



Vegetative Plant Propagation

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The propagation of plants is one of the most fascinating and rewarding aspects of horticulture. The ability to control the reproduction of plants used for food, fiber, recreation and aesthetic purposes has helped shape our society as we know it today. Most of the plants propagated by commercial nurseries or greenhouses can also be multiplied by the home gardener. Plant propagation is both an art and a science. Some skill or experience is necessary but it is comparatively easy to propagate many kinds of plants using certain methods and utilizing relatively inexpensive and easily-obtained materials or equipment.

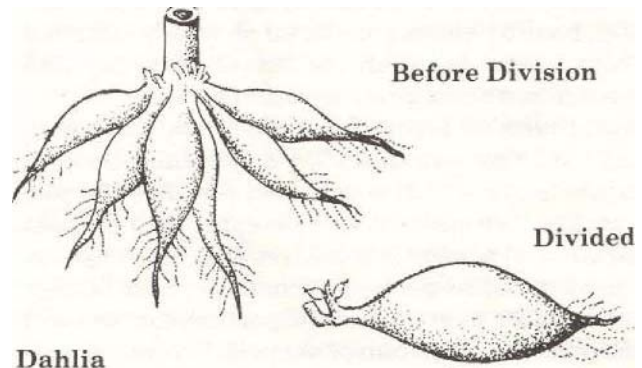
There are two basic means of increasing the number of plants: sexual (seed) and asexual (vegetative). Asexual propagation is reproduction by means of using vegetative plant parts such as buds, stems, roots and leaves. In asexual propagation there is generally no change in the makeup or appearance of the new plants. In many fruit or ornamental varieties large numbers of plants originate from a single plant. Such groups of plants are called clones and have all the characteristics of the parent plant. Some plants grown from seed may differ from their parents. Other plants may require a long time to grow or flower if started from seed.

There are several methods of vegetative propagation. Not every type of plant can be propagated by each method. With some plants, however, several techniques can be used or employed advantageously at various times of the year.

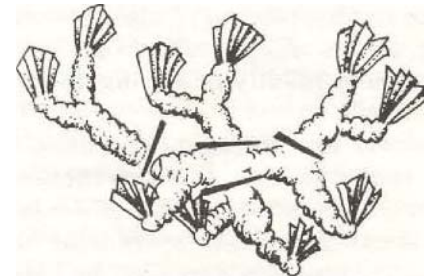
Propagation By Division

Some herbaceous perennial plants, house plants and basal sprouting shrubs can be increased simply by dividing them. In this method, clumps of plants that do not naturally break apart are cut or torn into two or more parts. In some cases, these plants become overcrowded and need to be separated. When the root ball must be broken apart, try to leave as much soil as possible on the root masses to prevent injury to the tiny root hairs. Separating naturally-detach

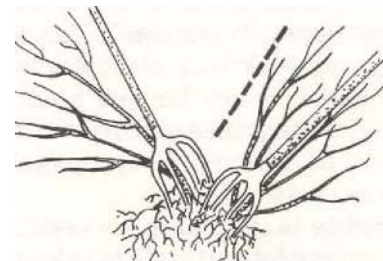
able plant structures such as bulbs (tulips and daffodils) or corms (gladiolus) is a modification of this method.



Dahlia



Iris



Perennials or Shrubs

Propagation By Cuttings

A wide variety of both outdoor plants and house plants can be propagated by cuttings. For each specific plant there is a recommended method which may be determined, in part, by the ease of root or shoot development, availability of propagation material, season of the year or the facilities available. Plant parts such as roots, stolons, rhizomes, tubers, stems or leaves may be used with or without buds to produce new plants.

A number of environmental factors are involved in the successful propagation of plants by cuttings. First, the rooting media must be able to support the cutting and supply moisture as well as air for the developing roots or shoots. Secondly, high humidity should be maintained around the leaves to prevent wilting and the subsequent death of the cutting. Thirdly, stem and leaf cuttings must be kept in light so that food can be manufactured to produce roots. Finally, healthy cutting material should be selected and kept in sterile, clean conditions so decay and rotting will not occur prior to rooting.

