



International Oaks

The Journal of the International Oak Society

*...the hybrid oak
that time forgot, oak-rod baskets,
pros and cons of grafting...*

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p. 6: Charles Snyers d'Attenhoven (*Q. oxyodon* Miq.); p. 7: Béatrice Chassé (*Q. acerifolia* (E.J. Palmer)
Stoyloff & W. J. Hess); p. 9: Eike Jablonski (*Q. ithaburensis* subsp. *macrolepis* (Kotschy) Hedge & Yalt.).

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p. 37, line 18: 148 rue de l'Abbé Groult

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Oak Open Day Pavia Nusery, Belgium September 22, 2013 The Art of Grafting

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Introduction

September 22, 2013 was the day when nearly 30 “oakies” (members of the International Oak Society and non-members) came together in Southern Belgium to share the knowledge of and listen to nurseryman Dirk Benoit, owner of Pavia Nursery (Deerlijk). The subject of the day: oak propagation, either generatively with seeds or vegetatively through grafting.

Longtime IOS member Dirk, who served on the Board of Directors for two terms until 2012, together with Katrien, his wife, hosted the group that included individuals from Belgium and neighboring countries the Netherlands, Luxemburg, Germany and France, but also from Italy and, though a bit late and purely by chance, an IOS member from Australia.



1/ Dirk Benoit presenting Pavia Nursery.

Dirk started off with a presentation about his methods of oak propagation and about his nursery. Oaks are not the only prominent genus in cultivation—the name of the nursery, Pavia, suggests that there must be more. A cabinetmaker for many years, Dirk started the nursery business in 1990 on family property. His first love (besides Katrien, his wife) was *Aesculus*—and Dirk collected what he could find of this genus. Other genera followed: *Sorbus*, *Tilia* and *Crataegus* (these last two of which Dirk has the widest range of taxa of any European nursery), *Carpinus* and, of course, *Quercus*. Today, with more than 200 different oaks (species and cultivars) Pavia Nursery holds on its 7 hectares/17 acres what is probably the widest range of oaks in a nursery worldwide.

Some of the oak species and oak hybrids Dirk has introduced into European cultivation, are *Q. ×willdenowiana* (Dippel) Zabel (*Q. falcata* Michx. × *Q. velutina* Lam.) or the newly discovered Hispanic *Q. alentejana* nom. ined. and of course, many oak cultivars. New cultivars from the United States, or from Europe, usually show up first at Dirk’s

place. He is himself a plant hunter and has introduced many novelties: several collecting trips to the United States, Mexico and different European countries have resulted in new plants. His own cultivars always do show very special characters, e.g., upright habit, lacinate leaves, unusual fruit or excellent fall color.

Dirk propagates oaks either with seed (most botanic species are propagated from acorns that come from all over the world, wild-collected in most cases or at least from known provenance); or by grafting (for the cultivars and hybrids, but botanic species as well).

Cuttings and in vitro propagation

It is possible to grow oaks successfully with cuttings. In Germany for example, large-scale propagation of “Plus-Oaks”^{*} is done with long cuttings of about 50-60 cm/20-24 in selected from young plants. This technique requires special, expensive equipment that makes it uneconomic for nurserymen but feasible for institutional propagators such as university forest research units (Spethmann, 2000). If the number of cuttings exceeds more than 10,000, the costs of propagation come close to the costs of propagation via seedlings.

Propagation of evergreen oaks with ordinary small cuttings is usually successful, but with deciduous oaks it is trickier. Hawver & Bassuk (2001) have shown that a low content of endogenous cytokinin (a class of hormones which may inhibit adventitious rooting) could improve adventitious root formation. They also showed that the influence of “end-of-day” light, rich in the far red wavelengths, can improve rooting. With the necessary lights, this technique could be handled easily by nurserymen.

Another modern technique, *in vitro* propagation, is also too expensive for a nursery that is propagating small numbers of one taxon although Meier-Dinkel (1987, 1993) has shown that it is possible to get very good results with this technique. Thus, propagation of oaks either by cuttings or *in vitro* does not play an important role for commercial nurseries because it is not economically feasible.

