

PROPAGATING DECIDUOUS AND EVERGREEN SHRUBS, TREES, AND VINES WITH STEM CUTTINGS



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**F. E. LARSEN, Professor of
Horticulture, and W. E. GUSE,
Teaching Assistant in
Horticulture**

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Deciduous plants lose their leaves each fall and are without leaves during the winter. Evergreen plants normally do not lose all their leaves at once and retain individual leaves for several years. Both types of plants have woody stems and are represented by many common shrubs and trees.

Cuttings are detached vegetative plant parts that will develop into complete new plants by reproducing their missing parts. Cuttings might be made from stems, roots, or leaves, depending on the best method for each plant.

Many deciduous plants, such as forsythia, honeysuckle, grape, currant, willow, and poplar, can be propagated from stem cuttings. Many evergreens, both broad- and narrow-leaved, also can be propagated this way. Narrow-leaved (called needles) evergreens, such as low-growing juniper, arborvitae, and false cypress, root readily from cuttings. Broad-

leaved evergreens—as camellia euonymus, and cherry laurel—are easily propagated in this way. This publication discusses propagating these types of plants from stem cuttings.

Types of Cuttings

Make cuttings of deciduous plants from stem sections or tips one year old or less. Choose stem tips to propagate evergreens. The basal part of a cutting is sometimes older wood.

Tip cuttings probably are the most common type for use with deciduous plants during the growing season; they generally do not give the best results at any other part of the year. The tip section of a shoot is more subject to winter cold damage, may have flower buds rather than shoot buds, and may not have the proper internal nutritional and hormonal balance for good rooting during the dormant season. Simple or straight cuttings, starting 8 to 10 inches from the shoot tip, are usually more satisfactory for dormant cuttings.

Tip cuttings are most common for evergreen plants and generally give satisfactory results. Cut them about 4 to 10 inches long from stem tips, using stems one year or less in age. Make tip cuttings from the main shoot or long side branches. Large cuttings produce a usable plant in shorter time than small cuttings but may require more care while rooting.

Simple or straight cuttings from long, one-year-old shoots can be cut into sections. This is the most common type of cutting for propagating leafless (dormant) cuttings of deciduous plants. It might occasionally be used for broad-leaved evergreens.

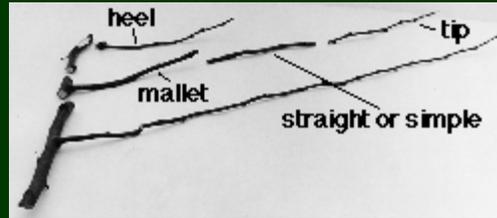
Heel cuttings are made from side shoots produced on stems two or more years old. To make the cuttings, pull the side shoots from the main stem. Pull directly away from the tip end of the main stem. This usually leaves a heel of older, main-stem tissue attached to the basal end of the side shoot. The heel cutting also can be cut from the main stem with a knife.

Mallet cuttings, similar to heel cuttings, include a complete cross-section of the older, main stem at the base of the side shoot. Use a knife or a pair of small pruning shears to make this cut.

Some evergreens may root better from heel or mallet cuttings because these plants normally develop root primordia (specialized cells that develop into roots) in older stems. These root primordia remain dormant until the stem bends naturally to the moist soil or until the stem is cut from the plant and placed in a rooting medium. Some deciduous plants also produce root primordia.



Several types of hardwood cuttings made from a narrow-leaved evergreen plant—cuttings also might be made from very long side shoots.



Several types of hardwood cuttings made from a deciduous plant

Factors that Affect Rooting

Time of year cuttings are taken may affect rooting considerably. Expect best results from cuttings of many deciduous plants taken from late fall to early winter before enough cold weather occurs to complete the rest requirements of the leaf buds. This allows the cutting to be rooted under warm conditions without development of leaves. After rooting has started, however, the cuttings must be subjected to cold temperatures according to individual plant requirements. Some deciduous plants only can be rooted from leafy softwood or semi-hardwood cuttings taken during the growing season. Others root readily almost any time of the year.

