

Clonal Oak Propagation by Grafting

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In this article I would like to share with you my experiences and observations with clonal oak propagation by grafting. We all know that the best way to propagate an oak is to gather acorns and to sow them. People who live in colder localities and at higher altitudes always should try to find acorns at higher altitudes or from the northernmost locations. Due to frequent hybridization and variation within each species, however, the result might be disappointing. Your oak will look slightly or completely different from the one from which you took the seed, especially when the acorns were not gathered from an isolated population. The only way to obtain a tree identical to the beautiful specimen that you are admiring is by clonal propagation.

Clonal propagation can be done by cuttings, layering or grafting. A very interesting technique of layering (mounding of etiolated shoots) has been developed at Cornell University by Georges Hawver and Nina Bassuk. You can read more about this technique in the proceedings of the Third International Oak Conference. (Issue No 12 of this journal.)

Let it be clear that we only choose grafting when all other means of propagation have failed or when they are too difficult or too cumbersome to execute commercially. Grafting becomes of interest when we want to maintain certain qualities such as some or all of the following:

- Leaf color: *Q. robur* 'Concordia', *Q. texana* 'New Madrid'....
- Leaf shape: *Q. dentata* 'Pinnatifida', *Q. velutina* 'Oakridge Walker'...and all hybrid oaks such as *Q. xhispanica* 'Waasland Select', *Q. xundulata* 'Kenton Blue', *Q. turbinella x mongolica* (Cottam Hybrid)...
- Habit: *Q. robur* 'Fastigiata', *Q. palustris* 'Green Pillar', *Q. castaneifolia* 'Green Spire'...
- Fall color: *Q. ellipsoidalis* 'Hemelrijk', *Q. xsargentii* 'Thomas'...
- Fall color and habit: *Q. xwarei* 'Chimney Fire', *Q. xbimundorum* 'Crimschmidt'.
- Leaf shape and habit: *Q. robur* 'Salfast'.

Grafted trees sometimes perform better than trees propagated by seed. Recently we have begun experiments with the use of *Q. buckleyi* as a rootstock to overcome high PH chlorosis in the red oak group.

An important disadvantage of grafting is that graft incompatibility may occur in some cases. Most of the time this problem starts to show up in the nursery stage through excessive formation of basal shoots from the rootstock followed by separation of the graft. It is incorrect to claim that all grafts will eventually break. Graft incompatibility is more frequent in the red oak group (*Q. palustris*, *Q. marilandica*, *Q. rubra*...) but it also occurs in other groups. It is remarkable to

observe that some grafted plants grow vigorously at first but soon start to produce an abundance of shoots from the rootstock, with ultimate separation of rootstock and scion. Peroxidase enzyme incompatibility is at least partly responsible for this problem, from the work of Dr. Frank Santamour, Jr. He found that there are several strains of this enzyme, roughly analogous to blood types in humans, and that incompatibility between different strains of the enzyme prevented lignification of some grafts in red oaks, accounting for the delayed failure of such grafts.

For success in grafting we need to choose the right rootstock. It is important to select, if possible, a rootstock that is genetically as close as possible to the clone that we wish to graft. In the case of a hybrid, seedlings of one of the parents might be useful. My practical experience is that in most cases other rootstocks of the same group can be used without any problem. For example, we use *Q. palustris* as a rootstock for *Q. x filialis* (*Q. phellos* x *velutina*) with a perfect long lasting result.



September graft.

Oaks can be grafted at different times of the year and here at Pavia Nurseries most of our production is grafted in September. Here is the technique that we use. As rootstocks we use strong one year old seedlings which we pot up in the spring in small 9x9x13cm pots. We let them grow without much fertilizer until September, when they will be grafted.

The grafting techniques that we mostly use are cleft or wedge grafting and veneer side grafting. The scions are cut shortly before grafting, but if necessary they can be collected and held for several days. At all times the scions should be kept together with their labels, being careful not to mix up the different sorts. The scions should contain at least two or three buds. After we have made the cuts in the scion we quickly dip the cut section in a fungicide solution and then insert



Side Inlay Graft.

it into or onto the rootstock; The graft is then tightly bound with a small rubber band.

When oaks are grafted in September it is not necessary to cut away the leaves, although when the leaf is large it may be cut to half or a third of its normal size. We do not seal the scion and grafting point with paraffin or some other grafting wax. Before we put the grafted plants in a cool tunnel under a thin plastic sheet, we spray them with a combination of two fungicides. It is important that the plastic sheet be tightly closed so that no humidity can escape. The tunnel can be lightly shaded to avoid temperature peaks ABOVE 35 °C. Here in Belgium the temperature is still high enough at this time of year to allow the grafts to seal in from 6 to 8 weeks, depending on the cultivar.

Every other week, on a cloudy day, the plastic is removed for a few hours and the plants are again treated with a fungicide. Once the callus has progressed from white through green to brown we can gradually start to harden off the grafted plants. This is done by gradually uncovering the plants starting on cloudy days. Once hardened off, the plants can stay in the tunnel until spring. We supply heat when temperatures drop below freezing, but during the first 6 week it is best to not let the temperature go lower than 10 °C. In the spring we then pot up the successful grafts in 12x12x20cm pots, where they remain for one season. In early June they are staked with a small cane. Depending on the cultivar, the grafts can reach 30 to 120 cm by the end of the growing season.

