Cutting Propagation Methods for PNW Native Shrubs and Trees

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The parts of a plant can be divided into two groups, sexual reproductive parts and vegetative parts. Sexual reproductive parts are those involved in the production of seed. They include flower buds, flowers, fruit, and seeds. The vegetative parts include leaves, roots, leaf buds, and stems. Although the vegetative parts are not directly involved in sexual reproduction, they are often used in asexual or vegetative forms of reproduction, such as cuttings.

Plant development is influenced by environmental signals which are transduced into physiological responses. These processes involve plant hormones and regulators. The nature of the plant's reaction depends on endogenous levels and the interaction between the different classes of regulators.

The ability of a plant to grow from a piece of stem taken from a parent plant is related to its ability to heal damaged tissues. When a plant stem is wounded, there is water loss and other, unwelcome, organisms can enter through the wound. An ability to heal wounds quickly is essential to survival. Initially the plant cells exposed by a wound collapse and die, sealing the wound. There is an increase in auxin, a naturally occurring hormone, in the plant's cells in the wounded region. These cells are then stimulated to form a callus or tissue that heals the wound. This same hormone will stimulate the growth of roots on a stem cutting. Under the right conditions your cutting will send out roots or shoots and become a new plant. Roots form from the young cells in the cambium layer, the layer of cells surrounding the core of the plant stem that is responsible for thickening the plant stem. The presence in the stem of auxins encourages the roots to grow.

Methods

I. Types of Cuttings:

A. Leaf

Although not the preferred method for generation of roots and shoots, a leaf bud cutting could work. This would require a cutting complete with leaf blade, petiole and a short piece of the stem with the auxiliary bud.

B. Stem

There are several ways to asses if a piece of vegetation is considered in its softwood or hardwood stage. One is that the softwood tends to have small emerging leaves that are reddish in color for 3 to 6 weeks. Once the leaves begin to turn green, the wood is considered to be in its semi-hardwood stage. Another indicator is the change in color of the woody stem in late fall. It turns a gray-brown indicating the hardwood condition. All stages of wood should be able to root year-round except for wood in its first two to four weeks of the softwood stage.

1. Softwood

   Softwood can be classified as emerging shoots, of trees, shrubs, and evergreens. They can be snapped off in the spring between May and early July depending on the species and latitude. Stems begin to assume a semi-hardwood to hardwood role come July and August. But cuttings should be taken based off of the current condition of the plant and not necessarily the exact date on the calendar from year to year. When taking softwood cuttings, care should be taken to keep cuttings moist to prevent wilting.However, softwood cuttings also have the tendency to rot in the rooting bench. Length should be around 2 to 5" long given it has several nodes. Rooting time may vary from 7 days to 5 weeks depending on the species. Rooting hormone is generally helpful in a low concentration of 1000 to 3000 ppm in talc or solution. Rooted cuttings can be over wintered in ground beds, provided it has protection from harsh winter elements.

2. Semi-hardwood

   This stage corresponds to mid-July through early September. The wood is reasonably firm and leaves have reached full size. The growth flush is over at this time. Any softwood on a semi-hardwood cutting will die in the rooting bed and should be removed. Timing of best rooting varies between species and cultivars. Cuttings should be around 3 to 6"

in length with half of the basal leaves removed. However, adequate leaf tissue is required for best results. A Georgia study revealed that cuttings with 8 leaves left on the cutting produced a better root system than 4>2>0. Also, larger cuttings tend to produce better root systems as well. Rooting time varies from 4 weeks to 3 months depending on species. Misting is used to keep the cuttings turgid. Softwood cuttings are easier to handle and stick. Needle evergreens can be taken as semi-hardwood but prefer cold temperature exposure and should be taken from September into winter.

3. Hardwood: Deciduous and broadleaf

Last season's growth is collected in the fall through winter. Stems are usually cut by a ban saw 6 to 20" in length, treated with hormone, and either stuck in the fall or late winter directly in the field, or callused/rooted by various methods until they are out-planted. Some of these methods include bottom heat, a plastic bag, stratification, warm temperature, and outdoor ground beds. *Bottom heat* method involves treating the cuttings in 2500 to 5000 ppm hormone, heating the base of the cuttings to 70ºF and cooling the tops, and leaving for 4 weeks. The *plastic bag* methods is sealing up the cuttings after hormone treatment in a dark room chilled to 50ºF. After callus and/or root formation, they are planted out. *Stratification* method involves placing the cuttings upside down and buried several inches underneath sand or sawdust. In the spring, they are turned right-side up. The *warm temperature* method is for cuttings taken in the fall and treated with hormone before they undergo moist conditions at 70ºF for 3 to 5 weeks. Outdoor ground beds involve bottom heat at 70ºF for cuttings collected in January through March and treated with 1% IBA in 50% alcohol, and kept under a poly-covered frame. Hormone treatments range from 2000 to 5000 ppm. Too much moisture during the callusing/rooting stage decreases success. It is important to keep the tops cool so they do not put out leaves before roots and die from lack of water.

