FROM 40 ENGLISH AND UGANDAN VINEYARDS

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For g wet weight ± standard deviation.

For: Student t test and the χ² test.

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Converting Mature Vineyards to Other Varieties

Keith H. Kimball
Research Associate
Department of Pomology and Viticulture

This picture of a mature vine of the DeChaumac (S-9549) variety was taken October 5, 1976. Just a year earlier in 1974 this was a mature Concord vine. This conversion system is described in this report.
INTRODUCTION

Much has been written about grape grafting (1, 2, 3, 4) yet the grafting of mature grapevines has not been a commercial practice in New York because results have been erratic and unpredictable. Occasional successes, however, indicated grafting could be successful if properly executed. Research was therefore initiated to determine the factors important in achieving consistent success with grafting mature vines.

During this 7-year investigation, many small screening trials involving 5-10 grafts were conducted. The experience gained as a result of these trials identified techniques and vine characteristics which contribute to successful field grafting.

Observations were concentrated in five areas:

1. Factors influencing the callus development of scions and trunks.
2. Techniques for placing and maintaining scions in contact with trunks.
3. Ways to maintain moisture in the scions.
4. Ways to maintain an adequate environment around the graft for callus development.
5. The application of the information acquired.

The topworking of mature grapevines has traditionally involved cutting off the vine and grafting cuttings to the stub of the trunk. This traditional method has proved risky and expensive for New York vineyards because of the following reasons:

1. There is a loss of crop while the new form is formed.
2. If the graft fails, the vines are weak and grafting becomes very difficult.
3. Cutting the old trunk induces profuse suckers which is a management hardship.
4. The growth of scion shoots is excessive and leads to shoot and scion breakage.
5. The excessively vigorous shoots may mature and are susceptible to winter injury.

The process described here permits the grafted top to be cut off before the top is cut off. Grafts made in the spring with limited growth the first year, usually about 10 inches, but they grow vigorously the second year, the grafts usually develop a second flush of growth so that there are enough buds on the rootstock for them to produce a commercial crop the following year. The top is then borne on the stock variety for two years, at which time the variety is cropped the third year.

Advantages of this new process are:

1. It is possible to change from one variety to another without appreciable crop loss.
2. The top of the stock vine is not cut off until the graft is well established; consequently, there is no danger of weakened vines because of grafting injury.
3. There is no management problem with profuse suckers as occurs where tops are cut off before bud break.
4. The limited growth during the first year is further reduced and generally allows sufficient growth to insure winter survival.
5. More than 80 per cent surviving grafts are obtained.
6. Although complex, the process can be easily carried out.

In this 7-year study, more than 700 grafts were examined. A pictorial description of this process is presented in this report followed by a detailed description of each step. The entire process is followed carefully in the vineyard, it will give excellent results.

Distinctive features of this new process are:

1. Plastic tube containing water and affixed by a rubber band to the top of the scion to maintain moisture in the scion.
2. Various refinements in the grafting process itself.

PROCESS IN PICTURES

This process involves a series of important steps which must be carried out at a particular time and in a particular order to achieve success. The following sequence of photographs shows the process in its entirety. Each photograph is followed by a brief description of the procedure. A pictorial description of the process presented.
1. There is a loss of crop while the new vine is being formed.
2. If the graft fails, the vines are weakened and re-grafting becomes very difficult.
3. Cutting the old trunk induces profuse growth of suckers which is a management hardship.
4. The growth of scion shoots is excessively vigorous and leads to shoot and scion breakage.
5. The excessively vigorous shoots may not properly mature and are susceptible to winter injury.

The process described here permits the grafting of the vine before the top is cut off. Grafts made in this way make limited growth the first year, usually about 10-30 inches or more, but they grow vigorously the second year. During the second year, the grafts usually develop enough cane growth so that there are enough buds on the new variety to produce a commercial crop the following year. Thus, a full crop is borne on the stock variety for two years, and the new variety is cropped the third year.

Advantages of this new process are:
1. It is possible to change from one variety to another without appreciable crop loss.
2. The top of the stock vine is not cut off until after the graft is well established; consequently, there is no danger of weakened vines because of graft failure.
3. There is no management problem with the forcing of suckers as occurs where tops are cut off before grafting.
4. The limited growth during the first year is less subject to breakage and generally allows sufficient cane maturation to insure winter survival.
5. More than 80 per cent surviving grafts may be obtained.
6. Although complex, the process can be easily learned.

In this 7-year study, more than 700 grafts were made and examined. A pictorial description of this new process is presented in this report followed by a detailed analysis of each step. If the whole process is followed carefully in the vineyard, it will give excellent results.

Distinctive features of this new process are the use of a plastic tube containing water and affixed by a cork to the top of the scion to maintain moisture in the scion along with various refinements in the grafting process itself.

