TWO CULTIVARS FOR UPGRADING MAGNOLIA VIRGINIANA SEEDLING PRODUCTION

JOSEPH C. McDANIEL
Division of Ornamental Horticulture
University of Illinois
Urbana, Illinois

This paper concerns a magnolia species for which seedage methods are well established and in which the past American nursery production has been mostly by seedage or collected seedlings. Named clones now are becoming available, most of them adaptable to cutting propagation. Two of the new cultivars at least, and probably others still to be tested, offer seed sources with which seedling growers can upgrade their production in this species — for uniformity, for wide general adaptability, and for landscape quality — above the average obtainable from unselected seedlings. In this respect they parallel the superior seed sources which are being discovered in many other genera of ornamental trees and shrubs.

There is much botanical and horticultural diversity within *Magnolia virginiana* L., the sweetbay magnolia. First, botanically, there is the typical variety, *M. v.* var. *virginiana,* which is the one most frequently cultivated in America. Its natural range is along the Atlantic Coastal Plain, mainly northward from Savannah, Georgia. It occurs, or once did, from eastern Georgia to New Jersey and Long Island, with a northern outpost at Magnolia, Essex County, Massachusetts. This variety varies from a multistemmed, arching shrub to a small tree, largely deciduous when mature under northern conditions, and its plants are highly compatible to their own pollen.

Trees of the second botanical variety, *M. v.* var. *australis* Sarg. are less often cultivated but are found wild in large numbers near the coasts southward and westward from Savannah, going as far south as the Florida Everglades, westward into east Texas, and inland to outposts in Hot Spring County, Arkansas, McNairy and Polk Counties, Tennessee, and Polk County, North Carolina. In favorable southern sites *M. v. australis* grows to a large tree size. It is not always fully evergreen, but some clones of it are, even when cultivated as far north as U.S.D.A. Plant Hardiness Zone 5. Two characters that will nearly always separate the sometimes disputed *M. v. australis* from the northern variety are the stronger, more lemon-like odor of its flowers, and their general self-incompatibility. The typical northern variety and its pubescent form are both self-compatible.

Either botanical variety, I have found, will set seeds to pollen of the other, and at least some of my fertile intervarietal hybrids retain the self-compatibility of *M. v.* var. *virginiana.* Some individuals of both varieties will produce hybrids when pollinated by *M. grandiflora*;

they can also sometimes produce apomictic seedlings when stimulated by pollen of *M. grandiflora* or more distantly related species. Other hybrids, sterile or virtually so, have been produced by crosses between *M. virginiana* var. *virginiana* (as seed parent) and the species *M. tripetala* and *M. obovata (M. hypoleuca)*. Our hybrids with *M. guatemalensis* and *M. macrophylla* are too young to have flowered.

The cultivars, including interspecific and intervarietal hybrids, can be reproduced clonally by cuttings or by grafting. Grafting, so far, seems the only practical method for the hardy evergreen *M. v. australis* 'Henry Hicks'; several expert propagators have failed to root cuttings of it. Two superior cultivar forms of the northern variety, *M. virginiana* var. *virginiana*, on the other hand, have now been tested enough that I can recommend them not only as clones but as seed sources for the production of distinctive and quite uniform lots of seedlings. They have been tried in nurseries over a wide climatic range, from Zones 5 through 9. Both parent plants have long proved hardy in central Illinois upland prairie soils. Their grafts and seedlings have been adaptable also to more southern conditions. For one source, the known adaptation goes as far south as Tampa, Florida. The other is very good, at least to extreme southern Alabama, and probably would also grow south of there. I wish to thank cooperating members Tom Dodd, Jr., Semmes, Alabama, and Don Shadow, Winchester, Tennessee, as well as Tampa landscape nurseryman Jack O. Holmes for their rather extensive field trials which enable me to recommend both the 'Havener' and the 'Mayer' cultivars of *M. virginiana* as reliable seed sources. Treseders' Nurseries are now testing both cultivars in Truro, Cornwall, England.