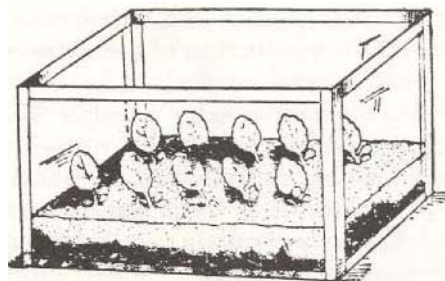
Several suitable types of natural or manufactured rooting media are available. Try any of the following materials to see which works best for you: 100 percent perlite, 100 percent coarse sand, 100 percent vermiculite, 50 percent perlite plus 50 percent sphagnum peat moss, 50 percent vermiculite plus 50 percent sphagnum peat moss or 50 percent coarse sand plus 50 percent sphagnum peat moss. Processed peat or plastic foam products are also available. It is not a good idea to use most garden soils or any unsterilized media for rooting plants. While some plants will root in water, others will rot or form sparse, brittle roots not suitable or readily adaptable for transplanting into a soil mix.

Containers for rooting are endless. Try to use a shallow container that is 3 to 6 inches deep. Small plastic or clay pots are suitable as are larger shallow pots. Milk cartons, plastic margarine tubs and other household containers can also be used. Whatever container you select, remember that it should be as clean and sterile as possible to prevent any fungal or bacterial contamination that would cause the cutting to rot and decay. Wash containers in hot, soapy water, rinse and soak in a bleach solution (1 part bleach to 9 parts water) for one hour, then wash again in soapy water, rinse and dry. Cold frames and hot beds can be utilized for propagation during appropriate seasons.

High humidity is critical in successful rooting of cuttings. A cutting has no roots to take up water and plants continually lose water through their leaves (transpiration) causing the cutting to wilt. If the humidity is high around the leaves, less water is lost to the air and the chance of wilting is less. High humidity can be maintained in several ways. Try using clear glass jars or glass canisters for rooting cuttings. Terrariums or small aquariums also are good or you can make your own glass or plastic

covered propagation box. A plastic bag or glass jar placed over the cutting will increase the humidity or you can mist the cutting with water several times a day. Plants with thicker or waxy leaves suffer less from low humidity than do thin-leaved plants. Plants in sealed containers may require a fungicide spray to deter harmful pathogens.

A forsythe pot is often recommended for home propagation. It is made with two clay pots, one about 2 inches in diameter, the other 6 to 8 inches in diameter. The rooting medium is placed in the larger pot. Plug the drainage hole of the small pot and set it in the center of the larger one, level with the edge. The small pot is filled with water that seeps into the rooting medium where the cuttings have been inserted.



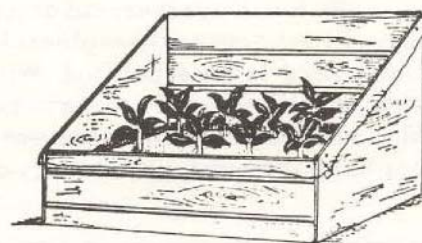
Terrarium



Plastic Bag Covering



Forsythe Pot



Propagation Box

After you have selected a medium and a container, it is a good idea to fill the container with medium and wet it thoroughly before inserting the cuttings. The medium should be kept moist. In a plastic bag or terrarium this will not be a problem, otherwise the medium should be watered regularly to keep it moist until rooting occurs. Avoid an airtight seal to allow some gas exchange.

Light is important in locating your cuttings. Light is necessary for the leaves to produce food and energy which, in turn, will produce roots. Full sunlight is not recommended. Never place cuttings enclosed in a plastic bag or terrarium in full sunlight but several hours of good, bright light just out of direct sun are necessary. Placing cuttings enclosed in plastic or glass containers in direct sunlight will cause excessive heat to build up inside which could hurt the plants.

Rooting hormones are powders that stimulate root formation. While not absolutely necessary for rooting, these powders are good to use on cuttings which are difficult to root. These materials are available in varying concentrations and some may contain an added fungicide. Do not use an excess of rooting powder. Too much can be harmful. Dust or dip one-half inch of the base of the cutting in the powder and tap or shake off any excess. To avoid possible contamination of the entire hormone container, place a small amount of the powder on a piece of paper.