PROCесс IN PICTURES

This process involves a series of important details that must be carried out at a particular time and in a particular way in order to achieve success. The following sequence of photographs shows the process in its entirety with abbreviated remarks. The text following these photographs tells why these things must be done in the manner presented.

Figure 1.—These are scions as they were cut for storage. An entire internode is left above the top bud and the cut at the bottom is just below the bottom bud.

Figure 2.—At the time of grafting, the scions are cut with a diagonal cut 1½ inches above the top bud and 3 inches below the bottom bud with a straight cut across the scion.

Figure 3.—A hole for the nail that will support the scion and the weight of the tube is drilled 1½ inches from the bottom of the scion. See text for drilling instructions.
Figure 4.—The scion wedge is cut starting 1/8 inch below the nail hole for the outside surface and 1/4 inch above the hole on the inside surface. The two points at the base must be distinctly separate so they form a fork. The outside face should be about an inch long while the inside face will be about 1/4 inches long.

Figure 5.—The proper and improper cutting of the scions is shown in this close-up of the outside faces of some scions. The scion on the left is cut properly. The pith was removed simply to demonstrate the fork. The scion in the center is cut too short and stocky. The blunt tips are too stiff to adapt to the curvature of the trunk. The scion on the right is cut with a flat surface and also will not adapt to the trunk curvature.

Figure 6.—This side view of the scion shows the relative difference in length of the two sides of the scion wedge and the fact that the scion comes to a point. This latter is important. The left scion is cut correctly.

Figure 7.—This is the inside face of the scion cut started above the nail hole. The left scion is slightly.

Figure 8.—The cork is placed on the top and pressed to the thickening above the top bud.

Figure 9.—The tube is held in one hand and pressed into the tube firmly with the other. With the use of scions, it is advisable to use a device. The tube while the cork and tube are pressed into place of 1/8 inch dowel about 4 inches long inserted board is useful to provide support for the tube when it is pressed into it.
The scion wedge is cut starting ¼ inch below the outside surface and ½ inch above the inside surface. The two points at the base must separate so they form a fork. The outside face but an inch long while the inside face will be cut correctly...

Figure 7.—This is the inside face of the scion showing the cut started above the nail hole. The left scion is cut correctly.

Figure 8.—The cork is placed on the top and pushed down to the thickening above the top bud.

Figure 9.—The tube is held in one hand and the cork pressed into the tube firmly with the other. With large quantities of scions, it is advisable to use a device to hold the tube while the cork and tube are pressed into place. A piece of ½-inch dowel about 4 inches long inserted in a hole in a board is useful to provide support for the tube while the cork is pressed into it.
PREPARATION OF THE TRUNK

Figure 10.—The nail is pushed partway through the hole.

Figure 11.—The scions are now placed upright in a pail with 2 inches of water in the bottom to keep the end of the scion wet. The tubes are filled with water and are allowed to stand for at least an hour to determine any leakers to be repaired by pressing the cork in more firmly. The scions can be prepared as much as 24 hours in advance and left in the pail until taken to the fields. If the scions are left this long, however, the nail should not be inserted until just before taking the scions to the field. The nails will rust in water in a few hours and stain the scions.

Figure 12.—A typical Concord trunk to be grafted. Note the injury at the bottom which would make grafting close to the ground very difficult.

Figure 13.—Close-up of the straight port grafting.

Figure 14.—The loose bark is peeled off.

Figure 15.—A piece of ¼ inch grafting tape around the trunk. This is very important.
Figure 13.—Close-up of the straight portion selected for grafting.

Figure 14.—The loose bark is peeled off the trunk.

Figure 15.—A piece of ¼ inch grafting tape is wrapped around the trunk. This is very important.
Figure 15.—The bark is ringed by a cut all around the trunk, 1 inch above the tape.

Figure 16.—Two cuts are made from the ring down to the edge of the tape to form the flap of bark under which the scion will be inserted. All of the above preparation of the trunk can either be done at the time of grafting after the phloem has loosened or in advance during the last 10 days of May before the phloem has loosened.

Figure 17.—At the time of grafting, after the phloem has loosened, the flap of bark is lifted by the point of the knife at one corner.

Figure 18.—The scion is pushed down until it cannot go no further.

Figure 19.—The flap is moistened immediately after it is cut from a squeeze bottle.
bark is ringed by a cut all around the trunk. A narrow tape

Two cuts are made from the ring out down to the free bark to form the flap of bark under which the scion is inserted.

The preparation of the trunk can either be started after the phloem has loosened during the last 10 days of May before the scion is inserted.

Figure 19.—The flap is moistened immediately by a squirt of water from a squeeze bottle.

Figure 20.—The scion ready to be slipped under the bark.

Figure 21.—The scion is pushed down under the bark until it can go no further.
**Figure 22.**—The nail is carefully driven in to hold the scion firmly. Try not to batter the scion itself.

