Gazania uniflora leucoleana	New colors Orange White Bronze	Cuttings, division
Hypericum repens	Dwarf St. Johnsworth	Cuttings
Lantanas	New colors	Cuttings
Lysimachia nummularia	Moneywort	Cuttings, division
Mazus reptans		Cuttings, division
Osteospernum fruticosus	Trailing African daisy	Cuttings
Potentilla verna		Cuttings
Santolina virens	Green santolina	Cuttings
Teucrium chamaedrys prostratum	Prostrate germander	Cuttings
Verbena peruviana	New color in hybrids Red, white, pink, rose, purple, burgundy, candystripe	Cuttings

GRAFTING EVERGREENS

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My main interest has been in grafting deciduous fruit trees. Because of my experience with techniques which, for the most part, are in general use, Mr. Knut Lunnum, Extension Forestry Specialist, Washington State University, prevailed upon me to help him graft some evergreens. At least, to Mr. Lunnum's knowledge, some of the grafting techniques used in horticultural crops are used to a very limited extent in evergreens. As I describe these techniques, I shall include some limited experience in grafting evergreens and suggest instances in which I think horticultural grafting techniques can be applied to evergreens.

Success in horticultural grafting depends very much upon the condition of the material and how expertly the operations are carried out. I assume the same situation applies to evergreen grafting and that possibly evergreens may be somewhat more exacting in their requirements. In horticultural grafting, failures are due mainly to failing to follow the basic principles. I trust that pointing out some of the mistakes and suggesting techniques for avoiding them will help those interested in evergreen grafting.

Time of Grafting

Occasionally you hear a grafter say, "I am not particular when I do the grafting". In our area we have a very successful grafter who says that any time after about March 1, and up to the time the trees are well leafed out is satisfactory. He sees no greater success during any one part of this period than another. Following our major freeze of 1955, we had a good opportunity to compare different times of grafting. In the springs of 1956 and 1957, when most of the repair grafting was done, some started in early March and others grafted as late as June. We also have some peach growers who insist that February is the ideal time for grafting peaches. They insist that after the last of March is too late, and January is almost as good as February. It is difficult to pick out one time that is better than all others for grafting the different kinds of tree fruits. The nearest approach to an all around satisfactory time is immediately prior to or just as root activity starts. The Douglas fir grafting which I did was done before visible bud swelling was apparent. This appears to be a satisfactory time. With ponderosa pine, however, I understand better success is obtained by waiting until the growth of both stock and scion is about half completed.

The Scionwood

Our experience in grafting fruit trees confirms the general opinion that the scionwood should be dormant and unshrivelled. This is true even though, in 1957, some apple growers in our area took scionwood from trees after growth had started and placed it directly on nearby trees. There was very little delay between the time the wood was cut and when it was put on. It may be surprising but success from this procedure was very credible. This situation is not unlike that of ponderosa pine.

Some grafters fail to use fully developed scionwood. Wood of good average vigor, grown in good sunlight appears to be better than weak or very succulent wood. Water sprouts can be used but normal twig growth is preferable. The central two-thirds of a 12 or 14 inch scion stick is better than either the tip or the butt of the stick.

For most fruit trees one-year-old wood is preferable to older wood. This doesn't mean that two- or even three-year-old wood will not grow. One of our walnut grafters prefers two-year-old wood.

Most of our fruit tree grafters shorten their scions to about three buds. If wood is scarce they shorten them even more. These same grafters seldom ever use terminal wood. There are some, however, who use much longer wood and seem to actually prefer terminal wood. Using terminal wood does not seem to cut down the number of takes. Short scions seem to produce more wood and come into fruiting a little later. It would seem that if early fruiting is not essential and vigorous growth is not objectionable, short scions have an advantage. In the Douglas fir grafting I did, I used short scions, some of which were terminal

and some were sections. Success was better with the terminal scions.

I understand that February is a good time for collecting Douglas fir scions and that dipping the butt ends in paraffin as they are being collected is a good practice. Similarly, scionwood taken from the top five whorls of a mature tree produces trees with an upright growth habit, whereas those taken from lower whorls produce more spreading growth.

Cutting the Scion

Few things in grafting are more important than a sharp knife and using it properly. It has been my experience that amateur grafters often fail to develop a technique for making good cuts when shaping the scion.

