HORT 201 - Plant propagation
Laboratory Exercise 10

Practicing Grafting and Budding

References: Text pp. Grafting – 461-467, 492-496 (Note illustrations).
Budding – 517-531 (Note illustrations).

Key words and terms from CD:

Bark graft, bench grafting, budding, callus, cambium, chip budding, double working, graft incompatibility, graft union, graft wax, grafting, incompatibility, interstock, mound layering, root grafting, T-budding, understock, waxes (grafting), whip-and-tongue grafting.

Objectives:

1. To develop proficiency in grafting and budding.

2. To become familiar with grafting machines.

3. To learn some basic principles in handling grafts.

Introduction:

Grafting is used for propagation of fruit and nut trees. Because seed reproduction results in considerable variability in fruit quality, and many fruit and nut tree species are difficult to propagate by cuttings, grafting is the method of choice to propagate fruit and nut trees. Grafting can be used for several reasons, a few which are mentioned below.

1. A cultivar which has fallen out of favor with consumers can be replaced with a cultivar which is in demand by consumers. An entire orchard can be converted to a more desirable cultivar by the grafting technique called topworking. New cultivars can be brought into bearing in 2 or 3 years if topworked on stock of bearing age.

2. Many species require cross-pollination by a different cultivar. Grafting a pollinator scion wood to an already established tree is faster than planting new trees

3. Choice of rootstock will determine the size of the mature grafted tree. Apple rootstocks can be classified as dwarfing or semi-dwarfing. The rootstock EMLA 7 which we will use in lab 11 is semi-dwarfing which means apple scion wood grafted to this rootstock will produce a tree that is 55% in size of a standard full size tree. Full sized apple trees average about 30 feet in height. Apple scion wood grafted to a semi-dwarfing rootstock average 20 feet in height. This allows easier access to fruits high up and more trees in a given acreage. Dwarfing rootstocks result in trees 10-15 feet in height.

In this lab you will learn and practice the following grafts and budding techniques. **Please bring your textbook to lab so you can use the grafting and budding illustrations for guidance!**

Part A - WHIP and TONGUE GRAFTING

Reference: Text, p. 465-467; Illustration, p. 465;

Introduction

The whip and tongue graft (called a whip or splice graft if the tongue is excluded) is used for grafting rootstocks 1/4 to 1/2 inches in diameter. The operation is done in winter or early spring, and it is important that good callusing and healing occur before the scion leafs out. When barerooted stock plants are used (the usual case) the operation is termed bench grafting. When the root stock is already established in a field the operation is termed field 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. Sharpen your knife as shown last week.

B. Practice. The object of this exercise is to develop some degree of proficiency in grafting. Your knife should already be sharp and ready to go. Practice each graft or budding procedure at least several times so that you develop skill and confidence. Use the Kevlar® gloves and leather thumb guards 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.

   1. Observe as the instructor demonstrates the whip and tongue as well as several machine grafts. Dormant wood will be available for practice.

   2. Practice making grafts with the machines listed below as well as hand grafting by the whip and tongue method.

C. Grafting machines. Machines have been used for many years to graft grapes. Two of these machines, and examples of unions made with them are illustrated in the text (p. 465-66). Grape wood is hard and grafts "take" very readily. Machines have met with somewhat limited success in grafting other species, however, and hand grafting still predominates. Recently several new machines for both grafting and budding have been introduced and are being used more extensively. These include the following, which you will have an opportunity to use:

   1. The Plesa - 2 Universal Manual Grafter, from Hungary, which makes an omega-shaped lock and key arrangement. The response to this machine has been mixed. It appears that some nurseries may be getting poorer results with the machine because they're not paying as careful attention to handling and callusing as with hand grafts. Cost = $75

2. The FieldCraft Top Grafter from New Zealand, which makes a "V" cut in the rootstock and a matching cut in the scion, is useful for mechanized top grafting and bench grafting. It has yet to be widely adopted in the commercial industry. Cost $330.

Keys to Successful Grafting:

1. Make sure there is good contact between stock and scion. Make straight, flat cuts that are at least 3/4 inch long.

2. Cambium layers must be matched as closely as possible.

3. Tie the union tightly. Ties may be cut (if necessary) several weeks after scions are growing.

4. Leave a second "back-up" bud on the scion.

5. Keep the union wet or near 100% relative humidity.

6. Hold the temperature around 70° to 80°F to encourage callusing. Maintain these temperatures for 10 to 20 days, depending on rate of scion bud development.

7. Disbudding the rootstock is necessary after planting. Growing buds on the rootstock will compete with those on the scion.