For winter grafting we use our “Hot-Pipe Callusing Unit.” With this technique we use oak seedling in plugs, which we bench graft using the same procedures as in September. We use rubber strips to hold the graft tightly together and we seal the scion and the grafted section with a special wax containing a fungicide. In this technique the scion may be a little longer because we have to cut off all the buds that are too close to the grafted section.

The Hot-Pipe Callusing Unit consists of an isolation tube approximately 8 cm in diameter in which we have cut slits where we can put the grafted section. Within this tube runs another tube (diameter 2 to 3 cm) with warm water or an electric cable connected to a thermostat. For *Quercus*, 18 to 21 days at 20°C are sufficient to heal the graft. The advantage of this technique is that only the grafted section of the plant is heated and the rest of the plant (roots, buds) stays dormant. If the buds at the base of the scions are not cut away they might start to develop inside the tube. The roots on the understock can be kept moist by covering them with some peat. The Hot-Pipe Unit can be placed in a cool but frost free building. After healing, the grafted plants are placed upright in peat in high nursery cases until they are potted up in spring.

In both techniques (September grafting and Hot-Pipe Callusing method) the rootstock is cut slightly off center, so that the cut does not pass through the pith. In my experience, this gives both better grafting success and better and quicker healing of the cuts.

Another technique that we sometimes use is Side Inlay Grafting on 2 year old established trees in the nursery row. Here one or two year old oaks are planted in the open ground in spring and then grafted in the spring of the following year. Here the scions should be cut in the dormant season and stored at -2°C (28°F) as previously described. One can start to graft about 10 days before the last possible frost. Here in Belgium this is usually around the first of May. By that time the rootstocks may already have started to leaf out, but that is not a problem. The

technique that is employed is side inlay grafting: Two sloping cuts are made at the basal end on opposite sides of the scion, so that it gradually tapers to a wedge. An incision is made at the base of the rootstock. A downward cut diagonally should be made with the blade to form a flap that remains attached to the rootstock on one side. One day before grafting, the scions are taken out of the cool house to gradually thaw and to allow any moisture on them to dissipate. When dried off they are quickly dipped in hot paraffin and immediately put in cold water, after which they are again stored in plastic bags at 5°C until they are grafted.

After grafting, the grafted section should be tightly sealed with tape and cold grafters wax. About ten days after grafting, the upper part of the rootstock can be cut away in two stages, leaving about 10 cm of stem above the grafted section for use in stabilizing the scion if this is necessary or desirable. We trim the rootstock in two stages because we want to keep the sap stream active until the cuts are healed and the scion takes over and starts to grow. About one month after grafting, small canes can be inserted into the ground so that the new growth can be shaped as may be desired. When using the Side Inlay Grafting Technique plants sometimes grow more than a meter and a half during their first year. During the next winter, the rest of the stem of the rootstock above the graft that had been left for stabilization of the scion can be cut away so that a nice union can gradually form. We sometimes use Side Inlay Grafting in the open ground to obtain quick production of scion wood that we can then use for September grafting or for winter grafting on the Hot-Pipe Callusing Unit.

The advantage of these techniques is that the scions can be cut in the dormant season and stored. Longer storage is possible if the scions are packed in airtight plastic bags and held in a cool green house or refrigerator at -2C (28F). Scions of deciduous oaks can be shipped long distances without any problem if they are packed dry and airtight in plastic bags.

The fourth and last technique that we have tested is Chip-Budding. This is carried out in summer in the open ground on established rootstocks in the nursery row. Here the scion is a single bud that is cut out of a firm one year old shoot with a sliver of wood attached to it. A cut of identical shape is then made at the side of the rootstock to match the sliver with the bud. Everything is nicely covered with a special plastic strip while leaving the bud free. The plastic tie is cut away after 5 weeks to prevent girdling of the rootstock. The next season the rootstock is cut off, slightly above the grafted bud forcing the bud to break. In our cool and damp Belgian climate this technique has been a disappointment, but I've seen it used in France in the Orleans region with great success.

The last two techniques could be interesting for the hobby grafter because they don't require a greenhouse or other special installation.

With fruit trees it is important to plant the grafted tree with the grafted section above the ground. With oaks, however, I always advise people to plant the tree with the grafts below the ground surface for the reason that the scion often starts to produce roots of its own.

This is of course advantageous in case the graft should fail later. We have noticed this phenomenon with grafted *Q. pontica*, *Q. canariensis* and many other species. For this reason it is important always to graft as low as possible.

It may be that in the future other and better techniques of clonal oak propagation will make the grafting of oaks superfluous. But at the present time I can't think of a better method for commercial production of the thousands of plants



Author and one-year-old graft *Q. nuttallii* 'New Madrid.'

that we require every year.

It is important, however, that we nurseryman not deny or neglect the problem of graft incompatibility and that we not graft cultivars that have been shown repeatedly to be prone to this problem.

More information, pictures, and drawings of grafting techniques can easily be found on the internet.

Finally I would like to say what a great joy it is to be a nurseryman and to do this kind of work: to look for new hybrids and new and interesting forms of trees, and to collect, graft and grow them. Many of the trees that we grow have a clonal parent somewhere else in the world, and seeing these trees in our garden and nursery brings back sweet memories of the times that we were actually there where we first recognized a promising new cultivar.

Editor's Note: For more interactive discussion of this topic, please go to the Propagation and Nursery Q&A page of the International Oak Society website.



Q. velutina 'Oakridge Walker'



Q. xwarei 'Chimney Fire'

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