Temperature is critical in rooting; 65 degrees to 85 degrees F. is best. A heating cable can encourage faster rooting by supplying bottom heat. Fertilizer or plant food is not necessary in rooting cuttings. Do not worry about adding fertilizer until the new root system has formed.

Most house and garden plants will root in a week or so depending on the type of plant. Some woody shrubs or evergreens may take several months to root. Periodically check for callus growth and root development by pulling up a cutting. When the cutting has formed roots one-half inch or more in length, it can be potted in a more permanent mix or transplanted directly into the garden.

Type of Cuttings

There are several types of cuttings. Perhaps those most widely used are the various stem cuttings. Sometimes these cuttings or "slips" are also referred to as tip cuttings or as terminal stem cuttings because they are taken from the ends of shoots or the top of the plant. This type of a cutting involves a piece of the stem plus about 3 to 6 leaves. Many plants can be propagated by tip cuttings. The piece of stem should be from 2 to 5 inches long. Cuttings seem to root more easily when the twig or shoot has a high content of stored carbohydrates.

In many woody plants the naturally-occurring growth hormones are located primarily at the nodes whereas in certain herbaceous plants these mate

rials may be distributed throughout the entire stem. In general, it is probably best to sever the cutting just below a node where a leaf or bud is attached. Trim off any leaves which would be below the surface of rooting medium upon insertion. It is also usually a good idea to remove any flower buds from the cutting. It is usually best to select cuttings or slips without flowers or flower buds but, if present, they should be removed.

Stem cuttings may be divided into three groups based on the age or maturity of the tissue when the cutting is taken. *Softwood* cuttings are taken from new growth which is still relatively soft and succulent before the tissue has matured or become woody. Most house plants, many herbaceous perennial plants and some deciduous shrubs are propagated in this manner.

Softwood cuttings of shrubs usually root more easily and quickly than other types of stem cuttings taking about 5 to 8 weeks. Extremely fast-growing, soft, sucker shoots are often not desirable because they often will deteriorate before rooting. On the other hand, old woody stems are very slow to root. The best cutting material is flexible but mature enough to break when bent sharply. The snap or turgidity test is a quick way to determine if the material possesses proper maturity for successful rooting. Bend the stem between thumb and forefinger. If it snaps, tissues are in prime condition for rooting. However, the break must be clean and not merely a bending of the stem.

Semi-hardwood or green wood cuttings differ from softwood cuttings only in the maturity of the wood. They are taken from deciduous plants later in the growing season when the lower portion of the stem has become lignified or partially matured. Cuttings of evergreen species generally are obtained from new shoots 5 to 10 weeks after a flush of growth when the wood is partially mature. This can be any time from June until the end of the growing season.

Hardwood cuttings of deciduous species should be taken using the current year's growth in the late fall or winter when the plant is dormant. Make cuttings about 4 to 12 inches long, depending upon the species. Be sure to include at least two leaf nodes and select mature wood about as thick as a lead pencil. Make the basal cut just below a node.

Tie the cuttings together in small bundles and store them in a cool (40 degrees F.) place to "callus" during the winter months. In our climate it is advisable to bury them in a box filled with a mixture of moist peat moss and sand. In the spring, dig them up and insert the individual cuttings right side up in your propagation area. Keep them moist until well-rooted, then transplant. Not all deciduous trees and shrubs can be propagated in this manner.

Some narrow-leaf evergreens are best propagated from mature wood in late fall or early winter. Not all evergreens root at the same rate nor do all species propagate readily from cuttings. Lists of specific plants and suggestions of the best propagation

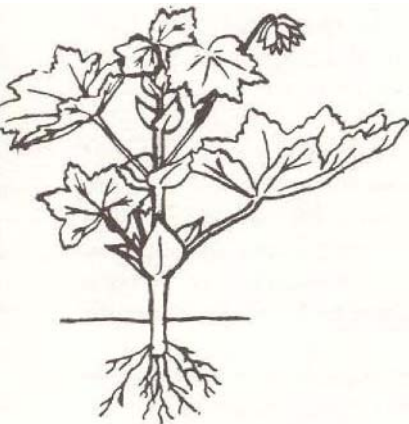
Leaf Cuttings

Some plants will form roots from a leaf, a leaf plus petiole or a leaf bud cutting. This method supplies the most plants from the least propagating material. Select a medium-sized healthy leaf. A few plants like begonias are unusual in that they will root along the veins of a single leaf when the leaf is held on the soil or propagating material. The main veins should be cut to promote rooting at those points.

