Rosaceae—Rose family

Prunus L.

cherry, peach, and plum

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Growth habit, occurrence, and use. The genus *Prunus*—often called the stone fruits—is one of the most important genera of woody plants. Its 5 well-marked subgenera include the plums and apricots (*Prunophora*), the almonds and peaches (*Amygdalus*), the umbellate cherries (*Cerasus*), the deciduous racemose cherries (*Padus*), and the evergreen racemose or laurel cherries (*Laurocerasus*). Plums can be distinguished from peaches and almonds by lack of a terminal bud, multiple flowers from a bud, and an elongated pedicel (Janick and Moore 1996). Plums can be distinguished from cherries by the lack of a terminal bud, the presence of a suture, a waxy bloom on the fruit, and a flatter pit.

Nearly 200 species—ranging from prostrate shrubs to trees over 30 m tall—are found in the North Temperate Zone, with a few in Central and South America (Harlow and Harrar 1958; LHBH 1978; Rehder 1940). By far the greatest number of species of cherries occur in eastern Asia (Hedrick 1915), but most of the long-cultivated food-producing species originated in Europe and western Asia (table 1). Over 100 species have been brought under cultivation, mostly as food crops or ornamentals (Rehder 1940). Thirty-two of the more important species for planting in the United States are described in table 1.

Many of the stone fruits have been cultivated since ancient times for their edible fruits and a few for edible seeds (almonds). Wild species have also been a source of food for Native Americans and early European settlers in this country and are still used to some extent. Many selections of wild plums have been propagated for fruit production. Several species are useful as ornamentals because of their showy flowers, variety of growth habits, relatively fast growth and ease of cultivation, and adaptability to a wide variety of soils and climates (Hedrick 1915; Olson and Nagle 1965; Rehder 1940; Strausbaugh and Core 1964).

Trees for fruit production and many ornamentals are propagated by budding or grafting, but seed production is necessary to grow the rootstocks and in breeding programs. The most important rootstock species and their scion combinations include almond rootstock for almonds and plums; apricot for apricots; mazzard cherry for sweet cherries; mahaleb cherry for sweet and sour cherries; peach for peaches, almonds, apricots, and plums; American plum for plums in cold climates; Bessey cherry for dwarf peaches; bullace plum (St. Julien types) for plums; myrobalan plum (mariana types) for almonds and plums; and myrobalan plum (myrobalan types) for plums (Cochran and others 1961; Sudworth 1908). Certain strains of

peach, mahaleb cherry, and myrobalan plum are preferred for use as rootstocks because of their resistance to pests or for other qualities (Cochran and others 1961; Hedrick 1915).

Black cherry is the most important timber-producing species in the genus, but several others that attain sufficient size, such as mazzard cherry and mahaleb cherry in Europe and Japanese flowering cherry (*P. serrulata* Lindl.) in Japan, are used for wood products. Minor products include drugs, cordials, flavorings, honey, and perfume oil (Edlin 1967; Hedrick 1915). Probably all wild species are useful to wildlife as food. Birds and mammals eat the fruit, rodents eat the seeds, and deer (*Odocoileus* spp.) and beaver (*Castor canadensis*) use the leaves, twigs, and bark (Grisez 1974; Martin and others 1951; Van Dersal 1938). Several thicket-forming species of plums and cherries provide cover. Livestock feed on several species but others can be poisonous (Van Dersal 1938). Several species are used for erosion control and in shelterbelts (Engstrom and Stoeckeler 1941; Grisez 1974). In addition to those indicated in table 1, sour cherry, European bird cherry, and sloe are used for erosion control in Russia; and the same species plus mazzard cherry, apricot, myrobalan plum, garden plum, and pin cherry are used in shelterbelts (Al'benskii and Nikitin 1956; Koreisho and Morozov 1955).

Geographic races and cultivars. Very few racial differences affecting seed characteristics have been recognized. Differences in seed size, germination percentages, and other characteristics have been recognized, but these are likely to be treatment differences or simply random variations. For example, the moisture content of seeds (which is seldom reported) and tree-to-tree variation can have more effect than place of origin on numbers of seeds per weight (Grisez 1974). According to Hedrick (1915), "Cherries of any variety grown on poor soils or in uncongenial climates tend to have large stones and little flesh, while the pits are smaller and there is more flesh with the opposite extremes in environment." Black cherry seed weight increases with latitude (Pitcher 1984). Seed weights range from 7 g in Florida to 14 g in northern Michigan. There is a significant negative correlation ($r = -0.35$) between seed size and germination in that smaller seeds have better germination (Pitcher 1984).

There often are great differences among cultivars or groups within each of the domesticated fruit species, particularly in the percentage of viable seeds. In mazzard and sour cherries, the late-ripening cultivars (cultivated varieties), which require 80 days from flowering to fruit ripening, produce seedcrops with nearly 100% sound seeds. On the other hand, early cultivars, which require 60 days or less to ripen, produce almost no sound seeds. Those ripening in 60 to 75 days are intermediate (Tukey 1927). The final stage of fruit development is the rapid growth of the pericarp, and in early ripening cultivars of these species and peach, this stage begins before the embryo reaches full size (Tukey 1936). Garden plum also shows wide variation in germination capacity among cultivars tested under identical conditions (Suszka 1967). Immature embryos have been brought to a germinable stage by (1) growing excised embryos in artificial culture, (2) storing whole fruit (Hesse and Kester 1955), and (3) not picking until the fruit is over-mature (Zielinski 1958). Current technology allows the successful culture of ovules as small as 0.6 mm (Janick and Moore 1996). Only 32% of embryos <10 mm long produce plants, compared to 78% for larger embryos (Ramming 1990).

Nonviability of apparently normal seeds derived from crossbreeding cherries or plums has been a problem (Cochran and others 1961). The Duke cherries—hybrids of mazzard cherry and sour cherry—often have empty seeds (Hedrick 1911).

Flowering and fruit-ripening dates vary among cultivars of a species grown in the same

location (Hedrick 1911, 1915; Kester 1969). Individual trees of black cherry vary in a similar manner (Grisez 1974), and the same variation can be expected in other wild species. The food quality of fruit varies greatly among wild plants of Bessey cherry and the plums. Selections of 15 species of plums have been grown under cultivation for their fruit (Hedrick 1911, 1915).

American plum seeds from northern Minnesota germinate much better at a temperature of 10 EC than at higher temperatures, whereas those from Nebraska germinated as well and more rapidly at 21 EC (night) to 27 EC (day) (Grisez 1974).

In apricots, the variety called Russian apricot is hardier than the typical form (Grisez 1974). Mazzard cherry cultivars require 5 to 6 days longer to begin germination in stratification than wild mazzard cherry (Suszka 1967).