A beginer should first understand how to hold the scion stick and the knife, and then learn how to move the hand and arm as he grips the knife. With these principles well understood, and some whittling practice, anyone can develop skill with which he can make perfect cuts rapidly and with ease.

There are several different kinds of grafts which I think have a place in evergreen grafting. I shall mention a few of them.

The Cleft Graft

To prepare to cut the wedge, hold the scion stick firmly in the left hand with the butt end pointing toward you and about 3 inches of the butt extending out of the left hand. Grip the knife firmly in the right hand but don't choke down on the blade. The position of the knife in the hand is fixed and rigid. As you make the cut, the hand and the knife do not change their positions in relation to each other. There is no finger movement. The whole arm moves.

To make the first cut, place the butt end of the scion stick between the thumb of the right hand and the blade of the knife with the basal bud of the scion on the top or exposed side of the stick. With one smooth movement of the right hand, make a straight cut that is 1½ inches long by the time it comes to the center of the stick. This means that the wedge, when the cutting stroke is completed, is somewhat longer than 1½ inches. The cut surface should be straight as though you made it with a carpenter's plane. When making this cut the thumb simply serves as a supporting guide for the scion stick as the knife slides. The thumb never changes its position in relation to the knife. It always moves just as fast as the knife; you never cut your thumb.

To cut the other side of the wedge turn the scion counterclockwise almost 180 degrees and make a similar cut on the other side of the scion. Turning it less than 180 degrees, possibly 165, makes one side of the wedge thicker than the other. With practice this and the previous cut can be made in single strokes. As you complete the second cut, the tip of the wedge need not come to a feather edge. Actually it is better if it does not. As pointed

out earlier, the wedge of the average-sized scion should be about 1½ inches long and slightly thicker on one side than the other.

Making the cleft — the cleft is made with a grafting tool or similar device by splitting through the middle of the stub. Actually the splitting should be as much or more cutting than splitting. How far the cleft should extend into the stub depends upon the diameter of the stub. For stubs an inch or less in diameter an inch is enough. For stubs 2 inches or more in diameter it should be 2 or 3 inches long.When preparing to make the cleft, its direction is determined almost automatically by the smoothness and shape of the stub. But if there is a choice, there is an advantage in splitting the stub so the cleft extends radially toward the center of the tree rather than perpendicular to this direction. Then there is an inside or top scion which usually becomes better anchored than one on the bottom of the cleft.

As pointed out earlier, the cambium layers of both the stock and scion form a paper- thin cylinder of cells which lie inside the bark and outside the sapwood. This very thin layer of cells is not in the wood and it is not in the bark. It is between the two.

The fact that the cambium layer is paper-thin and that it lies only between the sapwood and inner bark requires precise manipulation to make contact between scion cambium and stock cambium.

Inserting the cleft graft scion — The first step is to open the cleft. Drive the wedge of the grafting tool in far enough to open the cleft far enough to accommodate the scion wedge. In general, it is well not to open the cleft any more than necessary. When inserting the scion, push the scion down into the cleft until only about ⅛ inch of cut surface at the top of the scion wedge is exposed. To insert the scion, it may be necessary to spring the cleft open slightly more by applying pressure to the grafting tool handle. Slant the top of the scion outward from parallel to the grain of the stock slightly to insure contact. In this way the cambium layer of the scion crosses that of the stock. Try to make them cross at approximately ¼ inch below the shoulder of the stub. When the scion is in place it should be very tight.

Veneer or bark graft

.. This graft is a surface graft. The scion is fit against the surface of the sapwood. It is not set in a cleft or notch cut into the wood. In contrast with the cleft graft, in which the stock is split and the scion is set in the wood, the veneer graft involves only the bark area of the stock. As the graft grows it forms a veneer covering over the stock. This graft is used for many special situations such as bridging over injured areas.

In general, the scion is shaped into a one-sided wedge 1½ to 2 inches long. This wedge exposes a complete elliptical circle of cambium cells near the edge of the cut surface of the wedge. To make contact these cells are placed flush against stock sapwood on which cambium cells remain as you loosen the bark. The cambium cells which adhere to the sapwood thus come in

contact with this circle of scion cambium cells. Obviously the contact with this graft is very generous compared with that of the cleft graft.

