Using Old Stock Plants for New Research on Shading and Stooling

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INTRODUCTION

Stock plants are a valuable resource in woody ornamental plant propagation and nursery production. Stock plants may be specimen trees, shrubs, hedged stock blocks, or specialized plantings used for seed production, stooling, layering, and even root-piece production. Many nurseries have come to appreciate the value of stock plants from the perspective of having better control over the plant propagation process, rather than trying to tie propagation into a production schedule.

Stock plants or blocks have many positive attributes, particularly in comparison with propagating from plants in container or field production. For example, risks such as mixing up cultivars, taking substandard quality cuttings or suffering from a gradual deterioration of plant quality are avoided when propagation occurs from established plants that are well maintained, well labeled, and not part of the plant production schedule (Hartmann et al., 1997). The history of a stock block is known in regards to plant identity, plant age, geographic or commercial source, and propagation (e.g., seed versus asexually propagated, cutting versus tissue culture origin).

Furthermore, the health and vigor of the stock plant can maintained to meet specific plant needs and propagation goals. The use of pest-free propagation material can have a marked effect on production success (Hartmann et al., 1997). Maintaining a pest-free and, in particular, a virus- or bacteria-free stock plant is a more sound integrated pest management (IPM) technique than treating sick plants during production.

Often the needs of the propagator and production manager differ. Production goals include maximizing growth or flowering, while successful propagation may be favored by slower growth rates, lower nitrogen levels, specially timed harvests, and lack of flowering (Hartmann et al., 1997). But most important might be the opportunity to manipulate stock plants for better rooting potential or propagule health. Possibilities include maintaining the juvenility of seed-derived stock plants through hedging or stooling, altering plant nutrition, manipulating light levels and photoperiod, or even forcing plants to time cutting harvests better. The transition of seedling-grown trees and shrubs from the juvenile to adult phenotype, and the genetic changes leading to new cultivars have been studied extensively (Hartmann et al., 1997). Phenotypically juvenile clones can "age" to the adult phenotype over time and cultivars derived from genetic mutations or "sports" can revert to the wild type. Repeated pruning, hedging, or coppicing can delay or prevent these transitions and associated loss of rooting potential or other desired characteristics. This may be particularly important as more blocks are established from tissue-cultured plants, which characteristically root more easily than conventionally propagated plants.

While the mechanism(s) by which nitrogen fertilization reduces rooting potential is not well understood, the practical application of withholding nitrogen from stock

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plants as a means of increasing rooting is ideal for use with established stock plants. Similarly, it is feasible to manipulate the manganese, zinc, or boron nutrition of stock plants to maximize cutting rooting potential (Hartmann et al., 1997). It would be difficult or undesireable to manage production blocks in this way just to increase propagation potential.

Considerable work has been done with the methods of etiolating, shading, and blanching tree and shrubs to increase rooting (Maynard and Bassuk, 1987). Many of the same principles apply to the practices of stooling, layering, and girdling — propagation methods designed for use with stock plants, not production-cycle propagation. Forcing stock plants in greenhouses has been associated with several of the methods mentioned above (particularly etiolation), and is useful for controlling new shoot growth or extending the growing season. Recent advances in greenhouse materials and construction permit the use of temporary or retractable-roof greenhouses to force new growth, perhaps even on plants growing in the field or landscape.

The use of stock plants or hedges as sources of propagation material is an established practice for many in the nursery trade. Considering the myriad advantages of using stock plants it is interesting that so many nurseries still prefer to take propagation material, usually stem cuttings, from plants in production. Drawbacks to the use of stock plants include occupying potentially valuable production space, requiring at least minimal maintenance, and being less well suited to nurseries that change their offerings frequently, because of the time invested in establishing new plant stock blocks.

The propagation trials described herein are part of a ongoing effort to evaluate, using long-established stock plant hedges, methods of increasing rooting potential of difficult-to-root tree and shrub taxa. The research has been conducted in collaboration with Hoogendoorn Nurseries,Inc., Middletown, Rhode Island. Wherever possible, stock plant treatments are carried out only up to the time of cutting harvest, at which point cuttings are collected, prepared, and rooted by nursery staff according to standard nursery practice.

Paperbark maple was chosen because of continued difficulty in obtaining high rooting percentages of softwood stem cuttings. The stooling of Harry Lauder's walkingstick was evaluated from the perspective of getting own-rooted liners, to avoid problems of suckering on grafted plants, and to reduce propagation costs.