**Figure 23.**—The grafting rubber is wrapped around the trunk to hold the flap against the scion.

**Figure 24.**—The tape is removed and the same piece of tape is placed behind the scion and brought down over the union to keep paint off the cuts of the scion and trunk.

**Figure 25.**—The union is now painted to create an environment for callusing.

**Figure 26.**—This is a cork has been placed to keep out spray mud.

**SEQUENCE OF GROWTH**

**Figure 27.**—This photograph, taken in the same year. This is a Riesling scion variety, Leon Millot. The scion grew ab
Figure 25.—The union is now painted to maintain a humid environment for callusing.

Figure 26.—This is how the completed graft looks. A small cork has been placed in the top to reduce evaporation and to keep out spray material.

SEQUENCE OF GROWTH

Figure 27.—This photograph, taken in December 1974, shows the author holding the tip of a cane from a graft made the same year. This is a Riesling scion grafted onto the variety, Leon Millot. The scion grew about 30 inches.
Figure 28.—This is the same vine showing the crop borne by the Leon Millot vine in 1975. The Riesling variety grew vigorously during this year.

Figure 29.—This photograph, taken in December 1975, shows the growth made by both the scion and stock varieties in 1975.

Figure 30.—At the end of March 1976, the stock vine was cut off with a slanting cut just above the graft union. This cut should be painted.

Figure 31.—With the top of the stock vine, growth of the Riesling is more clearly visible.

Figure 32.—The Riesling variety is pruned a total of 70 buds. These buds will be thinned growth starts, and clusters will be thinned. Tips of canes removed by pruning were excised 20 per cent bud injury. Although the thermometer at this site, the nearest similar s minimum temperature of -11 F in January

Figure 33.—This is a view of the union of graft onto Leon Millot. The picture was taken in the vine was grafted. Note the swelling associated with the peeling away of the tape as a result of the expansion of the trunk and scion.
This is the same vine showing the crop borne on the rootstock vine in 1975. The Riesling variety grew well in the spring this year.

Figure 31.—With the top of the stock vine removed, the growth of the Riesling is more clearly visible.

This photograph, taken in December 1975, shows the union made by both the scion and stock vine.

Figure 32.—The Riesling variety is pruned to 4 canes with a total of 70 buds. These buds will be thinned to 30–40 after growth starts, and clusters will be thinned. The canes and tips of canes removed by pruning were examined and indicated 20 per cent bud injury. Although there was no thermometer at this site, the nearest similar site indicated a minimum temperature of -11°F in January 1976.

Figure 33.—This is a view of the union of a graft of Riesling onto Leon Millot. The picture was taken in the fall of the year the vine was grafted. Note the swelling associated with the ringing and the peeling away of the tape and paint as a result of the expansion of the trunk and scion.
cutting buds on sample cuttings. If it is necessary to cut the trunk, they should be excised. Do not underestimate the importance of good bruising. Those who have not used good bruising have achieved dismal results and the cutting of less than healthy cuttings is a waste of time. The cuttings are collected as three bud cuttings.

The diameters of the cuttings should be in the range of 1/4 to 1/2 inch. This measurement should be made at the shortest part of the cutting, since a grape cutting in cross-section is oval and should be at the narrow diameter. For measurement, a simple caliper can be used and the cuts should be of the appropriate width in a way that the diameter of the cutting can be accurately determined. One must observe bored holes properly sized to provide a seal between the stem and the cutting. It is for this reason that we express cuttings as 1/32nds of an inch, since the diameter of holes must be expressed in this way. A cutting measured in this way will have a cork with a hole 1/32 of an inch in diameter, or a 9/32 inch hole and result in a good seal.

TIME OF GRAFTING

There is approximately a 2-week period when grafting can be done successfully. This period is the time of bloom in the Concord variety in New York State. Bloom is usually delayed by a few days later than other varieties, in areas where earlier pruning of the phloem will be earlier, but still will occur 3 to 4 weeks before bloom.

The proper timing is critical for successful grafting. The means of placing the cutting of the trunk in contact with the cambium of the trunk is by inserting the wedge cut at the bottom end of the trunk, 6 to 10 inches long, into the trunk. This technique is commonly known as the bark graft, but we have another name. The bark can be easily removed from the trunk as a cherry, above a June 15 with the Concord variety. This becomes the earliest time that grafts can be made in the Concord variety. The loosening of the bark signifies the formation of the new phloem (bark) which occurs approximately 3 weeks later and occurs at the formation of the new xylem (wood) of the trunk. During development, any phloem of the trunk that has the tendency to root.

Figure 34.—This shows a union at the end of the second year. The scion is firmly attached at the bottom and sides.

Figure 35.—This 8-year-old graft is the first made by this process. The scion is now larger than the original trunk, the end of which can be seen. It should have been cut off closer to the scion and painted.