Magnolia 'Havener' has recently been given cultivar registration with the American Magnolia Society. The original tree stands about 28 feet tall, full size for *M. virginiana* under Midwest conditions, in Mount Pulaski, Illinois. That little community probably has more old sweetbay magnolia trees for its size than any other Illinois or midwestern town. They are not part of the original flora there, but have been cultivated in Mount Pulaski since a local nursery propagated them some time in the late 19th century. *Magnolia* 'Havener' is extreme among all northern variety sweetbays I have seen for its large flower size to 5 inches across, and the high average number of petals per flower. Typically, in both *M. v.* var. *virginiana* and *M. v.* var. *australis*, the flowers have 3 sepals and 8 petals. Most *M.* 'Havener' flowers have extra petals, from 12 to as many as 20 on some. Their color also is rather unusual, being a light creamy shade, with some slight tinge of pink toward the inside base of petals. I have seen this flower coloration in other northern sweetbays, but without the "doubleness" of *M.* 'Havener' and its seedlings.

Don Shadow, of the Tennessee Valley Nursery at Winchester, Tennessee, now has raised several hundred seedlings from *M.*

'Havener' to flowering age. When I examined them there at the end of May, 1970, they were remarkably similar to the parent clone. While there were some variations in flower size, and in the degree of pink inner blush, nearly all flowers had more than 8 petals; all were creamy, and all showed some pink near their centers. Perhaps even more significant from the point of landscape value was their uniform habit contrast with hundreds of typical *M. virginiana* seedlings in adjacent rows, grown from a New Jersey native seed source. The *M.* 'Havener' seedlings were stockier, more fully furnished with lateral branches, and their larger flowers were more abundant than on the New Jersey source seedlings (one year older) under identical culture.

Magnolia 'Havener' is clearly a superior seed source for tree-type *M. virginiana*. The owners of the original tree have given me seed picking privileges in late summer. If there are not enough sample packets here to go around, write to me and I probably can supply you with a start. Scionwood also will be available in the winter season. At Semmes, Alabama, Tom Dodd finds that "cutting material of *M.* 'Havener' roots as well as other *M. virginiana* and certainly better than *M. grandiflora*. We have had good success with seed but prefer cutting-grown plants."

The second seed-reproducing source is a distinctly shrubby, precocious and free-flowering sweetbay form grown from Prof. Robert W. Mayer's plant in Champaign, Illinois. Indirectly, we can thank Mount Pulaski for this form, also. Prof. Mayer grew up there, and knew *M. virginiana* from his childhood. In landscaping his new home, he obtained two plants from a former Urbana nursery, whose original source is not known. The better performing one, progenitor of *M.* 'Mayer' is a multistemmed, narrow-leaved shrub, now mature at about 9 feet tall. Its abundantly produced eight-petalled flowers are in the average size range for the species. Its seeds are unusually small, the smallest I have seen in the genus, and lighter colored than most other *M. virginiana* seeds.

Open-pollinated (mainly selfed) seedlings from *M.* 'Mayer', reproducing its shrubby, precocious habit, are thriving in Mobile County, Alabama, and at Tampa, Florida, as well as in Champaign County, Illinois, and intermediate points. They frequently flower before they are a foot tall. In the lower South, they are nearly evergreen. Both the original *M.* 'Mayer' and its seedlings are readily rooted from summer cuttings under mist. They should fill a need for many nurserymen, north or south, who want a reliably shrubby, easily reproduced type of sweetbay. The Tom Dodd Nurseries can supply other propagators with seedlings of *M.* 'Mayer'. I also expect to be able to supply some seeds and cuttings of the original plant.

Both *M.* 'Havener' and *M.* 'Mayer' probably owe their uniformity of seed reproduction to the attainment of a relatively homozygous condition through past inbreeding. While they are both self-

compatible, I have found that they are capable of outcrossing with other plants of the species. It is suggested, therefore, that plantings of either cultivar intended for seed production be established at a reasonable distance from other *M. virginiana* plants.

