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Newsletter

of the American Magnolia Society

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The Meeting at Mobile

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The first thing you notice about Mobile, Alabama, is that it sparkles. With seven feet of rainfall, nicely spaced through the year, dust and grime just can't build up on the leaves of trees and shrubs, even in the downtown area. Magnificent mature specimens of *Magnolia grandiflora*, their leaves like dark green mirrors, line the streets and grace the yards of this lovely city of the deep South. The meeting (May 22-24) was well-timed for the peak of *M. grandiflora*'s flowering season, and northern members were amazed to note that the great, white, lemon-scented bowls could be clearly seen on trees half a mile away.

Leaves are not all that sparkle in Mobile. Real friendliness and unaffected hospitality are in evidence everywhere with the Dodd family being particularly well endowed. Heading the Local Arrangements Committee, Col. William Dodd had everything in apple-pie order, even to the extent of supplying each member with a beautiful "keepsake" folder with printed map showing points of outstanding horticultural interest and a cover picture, in color, of a fruiting twig of *M. grandiflora* painted for the occasion by Louise Estes. A pretty girl from the Mobile Chamber of Commerce helped with Registration, and the air-conditioned meeting room was just right for the very satisfactory member turnout.

The weather was ideal, sunny but cool, and the Society's officers were photographed with Mr. Hank Blasick, Director of the Mobile Public Library, officially watering one of four healthy young *M. grandiflora* plants at the Library. These trees were donated for the occasion by Tom Dodd Nurseries, and like all products of that organization, were growing like bamboo. The *Mobile Register* was kind enough to print our picture the following morning. (Fig. 1)

Promptly at 9:00 on Friday, May 22, piloted by Col. Dodd, we set out on a tour of outstanding Mobile Magnolias. To put the word "outstanding" in proper scale, let me say that the first tree visited, at the Shackleford home, measured nearly twenty-two feet in circumference, breast high, and carried hundreds of flowers as large as size seven derby hats.

Back at the meeting room, after lunch, with President Joseph C. McDaniel in the chair, we launched with gusto into the program so professionally prepared for us by our genial Vice-President, Dr. Walter S. Flory of Wake Forest University. Walter must know every top-notch horticultural speaker in the country, and in partnership with Bill Dodd he put together a program of great interest and benefit to us all.

After Col. Dodd's "Word of Welcome" Dr. John M. Fogg, Jr. of the Barnes Arboretum showed beautiful slides of *M. grandiflora* taken on his worldwide travels which proved that this is "the most widely cultivated tree in the world." Mangos, for example, don't grow in Philadelphia, nor apples in Java, while *M. grandiflora* thrives in both.

Dr. Robert L. Egolf, of the University of South Florida, discussed practical means by which more species of the Magnoliaceae could be brought into cultivation. He suggested a central clearing house where Magnolias could be subscribed for by amateurs and arboreta alike, with seed to be propagated by selected nurserymen. A seed and scion exchange with Society members in other countries would be organized through the same channels.

President McDaniel extended the above thinking by suggesting that the Society get together an "availability" list of Magnolias, similar in purpose to the "Plant Buyers Guide" published by the Massachusetts Horticultural Society. Outstanding nurserymen growing a wide

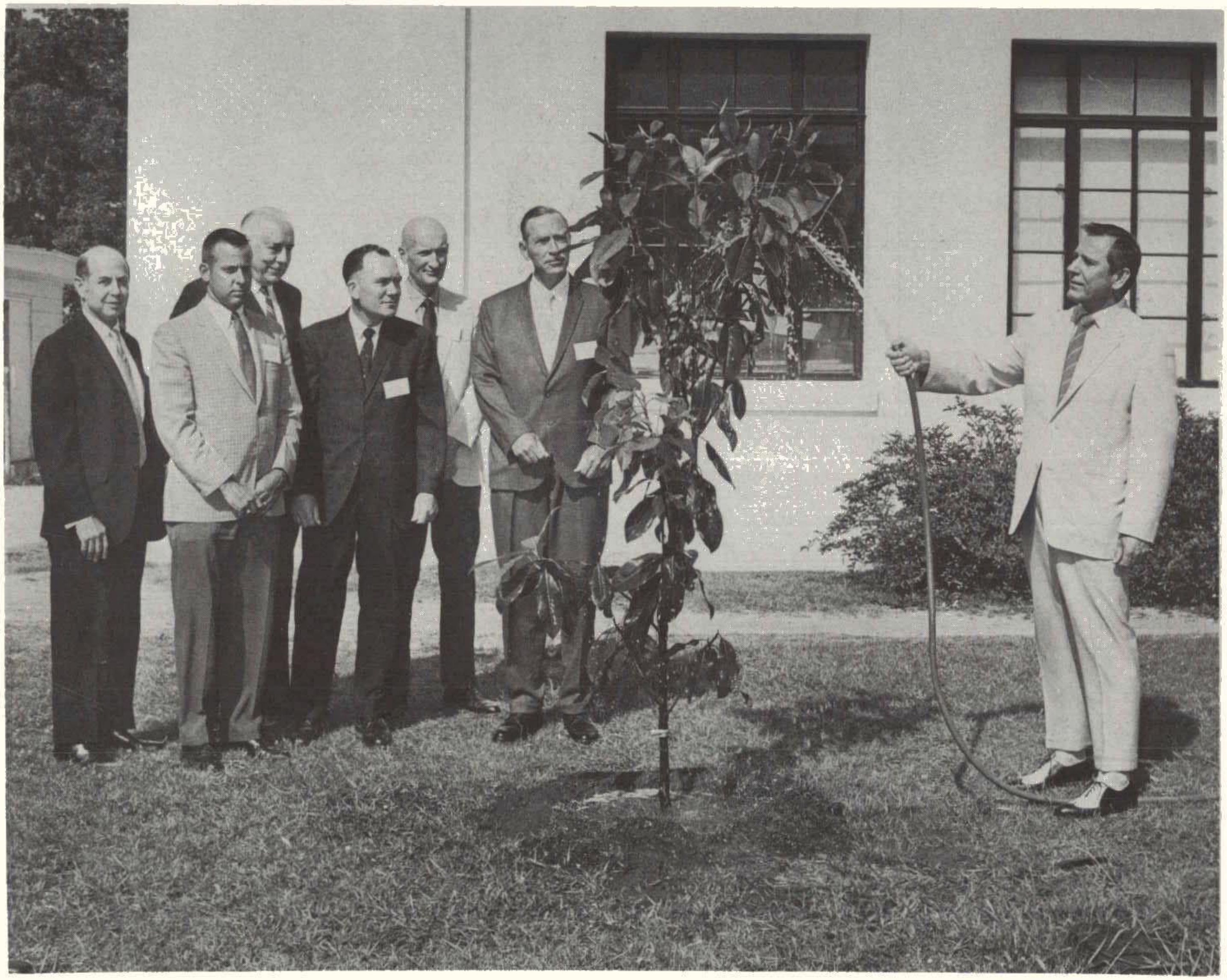

Fig. 1. Planting of Magnolia at Library

Left to right: Dr. Sam Eichold, (of the Tree Commission) Don Shadow, Dr. Walter Flory (Vice-President), Col. William Dodd, Philip J. Savage, Jr. (Secretary-Treasurer), Joseph C. McDaniel (President), Hank Blasick (Director of the Mobile Public Library).