Grafting

Why graft oaks? There are several reasons for choosing this method of propagation including unavailability of seed or the desire to reproduce a specific tree. Grafting will also allow you to increase the possibilities of cultivation for certain species by grafting them on rootstock with different characters (hardiness, alkaline tolerance, etc.). But, as with all living things there are some disadvantages as well.

Dirk has experimented with several grafting techniques and has adopted the hot-pipe system, where only the graft zone of the plant gets some heat (usually 20 °C/68 °F) which forces the two partners to grow together quite quickly and strongly. This is done mainly with plants that are difficult to propagate with traditional techniques (Benoit, 2009).

The major disadvantage of grafting is graft incompatibility: the rootstock and the scion do not grow firmly together and thus the plant fails to grow. Either the young graft will die directly, not producing callus at all, or it will die after a certain period. Interestingly this period can be quite long; grafted oaks can live for many years and suddenly fail. This

^{*} Plus-Tree: A phenotype judged (but not proven by test) to be unusually superior in some quality or quantity, e.g. exceptional growth rate, desirable growth habit, high wood density, exceptional apparent resistance to disease and insect attack or to other adverse environmental factors (Nieuwenhuis, 2000).

problem is known as “delayed incompatibility.” This is the main reason why collectors tend to plant oaks grown from seed. Nevertheless, as is discussed below, there are, despite the known disadvantages, reasons to plant clonally propagated oaks. Growing botanic species is very much in vogue with collectors but by far the vast majority of oaks are not planted by collectors but by cities for urban plantings and in these cases grafted trees are preferred for several good reasons. Their uniform shape, with good central leaders, is more suited to streets. In addition, if they are cultivars their disease and pest tolerance is probably better than that of botanic species.

It is not fully understood why some grafted partners fail to grow. As Santamour writes, the content of isoperoxidase in the plant is partly responsible for grafting results. He found that “general graft compatibilities were related to taxonomic classification, only in the sense that individuals with similar isoperoxidase patterns in either intersubgeneric or intrasubgeneric grafts are likely to be compatible.” But even among individual trees of the same group, much variation in isoperoxidase patterns is found (Santamour, 1983). Interestingly, certain individuals of species in section *Quercus* have isoperoxidase patterns that are similar to some individuals of species in section *Lobatae*. As a result one may find old vital grafted partners of different sections such as the 120-year-old *Q. imbricaria* Michx. grafted on *Q. petraea* (Matt.) Liebl. rootstock (!) which is growing vigorously in the Forest Botanic Garden of Hannoversch Münden in Germany.

Grafting is of course simply necessary if you do not have seeds—and acorns of rare species are often impossible to get (even for members of the IOS!). Up until recently it was very difficult to obtain fresh acorns from the wild, especially when “the wild” was remote and unexplored. Up until the second half of the 20th century it was not easy to travel across the Atlantic, collect seeds and bring them back in good shape for germination. An acorn needs to keep at least 45% of its water content to be able to germinate, if not it will die. After only a week in a dry bag, the vitality of the embryo is lost. Still today, though acorn availability throughout the world has improved thanks to seed exchange schemes organized by botanic gardens, it has happened to more than one of us to receive nice, big unknown acorns in a dry paper bag showing no sign of life.

Historically, nurserymen have had two possibilities for propagating rare oaks (and other plants): either collecting seed in collections, which resulted in some cases in hybrid offspring, for those species that do not come true from seed; or grafting to ensure propagation of the true species. This is why there are so many grafted oak trees of botanic species in old collections in Europe. Two good examples of this in Germany are the 120-year-old *Q. imbricaria* (grafted on *Q. petraea* in the Hannoversch-Münden Forest Botanic Garden), and the *Q. robur* L. Fastigiata Group graft dating from 1795 and still growing vigorously in Kassel.