In my magnolia breeding, I have tried both *M.* 'Havener' and *M.* 'Mayer' as parents for controlled crossing. *Magnolia* 'Havener' has so far been difficult to use as a seed parent in several attempted crosses, but I do have one intervarietal hybrid lot from pollinating it with a *M. v.* var. *australis* clone from the Florida Everglades. When *M.* 'Havener' was pollinated by *M. grandiflora* or by *M. macrophylla,* the resulting seedlings all appeared to be apomictic, and not hybrid.

Magnolia 'Mayer' has been a more productive seed parent in crosses. I have seedlings from crossing *M.* 'Mayer' x *M.* 'Havener' (not yet flowered) and from several different *M.* 'Mayer' x *M. v. australis* and reciprocal combinations. *Magnolia* 'Mayer' x *M. v. australis* 'Henry Hicks', for instance, gave all intervarietal hybrids as judged by their pubescence and the intermediate odor of flowers. This lot of intervarietal hybrids has been as precocious and almost as dwarf as the presumably selfed seedlings of *M.* 'Mayer'. I am carrying it to another generation by selfing and by back-crossing to *M.* 'Henry Hicks' and other *M. v. australis* clones. Some clonal introductions are anticipated from this line of breeding. The F_1 hybrids are cutting-propagated as readily as *M.* 'Mayer' and most other *M. virginiana* var. *virginiana* clones.

MODERATOR HESS: I'm sure we all appreciated your talk, Joe. We now come to the critique portion of the symposium and I'll call on Charley and Andy to take over the program at this time.

ANDY LEISER: The first paper on this afternoon's symposium concerns seed source and was presented by Harrison Flint. He indicated that this was also my research interest and I heartily second his remarks. There is one point, however, which I would like to re-emphasize and that is the problem of hybridization between species and variations within the species, but particularly between species in domestic collected seed. This can be quite critical in certain groups, particularly in the rose family, hawthorns, cotoneasters, pyracanthas and, in California and the warmer areas of the world, it is particularly important in the eucalyptus. We have had some problems in California with seed of eucalyptus obtained from commercial sources in that at the end of an experiment we found there was more genetic variation between the plants than there was between our treatments. This can be very disconcerting; to the homeowner expecting a certain leaf type or form it can be disappointing and costly.

One other point of Harrison's talk which I would like to re-emphasize, and with which I have been concerned, is the so-called

provenance selections, in which we are concerned with the variation among seed lots from different geographic locations. In ornamental horticulture I think we can come down to much smaller geographic areas than the provenance areas. We're finding considerable variation in seedlings from seeds which were collected only 7 or 8 miles apart. Thus, in some instances, even these small distances can result in extreme differences in the performance of the plant under cultivation. We are calling this "ecotypic" variation to separate it from the provenance designation which the foresters use. I feel that in the future we will become more and more concerned with this ecotypic variation.

One other point is that many of our main horticultural plants have been introduced only once and we have a very limited gene pool in these plants. *Pittosporum tobira* is an example of a plant which might have much more variation if it were re-introduced from the wild, particularly if selected over a wider geographic area. This would allow us to look for a wider seed source variation among these plants. The seed currently collected from domestic sources may have all been derived from a single original introduction.

CHARLEY HESS: I take exception to one thing Harrison said; "that it is cheaper to buy." I assume this was taking into consideration that there was a good seed source and that viability was good, etc. Borrowing from my brother Hans' experience with Japanese maple, he can select much better seed of much higher viability than he can import from Japan. There is also the possibility that a known source has limited controlled crossing and, therefore, the possibility exists of consistently obtaining a desired type of plant from seed propagation. As an example, some work being done at Rutgers indicates that we are leading towards a pink flowering dogwood which would come true from seed by having it cross with its own parents. Red maple is another example in that if the seed source is carefully selected you can often get populations with a high percentage of red-leaved individuals. Under these conditions there are distinct advantages for the nurserymen to collect his own seed rather than to purchase it. Harrison, would you like to challenge these remarks?

HARRISON FLINT: No, I don't wish to challenge your remarks. But my comments were made assuming equal qualities available.

CHARLEY HESS: Are there any questions or comments at this time?