Expect best results from cuttings of many narrow-leaved evergreens taken from late fall to late winter. Exposure of the mother or stock plant to cold temperatures prior to taking the cuttings stimulates rooting. But cuttings of broad-leaved evergreen plants usually root best if you take them during the growing season after a flush of growth, when the wood is partially matured. Some plants root readily almost any time of the year.

Softwood cuttings are taken during the growing season from new growth that has not matured or hardened significantly. When the wood is partially matured, they are called semi-hardwood cuttings. Those taken during the subsequent dormant season when the wood is mature and hardened or from wood older than one year are called hardwood cuttings.

Age of stock plant may be an important factor with hard-to-root plants. Cuttings from young seedling plants may root better than cuttings from older plants. Chances of rooting cuttings from large, old trees or shrubs may not be very good unless they are easy-to-root types.

Physical condition of the stock will affect the rooting of cuttings. Cuttings taken during the growing season from rapidly growing, succulent shoots often root poorly. Instead, take cuttings after growth has stopped and the wood has begun to harden; otherwise, many may rot. Shoots that have grown very little also root poorly. Neither type of shoot has the optimum physical condition and nutritional balance for the best rooting.

Too much or too little fertilizer on the stock plants may hinder rooting ability of the cuttings as it affects growth and the internal nutritional balance. Because of better physical condition and nutritional balance, lateral shoots may root better than terminal shoots from the same plant. Likewise, where a very long shoot can be made into several cuttings, sections from the central part of the shoot may root better than those from either end.

Shoots with flower buds or flowers may not root as well as shoots that are strictly vegetative in some hard-to-root plants. Removal of flower buds sometimes helps rooting.

Take cuttings only from healthy plants, free of insect, disease, or nutritional disorders.

Wounding the basal end of the cutting often stimulates rooting of such evergreen plants as rhododendrons and junipers, especially if the cutting has older wood at its base. Use the tip of a sharp knife to make a 1- to 2-inch vertical cut down each side of the base of the cutting. Stripping off the lower side branches of the cutting during its preparation also can be considered slight wounding. For more severe wounding on difficult-to-root types or larger-diameter cuttings, make several vertical cuts. Or remove a thin slice of bark down one or both sides of the base of the cutting. Expose the cambium (the one or two layers of cells between the bark and the wood), but avoid cutting deeply into the wood.

Wounding may stimulate rooting by promoting cell division and more absorption of water or applied root-promoting chemicals, or it may remove tough tissue that prevents outward root growth from the cutting. Wounding is used most often on evergreen plants, but it may be useful on deciduous plants.

The rooting medium provides physical support, oxygen, and water. Many types of media are available, but sand, perlite, peat, or mixtures of any of the three are most common. Very fine gravel sometimes is used.

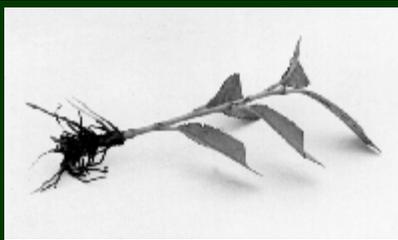
The rooting medium may affect the success of rooting and quality of the root system produced. When rooted in sand, cuttings of some plants produce long, unbranched, brittle root systems. When rooted in mixtures of sand and peat, the roots are slender, branched, and flexible. Differences in the air- and water-holding capacity of various media produce these effects. The container used for rooting may influence these responses if drainage is not adequate in the container bottom to prevent waterlogging.

Wounding a narrow-leaved evergreen cutting by slicing or scraping a thin layer of bark from the base of the cutting.



If evergreen cuttings or leafy softwood or semi-hardwood cuttings of deciduous plants are to be rooted, make sure both container and rooting medium are free of decay organisms prior to use by heating in an oven. A temperature of 140°F for 30 minutes in the center of the rooting medium is sufficient. Also take this precaution with hardwood cuttings of difficult-to-root deciduous plants that will be in the rooting medium for long periods. If new perlite is the rooting medium, it will usually be sterile and require no heat treatment, but be sure the containers for holding the medium are clean.