DETAILS OF THE PROCESS

The necessary details are in the following categories:

1. Collection of the scions.
2. Time of grafting.
3. Means of maintaining moisture in the scions.
4. Preparation of the scions.
5. Preparation of the trunk.
6. Attachment of the scion, and
7. Maintenance of the graft after it has started.

COLLECTION AND STORAGE OF CUTTINGS

Scions should be collected while dormant, preferably after leaf fall in late November or early December in New York to avoid any bud injury resulting from extremely low winter temperatures. This is particularly important with tender varieties such as those of the Vitis vinifera species. The cuttings should be packed immediately in moist sawdust, peat moss, or sphagnum moss at temperatures of 28-34 °F. Since the scions must remain dormant until the time of grafting, they must be kept in refrigerated storage. Cuttings that are stored without covering with moist material will not remain in sound condition even though the humidity of the storage is 100 per cent and the cuttings are watered occasionally. Small lots of cuttings may be stored in plastic bags in a refrigerator, providing the temperature is properly maintained and providing the cuttings are packed in moist material.

Cuttings to be used should be from high quality canes which means from exposed canes at the top of the vine. The best canes have a dark exterior color and a relatively small pith area when cut. The wood should be a healthy green without any browning of the xylem or phloem. Buds should be uninjured. Bud injury can only be determined by observing the bud condition before the bud is cut.
TIME OF GRAFTING

There is approximately a 2-week period when the grafting can be done successfully. This period is from the time the bark of the stock variety loosens (roughly June 1 for the Concord variety in New York State) until bloom. The reason for this time limitation is that this is the time of formation of the new phloem and the formation of the callus associated with this particular tissue. The exact time of bark loosening can only be determined by trial and error in your vineyard. Some varieties may be a few days later than the Concord variety. In areas with earlier growing seasons, the loosening of the phloem will be earlier, but still occurs about 2 weeks before bloom.

The proper timing is critical for successful grafting. In this grafting process, the means of placing the callousing surface of the cutting in contact with the callousing surface of the trunk is by inserting the wedge cut at the base of the scion underneath a flap of bark cut on the trunk. This is commonly known as a bark graft, but we have refined the technique. Since the bark can only be easily loosened from the trunk starting about June 1 with the Concord variety, this becomes the earliest time that grafts can be made on this variety. The loosening of the bark signifies the start of formation of the new phloem (bark), which occurs over an approximately 3-week period and occurs before the formation of the new xylem (wood) of the trunk. During this time of development, any phloem of the trunk that has been cut starts to form white succulent callus providing the callousing surfaces are maintained under conditions of high humidity. This white succulent callus is part of and attached to the phloem of the trunk, is of the same nature as the callus formed by the phloem at the base of the cutting. These masses of similar callus grow together easily, and this is what makes grafting possible. The earliest we have seen the callus visible on any grafting wound is June 6, and the major callusing occurs at approximately bloom. It is for this reason we advise that you do your work at this time.

MAINTAINING MOISTURE IN THE SCION

A plastic tube filled with water and affixed to the top of the scion provides moisture for development of the scion. This tube plays the largest part in the ability to graft onto vines without first cutting off the trunk. It is not necessary to paint the scion itself, only the graft union.

The tube is essential for success. This method of watering permits us to apply the process routinely to all vines down the row without regard to the conformity of the trunk. The grafting wound on the trunk is dry, thus the tube is the only source of water for the scion. Moisture control by painting alone is seldom successful.

This tube should be 8 inches long with an inside diameter of 3/4 inch. This particular size will hold approximately a 10 day supply of water, and yet is not too heavy to be manageable. The best material for the tube is 3/8 inch black plastic pipe such as is used for water lines. This tubing is inexpensive, light, readily available from many sources, cuts easily with a band or saber saw, has an uniform inside diameter, and takes a number 9 cork. This matter of the uniform inside diameter of the tube is important because it makes it easy to fit the right cork to the right tube size if all dimensions are exact and consistent. As many as 600 pieces of tubing can be cut in 30 minutes by two men using a band saw. The tubes are permanent and the corks long-lived.

The cork must have a hole in it to fit the scion. Boring the hole requires a tube type cork borer. There are both hand
operated and motorized models available. A drill cannot be used since the cork simply crumbles and the resulting hole is useless. The labor cost of boring the cork is greater than the cost of the cork itself. A better alternative is to buy prepared kernels which cost no more than plain corks. Rubber corks do not work well because they are so stiff that they do not easily conform to the shape of the scion which is oval in cross section.

Corks are sold in numbered sizes. A No. 9 cork fits 1/4 inch tubing, a No. 8 cork fits 1/16 inch tubing, and a No. 7 cork fits 5/32 inch tubing. These tubing sizes are actual sizes, not the advertised size.

**PREPARATION OF THE SCION**

At the time of grafting, the scions are taken out of storage and placed in water to keep moist while being prepared. Cut surfaces of the scions should be kept moist at all times. The following steps are involved in preparing the scion.