selection of Magnolias would be listed in an extension of Dr. Fogg's "Finding List." Joe mentioned several interesting new hybrids including *M. Sprengeri* 'Diva' × *M. Sargentiana* 'Robusta' named 'Caerhays Belle' and an unnamed *M. Sprengeri* 'Diva' × *M. Campbellii* from Caerhays Castle in England. He urged that the U. S. National Arboretum hybrids be better publicized and suggested directions that might well be taken in hybridizing and in systematic testing of F_1 populations.

Dr. Frank Galyon next described his recent hybrids of *M. denudata* × *M. stellata* of which he has four living plants. One plant that carried flower buds through the last winter died before blooming. Frank also described and screened many aspects of a putative hybrid of *M. Sprengeri* 'Diva' × *M.* × 'Pink Lennei.'

Mrs. Frank Gladney gave a progress report on the portion of Todd Gresham's hybrids entrusted to Gloster Arboretum, and with her husband showed many lovely slides taken in that unique spot.

Mr. Ivan N. Anderson, lifelong friend and associate of the late B. Y. Morrison, showed fine slides and described some of the eighty-five Magnolias currently growing at Pass Christian, Mississippi, in Mr. Morrison's and his collection. Hurricane damage was staggering, but recovery is taking place. Some of the plants shown were open pollinated seedlings of *M.* × 'Lennei' in a wide range of colors but retaining the classic bowl shape of typical 'Lennei."

We were charmed by the sincerity and enthusiasm of

Dr. Samuel Eichold of the Mobile Tree Commission who spoke of fighting to preserve fine old Magnolias and Live Oaks in Mobile, and of the planting of Magnolias made in honor of this meeting.

After supper Carl Amason, of Eldorado, Arkansas, headed a lively panel discussing "Southerners and Their Favorite Magnolias." A Southern gentleman himself, Carl's contagious enthusiasm and abounding good nature made him ideal for the job. The discussion soon involved everyone in the audience and one or two passers-by and rocked merrily on long past its appointed time.

Saturday morning, with your Secretary in the chair, we were treated to a really impressive talk by Dr. Frank S. Santamour, Jr. of the U. S. National Arboretum on the "Implications of Cytology and Biochemistry for Magnolia Hybridization." Frank is a clear-headed and engaging speaker, covering his subject with such relish that there was no hint of dryness in even the most technical aspects of biochemistry. If we are to progress in Magnolia hybridization in an orderly and productive manner, this information is vital. Frank is the author of four separate papers: "Biochemical Studies in Magnolia" published in the Morris Arboretum Bulletin. It would appear that the chemical make-up of certain pigments, and their presence or absence in various species, has greater than suspected taxonomic significance and must be taken into account when planning hybridization to an extent possibly greater than chromosome count.

Dr. Henry P. Orr of Auburn University plunged us abruptly from the theoretical into the commercial with a clear dollars and cents talk on the farming of *M. grandiflora* for the production of uniform cut branches for the florist trade. All of us knew that Holly greens are produced in "orchards" in Oregon and elsewhere, but few were aware of the respectable dollar volume generated by wild-cut *M. grandiflora* foliage. It was interesting to learn that the well-known cultivar 'St. Mary' had been chosen by Auburn University and by one of the large paper companies near Mobile as the most suitable cultivar presently available for Magnolia "orchard" use. Needless to say, successful commercial production requires optimum growing conditions, and Dr. Orr's research on soils, fertilization and pruning was therefore of interest to everyone.

Our cut-flower competition bore little resemblance to one of Mobile's enormous Camellia shows, but it was a start, anyway, and to my mind was won, hands down, by Carl Amason with some huge but beautifully shaped blooms from Arkansas that lemon-scented the entire meeting room.

Mr. Robert D. MacDonald, Director of the John J. Tyler Arboretum of Lima, Pennsylvania, explored the use of computer tapes in preserving the description and registration of Magnolia cultivars. A lively discussion followed, with many pros and cons. The principle "cons" seemed to stem from the fact that only large organizations have computers, and a communal use of such facilities by a relatively small society might result in the loss of at least some of its independence.

Dr. Fogg gave a report on some recently reg s ered cultivars and said that their names and sources would appear in a future number of the Newsletter, of which he is the Editor. He urged that all proposers of new cultivar names write to him requesting registration blanks.

The matter of publication of a Check List of Magnolia Cultivars was discussed, and it was agreed that the President should appoint a committee to assist Dr. Fogg in this undertaking.

Mr. Edward Horder of the U. S. Army Corps of Engineers gave an interesting talk on "Imaginative Use of Magnolias in Landscaping" which was very well received.

The Tennessee Valley Nursery of Winchester, Tennessee is a very large and successful wholesale operation and we are fortunate to number in our membership Mr. Don Shadow, representing this organization, who gave a splendid "how to do it" talk on propagation of Magnolias from seed and grafts.

Every step from the gathering of ripe cones, to finished nursery stock, was skillfully explained. Advice of this kind has been dearly bought by hard experience and is worth its weight in gold. It is fine indeed of the Shadow family to share their invaluable research so generously with us. The sight of long, neat rows of Magnolia seedlings sprouting in the fields like soy beans in Don's excellent slides made all of us realize we had the privilege of listening to an expert.

After lunch, the scheduled business meeting revealed the Society had $1,059.56 cash in the bank as of May 20th. The expense of publishing the Newsletter is certain

Fig. 2. J. C. McDaniel, Dr. Frank S. Santamour, Jr. and Dr. Walter S. Flory in the garden of Edward J. Horder (back to the camera) Photo by R. D. MacDonald.

to increase sharply, and we should all be grateful to charter member George Slankard for publishing it through 1969 at a figure much below his cost. The 1970 issues were printed in Philadelphia, so Editor Fogg and the printer are now "next door" so to speak.

An invitation to hold the 1971 National Meeting in Philadelphia next April was extended by Jack Fogg and Bob MacDonald, promptly voted on, and accepted with appreciation.