Leaves on evergreen cuttings and leafy cuttings of deciduous plants promote root formation through their production of growth-promoting hormones and food materials (carbohydrates). Keep as large a leaf surface as possible on the cuttings. There are disadvantages to this procedure, however. One is the space required to root some broadleaved evergreen cuttings with large leaves. In such cases, commercial propagators sometimes clip off one-third to one-half of the tips of large leaves. Another problem is that leaves lose water through transpiration. Excessive loss will interfere with root formation or cause the cutting to die. Take precautions to reduce water loss. If leaves form too early on hardwood cuttings of deciduous plants, they may encourage excessive moisture loss and cause the cutting to die.



A rooted cutting of a broad-leaved evergreen plant—surface was reduced to save space in the cutting bed by removal of about one-third of the leaf tips.

Water is necessary to the life of the cutting. A cutting has no root system to absorb water, yet water loss continues through the leaves. The base of unrooted cuttings can absorb small amounts of water, but this usually will not be enough to keep the cutting alive and healthy. Commercial growers use an intermittent mist system to apply a fine

mist over the cuttings and maintain a continuous film of water on the leaves. The moisture lowers the leaf temperature, creates a humid atmosphere, and reduces water loss through transpiration.

Most amateurs will not have a mist system available. However, you can obtain a similar effect by covering the propagation box with glass or plastic. This will keep the air humid, although the cooling effect provided by mist will not be created. Do not expose the cuttings to direct sunlight, because the temperature inside the enclosure will become too high. It may be helpful to syringe the cuttings daily with a spray bottle. Keep the rooting medium moist (not waterlogged), and provide drainage in the bottom of the rooting medium container.

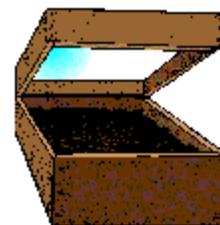
Deciduous hardwood cuttings often can be rooted without mist or even the protection of a covered propagation box, unless they take a long time to root, and leaves develop from dormant buds.

Light is important in rooting leafy cuttings. It is necessary for production of plant hormones or auxins, which stimulate rooting, and for photosynthesis, which provides the energy to form the new tissues that become shoots and roots. However, unless leafy cuttings are misted or the surrounding air is cooled, keep them out of direct sunlight. Hardwood cuttings of deciduous plants often root best in the dark, unless they require a long time to root, allowing leaves to develop from dormant buds.

Temperature must be controlled for optimum rooting. A desirable temperature encourages root formation but does not cause excessive moisture loss. Most leafy cuttings do best with air temperatures of about 60° to 65°F. Additional heat, 5 to 10 degrees higher than the air temperature and applied to the rooting medium, encourages rooting. Heating coils often are used beneath the rooting medium in the propagating bench to provide this effect.

Hardwood cuttings of some difficult-to-root deciduous plants will root best if taken in late fall and placed in a moist medium. Keep the medium temperature at 60° to 70°F until roots have been initiated but are only barely noticeable on the outside of the cutting. Then lower the temperature of the air and storage or rooting medium to about 40°F to complete the required cold (rest) period of the buds and hold back further root growth. Cuttings handled in this way are often tied in bundles keeping the basal ends all in the same direction. Plunge the bundle into the rooting or storage medium. When the root initiation and storage period are over, untie the bundles and plant the cuttings individually, usually outside in a closely spaced nursery row.

A simple propagation chamber can be made from two boxes. Top box has glass cover to admit light (cover could also be of plexiglass). When closed, interior of box becomes humid, giving effect similar to mist chamber. Provide drainage in bottom box to prevent waterlogging. For small number of cuttings, same effect can be obtained by putting plastic bag over a flower pot.