The scion is cut off using a knife to make a diagonal cut 1/4 inches above the top bud. This is where the cork is attached (Fig. 2).

Next, cut the scion off 3 inches below the bottom bud using pruning shears to make a straight cut across the scion. A hole is bored through the center of the scion 1/4 inches above the bottom end of the scion (Fig. 3). This hole is to accommodate the finishing nail that will attach the scion to the trunk. The size of the hole, of course, depends on the size of the nail used. We have used a 1/4 inch long finishing nail (called a brad in the United States), number 18 gauge. A No. 56 gauge drill bit fits this nail. Nails of a different gauge can be used, but be sure the hole drilled fits the nail snugly. You should not use flat headed nails or tape to attach the scion since these suppress the development of callus and the expansion of the scion.

Small finishing nails are best because the head is large enough to prevent the cork from splitting. The hole should be large enough to pull through the hole as the scion expands.

Drilling the nail hole is important because it is nearly impossible to drive a pointed nail through a scion without splitting. The point of the nail acts as a wedge and causes the split. Staples should not be used in place of nails.

The bottom of the scion is now cut to form a wedge (Figs. 4-7). This is done by starting the cut outside with a grafting knife at a point about 1/4 inch below the nail hole. Cut to the end of the scion so that the cut comes out at the middle of the scion at the bottom. This is the side that will be directly under the flap of bark, and this is the side from which you will eventually insert the nail in the hole. The scion is then turned over and a cut is made on this side starting about 1/4 inch above the nail hole. The top of the scion is cut at the bottom of the scion so that the two cuts form the wedge. The cut on the side that will be next to the trunk is started above the nail hole, and is consequently longer. This is to allow a flap surface which can rest against the bark at the top of the cut that you will eventually make in the trunk. This helps keep the scion firmly in place. This slight elevation of the scion from the actual surface of the trunk permits the callus developed on the inside surface of the scion to better unite with the callus from the side of the pruning cut on the trunk. In addition, it tends to keep the bottom points of the scion flat against the trunk. This is important because the callus of the trunk starts to grow at the last point of attachment of the phloem and xylem. The callus then grows out over the tops of the scion forming the first and most important point of attachment. The joining of the sides takes place later.

The first cut made should be about 1 inch long. The other cut is about 1/4 inches long. There are 1/4 inches of scion below the nail hole with which to work if the wedge is made properly. The tip will be essentially two points, or a fork. This fork is important because it allows flexibility of the scion to adjust itself to the cut trunk upon which it will be grafted. If the scion is cut so the wedge is an unyielding flat surface, the two sides of the scion will be elevated from the curved trunk. The trunk callus will grow under the scion and the graft will either not take or the union will be so poor the scion will subsequently fail.

The tip of the scion must be cut to two distinctly independent parts. This is flexibility of the scion points that permits the tip of the scion to adapt to a trunk as small as 1/4 inch in diameter. The scion is placed on the trunk with the small end of the cork upward and the cork is pushed down to where the upper node swells. This helps insure a tighter seal.

The grafting tube is now placed on the cork (Fig. 9). This must be a firm fit. Once the tube is firmly in place, the top of the tube is cut to the bottom of the hole to hold it in preparation for inserting the scion. The tube is placed upright in a nail with a couple of inches of water in it to keep the bottom of the scion moist (Fig. 11). The grafting tube is filled with water and the scions should stay there for an hour, or at least so that any leakers may be located and fixed. Leakers are determined by watching the water level at the top of the tube. Fixing a leaker involves either pushing the cork and scion in the tube tighter, or if that fails then a cork with a smaller hole should be used.

The scions are carried to the field in the pail with water in the bottom to keep the scion moist. The prepared scion is placed upright in a nail with a couple of inches of water in it to keep the bottom of the scion moist (Fig. 11). The grafting tube is filled with water and the scions should stay there for an hour, or at least so that any leakers may be located and fixed. Leakers are determined by watching the water level at the top of the tube. Fixing a leaker involves either pushing the cork and scion in the tube tighter, or if that fails then a cork with a smaller hole should be used.

**PREPARATION OF THE TRUNK**

Preparing the trunk involves first finding a smooth straight piece of trunk somewhere below the bottom wire (Figs. 12-13). This could be anywhere from ground level up to 18 inches to 2 feet above ground level. The spot selected should not be either directly above or directly below the scion. It should be located where the graft will not be in sunlight. On east to west running rows, it can be east or west side of the vine. On north to south rows, it is preferable to have it on the south side of the vine. If the correct locations are best so that the scions can grow straight and are not faced with the sun. Once the right spot of the old bark is peeled off around the trunk (Figs. 14-15). This is part of the entire process.

