As matching the cambium is the most important part of a good graft, I check this by stripping the phloem tissue from either side of the scion and observe the match with a hand lens. After checking in this manner I also strip off the phloem from the scion and by sight and touch (dragging the tip of the knife across the stock and scion) I can determine how closely the match has been made.

For large cleft grafts we bring in branches from trees on the campus, and tie them upright to the legs of the benches. The students complete their graft all but waxing and bagging and are then graded as mentioned above. Their label is marked with the grade for the lab and becomes the attendance record for the day.

Following the grading of the graft, students may work on actual material I have brought in gallon container stock, citrus, hibiscus, or camellias. The students are free to graft them over to selected varieties which we have and are then at liberty to take these home for their gardens.

I urge the students to practice before class and to take home the budding rubbers or grafting tools to try something at home.

MODERATOR BRIGGS: Thank you very much, Jolly.

Our next speaker is again from the University of California at Davis who will speak to us on the materials and equipment used in budding and grafting — Mr. Curtis Alley. Curtis:

MATERIALS AND EQUIPMENT USED IN GRAFTING AND BUDDING

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Grafting Materials

Rubber budding strips of various sizes are used for grafting. Exposed to air this material loses it elasticity and will fall off. Below ground there is no change so the strip must be cut after a period or it will girdle the graft union.

Raffia is used particularly with bench grafts of grapevines. This material is very good in that it rots in the soil. However, the material must be kept moist prior to planting. If allowed to dry it becomes loose and untied.

Medium to heavy cotton string is frequently used in field grafting. When covered with soil this material disintegrates in two to three weeks. If used in the air then it must be cut.

There are the various types of tapes that are used for grafting. Cloth nurseryman's tape has adhesive on one side. It is commonly used for whip grafting. This item is becoming more difficult to find. The cloth tape will deteriorate in the soil. Plastic nurseryman's tape is often used now in place of cloth tape. It is waterproof and very long lasting. Plastic tape is resistant to weather and soil and must be cut.

For topworking of fruit trees there are the common hot grafting waxes containing rosin, beeswax, linseed oil and sometimes lampblack in various proportions. For such compounds an alcohol lamp or the equivalent is needed in the field to maintain the wax in a melted condition. Overheating, or insufficient heat are problems encountered in the field.

The Gashell Grafting Compound is a type of grafting wax that is semi-solid. It is flexible at ordinary temperature and does not require heat for application. It is applied over the graft by forming with one's hand. It is used in the Pacific Northwest where is appears to be very satisfactory.

Then there are the cold type compounds such as Treseal and Treeheal, which have an asphalt base and are applied with a brush. These are water-soluble materials, that are good for most forms of grafting. However, there are two big defects: one is the compounds tend to crack, necessitating one or more return trips to reapply the material. Second is the fact that the material is black and has to be whitewashed in those areas subject to hot spells so as to prevent injury to the scion and stock from high temperatures.

Another cold type brush-on material is Farwell's grafting compound that is also used in the Pacific Northwest. It is a latex type compound that is made in several colors. This compound drives to form a waterproof flexible coating over the graft. As the graft grows the coat will also expand with the graft and does not need a reapplication as the coat does not crack. Being of a light color, yellow or red, it does not absorb heat like Tree Seal or Treheal. Some grower have had difficulty with this compound by "drowning" the scions from the bleeding of the stock due to the impervious nature of the coating. It was used this year on grapevines and appeared to be satisfactory.

Budding Materials

Rubber budding strips are still the most popular item used for trees, grapevines, and many ornamentals. There are a few other rubber materials that may be used. One is the Speed Easy Patch, which is a small rubber patch having a wire staple stuck through one edge. The patch folds over the inserted bud and the two sides are fastened together with the wire staple. Rapidix budding strip is another type of rubber strip that resembles a modified Band-Aid. The center part of the Rapidix patch is placed over the bud. Then the sides are wrapped around the branch and tied in front and over the corners of the bark thus holding in place the bark and bud.

The above-mentioned cloth and plastic nurseryman's tape is also used for budding.

Budding and Grafting Knives

There are many types of budding and grafting knives available. These are different depending on the size of the stock and scions to be worked and whether we are using trees, vines or ornamentals. Prices range from low cost fixed-blade knives

that cost $ .75 to $1.25 to the more elaborate forms of folding blade knives that cost $4.50 to $7.50. Some budders prefer to make their own knives from an old file.