8. Plant early in spring. Irrigate and shade your grafted trees if necessary.

Part B - CHIP BUDDING

Reference: Text pp. 524-528, illus. p. 526.

Introduction:

Budding is simpler, faster, and easier to learn than grafting, and usually results in a higher percentage of takes. In addition, budding makes more economical use of scion wood since every bud can result in a new tree. Rootstocks are generally 1/4 to 1/2 inch diameter one-year-old seedlings or layers (but can be larger and older).

Chip budding was pioneered by the East Malling Research Station in England and has become the most popular form of grafting for fruit trees, shade trees and ornamental flowering trees. It has replaced T-budding as it is quicker and more successful budding method.

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 strips. Usually the entire bud is wrapped over, unless it is very large as in the case of some ornamental cherries. The tape must eventually be cut off.

This technique is unique in that it can be done anytime, provided that "tight", well developed buds are available.

Procedure:

1. Observe as the instructor demonstrates the chip bud. Dormant wood will be available for practice.

2. Preparation of the rootstock: Cut downward 1/4 of the way into the rootstock at 45°. Start a second cut 1/2 inch above the first cut and go downward and inward until it intersects the first cut. This chip is removed and replaced with an identical one, containing a bud, cut from the scion.

3. Preparation of the scion: The cuts removing the bud from the bud stick are made just as in the rootstock. The lower cut is made 1/4" below the bud and the second cut 1/2" above the bud. The resulting "chip" is placed in the rootstock.

4. Insert the removed "chip" into the rootstock and tie the chip in tightly with a rubber strip or plastic tape, wrapping around but not over the bud. It isn't usually necessary to wax after budding if fitting and tying were properly done.

5. Practice making a chip bud using the The FieldCraft Chipbudder from New Zealand. This machine removes a section of stem containing a bud from the budstick and a similar section from the rootstock, has mechanized the process of chip budding. This relatively new tool has yet to replace hand budding in the field as it is somewhat cumbersome to use. Cost = $360.

Part C – T – BUDDING

Reference: Text pp. 529-531; illustration, p.529

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 a widely used grafting technique for roses, some fruit trees, and many other woody plants. T-budding can be done at any time during the growing season when well-developed buds are available (spring, summer or fall). Commercially, there are 3 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. Remove the root-stock top just above the bud using a sloping cut away from the bud the following spring before growth starts. Rub off all other rootstock buds as on grafted trees.

Spring budding – Budwood 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. Remove other rootstock buds and cut stock back in about 2 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 healing, 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 – Seed is 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, it's more difficult to accomplish because there's less stored reserve food in the stock. The stock is cut back to the new bud in 2 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.

Procedure:

1. Observe the T-budding demonstration. Practice wood, boiled to induce cambial slippage, will be available.
2. 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 budwood. The wood sliver can, but does not have to be removed. The shield should fit snugly under the bark flaps leaving only the bud exposed. The flaps are tied down tightly with rubber strips.
3. When budding live plants (next week) a second bud may be inserted on the opposite side of the stem and at least 2 inches higher than the first.
4. In 2 weeks, the rootstock can be cut back using a sloping cut immediately above and slanting back away from the bud. Remove any additional growing buds on the rootstock. These trees may be successfully planted outside.

Part D –Lab 8 follow up. Observe corn embryo and cauliflower tissue cultures.

Each student will need to examine their corn embryo and cauliflower tissue cultures and record his or hers observations on the data sheet attached to this handout. Data sheets are **due in class Mar. 26th**.

Please discard any contaminated corn embryo or cauliflower cultures by scooping out contaminated media into the kettle next to the autoclave and placing the empty jar next to the sink in the tissue culture prep room.

Part E – Lab 7 follow up. Transfer mums and African violets to stage iii media.
Please discard stage ii media remaining in the old jar as done for part D. Fill the empty jar and place it next to the sink in the tissue culture prep room.

DATA SHEET FOR CORN EMBRYO AND CAULIFLOWER TISSUE CULTURE - March 25, 2008

Your name:_____ Circle Lab Section # 1 2 3

If your group did not name your jars by your individual names, please do so now so you can check the same jars in upcoming labs. Write your name on the glass with a sharpie.

Do not pick up jars by the lids, the lids will come off, then your jar may be contaminated. Do not open the jars to observe your explants because contamination will occur.

Circle what you observe.

Baby food jar corn embryo	contamination present	embryo unchanged	embryo larger

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Baby food jar cauliflower	contamination present	callus at edges	tiny shoots	no change

<u>PLEASE DISCARD CONTAMINATED CULTURES AS INSTRUCTED BY YOUR TA's</u>