GRAFTING AND BUDDING TECHNIQUES FOR APPLE

OBJECTIVES:
1. Develop proficiency in grafting and budding.
2. Learn basic principles in handling grafted plants.

INTRODUCTION: Grafting is the art of joining plant parts so they unite and grow as one plant. The part that becomes the root system of the new plant is called the rootstock, and the part that becomes the top is called the scion.

Grafting is used to perpetuate clones difficult to propagate by other asexual means, to obtain the advantages of a particular root system, to produce a salable plant more quickly, to change cultivars on established plants, or to repair damaged trees. The art of grafting is very old, and many techniques and variations of these techniques have been developed to meet different situations or needs. In this laboratory, you will learn some of the basic, most commonly used methods of grafting.

The whip and tongue graft (called a whip or splice graft if the tongue is absent) is used for grafting rootstocks ¼ to ½ inches in diameter. This procedure is completed in winter or early spring, and good callusing and "healing" (graft union formation) should be completed before the scion leafs out. When bareroot stocks are used (the usual case) the operation is termed bench grafting.
PROCEDURE:

A. Knife sharpening. The key to successful grafting is a very sharp knife, which can be pulled slowly and steadily through the wood. Observe while your instructor demonstrates the correct method for sharpening a knife.

![Diagram of knife sharpening]

To sharpen a grafting knife, the initial grinding may be done with a medium-grit stone, but a hard, fine-grit stone should be used for the final sharpening. The stone should be wet with water or oil during sharpening. Do not use a carborundum stone, because it is too abrasive and will grind off too much metal. Most grafters prefer to use knives beveled only on one side, the back side being flat, whereas others prefer a knife beveled on both sides. In sharpening the knife, hold it so that only the edge of the blade touches the stone so that a stiff edge for cutting can be obtained. Use the whole width of the stone so that its surface will remain flat. A correctly sharpened knife of high-quality steel should retain a good edge for several days' work, with only occasional stropping on a piece of leather.

B. Practice. The object of this exercise is to develop some degree of proficiency in grafting.

Your knife will probably need to sharpened before you are ready to graft. Observe as the instructor demonstrates various grafts. Practice wood is in ample supply so make and tie plenty of unions, but please avoid wasting materials. Tape will be available, and you may want to wrap your fingers to prevent accidents. Never force a knife - push or pull only when you have complete control of the cut. You will injure yourself if you increase the force on a knife until it suddenly jerks through the wood.

C. Bench Grafting Apple Using a Whip and Tongue Graft

1. If you lack confidence in your grafting abilities, continue to practice the whip and tongue technique. Feel free to ask your lab instructor for help.
2. Obtain a Polish-2 rootstock (usually called P-2). This rootstock should be virus free. Polish-2 has a dwarfing effect on scion growth, and staking a tree with this rootstock is often recommended. This rootstock produces trees that are roughly 25% of seedling tree height (so the tree will grow to about 8 to 10 feet tall). Check this web site for additional information on this rootstock: http://www.treco.nu/P-2.htm.

3. During this bench grafting procedure, keep the rootstocks and scions moist and prevent them from drying. Obtain a piece of scion wood and BE SURE to write the cultivar name on the pot tag.

4. If scions and rootstocks are similar in size, complete a whip and tongue graft.
   a. If the sizes (diameters) of the rootstocks and scions are greatly mismatched (different), you may try a veneer graft on one potted apple tree.
   b. If the scion diameter is smaller than the stock, then a cleft graft could be used on the bareroot stock plant.

5. After making the graft cuts, try to line up the cambiums from the rootstock and scion. Line up ONE SIDE at a minimum!

6. Wrap the graft area with a budding rubber. If a lot of surface tissue is exposed, Parafilm® should be used to cover the graft. In most cases, Parafilm® should be used.

7. Carefully pot the plant (in a 1-gallon pot), and place it in the mist bench. Be sure to label the plant with the name of the scion cultivar. Leave the grafted plant alone for four to six weeks before unwrapping or checking the graft union.

Ingredients for Successful Grafting

1. Good contact between stock and scion - straight, flat cuts, minimum ¾ inch long.
2. Cambium layers matched as closely as possible.

3. Tying as snugly as possible. Cut ties (if necessary) several weeks after scions are growing.

4. Keeping the union moist or at 100% humidity.

5. Holding temperature at the union between 55° and 70°F to encourage callusing. Maintain warm temperature for 10 to 20 days, depending on rate of scion bud development.

6. Disbudding rootstock as necessary after planting. Growing buds on the rootstock will compete with those on the scion.

7. Planting early in spring, and irrigating and shading young grafted trees if necessary.

T-BUDDING


INTRODUCTION: Certain grafting techniques (bark grafting, T-budding) can only be done when plants are in active growth and the bark is slipping and easily separated from the wood cylinder.

T-budding is probably the most widely used grafting technique, since roses, most fruit trees, and many other woody plants are commercially propagated this way. It is simpler, faster, and easier to learn than grafting and usually results in a high percentage of success. In addition, budding makes more economical use of scion wood since every bud can result in a new tree. Rootstocks are generally ¼- to 1-inch diameter and one-year-old seedlings or layers (but can be
larger and older). Budding can be done at any time during the growing season when well developed buds are available. Commercially there are three periods for T-budding.

**Fall budding** - Late summer is the most popular time to bud since rootstocks have made essentially one year’s growth, and current season’s scion buds are fully developed. Choose vigorous, vegetative buds from the middle and basal portion of shoots. Use the petiole attached to the bud as a handle. In 2 to 3 weeks, if budding was successful, the petiole will fall off. The following spring before growth starts, remove the rootstock top just above the bud using a sloping cut away from the bud. Rub off all other rootstock buds as on grafted trees.

