

Air-Layering



Tools & Supplies

- 1. Hand pruners
- 2. Girdling scissors (optional)
- 3. A knife (A linoleum “hook” knife is preferred, but any knife will work.)
- 4. Pliers, Channel locks, or Vise grips
- 5. Rooting hormone
- 6. An applicator for the rooting hormone
- 7. Prepared air-layering bags
- 8. Heavy duty aluminum foil
- 9. Permanent marking pen



PREPARATION OF THE AIR-LAYERING BAGS

- The following outline will contain details for the application of 6" by 10" air-layering bags. This bag size has been useful in developing air-layers 3 to 6 feet tall with a branch caliper of 3/4" up to 2" in girth.
- Since a shoot-to-root ratio must be maintained, larger or smaller bags may be used when air-layering larger or smaller branches.

MATERIALS

- 1. Plastic bags, 4-6 mil. thick, 6 inches wide by 10 inches long.
- 2. Rooting medium. We used 100% pre-moistened peat moss or a mixture of 80% peat moss and 20% perlite.
- 3. Twine, 6' to 8' in length for each bag.



PREPARATION OF THE AIR-LAYERING BAGS

- 1. Add water to the rooting medium so that it is moist but not soggy.
- 2. Fill the bags 3/4 full. Place the medium into the bag so that it is firm but not overly packed.
- 3. Tie the bags closed using the twine. Leave a 6" "tail" at the short end of the twine. Coil the twine around each bag.
- The air-layering bags are now ready for application and may be stored for several weeks or months. It is best to store these bags in a cool, dark location to prevent the growth of algae or mold and the deterioration of the plastic by sunlight.



Rooting Hormone

- A liquid solution is preferred to dry powders. I found that an 8,000 p.p.m. I.B.A. solution achieved excellent root formation when rooting hard-wood branches.) An alternate rooting hormone that I have had good results with is liquid Dip N Grow.