There are several different ways of inserting the scion. The most common method is to make two vertical and parallel slits in the stock bark as far apart as the thickness of the scion. These slits should be almost as long as the one-sided wedge of the scion. Holding the scion up against the stock where you want to set the scion and using it as a guide helps to cut a tongue of bark as wide as the diameter of the scion. It is well not to make it any wider than necessary.

To insert the scion beneath the strip of bark, first, loosen the tip of the bark. It sometimes helps to clip off the heel of the scion, thus giving it a sharp, two-sided wedge point. Cut the scion to the desired length, usually three buds, and slide it down so that all but about 1/8 inch of its cut surface is covered. As you slide the scion into place, the scion forces the stock bark loose and the freshly exposed cambium cells of the stock make contact with cambium cells of the scion. Allowing the tongue to remain in place and slipping the scion under it is much better than pulling the tongue of bark loose ahead of time. Contact is made while all cut surfaces are fresh and juicy.

The side graft

The side graft scion is the same as the cleft graft scion except that the wedge is somewhat shorter (3/4 inch long) and both sides of the wedge are of the same thickness. The scion need be no more than three buds long. To insert the scion, spring the stock branch enough to open the crack you cut in it. Insert the scion at a slight angle, starting it at one side of the crest of the crack rather than at the crest, and directing the point of the scion so you get as much contact as possible. While the branch is still in a bent position tap or force the scion in well so it is tight. Insert the scion far enough so that approximately 1/8 inch of the cut surface of the wedge is exposed. Sometimes a loose flap of bark lays over the scion. Trim it off. Otherwise it interferes with waxing and adds no functional cambium contact. This graft, when well-made, provides cambium contact in four places. Release the stock branch and cut it off 2 or 3 inches from the graft unless other grafts are to be made farther out. As the branch springs back it pinches the scion and holds it very firmly in place. No nailing or binding is necessary; just waxing. Coat the graft thoroughly, using all precautions to be sure that the seal is complete and will last. Give special attention to chinking wax into cracks that otherwise may be missed. Coat the end of the stock where you cut it off as well as the tip of the scion.

Fitting Scion and Stock Together

Most grafters are quite aware that cambium layers are thin and delicate. To fit the cambiums of scion and stock together requires precision. Because the cambiums are highly susceptible to drying they dare not be exposed to drying air. Although a

small amount of contact between the two cambiums will suffice, more is better. Because of this fact, cutting the scion with smooth, straight cuts and then fitting them together with extreme care adds up to more takes.

Wrapping and Nailing the Graft

Once the scion and stock are fitted together, they must be held in contact position until they knit. Nailing is by far the most common method of maintaining contact in horticultural grafts. There are some grafters, however, who insert veneer graft scions without either nailing or binding the grafts. They do this with surprising success when the bark of the stock is thick. To me it seems that with evergreens, wrapping works better than nailing.

When the scion is very small in diameter, driving a thin nail through it sometimes seriously damages it. In such instances, wrapping the graft is preferable to nailing it. Commonly, used wrapping materials are paper grafting tape, electricians' tape, masking tape and gummed cloth tape. Wrapping provides very satisfactory contact and does not injure the scion. For most of the evergreen grafting I did I used masking tape. When wrapping certain types of grafts—whip grafts, for example—care must be made not to move the scion out of position. This is a fairly common error.

Waxing the Graft

Once the graft is fitted together and wrapped or nailed, it is ready for waxing. Without waxing, cut surfaces are susceptible to drying air and decaying organisms. To preserve the delicate and exposed surfaces until scion and stock can knit, the graft must be covered with a complete seal. There are numerous sealing compounds. If they are to weather satisfactorily, they must neither crack nor wash off. In the evergreen grafting I did, I used a tree healing material. Because it gets very hard I prefer one of the regular grafting compounds.

One of the most common mistakes in waxing is to fail to see that all cut surfaces are well covered. As a rule it is well to check the grafting the following day and cover any cracks that may have opened. In general, it is not economical to be scotch with the wax. Personally, I like to use cold brush wax, but many grafters prefer and get excellent results with hand wax.

AERATED STEAM TREATMENT OF SOIL — ITS PRINCIPLES AND APPLICATION

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Aerated steam treatment of soil is basically a transfer of heat from the boiler fuel to the soil. Variables such as soil moisture, compaction, and volume, affect the penetration and volume of steam required to heat the soil.