

# Propagation of Woody Ornamentals

## Introduction

The purpose of this factsheet is to outline the essential procedures and conditions required for propagating woody ornamentals from cuttings. For detailed information refer to the list of references at the end of this factsheet.

Asexual propagation refers to vegetative propagation techniques such as cuttings, grafting and tissue culture. Cutting propagation has many advantages:

- 1) it is economical;
- 2) produces large quantities of the original plant material; and
- 3) allows for retention of all the characteristics of that plant.

Grafting is used when cuttings do not root at commercially acceptable volumes or for other economic or production reasons. Tissue culture is used to propagate virus-free stock and to multiply hard to root plants.

Sexual propagation refers to seed propagation. Seed propagation is only used for plants that do not vary from the mother plant by an unacceptable amount. Seedling production is useful in areas such as forestry and in producing rootstocks for grafting. It is recommended that propagators consult a respected propagation reference text to identify important details regarding the plant to be propagated so that the resulting plants will be true-to-type and marketable.

## Stock plants

There are three common sources of cuttings: landscaped sites, prunings from nursery plants and stock plants. Cuttings should be collected from plants relatively free of disease and insect pests, and that are not under moisture or nutritional stress. Rooting success decreases as the stock or mother plant ages. Plants under six years of age are most desirable. Success decreases considerably for many cuttings when stock plants exceed ten years of age. Stock plants maintained on the nursery are the most desirable source of cuttings. Plants in a stock plant bed, maintained in top condition, provide healthy, pest and stress free cuttings of known identification.

## Timing

The time of year when cuttings are collected is one of the most important factors controlling rooting success. Some cuttings such as *Forsythia*, can be rooted at almost any time of the year while others will only be successful during a two to three month period. Table 1 lists many commonly produced plants and the suggested timing for cutting collection. Other factors affecting rooting success are position of cutting on plant, flowering versus non-flowering shoots, cutting

# Nursery Production FACTSHEET



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type, wounding and rooting hormone concentration. Many of these factors will vary from one plant genus and/or species to the next. The time of year that a cutting is collected determines whether the cutting is a softwood, semi-hardwood or hardwood cutting. Reference books referring to cuttings as one of these three types indicates at what time of year cuttings should be collected in your nursery, regardless of where the book was published. Softwood cuttings are collected during the summer months while semi-hardwood cuttings are collected during late summer and early fall. Hardwood cuttings are collected from plants whose tissues have fully hardened-off.

## **Labeling and Record Keeping**

While many of us avoid paper work, there are times when it is very worthwhile and this is one of those times. Correct labeling is essential to maintain a nursery's reputation. Record keeping is essential to the progress and knowledge of the nursery. Good record keeping does not have to take a lot of time. With all the factors that can influence the success of rooting a cutting, records are the only way to keep track of which methods have been successful for each plant produce by your nursery. There are often many ways to propagate and grow nursery stock successfully, but it is the methods that work for you that are most important. Keeping a record of what works and what does not work for you will allow you to repeat successes and avoid repeating failures.

## **Propagating Structures**

Any structure that allows you to control the air flow and light levels can be used for propagation. The most common structure in BC is the cold frame or polyhouse. Controlling or limiting the air flow immediately around the cuttings allows the humidity to be kept high. Controlling the light and therefore the air temperature of the structure with shade cloth or shading compounds increases rooting success for plants rooted in the summer months. Propagating beds can also be tented with clear or white poly within the cold frame allowing humidity to be kept high around the cuttings. Tenting allows the rest of the structure to be vented via doors and roll up sides for air temperature control.

The propagating bed consists of a bench or ground level bed with bottom heat. Construct the bed with a width that will closely fit the flat size to be used. This will provide more efficient use of heat and space. Heat can be provided by either electric heating cables or hot water pipes or tubes. Electric is usually more convenient for small facilities while hot water is usually more economical for larger facilities. Rigid insulation covered with black polyethylene and placed on the bottom and sides of the bed will reduce heating costs. Be sure to provide adequate drainage. A 2.5 cm layer of coarse sand is placed underneath the cables and a 5 to 10 cm layer is placed on top. This top layer distributes the heat from the cables to prevent cool spots on the surface. Some propagators find that the 10 cm layer distributes heat more evenly than thinner layers.

## **Water Management**

Water management is the most critical element in cutting propagation. It involves the management of the mist system to decrease leaf temperatures and increase the humidity. Mist systems can also keep the rooting media moist, however, some hand watering is often required to obtain just the right conditions.