Following the business meeting, an eagerly awaited highlight was a fine slide-illustrated talk by Dr. Sigmond Solymosy on "Cultivated Magnolias of the Gulf Coast." Dr. Solymosy of the University of Southwestern Louisiana is a widely known specialist in the Gulf Coast flora and his keen interest in Magnolia cultivars will be of benefit to us all.

Much of the success of this meeting was due to the detailed groundwork laid out with military precision by Col. Bill Dodd, his brother, Tom, Jr., and the office and staff of Tom Dodd Nurseries. A report on our visit to this huge and efficient operation on Saturday afternoon would require a Newsletter in itself. Let me say only that if a member wishes to study Magnolia growing, this is the place to go; but if he wants to study Johnson grass, he must go somewhere else.

On the way to Tom Dodd Nurseries a stop at the delightful home of Mr. Edward J. Horder revealed many well-grown native and exotic plants. (Fig. 2)

On Sunday morning we split into several groups, some ranging over the "points of interest" listed by Bill Dodd in his program, some by invitation to the forested grounds of Mobile College, and others to the beautiful campus of the University of South Alabama. I went with the latter group and we enjoyed a walk along a clear-running creek guided by Dr. Michel LeLong of the University staff. Our group included seven professional botanists and no plant was safe from immediate and accurate indentification.

As we took off for home Sunday afternoon, all of us were comfortably aware that we had attended a wonderful meeting at Mobile.

Did Magnolia Grandiflora Borrow some Genes? A Detective Story.

JOSEPH C. MCDANIEL
Urbana, Illinois

Members who attended our American Magnolia Society meeting at Mobile, May 22-24, 1970, have had opportunities to view the great variability of *Magnolia grandiflora* in the local plantings and in woods near its center of natural distribution. This will help them understand why forward-looking nurserymen are turning more to the use of clonal, asexually propagated cultivars, or at least to seed propagation from selected parent trees of the Southern Magnolia. Taking the species as woods-run, there are many differences in growth rate, tree habit, size, shape, gloss and indumentum of leaves, size, shape and fragrance of flowers, length and profusion of flowering, and size, shape and coloration of the fruits. The uniformity and concentration of horticulturally desirable characteristics obtainable in trees of a grafted or cutting-grown clone are in marked contrast. As we take *grandiflora* to colder climates outside its natural range, we encounter hardiness differences between different clones. These variations among seedlings give good reason for selection, rather than using just anything that comes along with the "grandiflora" label attached to it. In this article, perhaps to the Editor's relief, I am not introducing any new cultivar, but will look into some of the background of variability in the native *M. grandiflora,* which is both the source and the reason for cultivar selection.

M. grandiflora HAS MORE CHROMOSOMES (114 in somatic cells) than any other U. S. native species in its genus. This HEXAPLOID ("six-fold") number is matched in the other subgenus, by Asian species of Section *Yulania* (*M. Campbellii, Dawsoniana, denudata, Sprengeri*) and by some later generation *M.* × *Soulangiana* hybrids. Given an ancient and widely-distributed species, such a high number of chromosomes can accommodate a continuing high degree of genetic diversity, meaning that there is probably no such thing as a "true-breeding" line of *grandiflora,* although many seedlings CAN show marked similarities to their parent. Some of this diversity has accumulated as a result of mutations during the long life of *grandiflora* as a species. Some diversity probably was present from its beginning as a species. *M. grandiflora,* being a polyploid, most likely originated in the first place through one or probably more stages of chromosome-number increase from its ancestors. The ancestors could have been two (or more) simpler species which underwent natural hybridization, following which there was a doubling or partial doubling of the hybrid's chromosome complement. That event is too far in the past to estimate when it occurred. But coming down to recent times, geologically speaking, there have been opportunities for at least occasional cross-fertilization between *grandiflora* and some of the diploid (38-chromosome) American species, perhaps species outside its Section but still within Subgenus *Magnolia.* Such crosses have been experimentally accomplished in the past 40 years. Crossing with our *M. acuminata* probably would be precluded, not because *acuminata* is a tetraploid (76-chromosome) species, but because it is in the second Subgenus, *Yulania* (until recently called *Pleurochasma*), which is only remotely related in line of descent to *grandiflora* and the other species of Subgenus *Magnolia*. Within the *grandiflora* native range, the other species in Subgenus *Magnolia* that is most consistently found in quantity nearby is *virginiana*. Less abundant, but occurring with *grandiflora* on some of the more favorable sites within its range are *macrophylla* and *tripetala,* while the stands of *Ashei* and *pyramidata* are usually associated with other Magnolias, including *grandiflora*.

How much of its present genetic diversity, and consequent horticultural variability, does *M. grandiflora* owe to hybridization with other species now growing within its range? We might add to our question two more species now separated by a few hundred or several hundred miles, *M. Fraseri* of the Appalachians, and *M. Schiedeana* of northern and other parts of Mexico. Let's take a hypothetical climb among the branches of the Southern Magnolia's family tree, play plant detective, and try to prove the case of the BORROWED GENES. There are a number of facts which, taken together, can serve to support a theory.

It was as recently as 1930 that Oliver M. Freeman, with carefully controlled crosses, showed that *M. grandiflora* could cross-fertilize *M. virginiana*. In Washington, D. C., he produced many hybrid trees now growing in the U. S. National Arboretum. From among them the 'Freeman' cultivar (*virginiana* × *grandiflora*) was selected and named after Mr. Freeman's retirement. His seed parent tree, he told me, was a deciduous northern Sweet Bay Magnolia, *M. virginiana* var. *virginiana*.

The *virginiana* × *grandiflora* cross has since been repeated by other breeders, myself included, using both var. *virginiana* and the *M. virginiana* var. *australis,* which is the one most frequently associated with native stands of *grandiflora*. In some of my attempts the cross has failed, or the seeds from cross-pollination have given only apparently apomictic *M. virginiana* seedlings. But, over all, it is predictable that if one hand-pollinates just-opened *M. virginiana* flowers (protected against insect entry before and after) with viable *M. grandiflora* pollen, then saves and germinates the resulting seeds, he will obtain many seedlings which resemble their pollen parent closely enough to be obviously interspecific hybrids. (Note that emasculation is an unnecessary step. A magnolia flower in this and most other species does not shed any pollen until its stigmas have become incapable of supporting pollen germination. The receptive period lasts less than 12 hours, probably.) The cross can be made reciprocally (*grandiflora* seed parent × *virginiana* pollen), but in that case the true hybrids cannot always be sorted out immediately from any purely maternal *M. grandiflora* seedlings that could occur with them.