The piece of trunk that keeps the bark back too far when the scion is inserted under the bark will be cut. If the flap of bark is cut too far back too far at the time of grafting, the trunk grows back this distance and unites of this in the scion is delayed. The union will take place if the shoots of the scion to make terminal growth on its own, which will be a lateral growth, so that is xylem and phloem itself all in a very limited time.

Now, with the grafting knife, ring the wire through the bark all around the trunk about this piece of tape (Fig. 16). Then, make two starting at this horizontal cut and bring these down to the edge of the tape. This bark that will cover the outside face of the scion will unite with the scion through much of itself. This flap should be approximately wide so the bark has started to loose. This flap will be moistened with water from a plastic spray and then the grafting of the scion is carried out at the scion to the point of the knife in an area of the flap. When the flap is pried loose, the scion will be in a position to be placed in the scion. The grafting of the scion can be done in a manner similar to the scion grafting of making a small number of people within the scion. The actual grafting, of course, only a piece of the bark have been loose, only be determined by trail.

**ATTACHMENT OF THE SCION**

Once the flap is moistened, the scion, placed in the bark, is already partly through the hole, is slipped up through the bark all around the trunk about the scion. The scion will rest on top of the bark at the top wound, thus elevating the scion from the exterior of the trunk. If it is a wound, the properly prepared top of the flap will come up to a point just when the scion is inserted under the flap. If the flap is not exact, the top of the flap may come up the scion and curl up rather than be flat against the scion. In this case, simply cut off a piece of the flap.
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placed on the scion with the
of the cork is pushed down to
tubs. This helps sure a tighter
placed on the cork (Fig. 9). This
tube is firmly on the top, the nail
bottom to hold it in preparation
10). The prepared scion is now
a couple of inches of water in
is scion moist (Fig. 11). The grafting
the scions should stay there for
leakers may be located and fix-
ed by watching the water level at
leaker involves either pushing
the tube tighter, or if that falls then a
should be used.
the field in the pail with water
because of the scion moist and with
the top from drying out. Once the
the trunk, the tubes should be filled

4 OF THE TRUNK

Volves finding a smooth
bottom wire
anywhere from ground level up
ground level. The spot selected
should not be either directly above or directly below a knot.
It should be located where the graft will not be hit by equip-
ment. On east to west running rows, it can be on either the
east or west side of the vine. On north to south running
rows, it is preferable to have it on the south side. These
locations are best so that the scions can get as much
sunlight as possible. Once the right spot is found, the
shreds of old bark are peeled off around the entire trunk at
this point and a piece of grafting tape is wrapped tightly
around the entire circumference of the trunk (Fig. 12-15).
This is a very critical part of the entire process.

It is this piece of tape that keeps the bark from peeling
back too far when the scion is inserted under the flap of
bark that will be cut. If the flap of bark should be peeled
back too far at the time of grafting, the trunk callus must
grow back this distance and uniting of this trunk callus with
the scion is delayed. The union must take place in time for
the shoots of the scion to make terminal growth and for the
scion itself to make lateral growth; that is, to develop new
xylem and phloem itself all in a very limited period of time.
Now, with the grafting knife, ring the vine with a cut
through the bark all around the trunk about an inch above
this piece of tape (Fig. 16). Then, make two vertical cuts
starting at this horizontal cut and bring these vertical cuts
down to the edge of the tape (Fig. 17). This forms a flap of
bark that will cover the inside face of the scion and which
will unite with the scion through much of its length (Fig. 18).
This flap should be approximately as wide as the scion. If
the bark has started to loosen, this flap is easily pried loose
from the trunk with the point of the knife in the upper corner
of the flap. When the flap is pried loose, the surface of
the trunk will be white. Once pried loose, this flap of bark
should be moistened with water from a plastic squeeze bottle
to prevent any drying before the graft is sealed (Fig. 19).
The ringing of the trunk makes the graft take a little earlier
and does promote a better union at the sides of the graft.
Preparing the trunk may be carried out as much as 10
days before the bark slips. Getting this operation out of
the way early permits the actual grafting of more acreage by
the same number of people within the limited time
available. The actual grafting, of course, can only take
place after the flaps of bark have loosened, and this can
only be determined by trial.

ATTACHMENT OF THE SCION

Once the flap is moistened, the scion, with the nail
already partly through the hole, is slipped under the bark
and pushed down firmly (Fig. 20-21). The underside of the
scion will rest on top of the bark at the top of the trunk
wound, thus elevating the scion from the exposed surface
of the trunk. If all the dimensions are properly observed,
the top of the flap will come up to a point just below the
nail when the scion is inserted under the flap. If the dimensions
are not exact, the top of the flap may come up to the nail
of the scion and curl up rather than lie flat against the face
of the scion. In this case, simply cut off a piece from the top of
the flap.