MATERIALS AND METHODS

Shading Paperbark Maple. Methods of shading a paperbark maple (*Acer griseum*) hedge were described previously (Maynard, et al., 1998), with the exception that the hedge was covered on 17 May 1999, approximately 1 week after shoots had started to grow. Three thousand five hundred control (not shaded) cuttings, 400 cuttings from 60% shade, and 300 cuttings from 80% shade were collected by nursery staff on 18 June and treated as described previously (Hoogendoorn, 1985; Maynard et al., 1998). Rooting and cutting survival were assessed on 3 Sept. 1999 using 40 cuttings of each type of cutting, randomly sampled from the rooting bed.

Stooling *Corylus avellana* 'Contorta': Effects of Cut Back Height and Stooling Media. Twenty-five-year-old grafted stock plants of *C. avellana* 'Contorta', Harry Lauder's walkingstick, were cut back (stooled) in March 1998 to heights of 3,

Table 1. Rooting of cuttings from light-grown or shaded paperbark maple stems.

Stock plant treatment	Cutting Survival	Rooting (%)	Root Number	Root length
no shade (control)	65±10[x]	51±19	3.2±1	11.6±2.1
60% shade[y]	90±8.2	42±7	2.9±1	9.0±2.6
80% shade	93±9.6	9±12	1[z]	1.7

[x]Data are mean ± s.e.
[y]Stems were shaded from 17 May to 18 June 1999. Rooting assessed on 3 Sept. 1999.
[z]Insufficient cuttings rooted to permit estimation of standard error.

Table 2. Stool shoot production and rooting of stooled *Corylus avellana* 'Contorta'. Stock plants 25 years old stooled in March, mounded beginning in June, and harvested in November 1998.

Mounding	Number of stems produced Stooling height (inches)				Rooting percentage Stooling height (inches)			
Medium	3	6	12	Average	3	6	12	Average
2 bark :1 peat :1 sand[z]	8	15	8	10	100	73	100	91
Sand	3	7	11	7	100	100	100	100
1peat :1perlite	11	12	6	10	91	58	100	83
Bark	10	10	2	7	60	90	100	83
Control[y]	18	12	9	13	0	0	0	0
Average	10	11	7	9	88	80	100	89

[z]Mounding medium proportions reported on a volume basis.
[y]Rooting percentage averages across mounding media do not include rooting of control.

6, or 12 inches (7, 14, or 29 cm) from the ground. Three plants of each height were prepared and wild-type suckers were removed, as needed, as new shoots developed. Within each height group single plants were surrounded by wire mesh enclosures [¼-inch (0.6 cm) screen, 1.5 ft (0.46 m) diameter, 2 ft (0.62 m) tall which were filled with one of four media as needed, starting in late June when shoots were 3 to 7 inches (7 to 17 cm) long, to keep up with shoot extension through the growing season. Media evaluated included pine bark; a pine bark, peat, and sand mix (2: 1 : 1, by volume); sand; or a peat and perlite mix (1 : 1, v/v). Stems were harvested in November 1998 and evaluated for shoot number, shoot length, percent rooting, and root number per rooted shoot.

RESULTS AND DISCUSSION

Shading Paperbark Maple. The rooting of cuttings collected from unshaded stems was similar to that reported by Hoogendoorn (1985) and Maynard and coworkers (1998) (Table 1). In contrast with the latter study, cuttings from shoots grown under shade rooted much less. Cuttings from 60% shade rooted about the same as light-grown shoots, while cuttings from heavily shaded shoots rooted poorly. Root numbers per rooted cutting were also lower than previously reported (Maynard, et al., 1998). However, more cuttings died in the rooting bench among cuttings from unshaded stems than those from the shaded treatments (Table 1). One possible explanation for the greater survival of shaded shoots is that cuttings collected from unshaded shoots may have been under greater water stress at the time they were collected.

Stooling *Corylus avellana* 'Contorta': Effects of Cut Back Height and Stooling Media. Stooling height generally did not affect the number of stool shoots produced, rooting percentage of stool shoots, or other rooting parameters (Table 2). Slightly fewer stool shoots were produced on plants cut back to 12 inches (29 cm). More stool shoots were produced on control (nonmounded) plants, particularly on the plant cut back to 3 inches (7 cm). This result suggests that, in the absence of mounding, more severely pruned plants were more stimulated to produce replacement growth. Rooting of mounded shoots generally was high. All of the shoots in plants mounded with sand rooted (Table 2). The mean number of roots on rooted stool shoots was 11, and varied little with treatment. Mean height of rooted stool shoots after removal from the stock plant was 3.8 ft (1.14 m).