Only clonal propagation will preserve good hybrids that show the intermediate features of the parent plants. Dirk Benoit has some first class hybrids in his program, some of them coming from an American oak collector who has a good eye for these special plants. These include *Q. ×rudkinii* Britton (*Q. marilandica* Münchh. × *Q. phellos* L.); *Q. ×runcinata* (DC) Engelm. (*Q. imbricaria* × *Q. rubra* L.); *Q. ×tridentata* Engelm. ex A. DC.; (*Q. imbricaria* × *Q. marilandica*); and *Q. ×willdenowiana* (*Q. falcata* × *Q. velutina*).

Today, thanks to the busy IOS, it is quite easy to get acorns from species that were literally unknown in cultivation 20 years ago. But since the beginnings of horticulture nurserymen have known how to propagate plants clonally with cuttings or by grafting.

Grafting was practiced by the Phoenicians, and later by the Greeks and the Romans. As discussed previously, cuttings and in vitro propagation are not economically feasible for nurserymen. But the skills and techniques to propagate oaks by grafting is accessible to them.

The rootstock quest

The rootstock is the key to successful grafting. This seems easy enough to say but in fact it is quite tricky and requirements differ from species to species! The nurseryman must have precise knowledge of the needs and ecology of both grafting partners. If you want to graft two unknown species, it is therefore trial and error. You may use one of the two “all-time goodies” rootstocks, *Q. robur* for White Oaks (section *Quercus*) and *Q. rubra* for Red Oaks (section *Lobatae*). But today, innovative nursery people do try other rootstocks as well. Dirk is one of the most innovative in this respect. He has improved an old grafting method, called cleft or wedge grafting, that takes much better. Side veneer grafting is another technique used by Dirk. Also, he usually grafts in September, whereas most nurseries prefer to graft much later in the year, from December to the beginning of March (Benoit, 2009).

Dirk is always looking for new rootstock material. This is critical especially when it comes to meeting cultivation requirements for certain soil types. Many oaks will only thrive in acid soil (pH 6.8 or lower if possible). This is the case for most of the Red Oaks, and many White Oaks too. This is the main challenge for propagating oaks that will do well in an urban situation: the soil is usually alkaline with a pH of well above 6.8 (often reaching 7.0 to 8.5) and often also very compact. This soil is poison for species like *Q. alba* L., *Q. coccinea* Münchh. or *Q. palustris* Münchh.—all of which are used at least in



2/ *Quercus* × *schochiana* E.J. Palmer (*Q. palustris* × *Q. phellos*) grafted on *Q. palustris*.



3/ *Quercus tomentella* Engelm. grafted on *Q. robur*.



4/ *Quercus* ×*bebbiana* C.K. Schneid. (*Q. alba* × *Q. macrocarpa* Michx.) grafted on *Q. robur*.

European urban plantings quite frequently (often it is their various cultivars, such as the new fastigiata *Q. palustris* ‘Pingreen’ (Green Pillar™) or the older *Q. coccinea* ‘Splendens’ that are used). These oaks will not thrive in alkaline conditions. After only a couple of months or maybe a few years they will show chlorotic leaves and stunted growth. Using the right rootstock is critical if these widely used oak cultivars are to thrive in urban plantings. Dirk has introduced the use of *Q. shumardii* Buckley as an alternative rootstock for Red Oaks. It is one of the few Red Oaks that does well on alkaline soil. Until recently it was impossible to get acorns from that species—thus you will hardly see this pure species growing in collections, which is a pity because it has a lot of merit such as compact growth, stunning red autumn color, high drought and heat tolerance.

Together with *Q. shumardii* two other Texas natives have many of the same advantages: *Q. gravesii* Sudw. and *Q.*



5/ *Quercus* ×*schuettei* Trel. (*Q. bicolor* Willd. × *Q. macrocarpa*) grafted on *Q. robur* (*Q. macrocarpa* is also used).

buckleyi Nixon & Dorr. All three perform perfectly in Luxemburg, with no damage after winter temperatures below -20 °C/-4 °F, growing vigorously on a soil with a pH of 7.0! What would happen if these species were to be used as new rootstock? Our experience tells us that species grafted on them will perform much better in alkaline soils, (and this is, as stated above, the main restriction for planting oaks on a large scale in urban situations).