Do not jam the scion down under the flap of bark and
tape. The scion and trunk will grow together; you cannot
force them as indicated by undue pressure. Tap too hard,
and the scion is firmly attached (Fig. 22). A grafting rubber
is now wrapped two or three times around the trunk and flap,
starting just above the piece of tape (Fig. 23). This is a long,
thin strip of rubber traditionally used to secure grafts. The
loops of rubber wound over one end with the other end
tucked under a loop provide adequate pressure to hold the
flap of bark in place (Fig. 24). This is a very important step
in the callus forms and the scion and trunk swell. The rubbers
are only temporary—they disintegrate in a few weeks and
need not be removed. Grafting tape should not be used.
The trunk itself will increase in diameter substantially,
and the corresponding increase in circumference puts great
pressure on the development of the callus if tape is used.

The piece of tape around the trunk is now removed
(Fig. 24). This is very important because of the effect of the
restrictive pressure on the growth of the callus. This same
piece of tape is now used to protect the surfaces of the
scion and trunk wounds from contact with the grafting pai-
nt. This is done by stretching the piece of tape behind the
scion where it meets at the trunk and bringing the two ends
down, crossing over so that they cover the edges of the
graft. The entire wound is sealed by dabbing with liberal
amounts of grafting paint (Fig. 25). The objective here is to
maintain high humidity around the graft.

Covering the graft union with tape to keep paint off the
callusing edges is important as it affects the formation of a
sound union. Grafting should be done when there is no
threat of rain. The black asphalt water emulsifiable paint
will dry on the outside in a few hours in warm weather (Fig. 26).
On the other hand, a heavy rain right after grafting and
before the paint has dried can wash paint into the
grafting wound and be as harmful as though directly
applied. The proper grafting paint is water soluble when
wet, but impervious to water once dried.

MAINTENANCE OF THE SCION

Buds of the scion will start to swell within a week as a
result of the water in the tube, and a shoot about 2 inches
long will develop even if the graft does not take. Scion
shoots several inches long indicate the graft has taken.
This will be in about 3 to 4 weeks. Once active shoot growth
starts, it is important to control by economic thinning of
the flower clusters, and several inches of growth, the
tubes are no longer necessary. Wait until the vines are
dormant before removing the tubes, at which time the cork will
easily slide off the end of the scion.

There is enough water in the grafting tube to maintain the
scion for a week to 10 days. The tubes, however, should
never be left long without checking and refilling. If the tubes
should be checked a day after grafting to determine if there
are any leaks. These can usually be repaired in the field
by carefully tightening the tube on the cork. Sometimes,
leakers will seal themselves just by normal expansion of
The cork. The tubes will normally lose about 3 milliliters (⅛ inch) of water per day. A plastic squeeze bottle with a thin plastic spout can be used to refill the tubes. It takes about 2 hours to add an inch or two of water to the tubes in an acre of grafts.

Adequate disease control measures must be practiced. Thus, Riesling scions grafted onto a Concord vine will still be susceptible to powdery mildew and must be protected by sprays. This is also true with French hybrids. The spray program in the vineyard should be tailored to the grafts rather than the rootstock.

Shoots of the graft should be exposed to sunlight as much as possible. Cut off tips of shoots or even entire shoots of the stock vine to prevent shading. Any shoots from the stock vine that come into contact with the scion or are at all near it should be cut back. No tendrils should be permitted to encircle the scion or tube since a strong wind could put pressure on these.

Grafting below the bottom wire when possible makes it convenient for tying up scion shoots when necessary, and also for positioning the shoots of the stock vine or for cutting off tips so that the foliage of the graft can be exposed to direct sunshine at least part of the day. Shooters growing below the graft should be removed as early as possible.

The scions should not be permitted to fruit, and flower clusters should be removed when they develop. Woodchucks are attracted to the grafting paint and will eat it. Once they have started on the paint, they will eat the developing shoots on the scion and may cut the entire scion off. Therefore, it is preferable to attach the graft above the reach of the woodchuck.

Shoots from the grafts that grow out into the row or grow long enough to drop down and be subject to breakage should be tied up with string loosely tied around the shoot. The primary grafts should be pruned after the buds start to swell in the spring of the following year in order to determine any bud injury. Since the 1-year-old graft will be pruning to the stock, it should be left for fruiting in the third year, the graft should be pruned to provide an adequate number of canes, without being overloaded. Thus, buds approximately equal to the number of canes that will be left is adequate.

In the second year the trunk of the stock vine should be cut off and the 2-year-old grafts pruned in late winter after the danger of extremely low winter temperatures has passed (Fig. 30-32). This allows one to determine the degree of bud injury, if any, and compensate for this by leaving additional buds. At this time the vine will be balanced pruned according to its size just as any other mature vine. The cut of the stock trunk should be painted.

In vineyards that are to be harrowed mechanically, it is best to hand pick the grapes while the grafts are in their first and second year. Mechanical harvesting at the end of the third year when the new variety is in its first crop year should not be harmful since the scions are very firmly attached.