Monitor the rooting media frequently as it dries out from the bottom up. The amount of moisture in the rooting media that each genus or species can tolerate varies. Too much moisture promotes rot while too little moisture allows the cutting to dry out. The novice propagator will need to spend a fair amount of time monitoring rooting media temperature and moisture. Make adjustments in the equipment settings whenever necessary. Over time the propagator will get a feel for their propagation house and how the cuttings of each plant that they propagate react to temperature, humidity and media moisture.

## **Rooting Media and Containers**

There are as many rooting media mixtures and container combinations as there are nurseries in BC. Washed sand, and combinations of peat moss and perlite or vermiculite are all used. Two thirds perlite and one third peat moss is a commonly used mix. Adding controlled release fertilizers to the rooting media is beneficial for some plants while detrimental

for others. Some cuttings will benefit from the immediate availability of nutrients resulting in superior liners. In other cases, rooting is inhibited by the increased salt content of the rooting media.

Containers include wooden flats, individual pots in plastic flats and molded trays with varying numbers of cells in each model. Cost, equipment and labor will most likely determine which materials are selected. Regardless of the mix and flat or pot system selected, sanitation must be strictly monitored. Never reuse a rooting media. If flats or pots are to be reused, always sterilize them by washing them in a 10% bleach and water solution. Steam, formalin, quaternary ammonium compounds and phenol-based lysol are also effective for sterilizing equipment and benches. Keep the propagation house weed-free and remove all plant debris and failed cuttings from the propagation bed. Weeds can be a source of insects and rotting plant debris, a source of disease.

## **Cutting Preparation**

### ***1. Wounding***

Wounding can promote rooting of some cuttings while in other situations it can increase the risk of basal rot. Wounding can increase the number of roots and increase water uptake. It can also promote roots higher up on the stem, away from the cutting base where the rooting medium can be too wet.

Cuttings are wounded just prior to placing them in the rooting media. One method is to slice off a one-inch-long piece of bark from the bottom of the cutting. Make the cut into the cambium layer but not into the wood. A second method consists of making a one inch cut with a knife tip on the bottom portion of the cutting. This wounding technique does not remove any tissue and penetrates to the wood. Both slicing and cutting can be repeated on the other side of the stem base. A third wounding technique is the split wound. This type of wound consists of a 1 cm long cut made up the center of the cutting base. Pruners can be used to make this cut but remember to sterilize the blades first.

Wounding can be a successful technique with some plant species while with others it merely increases

labor costs and can even be detrimental. Wounding should be practiced on a small scale to allow the propagator to gain experience and keep accurate records to determine which plants benefit from wounding.

### ***2. Bud Removal***

The removal of flower and vegetative buds increases side shoot development. It prevents premature flowering and subsequent infection of the petals due to the moist environment present in a propagation bed.

### ***3. Trimming of Leaves***

Leaf trimming is a common procedure when rooting cuttings of shrubs with large leaves. Leaf trimming allows more cuttings to be placed in a flat, increases the amount of mist reaching the rooting media and reduces transpiration. A disadvantage of leaf trimming is the open wounds increase the cuttings' susceptibility to fungal infections.

### ***4. Collecting Cuttings***

Ideally, cuttings are collected in the early morning or late evening when air temperatures are lower and water stress is less likely. However, this is not always practical so take precautions to protect your cuttings from moisture and temperature stresses. Keep the cuttings shaded and cover with moist burlap or other similar material. In very hot weather, ice can be useful to keep cuttings cool. Insert cuttings into the rooting media and place into the propagation bed as soon as possible, preferably the same day. Cuttings of some species can be held in cold storage (1 to 5° C) for several days without substantial reduction in rooting.

## **Propagation Environment**

Once the correct time for collecting cuttings has been selected, the environmental conditions provided for the cuttings is the most important factor affecting rooting success.

The rooting media should provide moisture, drainage and aeration. To obtain all three of these factors rooting media must be chosen and handled carefully. Do not compact the mix into the flats or

pots but firm it only enough to support the cuttings. For small cuttings, a thorough watering often provides enough firming and settling of the media.

Bottom heat is used for most cuttings collected in fall or winter. Summer cuttings generally do not require bottom heat. Use thermometers to monitor the temperature at a few different locations in the propagation bed especially when using bottom heat. A temperature of 19° to 24° C is ideal for most cuttings.

Relative humidity around the cuttings should be high in order to reduce the transpiration rate and prevent moisture stress.