Dirk uses the swamp white oak, *Q. bicolor*, as rootstock for *Q. ×warei* T.L. Green & W.J. Hess ‘Windcandle’ (and other cultivars of this hybrid). This species shows no graft incompatibility while *Q. robur* does. Also, *Q. bicolor* grows vigorously in heavy, compact soils like clay, where *Q. robur* may fail. The recent bad press about cultivars of *Q. ×warei* is the result of the wrong rootstock having been used. When grafted on the right rootstock, this hybrid and its cultivars are exceptionally good and showy.

Sowing the seeds of future discussion

There was a lively discussion between participants throughout the day but also afterwards thanks to the internet, on suitable oaks for alkaline soils. Table 1 lists the species that the author knows grow well in alkaline soil without signs of iron-induced chlorosis. This may be dependent on provenance. Table 1 could well be enlarged by the experience of other IOS members and could result in a separate publication. (Please send a note to the author if you have interesting observations on oak performance in alkaline soil.)

SPECIES (SECTION)	REMARKS
<i>Quercus bicolor</i> (<i>Quercus</i>)	Depending on provenance; also tolerates heavy soil (clay); suitable as rootstock for <i>Q. ×warei</i> cultivars; showing less incompatibility problems than <i>Q. robur</i> for this oak.
<i>Quercus shumardii</i> (<i>Lobatae</i>)	New rootstock used for Red Oaks.
<i>Quercus buckleyi</i> (<i>Lobatae</i>)	New rootstock used for Red Oaks.
<i>Quercus gravesii</i> (<i>Lobatae</i>)	No observations yet if suitable for Red Oak rootstock.
<i>Quercus pubescens</i> (<i>Quercus</i>)	Disadvantage as rootstock: many suckers.
<i>Quercus imbicaria</i> (<i>Lobatae</i>)	Possible new rootstock, hardy, high pH tolerance, fast growing.
<i>Quercus muehlenbergii</i> (<i>Quercus</i>)	No observations yet if suitable for White Oak rootstock.
<i>Quercus cerris</i> (<i>Quercus</i>)	Often winter damage (stem), USDA zone 7 and below.

Table 1/ *Quercus* spp. growing on alkaline soil (pH > 6.8).

A stroll in the nursery

In the afternoon, after lunch in Dirk and Katrien’s garden, time was taken to stroll around the nursery, seeing the various fields of mother plants and those ready for sale.

We saw many rare and special oaks, including Dirk's own fine introductions, such as *Q. buckleyi* Nixon & Dorr 'Carlsbad', *Q. laceyi* Small 'Bandera', *Q. ×mazei* publ. in prep. 'Three Sisters' or *Q. vulcanica* Boiss. & Heldr. ex Kotschy 'Kasnak'. Together with his friend Allan Taylor of Boulder, Colorado, Dirk traveled widely in the Southwest of the United States, in Texas, New Mexico, Colorado, Oklahoma and Utah. Together they selected some 40 native oaks, the majority of them belonging to the *Q. ×undulata* Torr. (syn.: *Q. ×pauciloba* Rydb.) widespread hybrid complex of that area with a lot of variation between individuals (sensu stricto this hybrid complex is restricted to *Q. gambelii* Nutt. × *Q. grisea* Liebm. forms; sensu lato *Q. gambelii* crosses with any other White Oak species with which it is (or has been) sympatric, e.g., *Q. turbinella* Greene, *Q. muehlenbergii* Engelm., *Q. mohriana* Buckley ex Rydb. or *Q. arizonica* Sarg.). Allan and Dirk selected stunning cultivars out of these, most of them exclusively available at Pavia Nursery. 'Blue Hole', 'Mesa de Maya', 'Picture Rock' or 'Spring Ranch' are only a few of these (see *International Oaks*, No. 24, 2013, pp. 161-173 for a presentation of these cultivars).