If grafts do not grow or develop shoots and ripen off, they should be examined after the vines are dormant to determine the reasons for failure. Four common sources of failure are described below.

1. Raising the tip of the scion away from the surface of the trunk after the grafting is completed will result in failure of the graft. The solution is simply to attach the scion so that it is in an upright position. If it must be attached to a greatly sloping trunk, put it on the underside.

2. Failure to cut the scion wedge as a fork seems to be a common problem. The tip of the scion wedge should not be an unevenly red surface against the curved surface of the trunk, but should be cut as a fork so the individual points will adapt to this curved surface as a result of pressure of the grafting rubber.

3. Too short a scion wedge leads to the same problem as above. A very short wedge, even though cut as a fork, cannot adapt to the curvature of the trunk. The face of the scion wedge should be at least 1 inch long.

4. Allowing the tubes to go dry will result in failure. If any grafts fail, the vines may be regrafted the following year since they have not been weakened or the trunks injured.

CONCLUSION

This new process offers a useful tool for small growers who are dependent upon the income from their vineyards and who cannot afford to abandon, pull out or cut off any acreage of healthy vines simply because the variety is temporarily in over-supply. The possibility of conversion to a new variety and recreation to the stock variety at a later date, if conditions warrant, offers a substantial flexibility to the growers.

It is estimated that it takes about 12 man days to graft an acre of grapes. Material costs will be about $90 per acre. Total cost of grafting and materials will be about $350-$400 per acre if the labor is hired. With large scale trials of several acres, the greatest efficiency will be effected by using a crew because of the many diverse operations. On the other hand, two people should easily be able to graft an acre or more within the limited time (2 weeks) available, particularly if they prepare the trunks in advance in the 10-day period before the bark loosens. In cost comparison, the grafting process and what it accomplishes is much cheaper than pulling the vineyard and replanting. This latter involves a matter of several thousands of dollars when the loss of crop for several years is considered.

In 1973, 83 per cent surviving grafts were obtained from that were made by this process. In 1974, we achieved 80 per cent success of 87 grafts. In 1975, 20 interested people from New York, Michigan, and Pennsylvania grafted vines in their own vineyards in numbers ranging from 14 to more than 500. Successes in these individual trials ranged from 79 to 100 per cent with an average of 87 per cent of 1,200 grafts made.

Delaware, Catawba, Aurora (5-5279), Dechaunac (5-9549) and Riesling have been grafted onto the Concord variety with no sign of incompatibility since all grown vigorously. White Riesling has been grown 13 different varieties. Varieties on which they made vigorous growth in these first two years include Millic, Delaware, Concord, and Goldpark. The grafting process described here for vigorous vineyards; it will not make weak growing varieties grafted onto more vigorous vineyards also will be weaker growing and weak growing varieties grafted onto more vigorous varieties may grow more strongly themselves.

MATERIALS NECESSARY

Materials needed for this procedure are:

1. Pruning shears—any type.
2. Hand drill or drill press.
4. Band saw or jig saw or hack saw.
5. Plastic pins.
6. Plastic squeeze bottle (a plastic detergent work).
7. Finishing nails, ¾ inch, Number 18 gauge.
8. Number 85 drill bit to fit nails.
10. ¼ inch black plastic water pipe.
12. Grafting tape, 1 inch.
13. Grafting rubbers 8 inches x ⅛ inch.
15. Scions.

REFERENCES

failure. Four common sources of failure are: (1) a wound on the trunk, (2) a wound on the scion, (3) failure of the bud on the scion, and (4) a wound on the rootstock.

The scion away from the surface of the trunk must be very carefully performed. If it is not properly done, it may result in failure. If this does not occur, it must be attached to a greatly undersized trunk. To do this, the curved surface of the trunk must be cut off at a point where it will fit the scion snugly. The scion wedge as a fork seems to be a better method of attachment because it is easier to do and it is not as critical as the curved surface. The scion wedge should be inserted against the curvature of the trunk. The result is a result of pressure of the grafting knife against the trunk, which leads to the same problem as a fork, even though cut as a fork, cannot be used in the trunk. The face of the scion is between 1 and 1.5 inches long.

The scion may be regrafted the following spring if it has not been weakened or if the trunk is too small to support it.

**INCLUSION**

To get the best results from grafting, you need to have at least 12 male trees to graft an area. The cost of grafting per acre is about $350-$400 per acre. For large-scale trials, it is much less expensive. The cost is also lower because the trees are already in place and an additional cost is not incurred. The cost is also lower because the trees are already in place and an additional cost is not incurred.

**REFERENCES**


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INTRODUCTION

The Regional Plant Introduction Station, Geneva, published a publication entitled, "Ornamental Introductions: Past—All Still Used" in 1972 (b). This publication has been a valuable resource for horticulturists and gardeners alike. The station continues to explore and introduce new ornamental species, maintaining a commitment to the development and dissemination of knowledge in this field.

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