**Spring budding** – Bud wood is collected in winter before buds begin to swell, protected from drying, and held in a refrigerator. Budding is accomplished as soon as the rootstock bark is slipping. Rub off other rootstock buds and cut stock back in about two weeks to force out the new bud. Fall budding, however, is often preferred to spring budding because the higher late summer temperatures result in better graft union formation, the budding season is longer, and the new buds get off to a faster start in their first growing season the following spring.

**June budding** – Seeds are planted in fall or early spring, and the new seedlings are budded in May or June using current season buds. Useful especially for fast growing trees in areas with long growing seasons, June budding is more difficult to accomplish because less stored reserve food is in the stock. The stock is cut back to the new bud in two weeks, but the other buds are not removed until the new shoot is about 10 inches long.

All buds should be placed to face into the wind and should be sufficiently high on the rootstock to allow for deeper planting when moved to the permanent location. Buds are sometimes inserted upside down to give a wider branch/trunk angle, or to prevent water from accumulating between the bud and stock.
PROCEDURE:

A. Observe the T-budding demonstration - Practice wood, boiled to induce cambial slippage, will be available.

B. Practice making a T-bud cut and cutting a “shield” bud - A T-shaped cut is made in a smooth section of bark on the rootstock and the bark flaps are pried apart. A shield containing the bud is cut from the bud wood. The wood sliver can be removed or it can remain in place. The shield should fit snugly under the bark flaps leaving only the bud exposed. The flaps are tied down tightly with rubber strips.

C. Make a T-Bud

1. You planted two P-2 rootstocks. Use one of the potted greenhouse plants for T-budding. The cambium should be actively growing to make budding easier.

2. At about 4 to 6 inches above pot rim, make the necessary cuts for T-budding. After the cuts are made, the “flaps” of bark should be relatively easy to peel or loosen from the xylem; the bark should “slip” readily.

3. Cut the scion shield CAREFULLY! The wood (xylem) can be left in the shield.

4. Wrap the bud carefully with a budding rubber. Be sure to cover the entire area with the budding rubber EXCEPT for the scion bud. Use a strip of Parafilm to wrap the budded area, and stretch the material moderately when wrapping this area.

5. When budding live plants, a second bud may be inserted on the opposite side of the stem and at least 2 inches higher than the first. After budding is complete, place the budded plant in the mist chamber.

6. In two to three weeks, the rootstock can be cut back using a sloping cut immediately above and slanting back away from the top bud (if two buds are used). Remove any
additional growing buds on the rootstock. These trees may be successfully planted outside in May or June.

CHIP BUDDING

REFERENCE: Text pp. 519 – 521; illustration p. 520.

INTRODUCTION: This technique has long been a second choice to whip and tongue grafting for propagating dormant (leafless) rootstocks in winter and early spring. The East Malling Research Station in England has pioneered its use as a substitute for T-budding on growing (leafy) rootstocks. Their results indicate greater success and speed when budding many fruit and ornamental species by chip rather than T-budding. They believe that the graft union forms faster and more natural than with the T-budding. American nurserymen have been less enthusiastic than their European counterparts, indicating that climate may be a factor.

When used on dormant material, chip budding is handled exactly as was whip and tongue grafting. When placed in growing rootstocks, chip buds must be wrapped with wide, polyethylene or Parafilm strips. Usually the entire bud is wrapped over, unless it is very large as in the case of some ornamental cherries. The plastic or Parafilm strips must eventually be cut off.

This technique is unique in that it can be done any time, provided that “tight”, well developed buds are available.

PROCEDURE:
A. Observe as the instructor demonstrates the chip bud.
B. Practice Chip Budding.
Dormant wood will be available for practice. Cut downward into the rootstock at 45° angle just below a bud. Start a second cut ½ inch above the bud and go downward and inward behind the bud until intersecting the first cut. This chip is removed and replaced with an identical one cut from the scion. Tie the chip in tightly with a rubber strip, wrapping around but not over the bud. Waxing after budding is usually unnecessary if fitting and tying were properly done. For this lab, Parafilm (recommended) can be used in place of wax.

C. Complete Chip Budding

1. NOTE: Chip budding may be completed on your second P-2 apple stock growing in the greenhouse (or on the bareroot stock depending on differences in size diameters of the rootstock and scion).

2. Use the P-2 stock and remove the wood for the scion bud. If using the potted plant, remove the chip 4 to 6 inches above the pot rim. For bareroot plants, make the cut 4 to 6 inches above the last clump of adventitious roots. Either way, put a slightly dampened paper towel over the cut to prevent the tissue from drying.

3. Remove the chip from the scion as soon as possible after making the cut in the rootstock. The scion chip should be similar in size to the removed chip. If the sizes are different, line up ONE SIDE of the cambium at a minimum. Using a budding rubber, tie in the chip carefully and snugly, wrapping around but not over the bud. Cover the budded area with Parafilm stretched (moderately) over the entire area. Be sure to label this scion cultivar on a plastic tag.

4. You can add a second chip bud for insurance if you want. Locate it about two inches above the first chip and on the opposite side of the stem. Follow the directions in step 3 for the second bud chip.
5. Place the budded apple rootstocks on the mist bench and be sure to label your pot. Leave the pot on this bench for two to three weeks or until you leave in May. When you retrieve the plants, remove the rootstock above the scion. The trees can be planted outside. Keep in mind that the trees will probably grow to 10 feet tall by 15 feet wide.

Rootstock effect: 10-year old trees of 'Cox' apple on a range of clonal rootstocks.