Modified Nurse Seed Grafting of *Aesculus*©

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INTRODUCTION

Two years ago, I was asked to propagate an ailing *Aesculus* for replacement in the Arboretum collection. At the time, I had no understock available and decided to use a technique that I had used previously to graft *Castanea*.

This technique of grafting is one that is less commonly used. I first became aware of it from an illustration found in early editions of Hartmann and Kester (1983). The text there describes nurse seed grafting — a technique used by Moore (1963) for grafting *Castanea* and *Camellia*. He germinated seeds, removed shoot and root, and grafted a scion into the seed, between the cotyledons (Fig. 1). He reported that over time, successful grafts developed their own root systems. Jaynes (1967), working with *Castanea*, reported on experimenting with the method for 4 years and that he considered it a "qualified success." One interesting note is that he found most roots developed from the seed, not from the scion, and he suggested the name "nut grafting" to be more appropriate. Humphrey (1968) in the I.P.P.S. Question Box, briefly described propagating *Aesculus* by nurse seed grafting.

The illustration in Hartmann and Kester (1983), shows a modification that is attributed to J.C. Moore, however, the article cited does not describe the technique as illustrated (Fig. 2). The modified technique simply retains the root portion of the germinating seedling, and the scion is cleft grafted between the cotyledons.

I first used this modified technique about 20 years ago, working with student Edward Goodell (1983), whose interest was in *Castanea* propagation. We were successful with both cleft grafts and chip buds. We modified the technique slightly by grafting 1 to 3 cm above the point of cotyledon attachment. It was an obvious location to place the chip buds and for the cleft grafts, it was just easier than trying to cut between and tie around the cotyledons.

During the last 2 years, I have experimented with using this modified nurse seed or nut grafting technique with *Aesculus*, successfully grafting to the epicotyl and using cleft, inverted cleft, whip and tongue, and chip bud grafting. I have used both *A. hippocastanum* and *A. glabra* as the germinated understock. I made no attempt to establish the resulting plants on their own roots.

MATERIALS AND METHODS

After stratification, the seeds are sown individually into a band-pot. When the seed first germinates, the diameter of the epicotyl is quite small and the stem is very soft and pliable, making it difficult to work with. A simple solution: allow the seedling understocks to achieve a greater size before grafting. This takes about 6 weeks from the time of sowing. Once the seedling stems are about 15 cm tall and 4 mm in diameter, the stem is sufficiently sturdy to allow tying the scion in place with a budding band.

Scions used are from the previous season's growth, preferably terminals without a flower bud, but using a scion with flower bud removed is also successful. I tried to find thinner scions with longer internodes, but few were available from our old trees. Most, if not all, of the scions had a larger diameter than the understock. When

grafting, the top of the understock is removed, leaving 3 to 4 cm and the scion cleft grafted, tied with a budding band, and then wrapped with parafilm™. In preliminary trials, cleft, chip bud, and whip and tongue grafts were successful.

The inverted cleft graft is differentiated from the saddle graft in that no wedge of wood is removed from the scion. The scion is split, and splitting the 1-year-old scion was slightly easier to work with and tie than the standard cleft which requires splitting the succulent seedling stem.

In preliminary trials performed in Feburary 2000, *A. hippocastanum* was successfully used as an understock for the following: *Aesculus sylvatica*, *Aesculus flava* × *Aesculus pavia*, *Aesculus glabra* × *Aesculus pavia*, *Aesculus* ×*carnea* 'Plantierensis' and *Aesculus pavia* × *Aesculus sylvatica*. Only 4 to 6 of each of these was attempted.

In Feburary and March 2001, I grafted *A.* ×*carnea* 'Briotii' onto seedlings of *A. glabra* using cleft and inverted cleft grafts. Seedling understocks were sown on 11 Jan. 2001. Grafts were made from 23 Feb. 2001 to 20 March 2001.

I calculated success rate for all grafts. On 21 Sept. 2001, I evaluated all of the grafts that were made on 23 Feb. 2001. In addition to calculating success rate, for each plant I measured the amount of new growth above the graft union. I also determined the caliper above and below the graft union. Each grafted plant was given a subjective quality rating of 0, 1, or 2 (0 being the poorest quality). Analysis of variance (ANOVA) was used to determine the effects of graft type on the above measurements.

