



## Toronto Master Gardeners

Toronto Master Gardeners are trained volunteers dedicated to providing horticultural information to the public.

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## Toronto Botanical Garden

Toronto Botanical Garden is a volunteer-based, charitable organization whose purpose is to inspire passion, respect and understanding of gardening, horticulture, the natural landscape and a healthy environment.

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## How to Graft

Grafting is the joining together of two plant parts (scion and rootstock) in a manner that causes these parts to unite and become one plant. The scion is the portion that is propagated. This consists of a shoot that possesses dormant buds from which stems and branches will grow. The rootstock acts as the new plant's root system and sometimes serves as the lower portion of the grafted plant's trunk. The cambium layer is a group of actively dividing cells found between the bark and wood of the stem. Contact between the cambium of the scion and rootstock will enable the two plants to become grafted together. While grafting encompasses all methods of joining plants, budding is a grafting procedure that uses a small piece of bark or wood containing a single bud as the scion. Many gardeners may be hesitant to use grafting techniques to propagate their plants because of the skilled knife work required. However, with very little practice, most home gardeners can successfully use this propagation method.

## Why do we graft plants?

Grafting can be done for a number of reasons. One can alter the size of a plant by reducing (dwarfing) or increasing growth. It provides a means to reproduce plants that cannot be propagated by other asexual methods and that do not come true from seed. It allows one to produce plants with an increased level of resistance to soil-borne problems caused by insect, nematode and disease attack. Grafting also provides a means to repair damaged plants, to change the form or variety of plants, optimize pollination and cross pollination, and to create plants that are better able to thrive in a wider range of environmental conditions.

## Conditions Required for Successful Grafting:

Several requirements must be met to ensure successful grafting. The stock and scion used must be compatible. Plants used must be closely related (usually the plants must be within the same genus). The cambium layers of the scion and rootstock must be in close contact with each other and secured in place. This will allow the cut surfaces to heal together in a way that will permit the movement of water and nutrients between the two graft components. In addition, grafting of the scion and stock must be carried out when these components are at the appropriate physiological stage. The scion and stock may need to be either dormant or growing depending on the type of grafting procedure used.

## General grafting principles:

There are many different types of grafting and budding methods, but the fundamental process is similar.

- Normally most grafting is carried out during the end of the dormant season, in late winter to early spring. During this time the cambium is particularly active and the warmer conditions favor the growth of callus cells, which are responsible for sealing wounded plant tissue.
- Scions should be chosen from shoots grown in the previous year. They are collected just before bud break (early spring) and should possess 2-3 leaf buds. Scion wood should be taken from the middle of the stem and be stored in moist sawdust/ peat, in a plastic bag in the refrigerator. During the actual grafting procedure, the scion should never be allowed to dry out. Preserve them by placing them in water until the rootstalk is prepared.

- Lay the two cut edges together, making sure the joint between the graft components are as flush as possible. Bind them together tightly with rubber grafting strip, tape or twine. Once the graft is firmly bound, seal the area with grafting wax or paint. This will protect the graft from desiccation and fungal attacks.
- Aftercare is important until the graft unites and is completely healed. The graft should be examined regularly. New shoots sprouting from the scion tell you that the graft has taken. Slit the material used to bind the graft so that it does not interfere with growth. Shoots from the understock must be removed so that they do not choke out the scion. If the scion grows vigorously it may need to be tied or staked to prevent it from breaking off.

## Grafting methods:

There are many different types of grafting and budding procedures. Bridge grafting and inarching are used to bypass or support a damaged or weakened area of a plant, usually near the base of the trunk. Cleft grafting is used for top working flowering and fruiting trees (apple, cherry, pears, peaches) in order to change varieties. Saddle grafting is commonly used to propagate evergreen rhododendron species and hybrids. Veneer grafting is used to propagate conifers especially those that are very dwarf and slow-growing. Below are descriptions of two methods that are straightforward enough to be successfully completed by the everyday gardener. These are ideal methods for gardeners who are just beginning to graft.

### *Whip and Tongue Grafting*

Whip and tongue grafting is carried out in the spring using plants with stems up to 2cm (3/4 in) in diameter. For best results, stock and scion should be of similar diameter, between

0.5 -1 cm (1/4 -1/2 in). Whip grafting is an appropriate method for the beginner because of its high rate of success. This is made possible by the large area of contact between the cambium layers of the two graft components.

