95 percent of the sour cherries are processed, the reader is referred to a few pertinent publications on processing (*6, 25, 61, 69, 75, 76, 80,* and *85*).

VIRUS DISEASES [3]

Several virus diseases affect cherries in the north-central and northeastern areas of the United States (*82*).

Ringspot

The stone fruit ringspot virus is widespread in commercial stone fruit orchards throughout North America, but few trees show symptoms. On sour cherry it induces symptoms only during the initial stages of infection, which usually last 1 to 2 years. After this, infected trees may show no symptoms except varying degrees of retarded growth, yet they stand as virus reservoirs from which further spread can occur.

During the early stages of infection, foliation is retarded and sparse. As the season advances, leaves fail to size and many bear

[3] Prepared by L. C. Cochran.

ring and necrotic patterns. The patterns become progressively necrotic and some areas drop out giving some leaves a shot-holed and tattered appearance (*87*). Leaf symptoms are accompanied by necrosis of leaf and flower buds and few fruits are set on affected parts.

The ringspot virus is seedborne in stone fruits and infects a high percentage of the seeds of sour cherries. It also infects pollen and is carried from diseased to healthy trees in pollen. Some of the infected pollen grains fertilize the ovules and result in infected seed, and some invade the ovary tissues where they discharge virus. This virus then is translocated from the young fruits into the previously healthy tree.

Prevention is the best control. There is no cure once a tree is infected. Budwood can be freed of the Prunus ringspot virus by exposure to dry heat at 100° F. for 4 to 5 weeks. This budwood can then be used to establish foundation stocks, which in turn are used by nurserymen to produce ringspot-free nursery stock. Seed for rootstocks must also come from ringspot-free trees grown in isolated areas where they cannot be pollinized by diseased pollen. Do not plant young orchards of ringspot-free trees near old, infected orchards. Promptly remove newly infected trees in young orchards. When 10 percent or more of the trees have become infected, roguing to delay further spread is probably no longer practical. Diseased trees produce less and poorer quality fruits, but they are still salable.

Sour Cherry Yellows

The disease known as yellows is widespread in sour cherry orchards. One-third of the trees in commercial orchards in the United States are infected. The disease is caused by a combination of the Prunus ringspot virus and the agent that induces prune dwarf in *P. domestica* plums. There is evidence that the latter is a mycoplasma and not a virus.

The first symptoms of yellows—green and yellow mottling of the older leaves—appear in early summer, 3 to 4 weeks after petal fall. These leaves usually drop promptly and periodic waves of leaf fall follow. Symptoms are most pronounced on trees in the better producing areas that have cool summers, such as those bordering the Great Lakes. Symptoms may not be expressed on diseased trees in the warmer areas of the Midwest.

When trees have been affected by yellows for several years, they develop abnormally large leaves and produce few fruit spurs. The shoots that should have become spurs lengthen, become pendant, and give the tree a weeping appearance. Affected trees bear small crops of large fruits. There is no cure for infected trees, but

more spurs and greener leaves have resulted from experimental gibberellin treatments (*65*).

Yellows is spread by infected pollen and seed in the same way as Prunus ringspot. The control is similar to that for ringspot. Several nurserymen can now supply yellows-free sour cherry nursery trees.

X-Disease

X-diseased sour cherry trees have sparse, light-green foliage and fail to mature their fruits. At normal maturity time, affected fruits remain small and pink. Affected trees die back over several years. Recent evidence indicates that X-disease is caused by mycoplasma and is not a virus disease (*43*).

In the Eastern United States the X-disease agent moves directly from diseased choke cherries (*P. virginiana* L.) to unaffected cherries. It can be controlled by removing the choke cherries from within 500 feet of the orchard. In the Western United States the agent is spread by leafhoppers, which feed and breed on cherries as well as on choke cherries. Trees on mahaleb cherry rootstock tend to die rapidly and are poorer reservoirs of infection than are trees on mazzard rootstock. To control X-disease in the Western United States, it is necessary to remove not only choke cherries from the vicinity of the orchard but also diseased cherry trees, particularly those on mazzard rootstock, as soon as they can be recognized. X-disease also affects sweet cherries and the entity moves from them to sour cherries. Where possible, do not plant new orchards near old sweet or sour cherry orchards.

In areas where this disease spreads rapidly and orchard isolation is not possible, some control has been obtained by topworking scions on the individual scaffold arms of mahaleb framework trees. Since the causal agent does not pass from one arm through the mahaleb interstock, the agent can be eradicated by removing the diseased arm just below the graft union. The so-called "Russian" or "Turkish" mahaleb cherries are more vigorous and cold hardy than the common clones.

Pink Fruit

The pink fruit disease is limited to a small area on the west side of the Cascade Mountains near Tacoma, Wash. It is a devastating disease but has shown no indication of rapid spread.