Hormones or plant auxins are commonly used to promote rooting of cuttings. Auxins are compounds that occur naturally in plants. Some have been synthetically produced and are available to plant propagators. They increase the rooting percentage of many hard-to-root plants. They also may shorten the time for rooting and improve root quality and quantity. Cuttings of most plants will benefit from the use of auxins, although some hardwood cuttings from deciduous plants may show little effect. Hormones or auxins are an aid to rooting and should not be considered a substitute for good technique.

Naphthaleneacetic acid (NAA) and indolebutyric acid (IBA) are the compounds most commonly used to promote rooting of cuttings. Both are available as solutions or powders and are often used in combination. The powders are the most practical for the amateur because they are diluted with talc to concentrations that will not harm the cuttings and because they are easy to use. Two common commercial root-promoting preparations often available at local nursery, garden, or variety stores are Rootone and Hormodin.

Plant species may influence rooting. Many deciduous and evergreen plants are propagated from hardwood cuttings, but they vary considerably in ease of rooting. Honeysuckle, currant, grape, and willow root readily. Apple and pear are more difficult, while cherry and lilac are usually very difficult to root using hardwood cuttings.

Among evergreen plants, false cypress, arborvitae, and low-growing juniper generally root readily. Yew roots fairly well. The upright junipers, spruces, and hemlocks are difficult to root. Cuttings of firs and pines usually are very difficult to root.

Considerable variation exists among species within these groups. Even genetic variability from plant to plant may give differences among plants of the same type.

Procedures for Making and Handling Cuttings

Evergreen and leafy deciduous cuttings

Remove from the parent plant a portion of stem 4 to 8 inches long with the leaves attached. For most deciduous plants, a tip, simple, or straight cutting will suffice. For most evergreen plants, use tip or heel cuttings. Snip off leaves (or needles) which would contact the rooting medium (the bottom 1½ to 2 inches of stem) to prevent rotting of these leaves. The remaining leaves will continue to produce substances that aid in root formation on the cutting. If hardwood cuttings of evergreen plants are used, wound the base of the cutting using one of the methods

described. Use the more severe methods of wounding for harder-to-root types.

Spread a small amount of auxin compound on waxed paper or in a clean dish. Dip the base (cut end) of the cutting in the powder so that some adheres to the cut surface and wounded areas. Discard leftover powder to prevent contamination. Talc preparations lose their effectiveness after about eight months, even if kept in a closed container and refrigerated.

Make a hole in the rooting medium so that the powder is not scraped off when you insert the cutting. Insert the base of the cutting into the prepared hole in the rooting medium. If bottom heat is used, insert the base of the cutting nearly to the bottom of the container so that it is close to the heat source. Firm the rooting medium around the base of each cutting. After all cuttings are inserted and firmed in place, apply sufficient water to the rooting medium to settle it around the cuttings. This "watering-in" procedure will leave the rooting medium in close contact with the base of each cutting.

Place the cover over the propagation box or container. Inspect the cuttings daily and remove any leaves which fall. Syringe the tops of the cuttings, and keep the rooting medium moist. When the cuttings resist a slight tug and begin to feel anchored, they are beginning to root. Some types may require 2 to 3 months or more to form sufficient roots to allow removal from the rooting medium.

When the cuttings have two or three roots about one-half inch long, place them in pots about 4 inches in diameter. Use a good potting soil. Since the cuttings have been accustomed to the humid atmosphere of the propagating box (or mist, if used), accustom them to the "outside" atmosphere by gradually aerating the propagation box (or reducing the mist) before potting. Another way is to cover the potted cutting with perforated plastic film for about a week after potting. This is called "hardening off."