Even though knives may be inexpensive they are still satisfactory if they are made of good steel and will hold an edge. Such knives are primarily for instruction purposes or those who do little budding or grafting. Propagators who do considerable budding generally buy the more expensive European made knives that have a folding blade. One of the best characteristics of a good budding or grafting knife is a large, round handle. One of the best that I have seen is an Italian knife used for chip budding and light grafting of grapevines. The German knives are of excellent quality but the handles are small and more or less rectangular. These are more difficult to hold steady, and are not comfortable to handle all day.

Most budding and grafting knives have a curved blade on both sides. The better knives, however, can be purchased as right or left-handed, being curved on one side and flat on the other.

When knives are sharpened they should be sharpened only on one side. This permits a cut to be made below a bud or on a grafting stick in which the knife will make a straight cut obliquely through the wood very easily. The knife that is sharpened on both sides requires the angle of the blade to be much greater. Thus it is much more difficult to get a smooth flat cut with such knives.

Knives should be sharpened with a medium and then a fine grit stone for the initial sharpening. It should be finished with a very fine stone that nearly resembles marble or with a leather strop. Knives can not be sharpened in three or four minutes. This requires a minimum of ten minutes and preferably longer. When sharpening a knife it is recommended that the blade be moved in one direction, going against the edge of the blade very similar to the way in which a wood chisel is sharpened. After the blade has been well-sharpened, then it is only a matter of touching up the blade at intervals to keep the keen edge.

Once a good knife is well-sharpened it should be used only for grafting and budding, not for general purposes, such as cutting string, paper, or carving wood. When not in use, knives having a straight blade should always have a guard placed over the blade. This can be made easily by folding a piece of cardboard over the blade and fastening firmly with Scotch tape, masking tape, etc. This affords a very inexpensive and quickly-made shield which will protect the fine edge.

There are several methods of determining when a knife has been properly sharpened. An experienced budder or grafter can tell by running his thumb lightly over the edge of the blade when it is sharp. Another easy method is to try to shave one's arm. Still another method is to see if the knife edge will easily cut a thin sheet of paper on edge.

A good budding or grafting knife given good care and not abused will last for years.

MODERATOR BRIGGS: Thank you, Curtis, for a most interesting presentation.

Our next speaker will be Don Sexton, who is a propagator with the Monrovia Nursery Company, Azusa, California. He will discuss grafting procedures for certain ornamentals: Don Sexton:

GRAFTING OF SELECTED ORNAMENTALS

DON SEXTON
Monrovia Nursery Company
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Many desirable ornamental plants are propagated by grafting. This is necessary because of seedling variation and the fact that cuttings of certain plants are difficult to root in high percentages under available conditions. In other cases, cutting-grown plants are very slow or weak-growing.

Fruit trees and certain shrubs, including junipers, have long been propagated commercially by grafting and budding. Fifteen or twenty years ago we grafted about 20,000 junipers each year at Monrovia Nursery Company. Now we are producing at least 200,000 grafted plants each year and the amount is still growing. The demand for grafted junipers has increased, particularly for forms of *J. scopulorum*, so that we grew 90,000 grafted junipers last year. Also, in recent years, grafting of ornamental trees has become a common practice.

Grafted plants, of course, can offer many advantages. When the scion and stock are compatible and a good union is made, rapid and vigorous growth can be expected, provided the stock and root system were in good condition and this is maintained. Uniformity of the grafted plants depends largely on the uniformity of the rootstock, since the scion wood is of a particular clonal selection. If clonal rootstocks grown from cuttings are available, this is best. Otherwise, seed from selected plants known to produce uniformly vigorous seedlings should be obtained. Clones of ornamental trees may be selected on the basis of many different characters. Some of these are habit of growth, foliage quality, time and intensity of fall coloring, absence of undesirable fruit as in *Ginkgo* and *Fraxinus*, cold hardiness, and disease resistance.

At Monrovia Nursery Company, grafting of ornamentals is generally done in the following manner. All of the stock used, with the exception of *Pyrus*, is in containers. Most plants are in four-inch pots moved up from rose pots the previous summer, or in gallon cans. Junipers are moved up about August 1st.

The understock plants, such as *Juniperus*, are carefully cleaned up so that side shoots and stubs are removed and the top cut half way back and thinned. Side grafts with a tongue are generally made, resulting in more surface for the union to take place; the top of the stock "draws up" sap and nourishes the scion. The grafts are tied with rubbers and are thoroughly