RESULTS AND DISCUSSION

Unexpectedly, there were significant statistical differences between the two techniques. Success was greatest in the cleft-grafted plants (100%), and among the inverted cleft-grafted plants when they were grafted early (Table 1). Cleft-grafted plants also grew much taller (Table 2), due to longer, not more, internodes, and had larger leaf areas (data not reported). Also, the stem diameters of these plants were larger (Table 2). The superior growth and performance (both in shoot growth and caliper increase) of the cleft-grafted plants indicate that the unions healed better than the inverted cleft. This was also evident when the plants were given quality

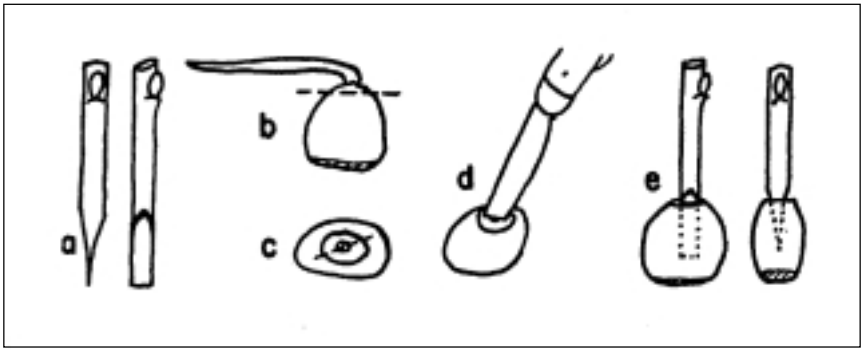

Figure 1. The nurse-seed graft. (A) Two views of scion prepared with wedge-shaped cut. (B) Germinating nut. Dashed line indicates cut that will remove root and shoot. (C) Shoot and root of nut removed. Dashed line indicates where knife blade is inserted into nut through the petiole stubs. (D) Knife blade inserted in nut. (E) Two views of completed graft, scion inserted in nut. (After Jaynes, 1965).

Table 1. Date, type, quantity, and success rate of *Aesculus* ×*carnea* 'Briotii' grafted onto *A. glabra* seedling understocks.

Date	Graft type	Quantity	Success rate
23 Feb. 2001	cleft	12	100%
23 Feb. 2001	inverted cleft	10	80%
9 March 2001	inverted cleft	15	80%
20 March 2001	inverted cleft	19	68%

Table 2. Means of growth responses and quality rating of *Aesculus carnea* 'Briotii' grafted onto *A. glabra* seedling understocks. There were 12 and 8 cleft and inverted cleft grafts, respectively. Within a column, means followed by the same letter are not statistically different at P≤0.05.

Type of graft	New Growth (cm)	Caliper below union (mm)	Caliper above union (mm)	Quality rating
Cleft	6.1a	6.1a	5.4a	1.8a
Inverted cleft	2.9b	4.8b	4.9a	0.8b

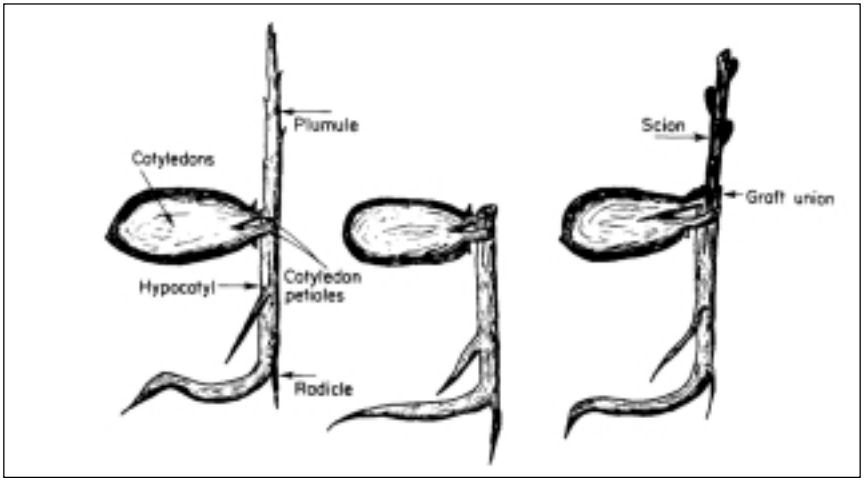

Figure 2. Modified nurse-seed graft. Left: seedling plant, ready for grafting. Center: hypocotyl cut open longitudinally, ready for insertion of the scion. Right: scion inserted; the graft is now ready for tying. [Hartmann/Kester, *PLANT PROPAGATION: Principles and Practices, 4/e, ©1983, p.444.* Reproduced by permission of Pearson Education, Inc., Upper Saddle River, New Jersey.]