RALPH SHUGERT: With seed that requires pre-treatment it is very important to keep records concerning the source and viability of that seed. You will find that with some seed the pre-treatment such as hot water soak and/or number of days in stratification can vary considerably depending upon the source of the seed; this is particularly true with *Robinia* seed. Whether you have a small amount or

a large amount of seed, you should keep these records so that they can be referred to later.

ANDY LEISER: Since there are no further comments, we will move on to the next paper. As Dr. Pollock pointed out, very few new concepts in seed dormancy have been found in the last 30 years. This was one of the most exciting papers I have heard in some time because of the concept of the timing and interaction of temperature and moisture which he pointed out. In fact this was a take-home lesson for me because now I know why the beans I planted last spring followed by a week of cold weather, gave me a less than a 25 % stand, while with seeds planted out of the same package one week later I got nearly a 100% stand.

Charley, I am wondering if you think we can extend this idea of "turning on the genes" which Dr. Pollock mentioned in respect to his work to "turning on the genes" which changes the vegetative above-ground tissues into root initials and root promordia?

CHARLEY HESS: Yes, I do, but first I would like to say that I enjoyed Bruce's paper very much and I believe his approach is one that will lead to significant new developments in the concepts of seed germination and dormancy problems.

The concept of gene action regulating root initiation is very applicable to germination problems, dormancy, root initiation, and juvenility. Our present approach in studying easy and difficult to root plants involves taking a look at enzyme systems which are involved in the process of root initiation. We have tried for a number of years to find mobile rooting substances; these can be extracted and reapplied to the difficult-to-root cutting, but yet the plant still remains difficult to root. Under these conditions we feel that what may be limiting are certain enzyme systems which have not been "turned on." Are there any questions at this time?

MR. UHLINGER: What temperature do you use when imbibing the seed prior to giving them the experimental conditions?

BRUCE POLLOCK: We routinely use 25° C, though with some seeds a higher temperature might be better.

MR. UHLINGER: I would also like to ask what you think of high temperature during acid scarification treatments for hard seed coats during this critical time?

BRUCE POLLOCK: Your question touches on an area which I think we need to begin to look at with respect to high temperature sensitivity. As I pointed out, the only data I have concerns herbaceous species. There are a number of pieces of evidence accumulating which indicate that there are some problems in this area. I can't give any good answer here, but I do believe this should be looked into.

CHARLEY HESS: My only comment with respect to Brian Humphrey's paper is that I am sorry that he could not be here with us to deliver it in person. It was an excellent paper on the practical

techniques used in England. Perhaps Dick Martyr would be willing to answer any questions concerning seedling production in England.

ANDY LEISER: I would like to know if there has been any attempt to use the field steam-sterilization techniques such as has been used in California with movable steam-rakes?

DICK MARTYR: Quick-steaming as we call it has been used only for frames. There has been a tremendous increase in chemical sterilization during the past few years.

ANDY LEISER: Are there any weed-control chemicals which you use in England which we do not use here?

DICK MARTYR: I don't think so. I assume you have used allyl alcohol in the past.

HUGH STEAVENSON: We used allyl alcohol several years ago but have somehow gotten away from it. We applied it through our irrigation system. It is considerably cheaper than some of the other fumigants. We had very good results with this material and I think perhaps we should take another look at it.

CHARLEY HESS: What is controlled by the use of allyl alcohol?

HUGH STEAVENSON: Essentially, just weed seeds. Ralph Shugert has had some amazing results with Treflan on seedling areas. I was wondering if he has any further report on this work.

RALPH SHUGERT: Hugh is referring to some work which I reported at Fresno, California and can be found in Volume 18 of the Proceedings. My work in Ohio has been on perennials. I've used Dacthal over the top of germinating seedlings of perennials. If you use Dacthal you must have true leaves formed or the seedlings will be killed. Two applications of 12 lb. of Dacthal per acre spaced 45 days apart on perennial beds have been subsequently maintained with four girls after the area was cleaned the first time. Dacthal costs about $18.50 an acre applied; this includes the cost of material, tractor costs, operator, and about a 16 % overhead figure tacked onto that.

