Chip Budding: An Old Grafting Technique for Woody Plants With Rediscovered Advantages for Nebraska

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Chip budding is one propagation method used on woody plants. This NebGuide explains how to perform the technique and lists which plants can be successfully chip budded.

Chip budding is one of the primary grafting methods used for the asexual propagation of woody plants used to produce named cultivars (varieties) or clones of many ornamental trees, shrubs, fruit and nut trees. It is one of the two most popular budding systems used in nursery production, and it is the only budding system that can be done on rootstocks (stocks) that have either active or dormant vascular cambiums.

For successful chip budding, you must have:

- a compatible stock plant (rootstock) of the same genus and species as the cultivar, with at least a 1/2-inch (12 mm) stem diameter with an active or dormant cambial growth;
- mature “resting” buds, preferably in a quiescent condition from the superior cultivar/clone, for grafting onto the same species as the rootstock;
- a sharp grafting or budding knife that will maintain a razor sharp edge; and
- proper wrapping material that will tightly hold the bud in place on the rootstock, prevent desiccation, and keep excessive moisture from soaking into the bud union.

The chip budding technique is now preferred over the T-budding method for many woody plants. The benefits of chip budding include:

- Any professional or amateur propagator can learn this relatively simple grafting technique with a little practice.
- The technique is quick to do, a high percentage of the buds grow, and scionwood is conserved. Each lateral bud on the cultivar scionwood or budstick is a potential new plant.
- It can be used in nursery budding, bench grafting, container budding, and top working in orchards.
- It works well in regions of the world with shorter growing seasons and cooler night temperatures (including the central and northern United States), and it is an effective way to extend the regular budding season (April through September).
- Chip budding can be started in April in Nebraska (Climate Zone 5 [Z5]) instead of having to wait until May, as with T-budding, for active cambial (slipping) growth to occur.
- Chip budding in late summer (August through September) with current growing season’s “resting” mature buds give excellent results when the rootstocks’ cambiums are not active (Example: grapes).
- The propagator can perform chip budding anytime during the growing season rootstocks with active or dormant cambiums, whenever mature “resting” buds are available, giving a longer production “window” (Example: roses).
- Chip budding has better takes (success) with a stronger and superior union between the rootstock and the scion, and the new vigorous growth from the scion bud is straighter with more uniform tree growth than with the T-budding method.
- The chip budding technique assures cambial contact between the scion bud and the rootstock; however, it requires more skill in that the propagator must match the cambiums of the scion bud and the rootstock.
- Anatomical studies have compared the two main budding techniques and showed that chip budding heals more rapidly and with a more complete union of the xylem and the continuous cambial tissues than did T-budding.
- Mechanized budding machines can easily perform chip budding techniques.
- A wide variety of plant species of fruit and nut crops and ornamental plants can be chip budded, as well as thin-barked species that do not T-bud well. See page 4 for a list of these plant species.

Selecting Budwood/Scionwood for the Budstick

Growth from the current season should be collected for budwood from mature shoots of the desired cultivar. When selecting budwood from woody plants, choose vigorous shoots that have developed a terminal bud. These shoots will usually
Dormant budwood is cut from dormant stock plants during the winter months (after leaf-fall and up to four to six weeks before bud break), with mid-March being the best time in the Midwest (Z5). This scionwood is also wrapped in slightly moist paper (damp but not wet) and placed in a polyethylene (PVC) bag marked to identify cultivar name, should be refrigerated at 34° to 40°F (1° to 4°C) for only one to three days until they are used.

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Preparation of the bud scion chip

Holding the budstick, make the first horizontal cut below the scion bud about 1/4 to 1/2 inch (6 to 12 millimeters) down into the wood beneath the bud at an angle of 30° to a depth of inch (3 millimeters) deep (Figure 1, C). Start the second cut about 1/2 to 1 inch (12 to 25 millimeters) above the scion bud, cutting shallowly inwards and downward behind the bud (Figure 1, D) until it intersects the first cut, thus releasing a bud chip (Figure 1, D). The propagator can reverse the order of these scion bud cuts. Cut surfaces will dry very rapidly, especially on the scion chip bud. If the cut surface of the scion bud dries, the survival of the scion will be low. Try to have the chip bud placed on the rootstock within five to 10 seconds from the time you started to make the first cuts. Very few beginning propagators work this quickly while achieving smooth cuts. An alternative that works very well is to cut the scion bud first and immediately place it cut-side down on your tongue. Store it in your mouth while preparing the rootstock cuts. A scion bud can remain viable for hours in a propagator’s mouth. Saliva is harmless to the bud and the plant’s sap is harmless to the propagator unless a toxic pesticide has recently been applied to the plant. It might be possible to lay the precut scion bud on a damp sponge rather than placing it on the tongue. Dehydration of the cut surfaces can also be prevented by budding in a cool shaded area, early or late in the day and on a cloudy, humid day.