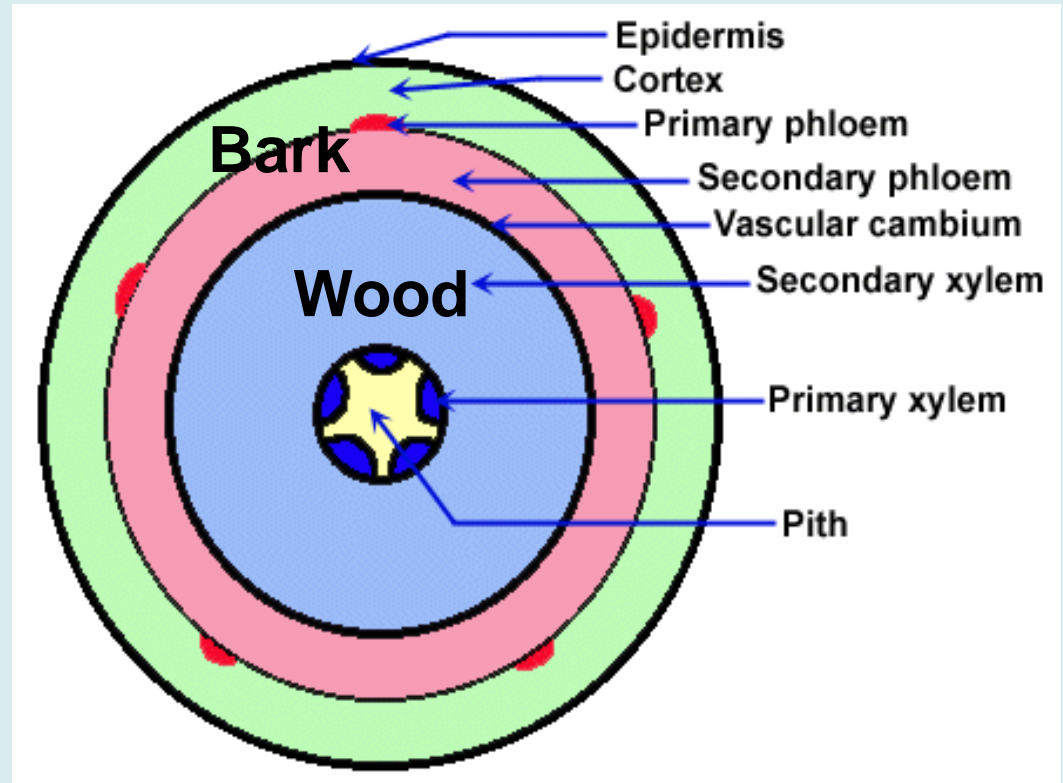
Applying the Air-Layers

1. Select the branch to be air-layered. An upward growing branch in good sunlight will have the best chance of developing good root formation. For the application of a 6" by 10" air-layering bag, select a branch which is 3' to 6' in length and is 3/4" to 2" in caliper.
2. Prepare the region of the branch where the air-layer bag is to be applied by removing all leaves and side branches for a length of approximately one foot.
3. Girdle the branch twice using the girdling scissors or knife. Girdling cuts should be approximately 1 1/2" to 2" apart.



Applying the Air-Layers

- The girdling cuts are made through the bark and stop when the inner wood is contacted (at the cambium).



Applying the Air-Layers



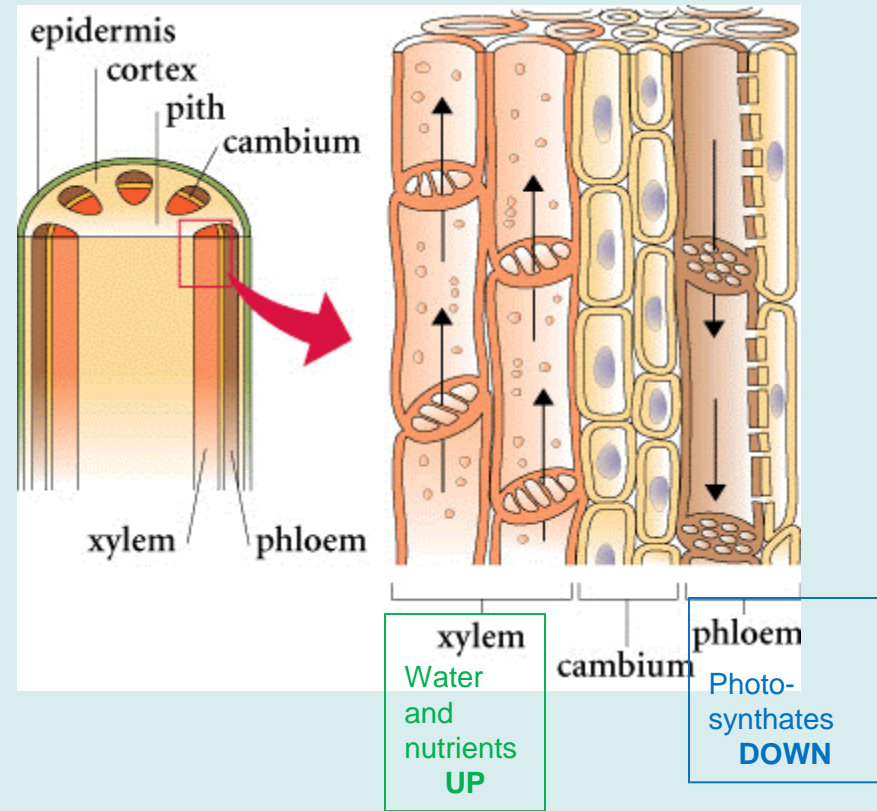
Remove the bark from the branch in the area between the two girdling cuts by using the pliers and stripping away the bark with a twisting motion.

This results in the removal of the phloem tissue while the xylem remains intact.



Phloem and Xylem

- **Phloem is found in the innermost layer of bark.** Phloem is the living tissue that transports sugars and other photosynthates (products from photosynthesis) from the leaves to all parts of the plant.
- The outermost parts of the trunk and older branches contain primary xylem that transport water and dissolved minerals throughout the plant from the roots.
- **When the phloem is removed by removing the bark, the branch will still receive water and nutrients through the xylem. Photosynthates accumulate above the girdled area and this stimulates the development of callus tissue from which roots develop.**



Applying the Air-Layers

- Using the knife, scrape the branch lightly in the area where the bark has been removed.
- Take time to be thorough and completely remove all cambium tissue in order to prevent bridging of the girdled area.



Applying the Air-Layers

- Wound the branch twice, on opposite sides of the branch, for a length of approximately 3"-5" above the girdled area.
- The wounded area exposes more of the cambium and increases the development of the callus tissue and roots.



Applying the Air-Layers

- Apply the rooting hormone. The branch should be completely coated for a length of 4" to 6" above the girdled area.