CONCLUSION

Continued investigation of the effect of stock plant shading on the rooting of paperbark maple cuttings reveals the importance of timing in applying the shading treatment. While shading did increase cutting survival, the critical window of shading during the first days following bud break may have been missed in the trial reported here. Future trials will focus on evaluating the importance of covering the stock plant prior to bud break.

Commercial stooling of *C. avellana* 'Contorta' at Bountiful Farms, Inc., Woodburn, Oregon is accomplished by cutting own-rooted stock plants back to a height of about 12 inches (29 cm), placing a hog ring around elongating stool shoots, applying a dilute spray of rooting hormone to foliage and stems, mounding with sawdust to a height of 12 to 15 inches (29 to 36 cm) and harvesting rooted shoots in November of the same year. Thousands of own-rooted liners are produced this way each year. Personal observation indicates shoot production and rooting results similar to those observed in the trial reported here. The use of hog rings to girdle the developing shoots facilitates the harvest of rooted stool shoots, but the use of rooting hormone may not be necessary, based on the high rooting percentages we observed. Future trials at Hoogendoorn Nurseries, Inc. will be expanded to permit replication of treatments and to evaluate the effect of girdling, hormone treatment, and sawdust as a mounding medium.

LITERATURE CITED

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THURSDAY GENERAL SESSION QUESTION BOX

DAN LONG: Question for Charles Flinn on PennMulsh. Have they guaranteed any minimum level of chemicals from the processing of the newspaper?

CHARLES FLINN: You will have to call the inventor, George Hamilton, at Penn State University; his phone number is 814-865-3007. Mr. Tim Hurley markets the product. His number is 814-234-0391.

VOICE: I think they use vegetable dies so I don't think it is a problem.

RALPH SHUGERT: Question for Mark Coggeshall. Prior to planting your seed, did you conduct any cutting tests?

MARK COGGESHALL: I collected 150 seeds at each test date and conducted a cutting test for viability. Overall it was 78%.

DICK BIR: Did you try any longer than 2 months warm period?

MARK COGGESHALL: No.

SHELLY DILLARD: Did you store the seeds for any length of time or sow them fresh?

MARK COGGESHALL: I collected the seeds for the three dates and stored them in a refrigerator at 38°F and sowed them over a series of different dates.

SHELLY DILLARD: The reason I asked is because maples can develop a secondary dormancy.

BILL BARNES: Would you tell the audience why it is called "diabolicum"?

MARK COGGESHALL: There are to thorn-like styles at the base of the seed.

BILL BARNES: It is hazardous to collect seed without gloves.

EDITOR'S NOTE: A question was raised on which species are taxonomically closely related. The species is in the Section Litocarpa and closely related to *A. sterculiaceum* and *A. sinopurpurascens*.

RICK LOWENDOWSKI: Question for David Beattie. Have you had any luck growing *Caulophyllum thalictroides* sexually.

DAVID BEATTIE: No.

STEPHINE SOLT: Question for Bob Geneve. If the epicotyle emerges after the first cold period but does not grow above the soil is it called combinational dormancy. I am referring to trillium.

BOB GENEVE: Trillium is definitely a combinational dormancy.

STEPHINE SOLT: The reason I ask is that I have done research on it and found that the radical and epicotyl emerge after the first cold period in a petri dish. The cotyledon develops and the seed coat is septorial. In all cases, in over 1000 seeds that I have germinated it occurs. My research is in disagreement with that of Barton from the 1940s.

BOB GENEVE: The best I can do is a seed ecology by Baskin and Baskin. They are at the University of Kentucky and would love to get a call from you.

BARBARA KOLNSBERG: Our germination of *Acer palmatum* is very asynchronous. Can you help any?

BOB GENEVE: I have never germinated that species.

GEORGE OKKEN: We collect the seed and do not let it dry out. We put in a plastic bag and just before it starts to ferment, we sow it.

BILL BARNES: Small seed germinate best, large seeds are recalcitrant.

BARBARA KOLNSBERG: Question for Mark Coggeshall. Have you uesd embryo rescue?

MARK COGGESHALL: No.

BARBARA KOLNSBERG: Question for Charles Flinn. Does the PennMulch have any weed barrier effects?

CHARLES FLINN: The reason they are weed free is because we use methylbromide but are phasing it out. I doubt it has much weed suppressant qualities.