GRAFTING OF GRAPE VINES

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Grafting is important in the growing of high quality grapes. Grafting is especially important to adapt certain grape cultivars to adverse types of soil and/or soil conditions, such as nematode infestation. Also *Vitis vinifera*, the old world grape, and many of the newly developed hybrids must be grafted onto rootstocks resistant to *Phylloxera*, a common root louse in order to be grown successfully. The type of grafting demonstrated in this paper is bench grafting, also known as indoor grafting. The operation commences with the selection and preparation of rootstock and scion material. A foundation planting of understocks is grown under a training system developed to yield maximum, uniform sized and straight cuttings. The rootstock material should be selected only from virus-tested, certified stock. The wood should be cut only after it has fully matured, usually in December, but as easily as possible to place it in cold storage. All tendrils and laterals are removed without making large wounds (the prepared rootstocks are kept moist at all times). The rootstock material is then cut to 30 to 34 cm (12 to 13 inches). To ensure that no shoots develop from the rootstocks, they are disbudded. The cut and disbudded stocks are counted, bundled, and labelled for later identification. The scions are also selected from well-matured, disease-free vines. We collect from our own vineyards to ensure trueness to cultivar. The scion material is then cut to 3 cm lengths and the buds are visually inspected for viability.

Maturity is all important. Cold fall temperatures induce hydrolysis of polysaccharides; that is, starchs are converted into mono and oligosaccharides, which represent sugars, creating a change in the starch/sugar ratio. This process results in increased osmotic pressure because the sugars are more soluble in water. The increased osmotic pressure lowers the freezing point of the vine, rendering it more frost-resistant, and more important, fully matured. This process is usually complete by mid-December. In mid-February the reverse occurs and sugars are converted back into starch, changing the starch/sugar ratio, and subsequently lowering the osmotic pressure. Cuttings should be taken from mid-December through mid-February when the starch/sugar ratio is at its optimum. The percentage of successful grafts is directly related to this aspect of the vine's physiology and any deviation from this optimum will result in a decrease in the percentage of successful grafts.

Once collected and prepared, the scion and rootstock material must be protected against the loss of moisture to ensure a high success rate. Much emphasis has recently been placed on hygenic methods and modern storage techniques. The temperature is of utmost importance, the optimum being 1°C (33°F), at which temperature loss of material reserves essential for callusing and rooting by respiration is at a minimum. Before storing the rootstock and the scions, we pre-soak the stock for 15 hr in a 0.3 to 0.5% Chinisol solution at about 10°C (50°F). Burlap bags facilitate handling. Chinisol is a soluble quinioline compound which inhibits the development of microorganisms such as *Botrytis cinerea*. The stock is then enclosed in 4 mil poly bags and stored at 1°C. Our controlled environment storage facilities used for overwintering of nursery stock is ideal for this purpose.

The grafting operation itself should commence such that 6 weeks are allowed for callusing and hardening-off, after the grafing operation is completed. We schedule our grafting for March. There are many different types of grafts used throughout the world. When hand grafting was prominent, the whip and tongue graft was used almost exclusively. However, recent mechanization has led to the use of the so-called slip-joint graft. The grafting material, both rootstock and scion, is slotted by means of precisely spaced blades on a grafting machine. The right side of the machine has 3 blades and cuts the scion; the left side has 2 blades and cuts the rootstock.

More recently, particularly in Europe, the Omega-graft is being used. The graft gets its name from the sign of omega, which represents the type of cut which is made by the machine. Its main advantage is that one blade makes the cut both on the scion and rootstock in one step, eliminating the possibility of mismatching the cambia. The machine does not require an experienced operator.

It is very helpful to sort the rootstock and scion material by diameter. The material is then ready for the actual grafting operation. Every grape cutting has a "broad side" that is, the side on which the nodes (buds) are located. All cuts are made on the broad side. On the scions, the cut should be made below, yet near the bud; on the rootstock, on the side of the upper bud. The scion and rootstock are joined very carefully to ensure that the cambium layers are aligned precisely to ensure a successful union. The vines are then dipped into a special wax called "vine grafting wax Ribinol" which has a melting point of 65° to 70°C (150°F) and contains a special *Botrytis* inhibitor. It is tolerated well by the vines and in no way disturbs the callusing, the coalescence of the grafted vine, formation of roots by the understock or shoots by the scion.

The grafts are layered horizontally in callusing boxes with 5 to 6 cm (2 inches) of moist peatmoss between the layers. Each packed callusing box contains approximately 500 grafts. The boxes are then palletized and put directly into cold storage until the entire grafting operation is completed. Six weeks prior to planting in the nursery, about mid-April for us, the callusing boxes are placed in the greenhouse or callusing room. A 96 to 98% relative humidity must be maintained. Ventilation, light, and temperature must be readily controllable. To initiate the callusing process, a 30°C (89°F) temperature is maintained for 4 days. The temperature is then reduced to 26°C (76°F) and is maintained at this level for 3 to 4 weeks. Heating is provided from the base in order to promote rooting and callusing prior to shoot development.

After emergence, the young green shoots must be sprayed with Benlate at 3 day intervals to prevent *Botrytis* and must be partially shaded to prevent burning of tender shoots.

The results of the callusing vary with the year and with the cultivars grafted. The ideal graft should have a strong, well-developed callus, young green shoot and uniform root initiation. The most important factor is a well-developed callus. Once, in the judgement of the propagator, callusing is completed, the temperature is progressively lowered in order to harden-off the grafts. The hardening-off generally takes 2 weeks.

Once hardened-off, the grafted vines are removed from the callusing boxes and planted in the field. Because of difficulties that we have encountered in transplanting the tender shoots directly to the field, we have recently attempted to grow the grafts on for about 6 weeks in a polyhouse and found a significant improvement in the percentage of successful grafts. The costs are greater but the results are very promising. There is better uniformity in grafts grown under these conditions; and the grafting wax sheds wax slowly because of its elasticity. Planting of grafts in the nursery field must be done with great care to ensure success.

CHARLIE HEUSER: Bob, thank you for presenting this paper for your brother. Our next paper will be presented by Dr. Al Einert of the University of Arkansas and the title of his paper is "Propagation of Dwarf Crapemyrtles".