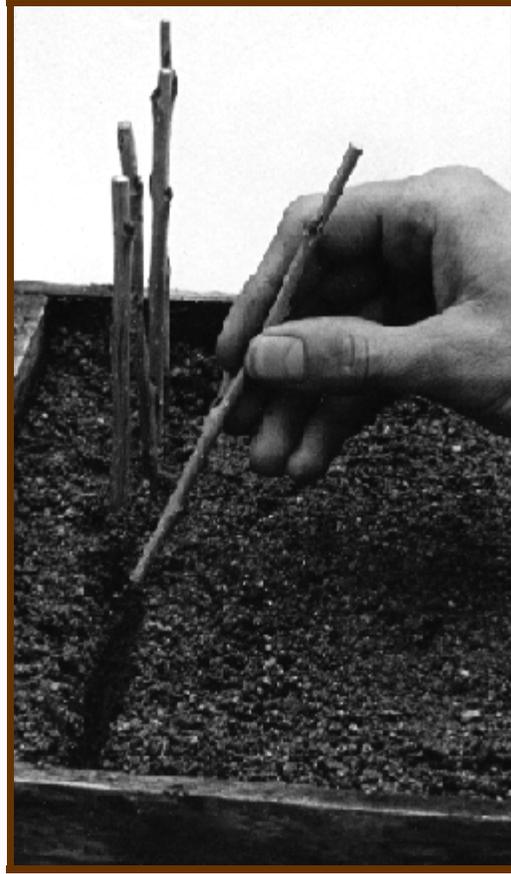
After potting, do not expose the cuttings to direct sunlight or temperature extremes until they have had several weeks to become accustomed to outdoor conditions.

Hardwood cuttings of deciduous plants

These cuttings may not need a covered propagation box or mist unless they require a long time to root, during which leaves develop from dormant buds. Easy-to-root types can be taken in the fall and rooted outdoors in the soil in mild climates, or they can be taken in the spring if winters are cold. Take difficult-to-root types in late fall. They will require treatment in a moist, warm rooting medium as described earlier until rooting begins. Follow by holding in cool, moist storage until spring weather allows outdoor planting. Wounding and treatment with root-promoting chemicals may be of value.



Tip and straight cuttings taken from a one-year whip of a deciduous plant



Sticking cutting in a rooting medium



Making a heel cut



Treating the basal end of a simple or straight cutting with a root-promoting chemical in powder form



Rooted hardwood cuttings of deciduous plants—and leaves developed while rooting occurred

Selected Evergreen Plants that Might Be Propagated from Stem Cuttings*

Plant Name	Favorable Time To Take Cuttings	Kind of Cutting+	Rooting Success Expected
Arboratae, <i>Thuja occidentalis</i>	summer or	semi-hardwood	high

(American) <i>Thuja orientalis</i> (Oriental)	winter late spring	hardwood softwood	low
Azalea, <i>Rhododendron</i> spp.	summer	semi-hardwood	moderate to high
Barberry, <i>Berberis</i> spp.	summer or fall	softwood, hardwood	moderate to high
Boxwood, <i>Buxus</i> spp.	spring, summer, fall	softwood or semi-hardwood	high
Camellia, <i>Camellia</i> spp.	summer	semi-hardwood	moderate to high
Cedar, <i>Cedrus</i> spp.	late summer or fall	semi-hardwood	low
Chamaecyparis (False Cypress), <i>Chamaecyparis</i> spp.	late fall or winter	hardwood	moderate to high
Cryptomeria, <i>Cryptomeria japonica</i>	summer	semi-hardwood	slow to root
Daphne, <i>Daphne</i> spp.	summer	semi-hardwood	moderate
Euonymus, <i>Euonymus</i> spp.	summer	semi-hardwood	high
Fir, <i>Abies</i> spp.	winter	hardwood	low
Heath, <i>Erica</i> spp.	summer or winter	semi-hardwood, hardwood	high
Heather, <i>Calluna</i> <i>vulgaris</i>	summer or winter	semi-hardwood, hardwood	high
Hemlock, <i>Tsuga</i> spp.	fall or winter	semi-hardwood, hardwood	low
Holly, <i>Ilex</i> spp.	summer or winter	semi-hardwood, hardwood	moderate to high
Ivy, <i>Hedera helix</i>	summer	semi-hardwood	high
Juniper, <i>Juniperus</i> spp.	summer or winter	semi-hardwood, hardwood	Upright types may root poorly
Laurel (Cherry), <i>Prunus laurocerasus</i>	summer or winter	semi-hardwood, hardwood	high
Laurel (Mountain), <i>Kalmia latifolia</i>	winter	hardwood	low
Madrone (Pacific), <i>Arbutus menziesii</i>	fall	semi-hardwood	moderate
Magnolia, <i>Magnolia</i> spp.	summer	softwood, semi- hardwood	moderate to high
Oleander, <i>Nerium</i> <i>oleander</i>	summer	semi-hardwood	high
Oregon Grape, <i>Mahonia aquifolium</i>	summer	semi-hardwood	moderate to high
Pachistima, <i>Pachistima canbyi</i>	summer	softwood	moderate to high
Pachysandra			