4. Hardwood: Needle evergreens

Needle evergreens are best rooted in late fall and winter within a greenhouse. Terminal cuttings should be 4 to 8" long, stripped of basal needles, wounded, treated with hormone (3000 to 8000 ppm IBA in 50% ethanol), and placed in peat, pearlite, sand or park. Cuttings are best kept in a poly-tent and watered with mist (with or without bottom heat). Rooting time about 10 weeks but may take up to 3 months. Once cuttings are rooted, they can be potted.

C. Root

Root cuttings are not the best way to propagate woody plants, unless they naturally sucker and is taken from a young plant or near the main stem/trunk. If not Once dug, they are cleaned and treated with a fungicide and stored in the late fall/early winter. Polarity is important and the proximal end should be planted pointing up or horizontally. If arranged vertically, the cutting should be level with or slightly above the soil line. If arranged horizontally, it should be covered with ½" or medium. Cutting length should be around 3 to 4". Moisture should be evenly maintained by a covering such as a poly-tent or some form of plastic. Bottom heat may be useful. Shoots can be taken as softwood or the whole cutting with shoots can be planted out. If not immediately in use, they should be packed up in a damp medium for storage.

II. Collection and Handling:

Although it is ideal to collect cuttings in the early morning or late afternoon to ensure the highest moisture levels, this is not always the reality. Some suggestions for keeping cuttings cool and moist during collection include plastic bags filled with ice, wet burlap, and ice chests kept in the shade. For transportation, a covered vehicle will help protect against wind and sun damage. Cuttings should be planted as soon as possible. While they are waiting to be treated and planted, it helps to keep them on a misted bench, or they can be kept in cold storage (33-41ºF) for several days.

When choosing your cutting material, be sure it is true-to-name. The most reliable stock can be found in nurseries, local arboretums and botanic gardens. Nursery cuttings might be too soft in which case the arboretum and botanic gardens are best.

III. Factors Effecting Rooting:

A. Nutrition/carbohydrates/nitrogen

Take cuttings from plants that are healthy and doing well

B. Juvenility

Rooting rates are higher in juvenile plants. Maintain stock plants in a permanently juvenile stage by frequent pruning. Root cuttings are a great way to produce juvenile shoots that will root easily.

C. Timing

Some plants can be rooted year-round while others may have a narrow window. Keep records of time and condition of plant for reference. Trial and error is imminent.

D. Condition and type of cutting wood

Cuttings should be taken before or after the flowering stage. Mallet form is the best for rooting. For an example of a mallet cutting, see figure below.

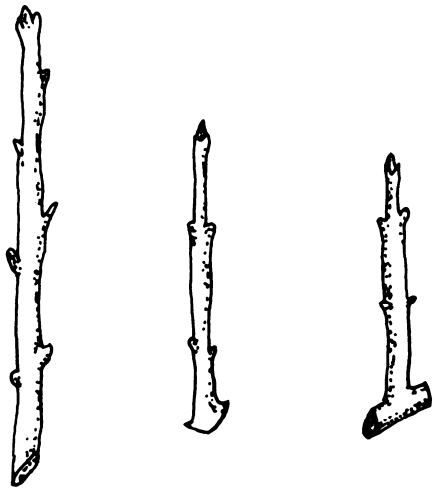


Figure 1. Example of cutting forms. From left to right: Normal, Heel, and Mallet.

E. Wounding and girdling

Some species benefit from wounding. Wounding is a ½" to 1" long cut removing the bark and damaging the cambium. If unsure, conduct a wound/no wound study. Girdling is the removal of the bark in the form of a ring from the stem. A slurry of 1% IBA, 1% PPZ, 20% sucrose, and 5% Captan in talc can be applied and covered with peat moss before wrapping the injured section in aluminum foil or a plastic bag. Let sit six weeks and roots will likely form. Girdling is helpful for plants that are difficult to root.

F. Hormones

Hormones are vital in controlling the growth and development in plants. Plant hormones are classified into five major groups; cytokinins, auxins, gibberellins, ethylene and abscisic acid. The most common ones used in cutting propagation are cytokinins, auxins , and gibberllins. The cytokinins promote cells division as well as delayed aging and death. Gibberillins also promote cell division; in addition, they also promote

cell elongation. Auxins are the most commonly used hormones because they are involved in so many processes that would benefit a cutting. They are involved in bending toward the light, downward root formation, promotion of apical domain, and formation of adventitious roots.
Commercial rooting hormones come in two forms, liquid and powder. The liquid for is traditionally used for softwood and herbaceous cuttings while the powder form is used for semi-hard and hardwood cuttings. Each bottle is labeled with instructions to follow for your specific plant needs.