Whilst traveling in Utah, they also visited the Walter Cottam Hybrid Oak Grove at the University of Utah, where Dr. Walter P. Cottam planted his oak hybrids resulting from extensive breeding programs. Some of the interesting hybrids are in cultivation at Pavia, as he was allowed to take scion wood for grafting back home. These include the hybrids *Q. gambelii* × *Q. turbinella*, *Q. macrocarpa* × *Q. turbinella* and *Q. macrocarpa* × *Q. lobata* Née, all unusual but of great beauty and hardy for Central European climates. We saw most of these new introductions, and many others as well, but the list would be too long to praise them all here!



6/ An impeccable greenhouse.

We noticed the high quality of the plants Dirk is cultivating, not only the oaks but all of the plants were magnificent. Many of us took the opportunity to buy some of the trees he had to offer. And it was clear that oakies are not only fixed on oaks. Trees like *Aesculus glabra* Willd. 'October Red', *Carpinus orientalis* Mill. 'Pardika', *Sorbus insignis* (Hook. f.) Hedl., *Tilia henryana* Szyszyl. 'Arnold Select' or *Zelkova sicula* Di Pasquale, Garfi & Quézel 'Ciranna' also went into the cars.



7/ *Quercus grisea* 'Blue Hole' grafted on *Q. robur* (*Q. macrocarpa* is also used).

A farewell drink and snack concluded this remarkable meeting. Some of the members brought seed to exchange, such as *Acer sempervirens* L., *Q. ithaburnesis* subsp. *macrolepis* (Kotschy) Hedge & Yalt. from Crete and *Q. ×libanerris* Boom from Trompenburg. The members of the group knew each other well from other meetings, and again this Oak Open Day was not only a perfect day for sharing knowledge about oaks or their propagation, but also about personal thoughts, renewing contacts, and making new friends. Again, a wonderful opportunity for IOS members to spend a splendid day!

Conclusion

It must be said that the advantages of grafting far outweigh the disadvantages, taking into account all of the factors of oak propagation. Grafting is also the most economic way of clonally propagating oaks, and this is a crucial issue for the nursery business. To stay in business, a nursery can collect seed as much as possible but must also find economic ways to propagate, cultivate and sell what they produce. It is surely exceptional that a nurseryman like Dirk can keep up such an unbelievably rich assortment of different taxa! We all owe him special thanks for making it possible for us to get rare oaks and other plants so easily!

Acknowledgements

Our appreciation goes to Dirk and Katrien for this wonderful meeting at Pavia Nursery, for opening the nursery to us and sharing their experience and knowledge, as well as for their hospitality. Many thanks to Shaun Haddock, IOS Tour Director, for organizing the event and of course, many thanks to all the participants for their input in the lively discussions, which influenced parts of this report. Thanks also to Charles Snyers d'Attenhoven, who wrote a brief summary of this meeting for the IOS website and who provided the photographs (Snyers, 2013).

Participants

William Funk (Australia); Jacqueline Batsle, Louis Begasse, Dirk & Katrien Benoit, Antoine Bultinck, Christof van Hulle, Ronny van Keer, Jan de Langhe, Dirk de Meyere, Karel Moentjes, Kurt van Nieuwenhuysse Charles Snyers d'Attenhoven (Belgium); Francis Barthelemy, Stéphane Brame, Jean-Louis Hélardot, Francois le Varlet, Alain Vernholes (France); Henning Hartmann, Mr. & Mrs. Reiner Wilken (Germany); Francesco Gandini (Italy); Eike Jablonski, Jean-Claude Weber (Luxemburg); Jeroen Braakman, Gert Fortgens, Wiecher Huisman (the Netherlands).

Photographers. Photos 1-7: Charles Snyers d'Attenhoven.

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