In a provenance study of black cherry, Cech and Kitzmiller (1968) found that the pattern of variation for seed traits is random throughout most of its range. However, seeds from the southern and southwestern parts of the range in the United States were characteristically lighter in weight and smaller in diameter as well as having thinner endocarps than seeds from other areas. Geographic locations and mother trees contributed about equally to the variability in total germination.

Flowering and fruiting. The flowers of nearly all species are bisexual. They normally have 5 white or pink petals and 15 to 20 or more stamens. In general, the pistil matures 3 or 4 days before the stamens (Hedrick 1915). The flowers are solitary, in umbel-like clusters or racemes, and usually appear before or with the leaves. The flowers are insect-pollinated. Except for plums and sweet cherries, most species are self-fertile and thus a tree will set fruit without a cross-pollinator (Janick and Moore 1996).

Of the 2 ovules, only 1 normally develops, resulting in a 1-seeded drupe. The drupe is thick and fleshy (except in the almonds) and has a hard, bony endocarp surrounding the seed itself (figures 1 and 2) (Fernald 1950; LHBH 1976; Kester 1969; Knuth 1906–09; Rehder 1940). The developed endocarp and seed are commonly called the stone or pit. Dates of flowering and fruiting are listed in table 2. Seeds are distributed mainly by birds and mammals (Grisez 1974). Fruit diameters of most species are between 5 and 25 mm, but those of almonds, apricots, plums, and peaches are larger (table 3).

Collection of fruits. *Prunus* fruits should be collected when fully mature (Al'benskii and Nikitin 1956; Swingle 1925; Zielinski 1958); doing so facilitates cleaning and is more likely to result in good germination (Grisez 1974; Huntzinger 1968). It is especially important in certain cultivars when the seeds are in a critical stage at the time the fruits are ripe and may not develop to a sound condition if the fruits are picked prematurely (Tukey 1927). Height, seed-bearing age, seedcrop frequency, and fruit descriptions of 24 species are listed in table 3. Color and condition of the fruits indicate maturity. For those species in which the ripe fruit color is nearly black, the preripe color is red. In red-fruited species, the preripe color may be yellowish or partly green and red (Grisez 1974). Almonds are ready to harvest when the husks (mesocarps) of fruits in the inner parts of the tree crown have split (Kester 1969).

Fruits are collected by hand-stripping or by spreading sheets of suitable material under trees to catch the natural fall or fruits that are shaken or beaten off the tree (Grisez 1974; Huntzinger 1968; Stoeckeler and Jones 1957). Small quantities can be picked from the ground (Huntzinger 1971). Black cherry fruits may be collected from trees felled in logging, but when fruits have reached the dead-ripe stage, a high proportion of them will be knocked off in felling

(Huntzinger 1968). Mechanical tree shakers are used in many commercial fruit orchards (Kester 1969; Miller 1960). There is even a machine to pick prunes (certain cultivars of garden plum) from the ground (Miller 1960).

Fruits may be carried in bags in small quantities—or in large quantities if they are to be processed immediately (Huntzinger 1971)—but boxes or baskets provide better protection against bruising and spoilage (Al'benskii and Nikitin 1956). Commercial cherries are often transported in water (Tennes and others 1968). Although this method was designed to protect the fruit, it could also be used to prevent spoilage and fermentation until the seeds are cleaned.

Extraction of seeds. Although satisfactory results have been obtained in a few cases by handling and sowing whole fruits (Engstrom and Stoeckeler 1941; Huntzinger 1968), it is generally desirable to clean the seeds of all pulp and juice (Heit 1945; Huntzinger 1968; Marcet 1951; Nyholm 1951; Robertson 1948–49; Shumilina 1949). Cleaning is done by macerators or hammermills with water to float off or screen out the pulp (Defler 1937; Dorn and Flick 1969; Grisez 1974; Hartman and Kester 1959; Huntzinger 1968; Steavenson 1940; Stoeckeler and Jones 1957). Hammermills should have worn or rounded hammers and be run at low speed (Mugford 1969). Small quantities may be cleaned by soaking and rubbing the fruits over a screen (Haut 1938; Jones 1963; Paton 1936) or by use of a household food blender (Huntzinger 1968).

Fermentation has been used to soften fruit to facilitate cleaning (Engstrom and Stoeckeler 1941; Grisez 1974; Rudolf 1961), but it is risky because the germination capacity of seeds may be severely reduced if seeds are allowed to become too warm or ferment too long (Cochran and others 1961; Engstrom and Stoeckeler 1941; Fogle 1958; Heit 1967). Fruits that are badly infested with brown rot should be discarded because this disease can spread through the seedlot (Janick and Moore 1996).

There is little need to separate out sound seeds in most species because the percentage of sound seeds is usually 96 to 100%, but it may be desirable in certain cultivars of commercial fruits. Separation of sound seeds of sour cherry has been done with 95% ethyl alcohol, density 0.8114 (Tukey 1927). A 17% salt solution (density 1.176) has been used to separate the heavy seeds of mazzard cherry, mahaleb cherry, and pin cherry, but the method is not always reliable (Cummings and others 1933). Seeds that float in water can be removed in the cleaning process, but some seeds that sink are not viable (Swingle 1925; Tukey 1927). The same methods should not be used with dried seeds because included air spaces can cause good seeds to float.

Seed yields and weights are listed in table 4. Additional data include the following weights per volume of fruit: sour cherry nested in water, 77 kg/hl (60 lb/bu) (Tennes and others 1968); black cherry, 72 kg/hl (56 lb/bu) (Stoeckeler and Jones 1957); and Manchu cherry, 77 to 85 kg/hl (60 to 66 lb/bu) (Grisez 1974). A bushel of black cherry fruit yields 5 kg (11 lb) of seed (Stoeckeler and Jones 1957).

Storage. Early experiences suggested that excessive drying for storage was detrimental (Cochran and others 1961; Engstrom and Stoeckeler 1941; Fogle 1958; Grisez 1974; Huntzinger 1968; Olson and Nagle 1965; Stoeckeler and Jones 1957); however, what was excessive was not defined. Very early ripening female parents may not produce fruits with fully mature embryos and these fruits should not be allowed to dessicate (Janick and Moore 1996). Apricot seeds can be dried to 6% moisture, mazzard cherry to 9 to 11%, and mahaleb cherry to 8% for storage without impairing their germination (Suszka 1964). Seeds to be sown

or stratified immediately need not be dried at all. Seeds to be used within a few weeks or months should only be surface-dried; apparently, excessive drying of seeds to be used within a year of collection is often harmful (Grisez 1974; Huntzinger 1968). For storage of 1 year or more, it is desirable to reduce the moisture content of seeds below the surface-dry condition. For mazzard cherry, the optimum moisture content is 9 to 11%, with optimum temperatures of !1 to !3 EC for storage up to 3 years and !10 EC for longer storage (Suszka and others 1996). The results of several storage studies are reported in table 5. In most cases, drying is done at room temperatures or lower. Surface drying usually requires only a few hours (Huntzinger 1968). The moisture content of black cherry seeds has been reduced from about 14 to 5% by drying at 32 EC for 3 hours (Huntzinger 1971).