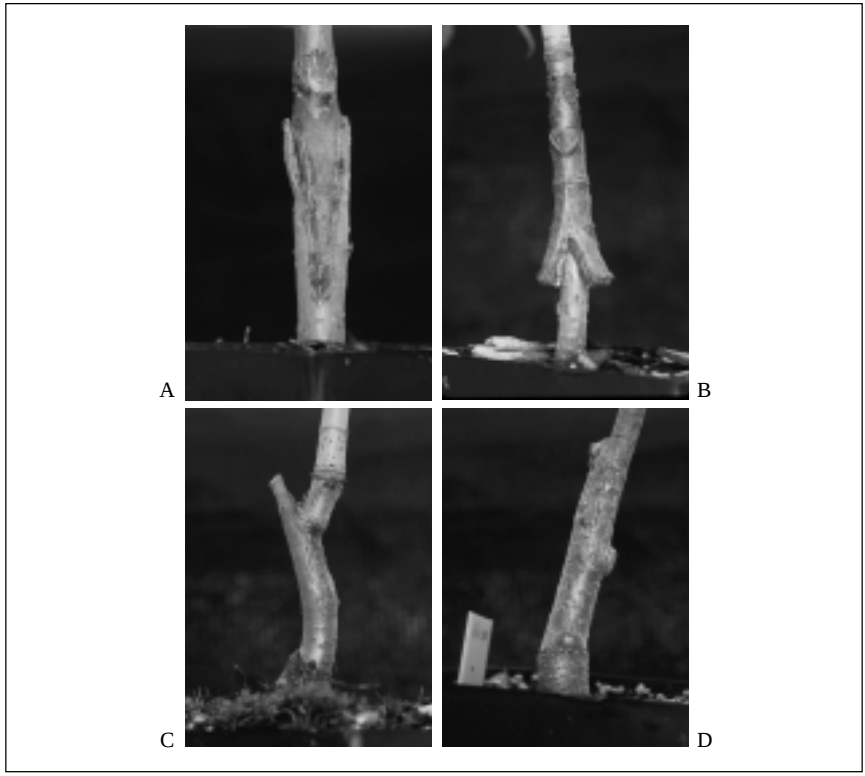

Figure 3. (A) Cleft graft and (B) inverted cleft graft unions of *Aesculus* ×*carnea* 'Briotii' grafted onto *A. glabra* seedlings. Photos 18 weeks after grafting. (C) Chip bud graft union of *A.* ×*carnea* 'Plantierensis'. (D) Whip and tongue graft union of *A. sylvatica*. Photos (C) and (D) 16 months after grafting onto *A. hippocastanum* seedlings. Photo credit: G. Ayers.

ratings (Table 2). Unlike the cleft grafts, the unions of the inverted cleft grafts all butterflied out as they grew (Fig. 3).

Brotzman (2000) also found differences in healing of *Aesculus* grafts and prefers the whip and tongue technique. I have not yet tried the splice, but the whip and tongue, which heals nicely, is slow and difficult to perform due to the thin diameter and succulence of the understock.

CONCLUSIONS

Grafting *Aesculus* onto recently germinated understocks is a viable practice. However the graft technique used is important, as the cleft graft is superior to the inverted cleft. Other techniques, such as whip and tongue and chip budding, show promise, but are more difficult to perform and were only tested in preliminary trials. Obviously, understock stem will not be as lignified as that of 1 or 2 year old understock and care must be taken not to break it while tying, but the extra care and time required is more than offset by the time and space saved using understock that is only a few weeks old compared to that which is 1 to 2 years old.

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Carpinus caroliniana Production at Johnson's Nursery, Inc.©

Michael Yanny

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Carpinus caroliniana is a small understory tree, 20 ft to 30 ft tall and wide. It is found in lowland woods from Nova Scotia to Minnesota and south to Texas and Florida. The plant is prized for its muscular-looking trunks of slate gray bark. The common name musclewood comes from this interesting characteristic.

Fall color can be outstanding. Some trees develop glowing reds, oranges, or clear yellows. Unfortunately, many other individuals have disappointing dirty yellow to brown fall color.

Musclewood is seldom used in the landscape industry. One reason for this may be its reputation for being difficult to grow. Eighteen years of growing experience with this species has proved otherwise. This plant is not difficult; it is just not understood.

Musclewood is slow growing but growth can be accelerated in the production process by avoiding inbred seed lots. The species is definitely slow to recover from either bare root or B&B transplanting, however, our nursery has rarely lost plants due to transplant. There are many other taxa, such as *Quercus, Corylus, Crataegus,* and *Amelanchier,* which could be considered more difficult to transplant.

Musclewood performs best when grown in full sun, in deep rich soil with a steady moisture supply. The species will survive in some surprisingly tough sites. I have seen plants growing successfully as street trees in relatively hot, dry locations. Musclewood has tolerated high pH nursery soils, (pH 7.2 to 7.6), with no noticeable ill effects. Many of the problems with growing *C. caroliniana* may be overcome by selecting and