(Spurge), <i>Pachysandra terminalis</i>	summer	semi-hardwood	high
Pieris, <i>Pieris</i> spp.	summer	semi-hardwood	moderate to high
Pine, <i>Pinus</i> spp.	winter	hardwood	low
Privet, <i>Ligustrum</i> spp.	summer or winter	softwood, hardwood	low to high
Pyracantha, <i>Pyracantha</i> spp.	summer	semi-hardwood	high
Rhododendron, <i>Rhododendron</i> spp.	summer	softwood, semi-hardwood	low to high
Spruce, <i>Picea</i> spp.	winter	hardwood	low
Viburnum, <i>Viburnum</i> spp.	summer	semi-hardwood	moderate to high
Yew, <i>Taxus</i> spp.	fall or winter	semi-hardwood, hardwood	moderate

*Some plants listed also have closely related deciduous types which might be handled differently.
+Good results can usually be obtained with tip cuttings of most evergreen plants. The use of heel or mallet cuttings might be desirable with juniper and yew.

Selected Deciduous Plants that Might Be Propagated from Stem Cuttings*

Plant Name	Favorable Time To Take Cuttings	Kind of Cutting+	Rooting Success Expected
Alder, <i>Alnus</i> spp.	winter	hardwood	
Azalea, <i>Rhododendron</i> spp.	summer	softwood	some may root poorly
Barberry, <i>Berberis</i> spp.	summer or winter	softwood, semi-hardwood hardwood	
Bittersweet, <i>Celastrus</i> spp.	summer or winter	softwood, semi-hardwood hardwood	
Blueberry, <i>Vaccinium</i> spp.	summer or winter	softwood, hardwood	
Boston Ivy, <i>Parthenocissus tricuspidata</i>	summer or winter	softwood, hardwood	
Bottlebrush, <i>Callistemon</i> spp.	summer	semi-hardwood	

Boxwood, <i>Buxus</i> spp.	summer or winter	softwood, semi-hardwood hardwood	
Broom, <i>Cytisus</i> spp.	summer or winter	semi-hardwood, hardwood	
Butterfly Bush, <i>Buddleia</i> spp.	summer	softwood, semi-hardwood	
Catalpa, <i>Catalpa</i> spp.	summer	softwood	
Ceanothus, <i>Ceanothus</i> spp.	summer or winter	softwood, semi-hardwood hardwood	
Cherry, <i>Prunus</i> spp.	summer	softwood, semi-hardwood	some may root poorly
Clematis, <i>Clematis</i> spp.	summer	softwood, semi-hardwood	
Cotoneaster, <i>Cotoneaster</i> spp.	summer	softwood, semi-hardwood	
Crab Apple, <i>Malus</i> spp.	summer, late fall	softwood, semi-hardwood hardwood	some may root poorly
Currant, <i>Ribes</i> spp.	summer or winter	softwood, hardwood	
Deutzia, <i>Deutzia</i> spp.	summer or winter	softwood, hardwood	
Dogwood, <i>Cornus</i> spp.	summer	softwood, semi-hardwood	some may root poorly
Elderberry, <i>Sambucus</i> spp.	summer	softwood	
Elm, <i>Ulmus</i> spp.	summer	softwood	
Euonymus (Spindle Tree), <i>Euonymus</i> spp.	winter	hardwood	
Forsythia, <i>Forsythia</i> spp.	summer or winter	softwood, hardwood	
Fringe Tree, <i>Chionanthus</i> spp.	summer	softwood	some may root poorly
Ginkgo (Maidenhair), <i>Ginkgo biloba</i>	summer	softwood	
Goldenrain tree, <i>Koelreuteria</i> spp.	summer	softwood	some may root poorly
Grape, <i>Vitis</i> spp.	summer or winter	softwood, hardwood	
Hawthorn, <i>Crataegus</i> spp.	summer or winter	softwood, hardwood	
Hibiscus (Rose Mallow), <i>Hibiscus</i> spp.	summer or winter	softwood, semi-hardwood, hardwood	
Honey Locust, <i>Gleditsia triacanthos</i>	winter	hardwood	
Honeysuckle, <i>Lonicera</i> spp.	summer or winter	softwood, hardwood	
Hydrangea, <i>Hydrangea</i> spp.	summer or winter	softwood, hardwood	