Sealed containers are preferred for *Prunus* seeds if the moisture content is to be closely controlled. Seeds of mazzard cherry were dried to a moisture content of 11% and stored in sealed bottles at 1 EC for 4 ½ years. During this period, viability decreased from 93% to 84% (Suszka 1970). Plastic bags have been satisfactory for storage of black cherry seeds for at least 3 years at cold temperatures (Huntzinger 1971). Cloth sacks may serve for short periods in cool temperatures (Suszka 1967). Maheleb cherry and myrobalan plum can be stored up to 2 winters at room temperature in jute sacks without loss of viability (Grzeskowiak and others 1983). Pin cherry seeds retained high viability after 10 years of storage at 1 to 3 EC under sealed conditions (Dirr and Heuser 1987).

Normally, storage temperatures should be within the range 0.6 to 5 EC, although American plum, mazzard cherry, and mahaleb cherry have been successfully stored at room temperatures for 2 to 5 years. American plum seeds can be stored at room temperature up to 30 months without loss of germinative capacity (Giersbach and Crocker 1932). Manchu cherry seeds stored for 21 months at room temperature did not lose viability (Dirr and Heuser 1987). Dried seeds of mazzard and mahaleb cherries and myrobalan plum can be stored up to 3 winters at !1 or !3 EC without significant loss of viability (Grzeskowiak and others 1983). Over 80% germination was obtained on black cherry seedlots containing 5% moisture after storage for 3 years in a freezer, but seedlots with about 15% moisture were completely spoiled when frozen (Huntzinger 1971).

Warm storage at a high moisture content for only a few months is harmful to seeds of mazzard cherry (Coe and Gerber 1934; Suszka 1967), black cherry (Huntzinger 1968), common chokecherry (Engstrom and Stoeckeler 1941), and probably other species as well. Black cherry seedlots should not be stored warm and moist more than 4 or 5 weeks, although about 2 weeks of such storage immediately after cleaning may be helpful for seeds about to be stratified (Huntzinger 1971).

Pregermination treatments and germination tests. *Prunus* seeds have embryo dormancy and require a period of after-ripening in the presence of moisture and oxygen to overcome it. Because of their stony endocarps, *Prunus* seeds are often been thought to have seedcoat dormancy. The endocarp may offer some resistance to germination, but it is permeable to water and *Prunus* is not truly hard-seeded (Hartman and Kester 1959; Heit 1967; Tukey 1924).

Several mechanical and chemical methods have been used in attempts to crack, remove, or soften the endocarp, including freezing, mechanical scarification, boiling water, sulphuric acid, citric acid, lye, or hydrogen peroxide. In most cases, no advantage could be shown, and in

many cases the treatments were detrimental. Peach seeds can be removed from the endocarp by applying pressure in the dorsal–ventral axis with a vise or special hand-clippers with a 2-sided blade (Janick and Moore 1996).

Removal of the endocarp by hand hastened or increased germination in American plum (Giersbach and Crocker 1932), almond (Gaudio and Pedone 1963), mazzard cherry (Zielinski 1958), sour cherry (Havis and Gilkeson 1949), peach (Crocker 1927, 1931), and sloe (Shumilina 1949). There was no advantage for bullace plum (Grisez 1974). Soaking for 48 hours in 0.1% citric acid resulted in 89% germination of black cherry; untreated seeds in this study germinated 57% (Jones 1963). In other studies, no advantage could be shown for citric acid treatments (Huntzinger 1968). Notching the endocarp and notching plus a hydrogen peroxide soak increased germination of an early-ripening mazzard cherry cultivar but had no effect on a late-ripening cultivar (Zielinski 1958). Gibberellin treatments apparently can substitute for a portion of the stratification period in apricot (Chao and Walker 1966), mazzard cherry (Fogle and McCrory 1960; Pillay 1962), garden plum (Janick and Moore 1996), and peach (Chao and Walker 1966), but it was effective only when the endocarp had been removed. Germination of mahaleb cherry seeds that were stored dry for several months was improved by 3 days of water-soaking prior to stratification (Swingle 1925).

Because good germination has been attained on stratified seeds of nearly all species of *Prunus* (table 6), it is evident that other pregermination treatments are not necessary if a seedlot is handled properly.

Although sand has often been used as a stratification medium, peat or sand–peat mixtures are preferred (Crocker 1930; Fogle and McCrory 1960; Huntzinger 1968; Shumilina 1949). Vermiculite was as good as peat in a test with black cherry seeds (Huntzinger 1971). Peat provides a larger and more constant supply of both air and water than sand (Crocker 1930; Shumilina 1949). The seeds are thoroughly mixed with the moist stratification medium. When peat is used, it should be soaked, then squeezed to remove all free water. The seeds should be mixed with about 1 to 3 times their volume of the medium (Crocker 1930; Grisez 1974; Huntzinger 1971). Seeds that had been dried for storage or those requiring a long period of after-ripening are sometimes stratified underground, in basements, or in shade prior to cold stratification or fall-sowing (Koreisho and Morozov 1955; Shumilina 1949).

Published results of experimental comparisons among various stratification temperatures for several species show that constant temperatures from 2 to 5 EC are more favorable than those below 1.7 EC or above 8 EC (Coe and Gerber 1934; Crocker 1931; Haut 1938). Seeley and Damavandy (1985) found that the optimum chilling temperature was between 4 and 6 EC for apricot, mazzard cherry, mahaleb cherry, and peach. The most suitable temperature for stratification of almond (cv. 'Truioto') with endocarp was 10 EC for 26 days (Therios 1982). A regularly alternating temperature range of 2 to 4 EC was better than constant 3 EC for 2 cultivars of mazzard cherry (Zielinski 1958).

Stratification periods necessary for after-ripening vary by species (table 6). In general, species and cultivars from warm climates require less chilling than those from cold climates. Satisfactory germination of the many cultivated species not included here can probably be attained by following general recommendations and the stratification requirements for closely related species of the same climatic zones.

Lockley (1980) stratified 13 open-pollinated families of common chokecherry for 10,

16, and 24 weeks at 3 EC and germinated the seeds at 3 alternating temperature regimes of 10 to 16 EC, 16 to 21 EC, and 21 to 27 EC. All germinating seeds were provided with 14 hours of light during the high-temperature portion of the cycle. Stratification for 10 weeks was inadequate. The best results, 77% germination on the average, were found with 16 weeks of stratification and germination at 21 to 27 EC. After 24 weeks of cold stratification, over 50% of the common chokecherry seeds germinated in stratification. There was a significant correlation ($r = 0.67$) between field emergence and laboratory germination at 16 to 21 EC and 21 to 27 EC when the seeds received 16 weeks of stratification. Common chokecherry families with low germination at 21 to 27 EC after 10 weeks of stratification were also low germinators in the nursery ($r = 0.68$).