Applying the Air-Layers

- Cut open a prepared air-layering bag by slicing lengthwise into the bag. Cut into the rooting medium $\frac{1}{2}$ the depth of the bag.
- Remove a small amount of rooting medium from the air-layering bag along the length of the cut.



Applying the Air-Layers

- Wrap the prepared air-layering bag around the girdled branch.
- The bottom of the bag should begin at the bottom of the girdled area and extend completely over the area of the branch where the rooting hormone was applied.



Applying the Air-Layers

- Close the air-layering bag by overlapping the cut sides of the plastic bag and wrapping the twine tightly around the bag in a spiral fashion. Tie the bag closed using the end of the twine and the “tail” of twine at the top of the bag.



- Rotate the air-layering bag so that the cut side faces downward toward the ground. This helps to reduce moisture loss from the bag.

Applying the Air-Layers

- Cover the air layering bag completely with aluminum foil. This blocks the sunlight, keeps the media from overheating and helps to prevent moisture loss from the rooting media.
- The shiny side of the foil should be facing outwards during seasons of high temperatures and the dull side should be facing outwards during seasons of cool temperatures.



- Place the date on the air-layered branch.

Applying the Air-Layers

- Many air-layers can be applied to a plant, but be sure not to air-layer too many branches so that the result is starvation of the root system.
- If you girdle too many branches, the roots will receive little or no photosynthates and the plant may die!



Root Initiation and Development

- As the photosynthates accumulate above the girdled area of the branch, callus tissue develops above the girdled region.
- Roots develop from this callus tissue, eventually filling the rooting media.



Bridging

- Bridging results in the reconnection of phloem tissue above and below the girdled area. When this occurs, roots will not develop.
- Bridging may occur if all cambium or phloem tissue was not removed from the girdled area. Some species of plants may have strong tendencies to bridge girdled areas with new phloem tissue.



Air-Layer Removal and Potting

- Air layers are ready to be removed from the parent plant when the air-layering bags have been permeated by developing roots.
- Normally this will take 6 to 12 weeks, but may take as long as 2 years. Inspect for root development by opening the aluminum foil. If more time is needed for root development, simply reclose the foil around the air-layer.



Air-Layer Removal and Potting

MATERIALS

- 1. 2-3 Gallon nursery containers
- 2. Potting soil
- 3. A bulb planter or hand trowel
- 4. Plant stakes
- 5. Plant ties
- 6. Hand pruners
- 7. A knife
- 8. A water filled container-5 gallons or larger
- 9. Labels
- 10. Anti-transpirant (such as Wilt-Proof or Cloud Cover) and a sprayer
- 11. A mist or shade house
- Additional options: A root stimulating hormone (such as Superthrive) and a starter fertilizer which includes mycorrhizae.)

Air-Layer Removal and Potting

- The air-layer should be removed when sufficient roots are present to hold the root ball intact but before excessive rooting has caused the root ball to become root-bound. Roots will be most visible on the downward side of the bag.
- Remove the air-layered branch from the parent plant by cutting the branch 2" to 4" below the bottom of the bag.



Air-Layer Removal and Potting

- Cut perforation holes into the plastic bag which will allow water to enter into the root ball.



- Rehydrate the root ball by soaking it in the container of water for a period of 1 to 8 hours or overnight.



Air-Layer Removal and Potting

- Adding a root stimulating hormone to the water can significantly improve the establishment of the air-layer into the container, both shortening the establishment time and the improving the root development.
- 'Superthrive' contains .048% **1-Naphthaleneacetic acid**, commonly abbreviated NAA. NAA is a plant hormone in the auxin family and is an ingredient in many commercial plant rooting horticultural products.



Air-Layer Removal and Potting

- Fill the nursery containers with pre-moistened potting soil and prepare a planting hole of the appropriate size for the air-layer's root ball.
- Leave several inches of soil below the planting hole so that the developing roots can grow downward into the container from the air-layer.



Air-Layer Removal and Potting

- Adding a starter fertilizer, especially one that contains mycorrhizae inoculants, to the potting soil or into the area around the planting hole can be very beneficial.
- Mycorrhizae must come in contact with the roots of a plant to form a symbiotic relationship.
- The starter fertilizer can enhance root development once the phosphorous is absorbed into the plant. Phosphorous does not readily leach into the soil and is best mixed into the root area.