CHARLEY HESS: While we're on the subject of herbicides, has anyone observed any problems with cuttings or grafts where the scions were taken from stockblocks which were treated with herbicides?

BILL FLEMER: In one case I am aware of, the problem involved rhododendron cuttings taken from the propagator's own stockblocks which had been treated with Casoran herbicide. He also had some cuttings which did not come from treated stock plants, which were made at the same time. Those from the Casoron-treated stock plants were a total loss while he got the usually expected rooting from the cuttings from the untreated plants.

ROBERT GARNER: I received quite a shock concerning some grafts of Mazzard cherries, *Prunus avium*. I had treated the stocks with Simazine when they were planted in the winter; then I budded them in August and this spring I was very disappointed in that in only a

few cases did the buds start. Since then another similar situation has occurred in a nursery in England on ornamental cherries, I suspect the trouble may also be caused by treatments with Simazine.

CHARLEY HESS: If you are using herbicides on your stockblocks it would be well to keep one area which is not treated so that you can know whether you are getting any deleterious effects from the use of herbicides on your stockblocks. I would encourage University workers to check this out under controlled conditions.

At this time I think we should discuss the next paper, that of Hugh Steavenson's, in which he brought up the problem of an "interface" which occurs in the case of planting canned stock. I was quite interested in this problem because theoretically one would assume that with a container plant you would not disturb the roots so it would carry on without interruption, but from what Hugh has reported it just doesn't work that way.

ANDY LEISER: Did you have the same kind of soil mix in the old and new container, Hugh?

HUGH STEAVENSON: The soils were similar but not necessarily the same. In my opinion, this is really not much of a problem with shrubs and evergreens, etc., in that the root binding will hold them back and keep them dwarfed thus making them salable for longer periods of time. But in the case of shade trees, if it is going to root girdle and die after about 10 years when it is just beginning to come into its own — then this is a different problem and can be a serious one.

ANDY LEISER: There are three problems, as I see it, with container-grown plants. One is the interface problem; that is, the problem between the difference in the soil in the container and that into which the plant is planted which sets up a water relationship problem. There is also a problem of actual or potential root girdling which is different from just pot binding; and there is a third problem which we, for want of a better name, have been calling stagnation. None of these problems are good and all of them need further study.

The stagnation problem is evidenced by plants which have been held too long in containers and are then planted out, and in some cases 2 or 3 years later the plants have still not started to grow. Sometimes drastic pruning will cause the plant to resume growth. We had a particular problem with Bradford pears in which one group was held in 3-gallon egg cans for 2 years and a second group for only 1 year. These were then lined out in the field and when measured three years later, those that were in the cans for only 1 year were uniform in size with a 4 inch caliper and 14-15 ft. tall, while those that were in the cans for 2 years were not uniform and only one of them was as large as the pears that had been in the cans for only 1 year.

BILL CURTIS: For a number of years I grew Colorado spruce *Picea pungens* 'Glauca' in beds until they were 12 to 14 inches tall and

then transplanted them into the field. One year I grew some of the spruce in gallon cans as well as in beds and at the end of 1 year they were the same height. I then planted these into the field and at the end of 2 years in the field the plants which had been in the gallon cans were 2 grades higher than those which came directly out of the beds. I believe the problem you are encountering is the result of plants being too pot-bound. Once they become pot-bound they will just not strike out and grow.

CHARLEY HESS: Moving on now to the paper by Bruce Usrey I would like to start off by asking Bruce what is negative ionization?

BRUCE USREY: It's a system which is used to reduce static electricity.

CHARLEY HESS: Have you used these units long enough to see any results as yet?

BRUCE USREY: No, not as yet. We've had some problems in getting the units operating properly.

CHARLEY HESS: This is certainly an interesting idea and we'll be looking forward to reports in the future on this.

RALPH SHUGERT: I'd like to thank both Andy and Charley; this was a unique experience for the Eastern Region, that of critiquing the papers, and I think they did an outstanding job. I also want to thank Hans Hess for a fine job of moderating the symposium this afternoon.

I declare this afternoon's symposium adjourned.