Procedure for making chip bud knife cuts on the rootstock

Remove a chip of bark from a smooth place between nodes near the base of the rootstock/stock (4 to 6 inches [10 to 15 centimeters] above the soil line) and replace with a scion chip of a slightly smaller size and shape from the budstick that contains a bud of the desired cultivar (Figure 1, A through D). The knife cuts in making the chips on both the rootstock and budstick are identical. Knife cuts should be made with a single, smooth stroke of the knife, starting at the base of the knife blade and finishing near the tip. Whittling, sawing or forcing the same spot on the blade through the entire cut will result in an uneven cut surface and will reduce your success rate. The first cut is made downward in the side of the stock through the bark and shallowly with the knife held horizontally so that the bottom of the cut is about inch (3 millimeters) deep at a 45° angle from the bark toward the pith of the rootstock to form an acute lip (Figure 1, A). This first cut is about 1/2 inch (12 millimeters) across. Withdraw the knife and make a second cut about 1 to 1 1/2 inches (25 to 38 millimeters) above the first cut. Cutting downward to meet the first cut, and the piece of wood will be released (Figure 1, B). Next, remove the chip of stem tissue, leaving a cut shaped like an “v” (Figure 1, B).
takes by covering the scion bud with this poly tape. Be sure to immediately wrap all cut surfaces to prevent desiccation. **Caution:** When using rapidly growing rootstocks, degradable budding bands (rubbers) that do not cover the actual bud works best. Parafilm can be placed over the budding band and bud for added protection. The poly wrap should be quite firm, stretching the tape almost to the point of breaking. The pressure or tautness of the tying strips must be snug enough to prevent the formation of large pads of undifferentiated rootstock callus (parenchyma cells), between the scion bud (bark) and the rootstock’s wood (xylem), which will hold the scion in place but does not form a successful union with the xylem and phloem vascular tissues. Always wrap from the bottom of the bud to the top so that each layer sheds rainwater from the layer below it like a shingle roof. Cover the bud completely but do not leave any of the bases of the petiole (a leaf stem) attached below the bud eye (leaf scar) uncovered. If exposed, these petioles will quickly rot and decay and may spread to the scion bud. Properly wrapping the chip bud is the most essential step in this technique to obtain success. It may prove inadvisable to wrap or tie over the actual bud of some species, i.e., cherries, walnuts and pecan, particularly when the bud is very large and prominent. Do not cover buds with grafting wax. Thinly stretched parafilm can be used as a covering over the bud of the chip, providing it is only one to two layers thick and stretched. Parafilm permits a young, healthy bud to emerge through the film.

### Care of the chip budded plants

Buds that are forced into growth in late summer do not have sufficient time to harden off before winter and are subject to damage by winter cold (Z5). The only thing to do is loosen the ties (later summer or fall) as the stem grows in girth (diameter) during September and October. In the spring of the next growing season, remove the top of the stock plant about 1 inch (25 millimeters) above the inserted bud (often referred to as a bud union).

Although budding bands and polyethylene tape are reported to decompose and generally do not need to be removed when T-budding, studies have shown that they must be removed when chip budding because binding or girdling of fast-growing stock plants may occur within one month. When the newly inserted bud begins to grow after forcing, some pruning and training may be necessary, especially on field grown plants. This will allow a stronger union to develop; otherwise, strong winds may cause the new vegetative growth to break off at the bud union. Vigorous new scion growth may need to be staked for proper training and upright growth.

Remove any new growth arising from below the bud union on the rootstock at the point of origin. This type of new sucker or water sprout growth may in time overgrow and dominate the grafted scion bud’s growth, resulting in stunting or even loss of the desired cultivar.