First-generation hybrids produce flowers intermediate in size, but more like *grandiflora* flowers, and opening during the forenoon hours, like *grandiflora*. The hybrid, climate permitting, has its leaves evergreen like *grandiflora,* though usually thinner and somewhat more flexible, and with some other differences to be discussed later.

The 3 to 1 preponderance of *grandiflora* chromosomes in the cells of the first-generation hybrids makes for general dominance by that species. Assuming that meiosis is normal, we have one gamete with 19 chromosomes (from *virginiana*) uniting with another (from *grandiflora*) that has 57 chromosomes. The resulting hybrid will have the tetraploid, 76-chromosome number. In further breeding, such an intermediate plant may be less fertile than a naturally tetraploid species. Fertility, in fact, is greatly reduced and apparently approaches zero in some hybrids, but the 'Freeman' clone does have some flowers producing functional pollen and functional egg cells; for me it has been able to give viable crosses with both its parent species. Such backcrossing, if the backcross hybrids also exhibit a degree of fertility, opens the way toward later generation recombinations, with either one species or the other, in which a relatively small number of genes are contributed by the second parent in the primary cross. This process is called introgressive hybridization, and it is known to occur frequently in some plant genera. But with this particular *M. virginiana* × *M. grandiflora* combination, there may be a barrier to continued recombination of the hybrids with *M. virginiana*.

I have now flowered several *M. virginiana* × 'Freeman' backcross hybrids. They look, as one might expect, more similar to *M. virginiana* than 'Freeman' does, because they have fewer chromosomes from *grandiflora* and proportionately more from *virginiana*. Apparently they are triploids (with 57 somatic chromosomes) and they share the sterility commonly found in triploid plants; so far, they have yielded no seed to hand-pollination by *virginiana*. (Similar sterility is reported by Kosar and Santamour for triploids of the *M. liliflora* × *M. Kobus stellata* cross at the National Arboretum.)

My several *M. grandiflora* × 'Freeman' hybrids are not yet to flowering size. They should be approximately pentaploids, with 95 chromosomes. By analogy with another pentaploid, the original *M.* × *Soulangiana,* we could expect them to show some fertility. If they or their descendants, like some clones of *Soulangiana* ('Lennei', etc.) can sometimes function at the hexaploid level, there should then be little hindrance to their free crossing with *grandiflora*. In that case, later generations could see extensive seedling populations of introgressed *M. grandiflora* possessing partially *M. virginiana* chromosomes and genes, and some phenotypic characters attributable to *M. virginiana* ancestry.

As has been stated, *M. grandiflora* has coexisted for thousands, perhaps millions of years in the same areas with *M. virginiana* var. *australis*. These two overlap also in flowering season, though the peak flowering of *grandiflora* in native habitat tends to be earlier in the spring. While *grandiflora* plants are normally self-compatible, *virginiana australis,* according to my experiments and observations, needs crossing in order to set seeds. It will, in the wild as in cultivation, sometimes be cross-fertilized with *grandiflora* pollen. In the normal course of events, then, some first-generation hybrids will survive competition, reach sexual maturity, and produce viable seeds. From such beginnings, and however slowly, there will exist the possibility of introgression from new or old hybrids into the local *M. grandiflora* populations. As Edgar Anderson has shown, hybrids would be favored in what he called a "hybrid site," where neither parent species had conditions that would cause it to suppress the growth of the other species. Say it would be a little wet for *grandiflora,* and a little dry for *virginiana australis,* then the hybrids would tend to increase. Hybrid vigor, or heterosis, occurring in certain combinations of genes, would favor the survival of plants with those combinations, when conditions were not entirely optimum.

Such, I believe, is the sequence of interspecific encounters that have taken place in our Southeastern states, between *M. grandiflora* and some diploids of Subgenus *Magnolia,* most often *M. virginiana,* and usually its var. *australis.* Because of the sterility barrier to further crossing at the triploid level, little if any *grandiflora* ancestry may be looked for among our present native populations of diploid magnolias, but the hexaploid *M. grandiflora* in many places can be what is called a "compilospecies," it having compiled an assortment of genes (and variability) derived from other species in its subgenus. Most of its outcrossing, but probably not all, was with *virginiana australis.* The fertile tetraploid 'Charles Dickens', for instance, is an evergreen whose broad leaves and large broad fruits indicate the likelihood of some *M. macrophylla* ancestry not far up its family tree.

In many *M. grandiflora* clones of unknown pedigree there are morphological characters supporting my theory of partially hybrid ancestry. Among the most prevalent is the presence of short stipular scars on their leaf petioles. Such scars are to been seen upon close examination, on some petioles of what is perhaps the oldest surviving cultivar, the 230-year-old 'Exmouth' (var. *lanceolata* Ait. or var. *exoniensis* as it may be more frequently called in the U. S.) A surprisingly high proportion of old and recently named *grandiflora* cultivars have such scars, readily seen at the base of just-abscissed petioles.

By Mr. J. E. Dandy's definition, the absence of stipular attachment to the petioles is diagnostic of Section *Theorhodon,* to which *M. grandiflora* and all but one of the many species native to Latin America are assigned. American species outside Subgenus *Theorhodon,* and all species in the allied genus *Talauma,* have clearly adnate stipules, which means that they detach to leave a distinct scar part way up the petiole, in addition to the one which encircles the Magnolia stem at a node. In 'Freeman' and in other first-cross hybrids between *virginiana* and members of Section *Theorhodon* (including *M. guatemalensis*) the stipular scars are present, but shorter than those seen in pure *virginiana.* The scars on W. F. Kosar's crosses between *guatemalensis* (another diploid) and *M. virginiana* are larger than those on the first-cross *virginiana* × *grandiflora* hybrids. So are those on crosses between pure *virginiana* and either 'Freeman' or 'Charles Dickens'.

In the latter two series of presumably triploid hybrids there is another difference from the primary hybrids. The leaf undersides develop a degree of the glaucous color usually seen in *virginiana* foliage. Very little glaucous color is developed in most primary *virginiana* × *grandiflora* hybrids, though two of Freeman's are said to have shown this tendency, and the cultivar 'Madison' (presumably a *grandiflora* × *virginiana australis* introgressant) has leaves tending to be grayish-brown beneath.

Both the *virginiana australis* × *grandiflora* and the *guatemalensis* × *virginiana* hybrids commonly have rather lanceolate leaves, with a much greater length/width ratio than their respective Section *Theorhodon* parents. 'Exmouth', 'Madison', 'Alabama Everblooming', 'Santa Cruz', 'Majestic Beauty', 'Russet', 'Griffin' and other cultivar clones share this more or less lanceolate leaf shape, with more acute apex than the general run of *M. grandiflora.* 'Empire State', newly registered, though reputedly selected long ago on Long Island, and since cultivated in Florida, has particularly long, lanceolate leaves, and most seedlings from both it and 'Madison' inherit this shape.