Jasmine, <i>Jasminum</i> spp.	summer or winter	semi-hardwood, hardwood	
Lilac, <i>Syringa vulgaris</i>	summer	softwood	some may root poorly
Locust (Black), <i>Robinia pseudoacacia</i>	summer	semi-hardwood	
Maple, <i>Acer</i> spp.	summer	softwood	some may root poorly
Mock Orange, <i>Philadelphus</i> spp.	summer or winter	softwood, hardwood	
Magnolia, <i>Magnolia</i> spp.	summer	softwood, semi-hardwood	
Mulberry, <i>Morus alba</i>	summer	softwood	
Peach, <i>Prunus</i> spp.	summer	softwood, semi-hardwood	
Pear, <i>Pyrus</i> spp.	late fall	hardwood	some may root poorly
Plum, <i>Prunus</i> spp.	summer	softwood, semi-hardwood	
Poplar, <i>Populus</i> spp.	summer or winter	softwood, hardwood	
Quince (Flowering), <i>Chaenomeles</i> spp.	summer or winter	semi-hardwood, hardwood	
Redbud, <i>Cercis</i> spp.	summer	softwood	some may root poorly
Rose, <i>Rosa</i> spp.	summer or winter	softwood, semi-hardwood hardwood	
Russian Olive, <i>Elaeagnus angustifolia</i>	winter	hardwood	
St.-John's-Wort, <i>Hypericum</i> spp.	winter	semi-hardwood	
Serviceberry, <i>Amelanchier alnifolia</i>	summer	softwood	
Smoke Tree, <i>Cotinus coggygia</i>	summer	softwood	
Snowberry, <i>Symphoricarpos</i> spp.	summer or winter	softwood, hardwood	
Spiraea, <i>Spiraea</i> spp.	summer or winter	softwood, semi-hardwood, hardwood	some may root poorly
Sumac, <i>Rhus</i> spp.	summer	softwood	some may root poorly
Sweetgum, <i>Liquidambar</i> spp.	summer	softwood	
Tulip Tree, <i>Liriodendron tulipifera</i>	summer	softwood	
Viburnum, <i>Viburnum</i> spp.	summer or winter	softwood, semi-hardwood hardwood	some may root poorly
Virginia Creeper, <i>Parthenocissus quinquefolia</i>	summer or winter	softwood, hardwood	

Weigela, <i>Weigela</i> spp.	summer or winter	softwood, semi-hardwood hardwood	
Willow, <i>Salix</i> spp.	summer or winter	softwood, semi-hardwood hardwood	
Wisteria, <i>Wisteria</i> spp.	summer or winter	semi-hardwood, hardwood	

*Some plants listed also have closely related evergreen types which might be handled differently.

+In general, use tip cuttings for those taken during the growing season (softwood or semi-hardwood) and simple (straight) cuttings for the leafless dormant type of cutting. Heel or mallet cuttings might be used for quince, which may have preformed root initials in two-year-old wood.

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