1. Prepare the rootstock by cutting it back to 10-25 cm (4-6 in) from the ground. The cut is a slanted, upward-pointing one, about 5cm (2in) in length. A short, downward facing cut is made on the rootstock in order to form the tongue. The length of this nick should be 1cm (1/2in) and begin at the point that is one-third the way down from the tip of the slanted cut on the rootstock.
2. Next, the scion is prepared. Healthy scion wood is collected in the winter and stored in a cool place (refrigerator) so that they remain dormant until the rootstock is ready in early spring. During the graft procedure, remove any soft growth at the tip of the scion wood and trim to 3-4 buds. Make a sloping cut, about 5cm (2 in) long, that ends just below the lowest bud on the scion. To ensure that a rootstock and scion stay firmly together, a tongue is carved into the cut surface of the scion similar to that made on the rootstock. This time, the cut, which should be 1 cm (1/2 in) deep, is made two-thirds of the way up the first slanting cut on the scion.
3. Fit the rootstock of the scion into that of the rootstock so that the cambiums of both line up as closely as possible. Bind the union with grafting tape and apply grafting wax or paint to the area. The cut tip of the scion should also be sealed with wax/paint.
4. Over the next 6-12 months a callus tissue will develop over the graft union and the surfaces will unite. Shoots will form from the scion buds if the graft is successful. If

any shoots arise from the previously dormant buds on the old rootstock, they should be removed with a sharp knife.

### *Budding*

Bud grafting uses a bud rather than a stem cutting for a scion. It is a thrifty and efficient way to propagate ornamental shrubs, roses and fruit trees since only a single bud is used as a scion and the rootstock can be raised from seeds or cuttings. Two common budding methods are chip budding and t-budding. Chip budding is used anytime buds are mature. It can be carried out over a longer period of time during the season than T-budding. T-budding is faster than any other grafting technique; it is easy to perform and has a very high success rate, even for beginners. The method is described below:

- T-budding can be carried out any time the bark of the understock easily separates from the wood (known as slipping) and when the scion buds are mature. While it can be carried out in the spring, most budding is best done in the summer and early fall from late July to early September.
  - The plant selected as understock material must possess new, vigorous growth. Budding of young plants commonly takes place on the trunk, 5-7.5cm (2-3 in) above ground level. For this reason, leaves and shoots should be removed from the lower portion of the stem, so that the area on the stock, where budding will be carried out, is smooth and clean.
1. Budsticks, obtained from the desirable plant to be propagated, are collected from the current seasons growth. Remove the leaves but allow 1cm (1/2 in) of the leaf stalks to remain attached to the budsticks. These leaf stalk 'stubs' can be used to handle the bud during the budding procedure. The branch should possess healthy, plump,

well-developed buds. To obtain a bud from the budstick, make a shallow, smooth, slicing cut upwards, starting 1-2 cm (1/2-3/4 in) below the base of the bud and finishing the same distance above the bud. Remove the bud along with a tail of bark that can be used to handle the bud during the graft. Never allow the bud to dry out during the procedure. Drop the bud in a container of water while the rootstock is prepared, if necessary.

2. Make a horizontal cut on the stock, 5-7.5cm(2-3 in) up the stem from ground level. Next, make a 2.5cm(1in) long vertical cut up to and joining the center of the first cut creating a 'T' shape.
3. Gently lift the bark, at the point where the two cuts meet with the knife. Insert the bud, sliding it down snugly between the bark and the wood, using the remaining leaf stalk as a handle. The cambium of both the rootstock and the bud should be in intimate contact.
4. Bind the bud area with budding rubber or grafting tape, making a few wraps above and below the bud. Make sure to leave the bud exposed.
5. Within a week to ten days you will be able to determine if the bud graft has taken. If it has, the bud and bud shield will look fresh. Remove the grafting tape at this time. A dry, wrinkled bud and bud shield, on the other hand, indicates failure.
6. The following spring, after the bud starts swelling, the rootstock can be removed by cutting it off above the bud.

### Considerations:

- Always use sharp, sterile knives during propagation procedures.
- Some research will need to be done beforehand to determine which understock is appropriate for the variety of scion that you wish to propagate.
- Grafting cuts must be smooth and straight. It is often helpful for the beginner to practice grafting cuts on spare pieces of stem before carrying out the actual graft. The better the union, the greater chance that the graft will be successful.
- Two other forms of grafting that the home gardener may be interested in attempting are tomato grafts and cacti grafts.

### References:

The Toronto Botanical Garden Weston Family Library is an excellent source for horticultural information.

Clarke, Graham and Alan Toogood. *The Complete Book Of Plant Propagation*. London, England: Cassell & Co., 2001

[www.ces.ncsu.edu/depts/hort/hil/grafting.html](http://www.ces.ncsu.edu/depts/hort/hil/grafting.html)

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