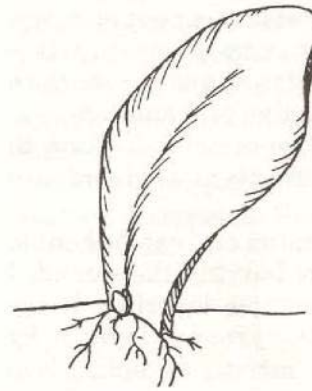
Node



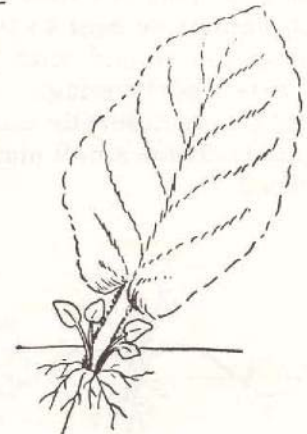
Internode



Stem Cutting



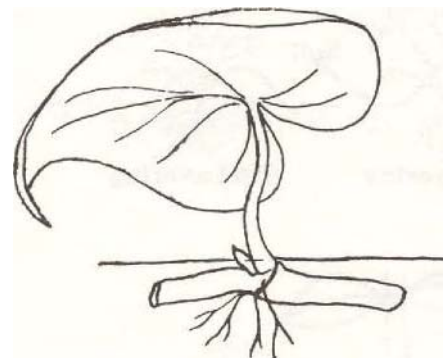
Entire Leaf Cutting



Leaf Petiole



Heel Cutting



Leaf Bud Cutting

alternatives are frequently listed in detailed books on the topic.

There are three kinds of stem cuttings: the common straight or regular cutting, the heel cutting and the mallet cutting. The heel and mallet techniques are used where the older tissue involved will increase the percent of rooting and to get more cuttings from limited materials.

The heel cutting is produced by stripping a side branch from a main stem and getting a small amount of the older wood from the node area of the main stem. A mallet cutting consists of a section of older stem tissue at the base of the cutting, the older tissue is about $\frac{1}{2}$ to 1 inch long and is cut off squarely above and below the node. On plants with opposite branches, the older stem can be split down the middle to provide half a mallet for each side.

Root Cuttings

Certain plants, particularly perennials, may be propagated from root cuttings in late summer. Select mature, thick roots. Cut them into 1- to 3-inch lengths. Lay them horizontally in a flat which is partially filled with one of the propagating mixtures or a modified soil mixture. Then cover them to a depth of about $\frac{1}{2}$ inch. Water the cuttings and protect

them from drying out by covering the container with glass or a lath shade until growth is visible. Young plants are usually ready for transplanting in 6 to 12 weeks.

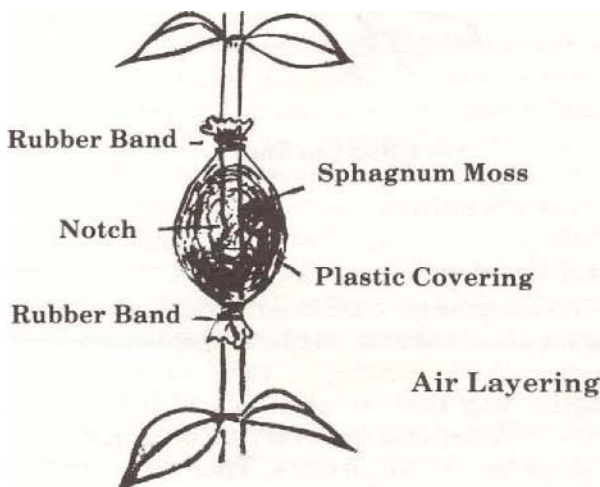
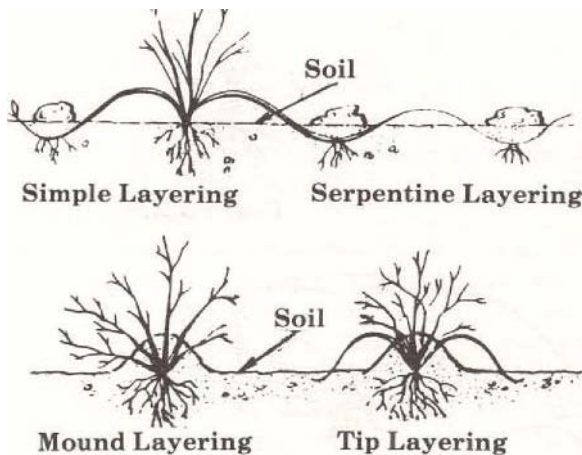
Layers