Up to 50 percent of the fruits on affected trees fail to mature and remain a salmon pink color at normal harvesttime. The vascular tissue in affected fruits becomes necrotic and turns rusty brown. The disease is distinguished from X-disease by failure of transmission to peach and by the random occurrence of dis-

eased and unaffected fruits throughout affected trees. Where affected trees have been promptly rogued, the disease has disappeared.

Other Virus Diseases

Several other virus and virus-like diseases occasionally affect sour cherries but as yet are not considered serious.

FUNGUS DISEASES [4]

The most important fungus diseases of cherry are leaf spot (fig. 17) and brown rot of the fruit.

PN-2962

FIGURE 17.—Sour cherry leaves affected by leaf spot.

Leaf Spot

Leaf spot is caused by a fungus (*Coccomyces hiemalis* Higgins) that overwinters on fallen leaves. In the spring the spores are discharged from these leaves and carried by the wind to the new leaves, where they germinate and cause infection. Small spots, purplish at first but finally brown, develop on the leaves and produce enormous numbers of summer spores. These spread infection to adjacent leaves and trees.

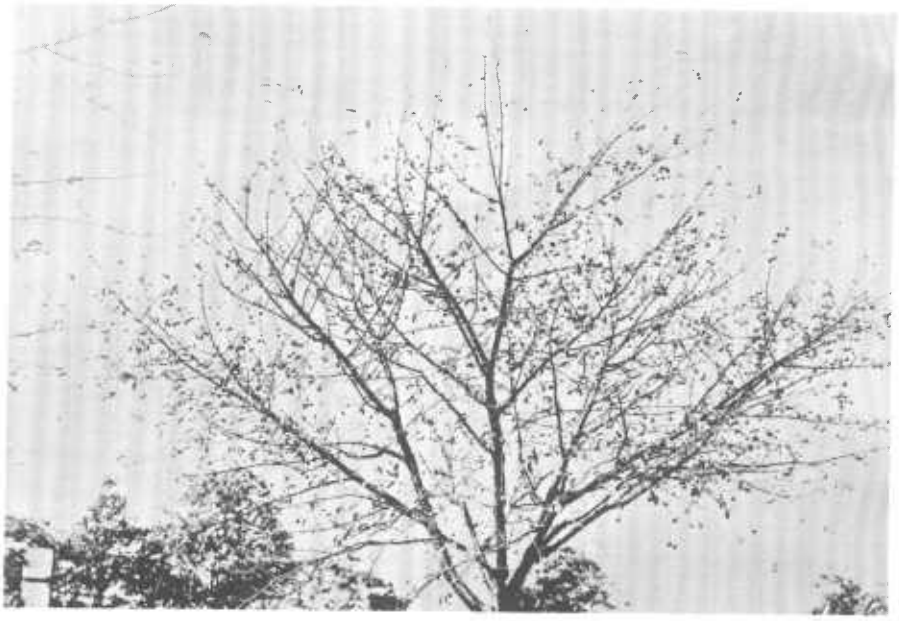
If not controlled, leaf spot causes partial to complete defoliation (*49*, *50*). In mild cases only a small number of leaves may be spotted, but frequently during damp or rainy weather the spots become so numerous that the tree is completely defoliated before the crop is harvested (fig. 18).

Control of leaf spot on sour cherries may require as many as five spray applications: (1) As soon as the petals have fallen, (2) when about three-fourths of the shucks have dropped, (3) about 10 days after the second spray, (4) 10 days to 2 weeks after the third spray, and (5) immediately after harvest.

Growers should consult their State agricultural experiment station or county agricultural agent for information regarding the fungicides best suited to their localities and the timing of sprays. Use only materials and rates currently registered for your area.

Certain materials that have been used to control leaf spot occasionally cause damage. Liquid lime-sulfur may discolor the fruit. Bordeaux mixture may reduce the

[4] Prepared by H. L. Keil.



PN–2963

FIGURE 18.—'Montmorency' cherry tree seriously defoliated by leaf spot.

size of the fruits. 'English Morello' and 'Wragg' cultivars are damaged by copper compounds. Organic fungicides are formulated for specific areas of the country. Antibiotics, which have given control experimentally (*54*), are not registered. Therefore strict adherence to local recommendations for materials, rates, and timing of sprays is essential for control without injury to the trees or fruits.

Brown Rot

A widespread and destructive fruit rot of peaches and plums is brown rot, caused by *Monilinia fructicola* (Wint.) Honey or *M. laxa* (Aderh. & Ruhl.) Honey. It frequently causes heavy losses to cherry growers during seasons when the fruit has been damaged by hail.

The first four spray applications for control of leaf spot usually control the brown rot fungus. If the orchard has had previous outbreaks of brown rot, an additional spray should be applied just as the fruit begins to color.