In a comprehensive study on stones of 7 widely planted species of *Prunus* including several cultivars and seed sources, germination was much higher after warm plus cold stratification than after cold stratification only. The schedule was 14 days at 20 EC followed by 189 days at 3 EC (Suszka 1967). Seedlots of sloe given 2 weeks of warm stratification treatment followed by 18 weeks of chilling yielded 80% germination (Gordon and Rowe 1982). Myrobalan plum and garden plum germination was promoted by 2 weeks of warm stratification at 20 EC before chilling (Michalska and Suszka 1980b). Muller and others (1990) found that 3 cycles of warm and cold stratification at a moisture content of 30% improved the germination of mazzard cherry. Virtually full germination of Mazzard cherry seedlots was achieved with 2 weeks at 20 EC, 8 weeks at 3 EC, 2 weeks at 25 EC, then 3 EC for the remainder of the treatment (Michalska and Suszka 1980a).

To achieve germination greater than 90%, Seeley and Damavandy (1985) found that apricot seeds need 50 days of chilling; mazzard cherry seeds, 120 days; mahaleb cherry seeds, 100 days; and peach seeds, 90 days of chilling before germination. Zigas and Coombe (1977) reported that 10 weeks of stratification at 3 EC was enough time to remove any inhibitory properties of the testa of peach seeds. The best treatment reported for mazzard cherry seeds in Europe is alternating cold and warm stratification without medium, with seeds at 28 to 30% moisture: 2 weeks at 20 EC, 6 weeks at 3 EC, 2 weeks at 25 EC, 4 weeks at 3 EC, 2 weeks at 25 EC, then 11+ weeks at 3 EC, with the treatment ending when 40 to 50% of the seeds readily germinate at 3 EC (Suszka and others 1996).

Seeds usually are held in cold stratification until incipient germination occurs (Giersbach and Crocker 1932; Huntzinger 1968; Suszka 1967). Visible signs of incipient germination are split endocarps or emerging radicles. When the cold period was interrupted with warmer temperatures before these stages were reached, secondary dormancy was induced (Huntzinger 1971; Suszka 1967). Michalska (1982) reported a 10-week delay in root growth of mazzard cherry when a thermal induction treatment was interjected into a 3 EC chilling period. Root growth was activated only after 12 to 16 weeks of chilling at 3 EC. In a test by Suszka (1967), seedlots of mazzard cherry were stratified for 154 days at 3 EC and then separated into 3 fractions: intact seeds, cracked seeds, and those with emerging radicles. A sample of each fraction was sown separately at a depth of 1 cm (⅜ in) and subjected to a temperature of 20 EC. Epicotyls emerged from only 8% of the intact stones, but from 90% of the cracked seeds and from 95% of those with emerging radicles. The optimum temperature for epicotyl emergence from cracked seeds of European bird cherry, however, was between 5 and 10 EC (Suszka 1967). Seedlings have developed from up to 100% of cracked seeds of black cherry

after sowing (Defler 1937; Huntzinger 1971).

Maximum germination, as judged by the presence of radicles at least 3 mm long, was obtained at 3 or 5 EC on seeds of apricot, mazzard cherry, myrobalan plum, garden plum, mahaleb cherry, European bird cherry, and black cherry (Suszka 1967). For many other species in table 6, temperatures somewhat higher than 5 EC were used for germination. Information is not available, however, on the proportion of seeds that had started to germinate during the cold stratification period before the temperature was raised. The diurnally alternating temperatures of 30 and 20 EC specified for *Prunus* in the International Rules for Seed Testing (ISTA 1996) apparently are much too high. The Association of Official Seed Analysts (AOSA 1996) specify a germination temperature of 18 to 22 EC for mazzard cherry and peach. ISTA (1996) rules specify 90 to 120 days of chilling for mazzard cherry, European bird cherry, and black cherry. Germination is hypogeal in many species as (figure 3), but epigeal in common chokecherry (figure 4).

Viability tests are usually preferred over germination tests because of the long stratification time required to break dormancy of most species. The excised embryo procedure is recommended by both AOSA (1996) and ISTA (1996) for all species, and it has been commonly used on American plum, almond, apricot, peach, sloe, and both wild and cultivated cherries (Chao and Walker 1966; Heit 1955; Shumilina 1949; Tukey 1944). Once the seedcoats are removed, the seeds are placed on dampened blotter paper in a 20 EC germinator for 10 days. The embryos are viable when the radicles begin to grow or the cotyledons turn green or open up.

The seeds of *Prunus* species also are easily stained with tetrazolium chloride, and they usually have high viability (table 6). The viability percentage is highly correlated with field emergence. Tetrazolium staining is recommended as an alternative method for viability tests on all *Prunus* species (AOSA 1996; ISTA 1996). The seed should be cracked and a small piece of cotyledon removed at the distal end, then soaked for 18 hours at 20 EC. The seedcoat should then be removed before incubation in a 1.0% solution for 8 to 12 hours at 30 EC (or 12 to 18 hours in 0.5%). Large-seeded species may require longer staining times. To be considered viable, the radicle tip and 1/3 of the distal area of the cotyledons should be stained (ISTA 1996).

Nursery practice. Untreated *Prunus* seeds may be sown in the fall or stratified seeds may be sown in spring. Some species that require long periods for after-ripening are stratified warm and cool even before fall-sowing, or they may be planted as soon as collected (Al'benskii and Nikitin 1956; Grisez 1974; Koreisho and Morozov 1955). American and Chickasaw plums and common chokecherry seeds benefit from 30 days of warm stratification followed by 45 days of cold stratification before sowing (Huffman 1996). In fall-sowing, it is important to sow early enough to allow seeds to after-ripen before the ground freezes (Swingle 1925). Secondary dormancy can be induced in partially after-ripened seeds by high soil temperatures (Grzeskowiak and others 1983). Suszka (1978) recommends covering the nurserybed with 10 cm (4 in) of straw mulch. Seeds should be sown in early September, or by mid-October at the latest, in the northern states (Grisez 1974; Heit 1938; Heit 1967; Huntzinger 1971). Mulching and deeper sowing help overcome the effects of late sowing and dry climates.