It is interesting that 'Exmouth' and most of the *grandiflora* cultivars selected for a consistently prolonged flowering season under American conditions have some leaves with the short stipular scars on their petioles, plus an upper leaf portion more acute than usual in *grandiflora.* 'Cairo' shares these characteristics, though most of its unique leaves are too wide to be called lanceolate. Some 'Cairo' seedlings, though, have definitely lanceolate leaves.

'Charles Dickens', on the other hand, has a normal late spring flowering season in the Tennessee Valley, and its broad leaves are blunt near the apex. It, unlike most of the other presumed introgressant *grandiflora* clones, probably owes little to *virginiana australis* ancestry, but more likely to *M. macrophylla.*

Most of the presumably introgressed cultivars are as normally productive of seeds as *grandiflora* in general, and I believe they are considerably removed from the first crosses. There is, however, or was recently, by the East Chattanooga branch Post Office in Tennessee, an apparently hybrid tree (*virginiana australis* × *grandiflora*) with only scant seed production from its abundant flowers. It, like the only partially fertile 'Freeman', could be a primary hybrid, but one from natural crossing.

Now, for a little while, let's take our plant detection south of the border. Outside the U. S., the more southern relatives of *grandiflora* in Section *Theorhodon* are mainly quite local in their distribution. With one known exception, they are endemics found each in its own little niche at high altitudes in the mountains of tropical America (Mexico to Venezuela, and an island series from Cuba to Puerto Rico). The exception is *Magnolia Schiedeana* Schlecht., widely scattered among the mountains in several Mexican states, in both Gulf and Pacific drainage areas. It is the most northern of Mexican magnolias, extending into Tamaulipas to north of the Tropic of Cancer in the Sierra Madre Oriental, near Gomez Farias, and still farther north where Dr. Frederick G. Meyer once collected it. Besides approaching the extreme Texas range of *M. grandiflora* more closely than any other Section *Theorhodon* species, it is also botanically closer to *grandiflora* than anything else in the genus. It is the only other American species with a 114-chromosome count. *M. Schiedeana,* though less pubescent than *grandiflora* and smaller flowered in general, is still enough like it to be confusing. The distinguished taxonomist and student of Mexican plants, Dr. A. J. Sharp, mentioned some (relatively) non-pubescent *grandiflora* plants around Charleston, S. C., and told me he thought *M. Schiedeana* should be classed with *grandiflora* as the same species.

I won't go that far, but am open to the suggestion that *Schiedeana* could be an ancestor of *grandiflora.* Though native magnolias do not now occur (except as planted trees) in the intervening hot drougthy country on both sides of the Rio Grande, both *Schiedeana* and *grandiflora,* or their common ancestor, could have grown there in previous times, when central Texas had a climate moist and cool enough to support fir and spruce forests.

From Meyer's collection in a northern *M. Schiedeana* outpost in Tamaulipas, Carl English, Jr., of Seattle, germinated seedlings of *Schiedeana,* and gave one to the University of Washington Arboretum whence I obtained rooted cuttings. This clone has some short stipular scars on its petioles, like the presumably introgressed *M. grandiflora* forms we have been discussing. Dr. Frederick C. Boutin, at the Huntington Botanical Garden has a different *M. Schiedeana* clone, grafted from a tree he collected in Nayarit or Jalisco state, far west of Tamaulipas and in the Pacific drainage. He tells me that it shows no sign of stipular scars. Is the Tamaulipas clone introgessed by *M. virginiana* or a near relative, which might have grown in Mexico when the climate was different? The only known surviving Mexican Magnolia outside Section *Theorhodon* is the most southern of all American deciduous species, *M. dealbata,* which is a close relative of *M. macrophylla* in Section *Rytidospermum.* It has been observed recently in mountains of Oaxaca, and probably grows also at high altitudes in Vera Cruz State, but seems never to have been brought into cultivation. It could be another speculative source for the stipular scars on the Tamaulipas clone of *Schiedeana.* Though not now known in that state, it could have occurred more widely in pre-Columbian or early Colonial times, as is unfortunately true of many rare Mexican and Central American plants, not to mention many native in the U. S.

Since the preceding paragraphs were set in type, there comes expert testimony that the clone from Meyer's collection near the Nuevo Leon and Tamaulipas border is not *M. Schiedeana,* after all, but a new undescribed species. See Mr. J. E. Dandy's letter (2 April, 1970) on page 7.

There are two more undescribed species, at least, in highlands of Chiapas. Both Thomas MacDougall and I have collected an almost completely glabrous species (differing somewhat from *M. guatemalensis*) at a stand between the Km. 65 and 66 markers on the road to Pueblo Nuevo, and Dennis G. Breedlove of Stanford University found a different (pubescent) species within 1 km. of the Guatemalan border in the lake region farther south. (My "unknown" grows now as a graft in the National Arboretum greenhouses, and may flower there soon.)

Here I might add that authentic *M. Sharpii,* too, sometimes has petioles with short stipular adnation. This was noted recently in my greenhouse, where I have grafted this Chiapas species from a clone growing at Fort Bragg, California. (It grew from seeds collected in habitat by MacDougall.)

I am ready to give an affirmative answer to the question raised in the title of my article, though further studies employing cytology and biochemistry might nail it down more firmly. To the question in my third paragraph, no exact answer is possible. But I am convinced that a great deal of the *grandiflora* variability, and its remarkably wide adaptability, too, traces to its "borrowed genes". These are the result of occasional natural crossing with other species, and with *M. virginiana* var. *australis* most of all. Fortunately, if we make selections from among the best of this introgressed material, the horticultural as well as the botanical result can be a GRANDIFLORA PLUS.

A Letter to the President

Dear Mr. McDaniel,

I have received (without covering letter) copies of letters by yourself and Dr. F. C. Boutin about *Magnolia Schiedeana* and other Mexican species. Presumably these are for my information and comment.

Up to date I recognize 4 species of *Magnolia* as indigenous in Mexico, as follows:

Sect. *Rytidospermum.*

M. dealbata Zucc. Vera Cruz and Oaxaca. Closely related to *M. macrophylla* Michaux.

Sect. *Theorhodon.*

M. Schiedeana Schlecht. Sinaloa to Michoacan and Vera Cruz. I have seen specimens from Sinaloa, Nayarit, Jalisco, Michoacan, Vera Cruz. This is the most widely distributed of Mexican Magnolias and also the most variable. The indumentum varies greatly, but I have been unable to make any sensible division into minor taxa as yet, though I have tried hard.