OTHER DISEASES

Other fungus diseases, such as black knot (*Dibotryon morbosum* (Schw.) Th. & Syd.), powdery mildew (*Podosphaera oxyacanthae* (DC) d By.), leaf rust (*Tranzschelia pruni-spinosae*

(Pers.) Diet.), wilt (*Verticillium albo-atrum* Reinke & Berth.), and scab (*Cladosporium carpophilum* Thuem.), occur to some extent on sour cherries. These diseases are usually less serious than either leaf spot or brown rot. Most of them are held in check by applying sprays used to control leaf spot and brown rot.

A bacterial leaf spot caused by *Xanthomonas pruni* (E. F. Sm.) Dows. sometimes affects 'Morello' cherries (*27*).

INSECTS [5]

The insect pests most commonly found on cherry trees are the black cherry aphid, the plum curculio, two kinds of fruit flies, and the pearslug.

Black Cherry Aphid

The black cherry aphid (*Myzus cerasi* (F.)) is a tiny, black, shiny insect that curls the tender young foliage of the cherry early in the season (fig. 19). Often it severely checks growth. It rarely injures the sour cherry seriously. The insects overwinter as tiny, black eggs on twigs and small branches. The eggs hatch in the spring about the time the tree growth starts, and the young aphids cluster on opening buds.

Plum Curculio

The plum curculio (*Conotrachelus nenuphar* (Herbst)) is a humpedback, brown beetle that hibernates in trash in the orchard or near it. Early in the spring, soon after the cherry trees bloom, the curculios move to the trees. Females insert their eggs just beneath the skin of the cherries. They then make crescent-shaped slits, each of

PN-2964

FIGURE 19.—Cherry leaves curled by the cherry aphid.

[5] Prepared by Merrill L. Cleveland, staff scientist, National Program Staff, Agricultural Research Service.

which partly surrounds an egg puncture (fig. 20). The curculio larvae, or grubs, feed within the cherries for several weeks.

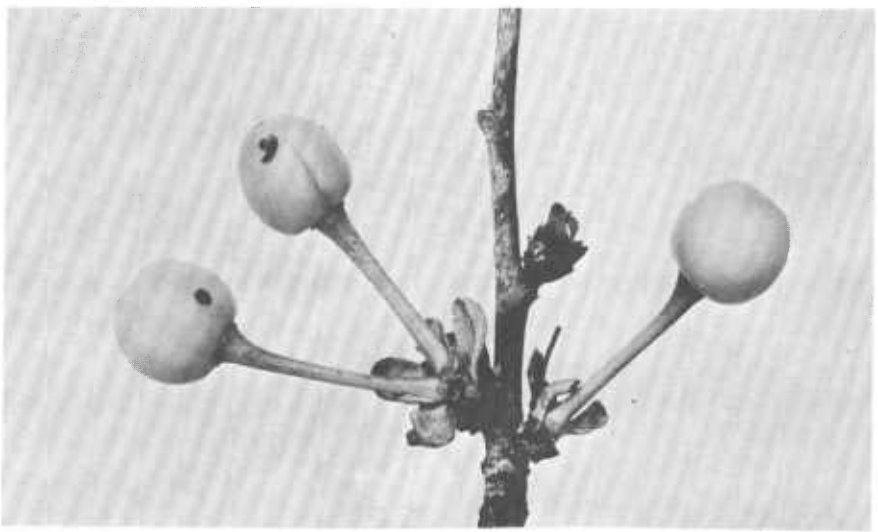
Fruit Flies

In the Northern States, cherries are sometimes infested by maggots of two species of fruit flies (*Rhagoletis cingulata* (Loew) and *R. fausta* (Osten Sacken)) (*36*). These species have yellowish heads and legs and are distinguished by conspicuous bands across the wings and distinct white crossbands on the abdomen of the *R. cingulata*. Adult flies, about two-thirds the size of house flies, appear just after the blossom buds open. The females lay eggs in the fruit when it appears. Maggots cause the fruit to be misshapen and often prematurely colored.

Pearslug

The pearslug, also called the cherryslug (*Caliroa cerasi* L.), is a slimy, dark worm that feeds on cherry leaves. The slugs appear on the trees in May or June depending on the locality. A second brood may appear in midsummer or late summer.

More information about these and other insects attacking cherries is available in Home and Garden Bulletin 190, "Insects on Deciduous Fruits and Tree Nuts in the Home Orchard," which may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.



PN-2965

FIGURE 20.—Puncture marks made by plum curculios inserting eggs into cherry fruits.

For information on insecticides to be used, dosages, and timing of applications, consult your county agricultural agent or State agricultural experiment station. Since some States have restrictions on the use of certain pesticides, check your State and local regulations.

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☆U.S. GOVERNMENT PRINTING OFFICE: 1974 O—505-755