Stratified seeds should be sown as early in spring as possible because high temperatures

and drying can reduce germination (Haut 1932; Huntzinger 1971; Koreisho and Morozov 1955; Suszka 1967). It is best if a high proportion of the seeds in the seedlot are cracked but have not yet begun radicle elongation (Koreisho and Morozzov 1955; Suszka 1964, 1967). Long radicles are easily broken in handling and sowing. For this reason, seeds should be checked toward the end of the stratification period for emerging radicles (Huntzinger 1968, 1971). Transparent containers are ideal for this purpose. If radicle elongation starts when it is too early to sow, the temperature should be reduced to near-freezing (Afanasiev 1942).

Normal precautions may be taken against fungi during stratification and sowing, but they do not appear necessary if seedlots are properly cleaned and handled. Rodents must be kept out of the nursery, however (Grisez 1974; Huntzinger 1971).

Prunus seedlings reach suitable planting size in 1 or 2 years. Low seedbed densities help assure adequate size the first year and reduce the proportion of culls (Grisez 1974; Stoeckeler and Jones 1957).

Seedlings may be planted 1 m (3 ft) apart in rows 3 to 4 m (10 to 13 ft) apart to produce 3,000 seedlings/ha (7,400 seedlings/ac) (Janick and Moore 1996). Seedlings that set terminal buds may be forced by gibberellin sprays or can be cut back to stimulate growth (Janick and Moore 1996). It has been observed in the nursery that apricot trees with large leaves and unbranched shoots are more likely to produce medium or large sized fruits, but plants with much branching, very thin shoots, and small leaves are likely to have small fruit and fruit at an older age (Janick and Moore 1996). Nursery practices that have been successful are listed in table 7.

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Table 1—*Prunus,* cherry, peach, and plum: nomenclature, growth habit, and occurrence

Scientific name & common synonyms	Common names	Growth habit	Occurrence
P. alleghaniensis **Porter**	**Allegheny plum,** sloe, Allegheny sloe, Porter plum	Tree or shrub	Connecticut to Pennsylvania & S in mtns to Georgia; also in Michigan
P. americana **Marsh.**	**American plum,** wild yellow plum, red plum, goose plum, hog plum	Tree or shrub	Massachusetts to Manitoba, New Mexico, central Texas & NW Florida
P. angustifolia **Marsh.**	**Chickasaw plum,** sand plum	Tree or shrub	Missouri, S Nebraska to NW Texas & Louisiana; naturalized E to central Florida, New Jersey, & Illinois
P. armeniaca **L.** *Armeniaca vulgaris* Lam.	**apricot**	Tree	W Asia; occasional escape from cultivation
P. avium **(L.) L.** *P. cerasus avium* L. *Cerasus avium* Moench	**mazzard cherry,** sweet cherry, gean,* bird cherry*	Tree	Europe & W Asia; naturalized locally in SE Canada & E US
P. caroliniana **(P. Mill.) Ait.**	**Carolina laurel cherry,** wild oraange	Tree (evergreen)	North Carolina to Texas
P. cerasifera **Ehrh.** *P. domestica* var. *myrobalan* L. *P. myrobalana* Loisel. *P. korolkowi* Vilm.	**myrobalan plum,*** cherry plum, marianna plum, flowering plum	Tree	W Asia; spread from cultivation from Washington to California, also in Michigan to Vermont, S to Ohio, New Jersey, & in Tennessee
P. cerasus **L.** *Cerasus vulgaris* Mill.	**sour cherry,** pie cherry	Tree	W Asia & SE Europe; naturalized locally from Nova Scotia & Michigan to N Florida & W-ward
P. domestica **L.** *P. damascena* Dierb. *P. communis* Huds.	**garden plum,** plum, European plum	Tree	W Asia & Europe; naturalized locally in SE Canada, NE US & Oregon
P. domestica **var. *insititia* (L.) Fiori & Paoletti** *P. domestica insititia* Fiori & Paoletti	**bullace plum,** damson, damson plum	Tree or shrub	W Asia & Europe; naturalized locally from Nova Scotia & Maine to New York SW-ward
P. dulcis **(P. Mill) D.A. Webber** *Prunus amygdalus* Batsch *Amygdalus dulcis* P. Mill. *P. communis* (L.) Arcang. *Amygdalus communis* L.	**almond**	Tree	West Asia & possibly North Africa; occasional escape from cultivation

***P. emarginata* (Dougl. ex Hook.) D. Dietr.** *P. mollis* Walpers *Cerasus prunifolia* Greene	**bitter cherry,** wild cherry, narrowleaf cherry	Shrub or tree	British Columbia to S California, Arizona, & Montana
***P. fasciculata* (Torr.) Gray**	**desert almond**	Shrub	California to Utah
***P. fremontii* S. Wats**	**desert apricot**	Shrub	S California
***P. gracilis* Engelm. & Gray**	**Oklahoma plum**	Shrub	Arkansas to Texas
***P. hortulana* Bailey**	**hortulan plum**	Tree	S Indiana to Iowa, Oklahoma, Arkansas, Alabama & W Tennessee
***P. ilicifolia* (Nutt. ex Hook & Arn.) D. Dietr.**	**hollyleaf cherry,** islay, evergreen cherry	Tree or shrub (evergreen)	Coast region, central to S California & in N Lower California, & Mexico
***P. laurocerasus* L.**	**laurel cherry,** cherry-laurel	Tree (evergreen)	SE Europe, SW Asia
***P. mahaleb* L.** *Cerasus mahaleb* Mill. perfumed cherry	**mahaleb cherry,** mahaleb, St. Lucie	Tree	W Asia & Europe; naturalized locally in SW Canada & NE US cherry,
***P. maritima* Marsh.**	**beach plum**	Shrub	Maine to Delaware
***P. munsoniana* W. Wight & Hedrick**	**wildgoose plum,** Munson plum	Tree or shrub	Kansas, Kentucky, Texas & N Mississippi; naturalized E to S Ohio & Georgia
***P. padus* L.** *P. racemosa* Lam. *Padus racemosa* (Lam.) Schneid. *Cerasus padus* (L.) DC.	**European bird cherry** mayday tree	Tree	Europe & N Asia to Korea & Japan; spread from cultivation in Canada & NE US
***P. pensylvanica* L. f.** *P. persicifolia* Desf. *P. montana* Marsh. *P. lanceolata* Willd.	**pin cherry,** fire cherry, wild red cherry, bird cherry	Tree or shrub	Newfoundland to British Columbia S to Colorado, South Dakota, Pennsylvania, & in mtns to Georgia
***P. persica* (L.) Batsch** *Amygdalus persica* L. *Persica vulgaris* Mill.	**peach,** common peach	Tree	China; naturalized locally, New England, S Ontario & Michigan to E Texas & Florida
***P. pumila* L.** *P. depressa* Pursh	**sand cherry**	Shrub	New Brunswick to Manitoba, Illinois, & New Jersey
***P. pumila* var. *besseyi* Bailey (Gleason)** *P. prunella* Daniels *P. pumila besseyi* (Bailey)	**Bessey cherry,** western sand cherry, Rocky Mountain cherry	Shrub	Manitoba to Wyoming S to Kansas & Colorado