M. Sharpii Miranda. Chiapas.

M. sp. nov. Borders of Nuevo Leon and Tamaulipas. Collected by F. G. Meyer & D. J. Rogers in 1948, but not described so far as I know.

Talauma mexicana (DC.) G. Don is certainly a valid species, as you say. It has nothing to do with *Magnolia grandiflora*, of course, and it is surprising that the two should have been confused.

Best wishes,
Yours sincerely,
J. E. Dandy
British Museum (Natural History)

Implications of Cytology and Biochemistry for Magnolia Hybridization[1]

FRANK S. SANTAMOUR, JR.[2]

Past efforts in hybridization in *Magnolia* have only scratched the surface of the possible interspecific combinations in the genus. The wide range of floral, foliar, and growth characteristics in this genus offers great potential to the plant breeder. However, there may be drawbacks, real or imagined, to intensive and widespread work in controlled pollination.

This paper is an attempt to draw, from basic research on cytology and biochemistry, some conclusions regarding the "whys" and "why nots" of species crossability.

Cytology

The lowest recorded haploid chromosome number in *Magnolia* is n = 19, and this is probably the basic number for the genus. Most species studied thus far are diploids with 2n = 38 chromosomes. However, in the Subgenus *Pleurochasma*, there are 3 tetraploid (2n = 76) species in Section *Tulipastrum*, and a group of hexaploid (2n = 114) species in Section *Yulania*. The only polyploid species in Subgenus *Magnolia* are the hexaploids in Section *Theorhodon*, which includes *M. grandiflora*. With the exception of *Theorhodon*, which also contains the diploid species *M. Hamori* and *M. guatemalensis*, present ininformation indicates that only one level of ploidy may be found in any given section of the genus.

Chromosome numbers are important in hybridization work because they may influence (1) species crossability, (2) the direction in which crosses can be made, (3) the fertility of hybrids, and (4) inheritance patterns. Our experience in *Magnolia* indicates that chromosome number *per se* is not a barrier to crossing. As evidence, we can point to well-known or experimental interspecific hybrids representing every possible combination of diploids, tetraploids, and hexaploids.

Fertility in interspecific hybrids may be influenced by parental differences in chromosome number but hybrid sterility may also occur in hybrids between species at the same ploidy level. Fertility is defined here as the production of functional gametes (pollen or egg cells) rather than the setting of fruit. Thus, we find that hybrids between the diploid *M. virginiana* and the diploid species *M. tripetala* and *M. obovata* are highly sterile (Santamour, 1966a 1969). On the other hand, diploid hybrids within the Section *Buergeria* and tetraploid hybrids in Section *Tulipastrum* may be highly fertile (Santamour, 1970b). It is likely that any intrasectional hybrids will be fertile, since such crosses generally combine species which are not only closely related but also have the same chromosome number. Crosses between species with different chromosome numbers will also generally be intersectional and the progeny will probably be quite sterile. Triploid hybrids derived from *M. stellata* (2x) × *liliflora* (4x) and tetraploids from *M. virginiana* (2x) × *grandiflora* (6x) show a high degree of sterility (Santamour, 1969). We may assume, therefore, that any crosses between species from different sections of the genus will result in partially sterile progeny, and a subsequent barrier to further breeding along that line.

Such hybrid sterility is seldom complete, however. The tetraploid *virginiana* × *grandiflora* hybrids occasionally produce viable seed and McDaniel (1963) has used 'Freeman' in backcrossing to *virginiana*. If such hybrids are to be used in further crossing, they should be used as male parents, since a few of the many hundreds of pollen grains applied to a stigma may have the potential of fertilization. If greater fertility is desired, the chromosome number of the hybrid may be doubled by the use of colchicine. Each chromosome in the colchiploid will have an identical partner, and meiosis will produce a high proportion of viable gametes.

The assemblage of hybrids between *M. denudata* (6x) and *M. liliflora* (4x), known collectively as *M.* × *Soulangiana*, represents a special and interesting case. First generation hybrids are, as expected, pentaploids (5x) with 2n = 95 chromosomes. Varying, but low, proportions of viable pollen or egg cells are produced by most

1. Based on a talk given at the 1970 meeting of the American Magnolia Society, Mobile, Alabama, May 23, 1970.
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pentaploids, and some seed is set to self- or cross-pollination. In addition, there are other cultivars (notably 'Lennei') of *Soulangiana* that produce good pollen and regularly set good crops of fruit. Janaki Ammal (1953) reported that 'Lennei' was a hexaploid (6x) and later authors (McDaniel, 1967) have assumed that all fertile cultivars of *Soulangiana* had the same chromosome number. Recent work (Santamour, 1970a) has established that 'Lennei' is a septaploid (7x) and that other fertile cultivars may be 6.5x, 7x, or 8x.

The fertile, but unbalanced, chromosome complements in the pollen of *Soulangiana* cultivars above the hexaploid level may offer an opportunity for increased variability among hybrids within the Subgenus *Pleurochasma* and perhaps even crosses with species of Subgenus *Magnolia*.

First-generation hybrids between species with different chromosome numbers will tend to resemble that parent with the higher number. This fact is especially well documented in the *virginiana* × *grandiflora* crosses produced by Freeman (1937). The tetraploid hybrids contain 57 chromosomes from the evergreen *grandiflora* and only 19 from *virginiana*. Thus, the progeny resemble *M. grandiflora* in most morphological details. When pollen from these hybrids is used in backcrossing to *virginiana*, the resulting seedlings (presumably triploids) have nearly equal numbers of chromosomes from each parent and are "hybrid" in character (McDaniel, 1963).

Because of the partial sterility of interspecific hybrids, and the consequent lack of enthusiasm by breeders for advanced generation breeding work, the influence of polyploidy on inheritance and segregation may not be an important problem. Still, when colored petals, increased hardiness, evergreen leaves or other special characters are a major goal of hybridization, the desired character should be present in the parent with the higher chromosome number. In this way, the F_1 hybrid is likely to approximate more closely the morphological or physiological traits that are wanted.

Biochemistry

Whereas the above data on cytology rest upon solid experimental evidence, the influence of biochemistry on species crossability is more speculative. The classical genetic explanation of sexual incompatability (generally self-incompatability) is based on a series of "S" alleles (genes at the same locus controlling the same process). An oversimplified description of the incompatibility reaction would be that when a pollen grain containing a particular allele lands on a stigma having the same allele, the grain either fails to germinate or the growth of the pollen tube is inhibited in the style before reaching the embryo sac.