If a branch of a plant is wounded and the wound is covered with a rooting medium such as soil or sphagnum moss, the branch usually will strike roots while it is still attached to the parent plant. It then can be severed from the parent and set out as a new plant. This method of propagation is layering. It is successful with more species of trees and shrubs than is any other method of vegetative propagation.

Layering usually is most successful if done in spring or in late summer. Rooting is most vigorous in cool weather.

If a branch is low and sweeping and can be bent to the ground easily, layer it by burying the wounded part in soil. This is called simple layering. If the branch cannot be bent to the ground, layer it by wrapping the wound with moistened sphagnum moss. This is air layering.

Many plants naturally send out runners to form new plants. These small plants can be pinched off and rooted.



Care After Rooting

The root systems of newly-rooted plants are small in relation to the tops. You can reduce loss of water through the leaves of these new plants and lessen danger of wilting and plant death by pruning and shading.

As soon as you plant new rooted layers in the nursery bed, you may wish to prune all side branches; remove 1/3 of their original length.

Erect screens around the new plants to shade them. Suitable screens can be made of snow fencing, lath, reed matting or burlap attached to wood framing.

After the first winter, remove the screens. The roots should be large enough by the end of the season to absorb all water needed by the plants. The plants then can be safely transplanted to their permanent location.

After rooting some types of plants, you may want to grow them in a coldframe for one winter before planting them in their permanent location. Harden the plants for moving to the coldframe by opening the plastic bag for an hour or two each day. After a week of this, the plants should be hardened enough to move safely.

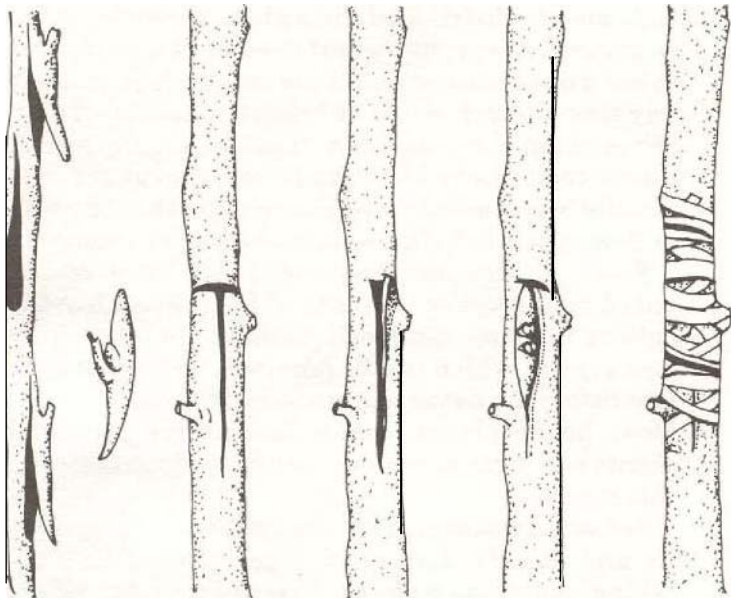
If cuttings root in spring or early summer, transplant them immediately from the pot to an open coldframe. In the fall, cover the coldframe with sash or plastic sheeting. Coldframes used for winter storage should not be located where they will receive full sun.

If cuttings root in late summer or fall, either transplant them immediately from the pot to a closed coldframe or place the entire pot of cuttings in the coldframe and transplant in the spring.

If you decide to leave the cuttings in the pot, dig a hole in the soil of the coldframe and set the flower pot in the hole with its rim even with the soil surface. Fill in around the flower pot and firm the soil.