Waugh. *P. susquehanae* Willd. *Cerasus canadensis* Mill.			
***P. serotina* Ehrh.** *P. virginiana* L. *Padus virginiana* (L.) Mill. *Padus serotina* Borkh.	**black cherry,** rum cherry, wild cherry wild black cherry,	Tree	Nova Scotia, S Ontario & Minnesota to E Nebraska, E Texas, & central Florida; also in Mexico & Guatemala
***P. spinosa* L.**	**sloe,** blackthorn	Shrub or tree & NE US	Europe, N Africa, & W Asia; naturalized locally in SE Canada
***P. subcordata* Benth.**	**Klamath plum,** Pacific plum, Sierra plum, western plum	Tree or shrub	W & S Oregon to central California
***P. tomentosa* Thunb.** *P. trichocarpa* Bge. *Cerasus tomentosa* Wall.	**Manchu cherry,** Nanking cherry downy cherry	Shrub	China, Japan, & Himalayas; central & N Great Plains
***P. umbellata* Ell.**	**hog plum**	Tree	North Carolina to Florida, Alabama, & Mississippi
***P. virginiana* L.** *P. nana* DuRoi *P. demissa* (Nutt.) D. Dietr. *Padus nana* (DuRoi) Borkh.	**common choke cherry**	Tree or shrub	Newfoundland to British Columbia, S to S California, New Mexico, Kansas, Illinois, Maryland, & S in mtns to Georgia

Source: Grisez (1974), Wasson (2001).
* Names commonly used for the wild form.

Table 2—*Prunus,* cherry, peach, and plum: phenology of flowering and fruiting

Species	Location	Flowering dates	Fruit ripening dates	Seed dispersal
P. alleghaniensis	Scattered	Late Apr–May	Aug–Sept	—
P. americana	—	Mar–May	June–Oct.	June–Oct
P. angustifolia	—	Mar–Apr	May–July	May–July
P. armeniaca	California	Feb–Mar	May–June	—
	Mar–Apr	July	July–Aug*	
P. avium	NE US	Apr–May	June–July	—
P. caroliniana	SE US	Mar–Apr	Sept–Oct	—
P. cerasifera	Geneva, NY	May 12†	July 15–Aug 10	—
	USSR	Apr–May	Aug	—
P. cerasus	—	Apr–May	June–July	—
	Geneva, NY	May 8–18†	June–July	—
P. domestica	Geneva, NY	May 12–21†	July 15–Oct 1	—
	USSR	May	Aug	—
P. domestica var. *insititia*				
	US & Canada	Late Apr–May	Aug–Sept	—
	Geneva, NY	May 16–21†	Aug 20–Oct 1	—
P. dulcis	California	Mid Feb–Mar	Late Aug–Oct*	—
P. emarginata	—	Apr–June	July–Sept	Aug–Sept*
P. hortulana	SE US	Mar–May	Aug–Oct	—
P. ilicifolia	—	Mar–May	Sept–Oct*	Oct–Dec
P. laurocerasus	SE Europe & Asia Minor	Apr–May	July–Aug	
P. mahaleb	NE US & SE Canada	Apr–May	July	—
P. maritima	Maine to Delaware	Apr–June	Sept–Oct	—
P. munsoniana	—	Mar–May	July–Sept*	—
	Geneva, NY	May 20–24†	July 15–Sept 10	—
P. padus	Philadelphia & vicinity	End Apr–early May	Late June–July	—
	USSR	May–early June	June–Aug	Aug*
P. pensylvanica	—	Late Mar–early July	July–Sept	—
	Warren Co., PA	May 1–15	Late July–early Aug	—
P. persica	NE US	Apr–May	July–Sept	—
	SE US	Feb–Apr	May–Aug	—
P. pumila—	May–July	July–Sept	—	
P. pumila var. *besseyi*				
	Nebraska	Apr–May	July–Sept	July–Sept
P. serotina	central Mississippi	Early Apr	June–July	July
	N Pennsylvania	Late May–early June	Late Aug–Sept	Aug 20–Sept; rarely Nov
	—	Late Apr–June 10	June–Sept.	July 1–Sept
P. spinosa	USSR	Apr–May	Aug–Sept	Sept
P. subcordata	—	Mar–May	Aug–Sept	—
P. tomentosa	Cheyenne, WY	Early May	Late July	Early Aug
	Bismarck, ND	May 10–15	July 10–15	July 15–Sept 1
P. umbellata	SE United States	Mar–Apr	Aug–Sept	—
P. virginiana	E US	Late Apr–early June	July–Oct	—
	Warren Co., PA	May 10–20	Early Aug	—
	California	—	Aug–Sept*	—

Sources: Altman and Dittmer (1962), Bailey (1976), Bonner (1975), Fernald (1950), Grisez (1974), Hedrick (1911), Hedrick (1915), Hitchcock and others (1961), Kester (1969), Koreisho and Morozov (1955), Long (1923),

McMinn (1959), Mirov and Kraebel (1937, 1939), Munz and Keck (1959), Pane (1966), Petrides (1958), Radford and others (1964), Rehder (1940), Sudworth (1908), Van Dersal (1938).

* Collecting dates.

† Average dates of height of bloom for one to several cultivars.

Table 3—*Prunus,* cherry, peach, and plum: height, seed-bearing age, seed crop frequency, fruit color, and fruit size