Chemically, there is some evidence that the incompatibility reaction depends on proteinaceous materials in a manner similar to the antigen/antibody reaction in animals.

There is less evidence for the involvement of other chemicals, notably flavonoids, in the incompatibility reaction. Santamour (1966b) discussed the literature on this subject and offered at least some data on the possible role of flavonoids in *Magnolia* hybridization. The following discussion is based primarily on work reported in 1966, tempered by a small amount of additional research and observation since that time.

Of the three flavonoid compounds found in stigmas and pollen grains of *Magnolia*, and which are discussed below, only "R" has been positively identified. This substance is rutin (quercetin 3-rhamnoglucoside). Substances "D" and "S" appear to be flavonoids, although no characterization has yet been attempted.

Table 1. Flavonoids in stigmas and pollen of Magnolia species.

Subgenus *Pleurochasma*	
"S" stigmas	*"RD" pollen*
stellata	stellata
Kobus	Kobus
salicifolia	salicifolia
denudata	denudata
liliflora	liliflora (?)
acuminata	acuminata
cordata	cordata
Subgenus *Magnolia*	
tripetala	tripetala
obovata	obovata
Sieboldii	Sieboldii
"R" stigmas	*"R" pollen*
virginiana	virginiana
macrophylla	macrophylla
Ashei	Ashei
grandiflora	grandiflora

Table 1 lists the species studied and the chemical substances found in their stigmas and pollen. All of the species of subgenus *Pleurochasma* contain "S" in their stigmas and "R" and "D" in their pollen grains. The same is true of three species of subgenus *Magnolia*.

A working (and probably workable) hypothesis of crossability is that species with "S" in their stigmas can only be fertilized by pollen containing substance "D".

In the subgenus *Pleurochasma*, it is likely that *all* species can be inter-crossed. We have ample evidence of this possibility in the *Soulangiana* hybrids, crosses within Section *Buergeria*, the *acuminata* × *liliflora* hybrids made at the Brooklyn Botanic Garden, and other experimental hybrids involving *Campbellii*, *Dawsoniana*, and *Sprengeri* 'Diva'. Most of these species should also be self-compatible to some extent. The question mark on *liliflora*, however, indicates known self-incompatibility in an individual whose pollen lacked substance "D".

Those species of Subgenus *Magnolia* which have "S" stigmas are also inter-crossable. Hybrids are known between *tripetata* × *obovata* and *obovata* × *Sieboldii* (*M.* × *Watsonii*).

The other species of Subgenus *Magnolia* have only "R" in both stigmas and pollen. These species can also cross with others in the same grouping. The Freeman hybrids (*virginiana* × *grandiflora*) and experimental hybrids of *virginiana* × *macrophylla* are examples of such crosses. Therefore, species with "R" stigmas can be fertilized by pollen containing "R" alone or perhaps "R" and "D".

The old *M.* × *Thompsoniana* hybrid was a natural cross between *virginiana* as the female and *tripetala* as the male. McDaniel (1966) has recently repeated this cross. The combination of "R" stigmas and "RD" pollen apparently is fertile. However, McDaniel failed to obtain seed when the cross was made in the opposite direction. *M. tripetala*, with "S" stigmas, could not be fertilized by *virginiana* pollen, which only contains "R" and no "D".

I would also predict success for the combination of *virginiana* (or others with "R" stigmas) crossed with *M. Sieboldii* of Section *Oyama*. Such hybrids might be very desirable horticultural items.

By the same token, it would appear that crosses would be possible between "R" stigma species of Subgenus *Magnolia* and species of *Pleurochasma* with "RD" pollen. To my knowledge, there are no true hybrids known between species of the two subgenera. However, if we are going to introduce colored tepals into evergreen types, or into later flowering cultivars, such crossing between subgenera will be necessary. No one knows how many attempts at crossing between the subgenera have been made; failures are seldom recorded. Personally, my *virginiana* 'Lennei' crosses gave only apomictic *virginiana* seedlings. I suspect my 1969 *grandiflora* × *liliflora* seedlings are also maternal, but I will wait a while before relegating them to the scrap heap.

Is the genetic barrier between the subgenera so rigid as to prevent intercrossing? It is in pines. In other Angiosperms, even intersectional crosses are impossible. *But*, let me go out on a limb and predict that crosses between the subgenera are possible and will be made in the next 10 years, if enough attempts are made.

Perhaps the breakthrough will first come by crossing of *Pleurochasma* species with those of subgenus *Magnolia* that have similar pollen and stigma flavonoids, notably *tripetala*, *obovata*, and the *Oyama* section. These latter species have been, I believe, relatively neglected in hybridization studies.

I trust that, in the next decade, the number of *Magnolia* hybridizers will multiply and some of the ideas expressed above can be put to a practical test.

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New Cultivar Names

The following cultivar names in *Magnolia* have been registered since the publication of the preceding issue (Volume 7, Number 1) of this Newsletter:

'Anne Pickard'. *M.* 'St. George × *M. grandiflora* 'Lanceolata'. A. A. Pickard, Canterbury, Kent, England

'Dark Splendor'. *M. liliflora* 'Nigra × *M.* × *Soulangiana* 'Rustica Rubra'. Otto Spring, Okmulgee, Okla.

'Griffin'. *M. grandiflora* × introgressed M. *virginiana australis*. J. C. McDaniel, Urbana, Illinois.

'Orchid Beauty'. *M.* × *Soulangiana* 'Rustica Rubra' × *M. liliflora* 'Nigra'. Otto Spring, Okmulgee, Okla.

'Philo'. Self-compatible clone of *M. acuminata*. J. C. McDaniel, Urbana, Illinois.

'Red Beauty'. *M. liliflora* 'Nigra' × *M.* × *Soulangiana* 'Rustica Rubra'. Otto Spring, Okmulgee, Okla.

'St. George'. *M. grandiflora* with variegated leaves. A. A. Pickard, Canterbury, Kent, England.

'Sundew'. Selection from *M.* 'Picture'. A. A. Pickard, Canterbury, Kent, England.

'Urbana'. *M. virginiana* × *tripetala*. J. C. McDaniel, Urbana, Illinois.

J. M. F., Jr.

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Impressions of 'Royal Crown'

JAMES GOSSLER
Springfield, Oregon

Doubtless members of the Magnolia Society will recall having read "Deciduous Magnolias of Californian Origin" by the late Todd Gresham, which appeared in the Morris Arboretum Bulletin, Vol. 13, 1962. This informative article was reprinted with additional material in the Journal of the Royal Horticultural Society in August, 1964.