A successful propagator needs to know how to perform the specialized techniques of budding and grafting woody

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**Figure 1.** Chip Budding is widely used in propagating woody ornamentals and fruit trees. The bud piece is cut as shown here and covered completely with poly tape. Sometimes the bud is not completely covered (Kester, et al, 2002).
plants as well as the proper timing of such operations. However, even more important is the horticultural care given to the stock and rootstock plants one year prior through one year after performing the propagation technique (i.e., proper irrigation, fertilization, weed control and plant training and pruning). Rootstock plants grown under proper irrigation (normal rates) will bud easier, the bud union will heal more completely and these scion buds will force more successfully into new growth than plants grown under drought conditions. Use stakes to ensure that the growth from the scion buds will be straight upright growth. Straight stems/trunks are essential to good growth from the scion buds. How fast the shoot growth develops, and the time scale until they become familiar with what to expect, how the shoots develop into new growth than plants grown under drought conditions. (normal rates) will bud easier, the bud union will heal more completely and these scion buds will force more successfully into new growth than plants grown under drought conditions.

To grow Plant species that can be chip-budded:

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Note</th>
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<tbody>
<tr>
<td>Actinidia (kiwi)</td>
<td>Macadamia</td>
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<tr>
<td>Almonds (Prunus)</td>
<td>Magnolia</td>
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<tr>
<td>Apples (Malus)</td>
<td>Mango (Mangifera)</td>
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<tr>
<td>Apricot (Prunus)</td>
<td>Maples (Acer)</td>
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<tr>
<td>Ash (Fraxinus)</td>
<td>Mountain Ash (Sorbus)</td>
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<tr>
<td>Avocado (Persea)</td>
<td>Mulberry (Morus)</td>
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<tr>
<td>Azalea (Rhododendron)</td>
<td>Oaks, English (Quercus)</td>
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<tr>
<td>Birch (Betula)</td>
<td>Osage Orange (Maclura)</td>
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<td>Blackgum (Nyssa)</td>
<td>Pawpaw (Asimina)</td>
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<td>Buckeye (Aesculus)</td>
<td>Peaches (Prunus)</td>
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<td>Cherry (Prunus)</td>
<td>Pears (Pyrus)</td>
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<td>Chestnut (Castanea)</td>
<td>Pecan (Carya)</td>
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<tr>
<td>Cotoneaster (Cotoneaster)</td>
<td>Pistachio (Pistacia)</td>
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<td>Dogwood (Cornus)</td>
<td>Persimmon (Diospyros)</td>
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<td>Elm (Ulmus)</td>
<td>Quince (Cyonia)</td>
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<td>Ginkgo</td>
<td>Redbud (Cercis)</td>
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<td>Grape (Vitus)</td>
<td>Rhododendron</td>
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<tr>
<td>Hackberry (Celtis)</td>
<td>Rose (Rosa)</td>
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<td>Hawthorn (Crataegus)</td>
<td>Saskatoon (Amelanchier)</td>
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<tr>
<td>Hazelnut (Corylus)</td>
<td>Serviceberry (Amelanchier)</td>
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<tr>
<td>Hollies (Ilex)</td>
<td>Sweetgum (Liquidambar)</td>
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<tr>
<td>Bean tree (Laburnum)</td>
<td>Walnut (Juglans)</td>
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<tr>
<td>Linden (Tilia)</td>
<td>[Bulman, 1989]</td>
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<tr>
<td>Locust (Gleditsia)</td>
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A propagator new to this technique should start on a small scale until they become familiar with what to expect, how the shoots grow, how fast the shoot growth develops, and the time that is needed to properly train the new budded plants.

**Budding/Grafting Supplies**

Parafilm™, Laboratory Film, American National Can, Neeiah, WI 54956

Grafting knives, tools and supplies, A. M. Leonard Co., 241 Fox Drive, Piqua, OH 45356, 1-800-543-8955, www.amleo.com E-mail: custserv@amleo.com

Budding Supplies, Wilson Irrigation and Orchard Supply, 1104 E. Mead, Wilson, Yakima, WA 98903, Tel.: 800/232-1174 or (509) 453-9983, www.wilsonirr.com E-mail: roger@wilsonirr.com

Chip Budding Tape, Raintree Nursery, 391 Butts Road, Morton, WA 98356, Tel.: 360-496-6400, www.raintreenursery.com E-mail: info@raintreenursery.com

**References**


This publication has been peer reviewed.