The air temperature should be lower than the rooting media temperature. A lower air temperature reduces the transpiration rate and suppresses bud development. A higher root zone temperature stimulates metabolic activity in that area and encourages root initiation and development.

Air temperature is often impossible to control. Depending on the time of year, air temperature can be controlled by ventilating, shading or heating or a combination of these. Air temperatures of 21° to 27°C during the day combined with lower night temperatures near 15°C work well. In fall and winter lower day and night temperatures will occur if supplemental heating is not used. Depending on the plant being rooted, lower air temperatures will not adversely affect the rooting process. Hardwood cuttings of many shrubs will root very successfully with only bottom heat with the air temperature comparable to the weather outdoors. Air temperatures below freezing will delay rooting with some plant species while others may suffer from frost damage.

## **Light**

Light intensity should be high enough to be a source of energy for photosynthesis but low enough to reduce transpiration. In the summer months a shade

cloth providing 65% to 75% shading will provide sufficient heat protection and still provide adequate light. The photosynthesis of a plant actively growing will utilize about 10% of the light intensity available on a sunny summer day while an unrooted cutting will utilize about 1%.

## **Hardening-Off**

Hardening-off is a procedure that acclimatizes the rooted cuttings to the outdoor environment. It will promote the development of secondary roots and harden the leaf and stem tissues. Remove cuttings from the propagation bed as soon as they are well rooted. While some plants will tolerate being under the mist for extended periods, others will deteriorate in quality. Some species will require shading to prevent sunscald.

Reduce the misting frequency and monitor the cuttings closely. Water as necessary to prevent the cuttings from drying out. Reduce bottom heat also. Once the misting and bottom heat have been reduced or eliminated remove the cuttings to a shaded cold frame. Apply a nutrient solution containing nitrogen at 50 ppm. There are other methods to harden-off cuttings but the principles are the same. Gradually move well-rooted cuttings from the high humidity and bottom heat of the propagation bed to the outdoor environment.

## **Timing**

The following chart lists favorable times for collecting cuttings of some common trees and shrubs. Collection times can vary between species within a genus.

For information on media for potting up cuttings, see the factsheet 'Importance of Aeration in Container Media' and the 'Nursery production Guide for Commercial Growers'.

### Timing Chart for Cutting Collection

<b>Deciduous Shrubs</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>Aug</b>	<b>Sept</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
Abelia							X	X	X	X		
Amelanchier					X	X						
Azalea						X						
Chaenomeles						X	X					
Cornus					X	X						
Cotinus					X							
Cotoneaster						X	X	X				
Deutzia					X	X						
Euonymus						X	X	X				
Forsythia					X	X	X	X	X			
Hydrangea					X	X	X					
Lonicera						X	X	X				
Rosa						X	X	X				
Philadelphus		X	X				X	X	X			
Potentilla												
Spiraea				X	X	X	X					
Syringa					X	X						
Viburnum						X	X					
Weigelia						X	X					
<b>Deciduous Trees</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>Aug</b>	<b>Sept</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
Acer palmatum					X							
Betula								X	X			
Betula pendula				X	X							
Cornus					X	X						
Magnolia						X	X	X				
Prunus (flowering)						X	X	X				
Salix	X	X				X	X				X	X
Tilia					X	X	X					
<b>Broadleaved Evergreens</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>Aug</b>	<b>Sept</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
Berberis							X	X	X			
Buxus							X	X				
Camellia						X	X	X				
Calluna	X	X	X				X	X		X	X	X
Cotoneaster						X	X	X	X	X		
Daphne					X	X	X					
Erica	X	X	X				X	X		X	X	X
Euonymus fortunei						X	X	X	X	X	X	
Genista lydia						X						
Genista pilosa							X	X	X			
Hedera					X	X	X	X	X			
Ilex							X	X	X	X	X	X
Mahonia									X	X	X	X
Nandina domestica						X	X	X	X			
Pieris	X						X	X				X
Pyracantha						X	X	X	X	X	X	
Rhododendron						X	X	X	X			
Viburnum						X	X	X	X	X	X	
<b>Conifers</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>Aug</b>	<b>Sept</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
Abies	X	X										
Chamaecyparis	X	X										X
Cryptomeria japonica	X	X								X	X	X
Juniperus	X	X										X
Picea abies cultivars							X	X	X			
Picea glauca							X	X				
Picea pungens	X	X				X						
Pinus							X	X				
Taxus	X	X										X
Thuja	X	X										X

## References

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