Species	Height at maturity (m)	Year first cultivated	Min seed-bearing age (yrs)	Interval between large crops(yrs)	Ripe fruit color	Fruit size (mm) Diameter	Length
P. alleghaniensis	4.9	1889	4	1	Dark purple	10	—
P. americana	3–9	1768	4	1–2	Red or yellowish	20–30	—
P. angustifolia	4.3–7.6	~ 1874	2	—	Red or yellow	10–20	—
P. armeniaca	10.4	Early	5	2	Yellowish with red	30+	—
P. avium	9–30.5	Early	6–7*	1	Yellow to red or Purplish black	20–25	—
P. caroliniana	5.5–12				Black	10–13	10–13
P. cerasifera	8.2	Early	3	2–3	Red	16–25	—
P. cerasus	9–15	Early	6-7*	1	Light to dark red	8–25	—
P. domestica	9–12	Early	5	—	Often blue-purple	30+	—
P. domestica var. *insititia*	6–7.6	Early	—	—	Yellow to bluish black	25+	15–20
P. dulcis	3–9	Early	4†,6–7	1	Brownish	30+	30–60
P. emarginata	1–15	1918	—	—	Bright red	8–12	—
P. fasciculata	1–2.4	—	—	—	—	13	
P. fremontii	1.5–3.7	—	—	—	Yellowish	15–20	13
P. gracilis	4.6	—	—	—	Red	13	—
P. hortulana	9	—	3	—	Red to yellow	25	—
P. ilicifolia	7.6–9	Pre-1925	3	—	Purple or black	13–17	25
P. laurocerasus	5.5	—	—	—	Purple to black	10	8–13
P. mahaleb	6–10	Early	3	1–2	Black	8–10	6–10
P. maritima	3	—	3	—	Purple	13–25	20
P. munsoniana	6–9	Pre-1909	3	—	Red or yellow	20–30	15–25
P. padus	15	Early	—	2	Black in typical variety	6–8	—
P. pensylvanica	3–12	1773	2	—	Light red	5–7	—
P. persica	3–7.6	Early	3	1–2	Yellow to red	30–60	30–75
P. pumila	0.3–2.4	1756	—	—	Purple-black	10	10
P. pumila var. *besseyi*	0.3–1.2	1892	2–3	—	Purple to black	15	—
P. serotina	15.3–33.5	1629	5	1–5	Black	7–10	6–10
P. spinosa	4	Early	—	1–2	Blue-black	10–15	15
P. subcordata	3–7.6	~ 1850	—	2	Red or yellow	20–30	15–30
P. tomentosa	1.8–3	1870	2–3	1–2	Red	10–31	15
P. umbellata	—	—	3	—	Black, red, yellow	10–15	10–13
P. virginiana	1.8–9	1724	—	—	Red-purple to dark purple	8	—

Sources: Bailey (1976), Everett (1957), Fernald (1950), Giersbach and Crocker (1932), Grisez (1974), Gysel and Lemien (1964), Hedrick (1911, 1915), Huntzinger (1971), Kester (1969), Koreisho and Morozov (1955), Munz and Keck (1959), Peck (1961), Petrides (1958), Rehder (1940), Strausbaugh and Core (1964), Van Dersal (1938).

* Minimum commercial seed-bearing age.

† Ages are for seedling stock; grafted or budded stocks bear seeds 1 or 2 years younger (Wright 1966).

Table 4—*Prunus,* cherry, peach, and plum: seed data

Species	Seed weight/45 kg (100 lb) of fruit: Range kg	Range lb	Average kg	Average lb	Cleaned seeds/weight: Range /kg	Range /lb	Average /kg	Average /lb	Samples
P. alleghaniensis	—	—	—	—	338	2,950	1		
*P. americana**	3–15	7–34	9	19	250–680	550–1,500	395	870	27+
P. angustifolia	4–14	8–30	7	16	350–694	770–1,530	467	1,030	14+
P. armeniaca, USA	14–18	30–40	—	—	91–254	200–560	144	317	10+
P. armeniaca, USSR	5–7	10–15	—	—	123–225	270–495	173	382	—
P. avium									
USA	3–11	7–25	3	12	658–1,361	1,450–3,000	1,070	2,360	9+
USSR	7–8	15–18	—	—	3,6166,108	1,640–2,770	4,740	2,150	—
P. cerasifera	—	5	10		355–603	782–1,330	451	994	7+
P. cerasus	—	—	9	20	685–1,815	1,510–4,000	1,320	2,910	6+
P. domestica	—	—	5	10	189–411	416–907	271	597	5+
P. domestica var. *insititia*	—	—	3	7	284–871	625–1,920	626	1,380	3+
P. dulcis	—	—	—	—	57–102	126–225	82	181	3+
P. emarginata	—	—	11	25	1,869–3,987	4,120–8,790	3,184	7,020	6+
P. ilicifolia	—	—	—	—	91–109	200–240	100	220	2+
P. mahaleb	9–11	20–25	—	—	2,177–2,540	4,800–5,600	2,359	5,200	—
P. munsoniana	—	—	—	—	408–1,016	900–2,240	767	1,690	3+
P. padus	—	—	9	20	2,994–5,580	6,600–12,300	4,042	8,910	5+
P. pensylvanica	7–12	16–27	—	—	3,629–9,889	8,000–21,800	6,442	14,200	6+
P. persica	—	—	9	20	33–111	72–244	71	156	6+
P. pumila									
typical	—	—	—	—	1,116–1,815	2,460–4,000	1,325	2,920	4+
var. *besseyi*	7–13	15–28	10	21	681–1,815	1,500–4,000	1,090	2,400	10+
P. serotina									
fresh seeds	—	—	9	20	1,270–2,740	2,800–6,040	1,923	4,240	68
fresh & stored seeds	6–15	14–33	10	21	1,288–6,260	2,840–13,800	2,436	5,370	197
P. spinosa	—	—	5	10	894–1,211	1,970–2,670	1,016	2,240	—
P. subcordata	—	—	—	—	204–286	450-631	252	556	4+
P. tomentosa	3–5	7–12	5	10	785–2903	1,730–6,400	2,150	4,740	9+
P. virginiana	8–11	18–25	9	20	1,315–3,810	3,010–8,400	2,173	4,790	19

Sources: Benjdl (1954), Cech and Kitzmiller (1968), Chittenden (1927), Cumming and others (1933), Defler (1937), Engstrom and Stoeckeler (1941), Everett (1957), Glazebrook (1941), Grisez (1974), Huntzinger (1971), King (1947), Koreisho and Morozov (1955), Krefting and Roe (1949), Krier (1948), Mirov and Kraebel (1937, 1939), Swingle (1939), USDA (1961), Van Dersal (1938).

Tables 5—*Prunus,* cherry, peach, and plum: germination of seeds after dry storage*

Species & storage period	Storage temp (EC)	Moisture content (%)	Germination (%)
P. americana			
18 months	7–10	Dry	70
53 months	7–10	Dry	45
18 months	Lab temp	Dry	72
53 months	Lab temp	Dry	16
18 months	30+	Dry	62
53 months	30+	Dry	0
P. avium			
7 years	!5	~10?	91–97
15 years	!5	~10?	98
55 months	1	11	84
55 months	1	11	88†
8-12 months	3	9–11	98–100
207 days	!3	8.6	100*
214 days	!3	9.0	99†
570 days	!3	8.6	100†
571 days	!3	9.5	94†
935 days	!1	8.3	99†
213 days	!3	9.0	99†
214 days	!3	8.9	98†
568 days	!3	8.6	100†
P. pensylvanica			
2 months	!18	Dry	95
6 years	1–3	Low	74
10 years	1–3	Low	76
P. serotina			
1 year	!18 to !14	4–6	52
2 years	!18 to !14	4–6	81
3 years	!18 to !14	4–6	81
5 years	!18 to !14	4–6	47
8 years	!18 to !14	4–6	66
1 year	!18 to !14	11–13	4
2 years	!18 to !14	11–13	7
3 years	!18 to !14	11–13	1
5 years	!18 to !14	11–13	4
8 years	!18 to !14	11–13	0
1 year	0.5–5	4–6	63
2 years	0.5–5	4–6	81
3 years	0.5–5	4–6	90
8 years	0.5–5	4–6	56
1 year	0.5–5	11–13	72
2 years	0.5–5	11–13	88
3 years	0.5–5	11–13	77
5 years	0.5–5	11–13	0
8 years	0.5–5	11–13	0

5 years 0.5–5

Sources: Ellis and Hong (1986), Giersbach and Crocker (1932), Grisez (1976), Heit (1967), Huntzinger (1971), Laidlaw (1983), Michalska and Suszka (1980c&d), Solovieva (1966, 1978), Suszka (1970).