IV. Sanitation:

Cleanliness is extremely important. Use clean benches, flats, sterilized media, water, and a preventative fungicidal program. Presoaking cuttings in Captan ® or Benlate ® improves the quantity and quality of rooting.

V. Aftercare, Over wintering, Storage:

After cutting has rooted, reduce misting and harden off. Do not transplant until spring of the following year. For most plants, keep in cold storage such that the soil temperature is between 34 and 41ºF. Or keep covered outside under a milkly-colored or opaque plastic if temperatures do not fluctuate too widely.

Materials

All tools and pots use for cuttings should be cleaned and sterilized. This can be done by washing them thoroughly using a household cleaner such as liquid soap and disinfectant, we recommend a 10% bleach solution. Media such as peat moss, vermiculite, and perlite are sterilized prior to purchase therefore, they don't need sterilization if they are use new. It is possible to re-used media if it sterilized. This can be done by putting the media in the oven set to 150-200 degrees F for 20-30 minutes. CLEANINESS IS VERY IMPORTANT TO SUCCESS.

Cutting Implements:

Pruner.- For hardwood, semi-hardwood.

Sharp knife.- For semi-hardwood.

Containers:

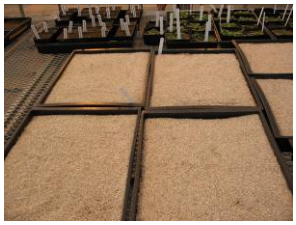
Flats or trays.- Can be shallow plastic, Styrofoam, wooden or metal trays with drainage holes.

Plastic Dome.- To conserve humidity and minimize transpiration. Particularly if no mist system is used.

Plastic containers in different sizes.- To transplant cuttings after rooting and prepare plants for planting out.

Media:

Media should be chosen carefully with consideration to the plants drainage needs. Poor drainage can leave plants susceptible to fungal diseases.


Sand


Horticultural Perlite course grade

Perlite is a natural occurring volcanic glass. Therefore, special precaution must be used. Wear a mask when handling this material because the fine dust is a respiratory irritant.


Pumice


Horticultural Vermiculite


Peat moss

Mixes:

Terralite.- This is a commercial medium that contain a mixture of peat moss, vermiculite, and soil.

At the UW Center for Urban Horticulture the cutting mix of choiceis usually a mix of 50% Pumice and 50% Terralite. Typically a mix is moistened then placed in to flat prior to usage for cuttings. Additionally, there are a variety of other mixes that can be used. Other Mixes:

1. ½ sand* and ½ peat moss

2. ½ perlite and ½ peat moss
3. ½ sand* and ½ vermiculite
4. ½ perlite and ½ vermiculite
5. Equal parts sand, perlite, vermiculite or peat moss instead of vermiculite.

*Sharp clean river sand.

Heat:

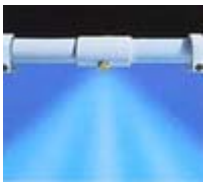
Heating pad.- Promotes faster rooting by radiating heat from the roots up. Usually is kept at 70 degrees.

Rooting Hormones:

To stimulate root growth and development.

Liquid- soft wood and herbaceous

Powder- hard and semi- hardwood



Mister- Greenhouse mega store has a do-it-yourself kit for $52.50.
Why: Cuttings don't have rooting systems to take in water. Therefore, increasing the level of humidity around leaves will help with water retention and also decrease heat in the leaves.

Plant Labels

Labels- It is important to label your cuttings with name of propagator, date, species, and any other important instructions.

Native Species

Listing of the most common PNW tree and shrub native species and the most productive cutting method used.

Hardwood:
Amelanchier alnifolia
Arctostaphylos patula
Artemisia tridentata
Beltula papyrifera
Ceanothus cuneatus
Ceanothus prostratus
Ceanothus velutinus
Chamaecyparis lawsoniana
Chamaecyparis nootkatensis
Cornus nuttal;oo
Cornus sericea
Holodiscus discolor
Lonicer involucrata
Juniperus communis

Semi-hardwood:
Mahonia aquifolium

Softwood:
Mahonia nervosa
Mahonia repens
Oplopanex horridum
Pachistima myrsinites
Philadelphus lewisii
Physocarpus capitatus
Physocarpus malvaceus

Populus spp.
Diasphora floribunda
Prunus virginiana
Purshia tridentata
Rhamnus purshiana
Ribes cereum
Ribes lacustre

Soft and hardwood:
Rohdodendron macrophyllum
Rosa gymnoocarpa
Rosa woodsii
Rubus parviflorus
Salix spp.
Sambucus cerulea
Sambucus racemosa
Symphoricarpus albus
Taxus brevifolia
Thuja plicata
Vaccinium parvifloium
Viburnum edule

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