In the spring, after they have overwintered in the coldframe, move the plants to a nursery bed. Shade them and water frequently during their first season. The plants, except shade-loving kinds, do not need shading or special watering after the first year.

Transplant new trees and shrubs to their permanent locations after they grow 12 to 24 inches tall.



Budding and Grafting

For grafts to be successful, the transferred part called the scion must be from a plant that is closely related to the rooted part called the stock.

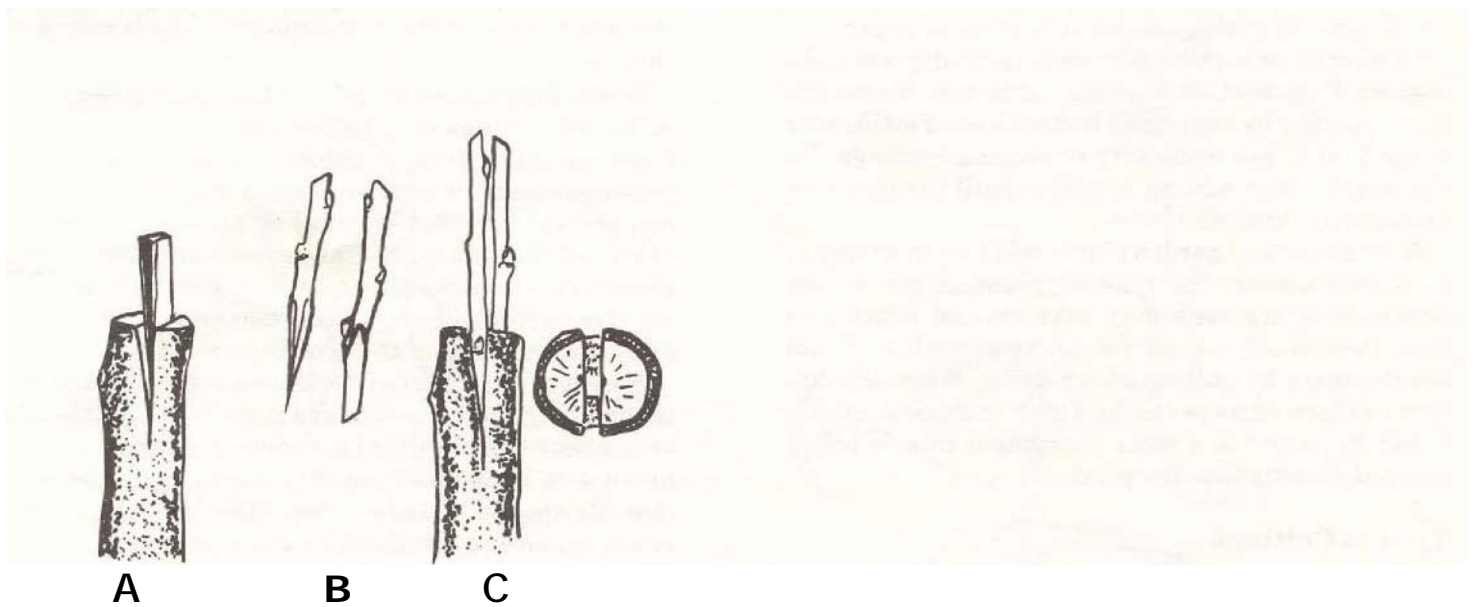
The growing tissues of the scion and stock must be in close contact for the two parts to unite. This growing tissue, the cambium, is the soft layer of cells between the bark and the wood.

Many types of grafts are used for the propagation of fruiting plants or ornamental trees and shrubs. The most useful types for the home propagator are probably bud grafts and cleft grafts.

Since the various techniques of grafting are quite complex, articles and detailed reference books on the topic should be consulted before attempting this method of propagation. Contact your county Cooperative Extension Service agricultural agent for suggestions.

A B C D E 10/80/5M Bud Grafting

A, bud stick; B, T-shaped cut in bark of the stock; C, bark raised along both sides of the cut; D, bud inserted; E, **completed bud graft bound** with a rubber band to **prevent** drying.



Cleft Grafting
 A, stock **prepared** for grafting; B, two **wedge-shaped** scions **prepared** for each split stock; C, scions inserted in stock so cambium layers **touch**.