† Viability determined by indigo carmine embryo staining test (2 hours in 0.05% solution at 20 EC).

Table 6—*Prunus,* cherry, peach, and plum: stratification periods, germination test conditions, and results

Species	Recommended stratification (days) Warm*	Cold†	Germ. test conditions Temp (EC) Day	Night	Days	Avg germination (%)	Samples	Viability (%)
P. alleghaniensis	0	150	10	10	60	25	7	—
P. americana	0	90–150	10	10	60	60	21	74
P. angustifolia	0	60–120	—	—	60	55	—	90
P. armeniaca								
endocarp removed	0	0	—	7	7	14	90	3
endocarp intact	14	189	3	3	‡	95	—	4
endocarp intact	0	80–90	5	5	‡	95	—	—
P. avium								
endocarp removed	0	90–125	21	21	—	91	—	69
endocarp intact	0	120–180	21	21	—	76	10+	—
endocarp intact	14	189	3	3	‡	88	—	—
P. caroliana	0	30–60	—	—	—	—	—	—
P. cerasifera	—	196	!1	!7	28	65	2	—
P. cerasus	0	90–150	—	—	—	—	82	—
P. domestica	14	189	3	3	‡	56	15	—
	0	120–150	—	—	—	—	85	—
P. domestica	0	90	2	2	—	—	91	—
P. domestica var. *insititia*	0	84–112	18	18	—	89	7	—
P. dulcis	0	65	2	2	‡	—	90	—
P. emarginata	0	90–126	24	24	60	4	3+	—
P. ilicifolia								
fresh seed	0	0	—	—	—	—	—	—
stored seed	0	90	—	—	—	—	24	—
P. laurocerasus	0	60–90	—	—	—	—	—	—
P. mahaleb	0	80–100	—	—	—	89	5	—
	14	189	3	3	‡	55	3	—
P. maritima	0	90	—	—	—	—	39	—
P. munsoniana	0	80–100	—	—	—	100	10 seeds	—
P. padus								
fresh seed	0	100–120	—	—	—	85	—	—
stored seed	14	210	3	3	‡	50	3	—
P. pensylvanica	60	90	25	10	60	62	2	91
P. persica								
endocarp intact	0	98–105	5(§41)	5(§41)	‡	32	8	—
endocarp removed	0	70–105	5(§41)	5(§41)	‡	82	8	92
P. pumila var. *besseyi*	0	120	—	—	—	60	72	—
P. serotina	0	120	26	10	40–60	86	32	80
	14	189	3	3	‡	90	3	—
P. spinosa	0	170	—	—	—	—	90	—
P. subcordata	0	90	—	—	100	1	—	—
P. tomentosa	0	60–90	—	—	—	2	—	86
P. virginiana	0	120–160	25	10	40	77	3	62

Sources: Afanasiev (1940, 1942), Al'benshkii and Nikitin (1956), Chadwick (1935), Chao and Walker (1966), Coe and Gerber (934) Crocker (1927, 1931), Defler (1937), Dirr and Heuser (1987), Emery (1964), Engstrom and Stoeckeler (1941), Everett (1957), Fogle (1958), Fogle and McCrory (1960), Glazebrook (1941), Giersbach and

Crocker (1932), Grisez (1974), Haut (1932, 1938), Havis and Gilkeson (1949), Hesse and Kester (1955), Heit (1938), Kester (1969), Koreisho and Morozov (1955), Krefting and Roe (1949), Morov and Kraebel (1937), Pollock (1959), Probocskal (1963), Roe (1941), Suszka (1964, 1967), Swingle (1939), Tukey (1924), USDA (1961).

* Seeds were in a moist medium at a constant temperature of 20 EC or at a temperature alternating diurnally from 30 EC (8 hours) to 20 EC (16 hours).
† Seeds were in a moist medium at a temperature between 0.6 EC and 5 EC; 2.8 to 5 EC was better.
‡ Germination occurred during the stratification period.
§ Results were similar at 10 EC.
2 Adequate germination was reported at unspecified temperatures.

Table 7—*Prunus,* cherry, peach, and plum: nursery practice

Species	Stratification periods* (days) Fall-sowing	Spring-sowing	Seeds sown/ft^2	Sowing depth (in)	Tree %	Outplanting age (yr)
P. americana	0–90	120	4	1–2†	33–50	1
P. angustifolia	0	15–20	1	33	1	—
P. armeniaca	0	90	9	2	50	1
P. avium	60‡	120	13	1–2	—	1 or 2
P. cerasifera	0‡	—	10	2	64§	1
P. cerasus	90‡	90	21	—	—	1 or 2
P. domestica	0	—	13	2	—	1 or 2
P. mahaleb	0–60	60	—	1–2	45§	—
P. padus	60‡	120	50	½–12	—	1 or 2
P. persica	0	85	0.75	2	—	—
P. pumila var. *besseyi*	0	120	6–7	—	77	—
P. serotina	0	120	1–0	½–22	7–83	1
P. spinosa	0‡	170	17–28	1–2	70–75§	1 or 2
P. tomentosa	0	60	15–30	12	72	1
P. virginiana	0	120–160	25	½	3–34	1 or 2

Sources: Afanasijev (1962), Al'benskii and Nikitin (1956), Bailey (1969), Bejdl (1954), Engstrom and Stoeckeler (1941), Grisez (1974), Heit (1938, 1967), Huntzinger (1971), Koreisho and Morozov (1955), Nyholm (1951), Rudolf (1961), Schaaf (1938, 1940), Shoemaker and Teskey (1959), Shumilina (1940, 1949), Stoeckeler and Jones (1957), Swingle (1939), Talbert (1946).

* Stratified in a moist medium at a temperature between 2.8 and 5 EC.

† Add a 10 to 15 cm (4- to 6-in) soil ridge to the nursery bed.

‡ Or stratify from time of collection to time of sowing when fresh seeds are used.

§ Germination percent (not tree percent).

2 On fall-sown beds, add ~8 cm (3 in) of straw or moss for a mulch.