Air-Layer Removal and Potting

- After the root ball is rehydrated, cut the twine away from the air-layer bag and carefully remove the plastic bag.
- Be certain not to disturb or break apart the root ball which may be very fragile.



Air-Layer Removal and Potting

- If the root development in the air-layer is excessive, it may be necessary or beneficial to lightly score the root ball so that new root development can grow into the potting soil more easily.
- An overdeveloped root ball can become root bound and may not readily root into the container.



Air-Layer Removal and Potting

- Place the air-layer into the soil filled container. The top of the air-layer's root ball should be just below the surface of the potting soil. The bottom of the root ball should be at least 3" to 4" above the bottom of the container.
- The stub of branch at the bottom of the root ball will help to stabilize the air-layer in the container.



Air-Layer Removal and Potting

- Pack the soil around the air-layer's root ball by carefully packing soil at the bottom of the root ball and working up.
- Be very careful not to damage the root ball or knock the root ball off of the air-layered branch as you pack the soil around the root ball.
- The finished soil level should be 1"-2" below the top of the container.



Air-Layer Removal and Potting

- Stake the air-layer by using 2 or 3 stakes. Place the stakes in opposing directions to stabilize the air-layer.
- Place the stakes at the outer parameter of the container so that the root ball is not damaged or disturbed.



Air-Layer Removal and Potting

- Water in the newly transplanted air-layer.
- Move the newly potted air-layer into a shaded staging area until the roots have spread into the container and begin to actively absorb water and nutrients.
- During this time it is essential to reduce transpiration from the leaves in order to prevent excessive desiccation and dehydration that can result in the death of the air-layer.



Ways to Reduce Transpiration

1. Remove some or all of the leaves from the air-layer.

- ❑ Since the leaves function in photosynthesis and make food for the air-layer, removal of all leaves can starve the new plant and result in the slower development of roots or the death of the plant.
- ❑ It is generally better to remove only some of the leaves or to cut large leaves in half in order to reduce transpiration while maintaining the production of food for the plant.
- ❑ It is important to retain the tips of the branches as these apical meristems produce hormones that stimulate new root initiation. Do not head the branches and remove these apical meristems.



2. Spray the foliage of the air-layer with an anti-transpirant.
(Wilt-Proof and Cloud Cover are two trade names for anti-transpirants that are available in California.)



Ways to Reduce Transpiration

- Place the air-layer in a mist house, high humidity greenhouse, moist shade house, or shaded spray bed.



Ways to Reduce Transpiration

- Bagging the air-layer in a translucent plastic bag can act like an individual high humidity greenhouse for each air-layer.
- It is best if the plastic bag does not touch the foliage. (You can support the bag with stakes or a tomato cage to prevent it from touching the plant.)
- The bag should be left open at the bottom to provide some air exchange and ventilation.



Bottom Heat

- Bottom heat at temperatures of 70-75 degrees can greatly speed up the development of roots on a newly potted air-layer.
- Bottom heat will increase water loss from the air-layer so should only be used when the air-layer is in an environment with very high humidity.

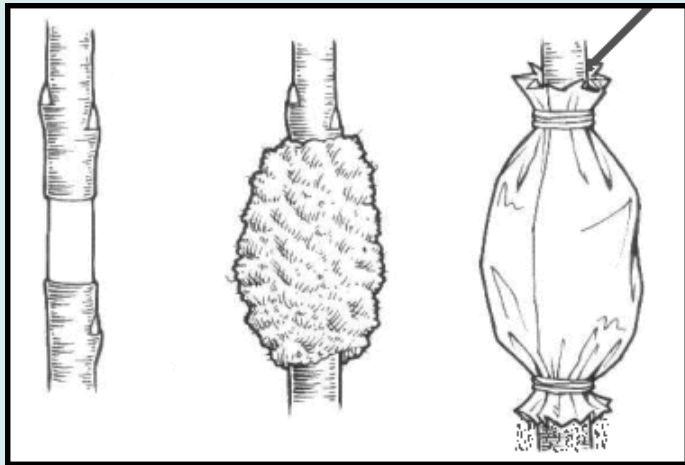


Air-Layer Removal and Potting

- It will take approximately 3-8 weeks for the new air-layer to root into the container.
- After roots have grown into the container, slowly acclimatize the air-layer into normal growing conditions.
- The air-layer will now be ready to replant into the ground or into a larger container.



Air-Layering



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