In the second version Mr. Gresham recalled the primitive origins of the Magnoliaceae, tracing back into millions of years of antiquity. He questioned, "Why man had not concerned himself with combining and recombining the colour, flower-form, and growth habit of the species to produce garden hybrids of fantastic appeal and beauty?"

In our early horticultural beginnings, Millais said that very little was known as to the proper hybridizing of magnolias. He stated that many of the early hybrids probably were flukes. Millais in his book "Magnolias" said, "The artificial pollinizer just had a bit of luck, and might have done the same thing five hundred times and had no success."

At his home, Hill of Doves, in Santa Cruz, Todd Gresham hybridized over 3000 seedlings composed from Yulania species and varieties. Apparently he was intrigued and challenged by the diverse mating of *M. denudata* × *M. liliflora* to produce a host of *Soulangiana* cultivars. His admirable goals were to develop earlier maturing plants that produced flowers more beautiful in color, larger in size, improved in substance and plants that would sustain harsher extremes of weather.

My slight introduction and contact with the Gresham hybrids came in 1968 in obtaining them from John Edwards Nursery in Palo Alto. I brought two plants labeled 'Royal Crown' home to my nursery in Oregon, where they were shifted into planting tubs and grown under lath for a year. Although they are only 5 feet tall at this writing, they are very floriferous with about 35 flowers to each plant. My second impression was that 'Royal Crown' is very early to bloom in the season, approximating other similarly grown plants of *M. denudata*.

Parentage of 'Royal Crown', the Gresham article relates, is *M.* × *Veitchii* × *M. liliflora*. First flowers of this mating appeared in 1950 on a plant named 'Dark Raiment.' Todd described 'Royal Crown' as having "Dark red-violet flowers; 12 tepals, the outer four inheriting the inward roll of the outer petals of *M. liliflora*, giving the effect of a crown's upstanding points; the inner surface of the tepals marble-white; buds 5½" wide." (Fig. 3).

My impression of the flowers and all over plant habit is exciting to say the least. The flowers are of excellent substance and measure a full 10" across. Their shape

Fig. 3. *Magnolia* 'Royal Crown'

and color far surpass a good many of our traditional *Soulangiana*. Apparently, 'Royal Crown' has exceeded the color of *M. liliflora* by toning down the excessive purple hues and presenting a most delightful shade of rose lavender. The size and regal character of the *Campbellii* blood gives the flower obvious added form and beauty. Although *M.* × *Veitchii* is a beautiful flower in its own right, we find its most pleasant aspect is its long blushed pink buds. I am very surprised to note that the open flowers of 'Royal Crown' exceed the beauty of *M.* × *Veitchii*. Beyond question the Gresham plant has more staying power to the buffeting of early spring winds and other unfavorable weather hazards.

I have propagated 'Royal Crown' and subsequently intend to test its hardiness in colder regions of the country. Hopefully it will carry on the rather ironclad hardiness of the rugged *M. liliflora* parent and the substantial cold resistance of the *M. denudata* side of *M.* × *Veitchii*. The plant's general form most closely resembles an upright *Soulangiana* perhaps as upright as *M.* × *Soulangiana* 'Alexandrina'. The number and distribution of the flowers appear to be nearly ideal, abundant but not overdone.

At this point it may be premature to say that this Gresham hybrid succeeds in measuring up to all the objectives that Todd espoused in this work. However, all the indications of my plants of 'Royal Crown' do indeed measure up exceptionally well to critical assessment. I believe it does exceed the beauty, form of flower, substance, and will exceed the cold hardiness of at least *M.* × *Veitchii*. Our thanks to Todd Gresham for a plant of exceptional merit, one that should make a worthy addition to our gardens.

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Pyramid Magnolia in Illinois

Joseph C. McDaniel

Urbana, Illinois

Southern Illinois, colloquially known as "Egypt," now has a Pyramid Magnolia that has flowered in 1969, probably a first for this state.

One of the less common and seldom cultivated American deciduous species, *M. pyramidata* grows usually in well-drained coastal plain sites between South Carolina and East Texas. The champion, according to a 1967 issue of "American Forests," grows near Bristol, Florida, with a trunk circumference at 4½ feet of 2 feet, 3 inches, a height of 51 feet and a spread of 19 feet. Usually it is a considerably smaller tree or alarge shrub. Its closest relative is *M. Fraseri* of the Southern Appalachians, and the two have sometimes been confused, though their respective ranges are separate, and *M. pyramidata* has smaller leaves, finer stems, and smaller flowers than *M. Fraseri*.

The late B. Y. Morrison was interested in getting the Pyramid Magnolia into cultivation around the country. From a seed source near Saucier, Miss., he made distributions in 1965 and probably earlier. Some of his seedlings are growing now in Knoxville and Winchester, Tenn., on the west coast at the Strybing Arboretum and in Jim Gossler's nursery at Springfield, Oregon, and probably at several other places. He gave me several tiny seedlings on the one occasion that I visited him at Back Acres, Pass Christian, Miss., late in 1965. I redistributed them to some other growers on the way home, including Harold B. Bauman at 403 West Robinson, Harrisburg, Illinois 62946.

Mr. Bauman wrote me on June 29, 1969: "Joe, your *Magnolia pyramidata* had two blossoms in early May, each about 8 inches in diameter, with the most delightful perfume you ever enjoyed. The blossoms were marble white and there was a double row of petals, the second slightly smaller and super-imposed on the first. Such a surprise this gave us for I didn't expect bloom so soon. It is only five feet tall. The tree is a treasure."

A *M. pyramidata*, cultivated in a yard at Semmes, Alabama, is a tree we saw when we met at Mobile in May. I hadn't seen it in flower, but was there in August when its maturing fruits were very colorful. Dr. Robert Egolf, of Tampa, Florida, discussed this species along with the even more rare *M. Ashei* in an earlier issue of this Newsletter. The Illinois experience would indicate that the Pyramid Magnolia, if its site requirements are met fairly well, is one of those species which can be cultivated well north of their natural range.

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M. sinensis			24"	12.00	36"	15.00
M. × Soulangiana 'Lennei'			24"	7.50		
M. Sprengeri 'Diva'*						
	12"	7.50	24"	10.00		
M. stellata			36"	10.00		
M. × Thompsoniana						
	15"	10.00				
M. tripetala			36"	7.50	60"	10.00
M. × Veitchii			24"	12.50	60"	20.00
M. virginiana			24"	7.50	36"	10.00
M. × Watsonii	12"	10.00	36"	20.00		
M. Wilsonii*	12"	7.50	24"	10.00		

Many of our Magnolias are on their own roots, some are propagated by grafting. Most are container grown, shifted frequently so not rootbound. They are thrifty, well grown plants. *Special rates available.