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ARNOLD ARBORETUM
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ARNOLDIA



A continuation of the
BULLETIN OF POPULAR INFORMATION

VOLUME XX
1960

PUBLISHED BY THE
ARNOLD ARBORETUM
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ARNOLDIA



A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 20

JANUARY 15, 1960

NUMBER 1

ROOTING GHENT AZALEAS UNDER PLASTIC

GHENT azaleas have long been admired for their spectacular blooms in late May. The group, however, has never risen to prominence in this country, chiefly because of the difficulties encountered in propagating these plants asexually. They must be asexually propagated to maintain the desirable characteristics of the many varieties; none of the Ghent azaleas can be reproduced true to name from seeds.

Attempts were made in 1951 to propagate some varieties from softwood cuttings. The results were highly discouraging. Not only did a large percentage of the cuttings fail to root, but the few that did root failed to survive the first winter. Most Ghent azalea varieties are propagated by layering in European nurseries.

The introduction of polyethylene plastic has changed these discouraging results. Softwood cuttings of Ghent azalea varieties are now rooted successfully, with vigorous resulting growth.

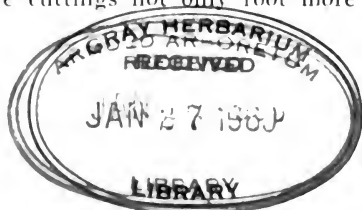
Rooting Procedure

The cuttings are rooted under wire frames covered with a polyethylene plastic. The frames are constructed of turkey wire, No. 9 gauge, with 2x4-inch squares. (Note illustration shown.) The wire is bent to allow a 10-inch distance from the surface of the medium to the inside top of the wire. Frames are four feet long, with the width determined by the width of the bench used.

After the cuttings have been placed in the medium, they are flooded in with water and the frames are placed over them. The medium is never pounded. After this, the ends and sides of the frames are covered completely with sheets of 2-mil. polyethylene plastic. This same type of structure can be used equally well over flats of cuttings. Whatever kind of structure is used, the plastic must be completely sealed.

A mixture of one-third sand, one-third peat and one-third ground Styrofoam has proved to be the best rooting medium. The cuttings not only root more

[1]



heavily, but also produce a uniform root system. The type of peat used in this combination is optional. The Arboretum has used many kinds and has found no great difference in results among them.

This rooting mixture is heated by a lead-covered cable, thermostatically controlled. The thermostat is set to turn on the current at 72 degrees F., but only at night, since in the daytime there is sufficient heat beneath the polyethylene plastic. The everyday temperature outside the greenhouse is high and the heat builds up accordingly. On many days the median temperature is 85 to 95 degrees F., a factor which aids in the successful rooting of Ghent azaleas.

Timing

Before the introduction of polyethylene plastic, it was necessary to wait until the new growth had set a terminal bud and had begun to harden off before the cutting material could be collected, because the softer, more succulent cuttings would wilt. Now, however, by use of polyethylene covers to maintain conditions of high relative humidity, it is possible to collect the cutting material from soft, succulent growth.

Prior to the use of polyethylene plastic covers, cuttings of Ghent azaleas were not collected until late July or early August, when growth had matured to a point at which it could be kept from wilting under open bench conditions. This was accomplished by shading the cuttings with newspaper or cheesecloth and syringing them manually at least once every hour.

The procedure, however, did not give good results. The cuttings rooted poorly, since they were taken so late in the season, and the few that did root, died during the first winter. (See Table I.)

Now it is possible to collect the cutting material in late May or early June. Collected at this time, the cuttings not only root faster, but also root more heavily, because of the soft growth used. (See Table II.) Once the cuttings are rooted, every attempt is made to stimulate new vegetative growth. This helps in the successful overwintering of Ghent azaleas and can be accomplished successfully by using artificial lights.

Artificial Lights

After the potting operation, the azaleas are placed on an open bench under a single row of 100-watt incandescent lights. The lights are spaced two feet apart in the row and 15 inches above the level of the bench; the benches themselves are 32 inches wide. The lights are operated in the following manner:

At 5 p.m. the lights are turned on and left on all night until 8 a.m. One can eliminate the overlap of artificial light and normal daylight by using a time clock. The plants are kept under the row of lights for approximately two months. During this period, the terminal buds break dormancy and produce two to eight inches of new growth. This new growth is then hardened off, and the cuttings are overwintered in a cold pit, where the temperature is 35 to 40 degrees F.

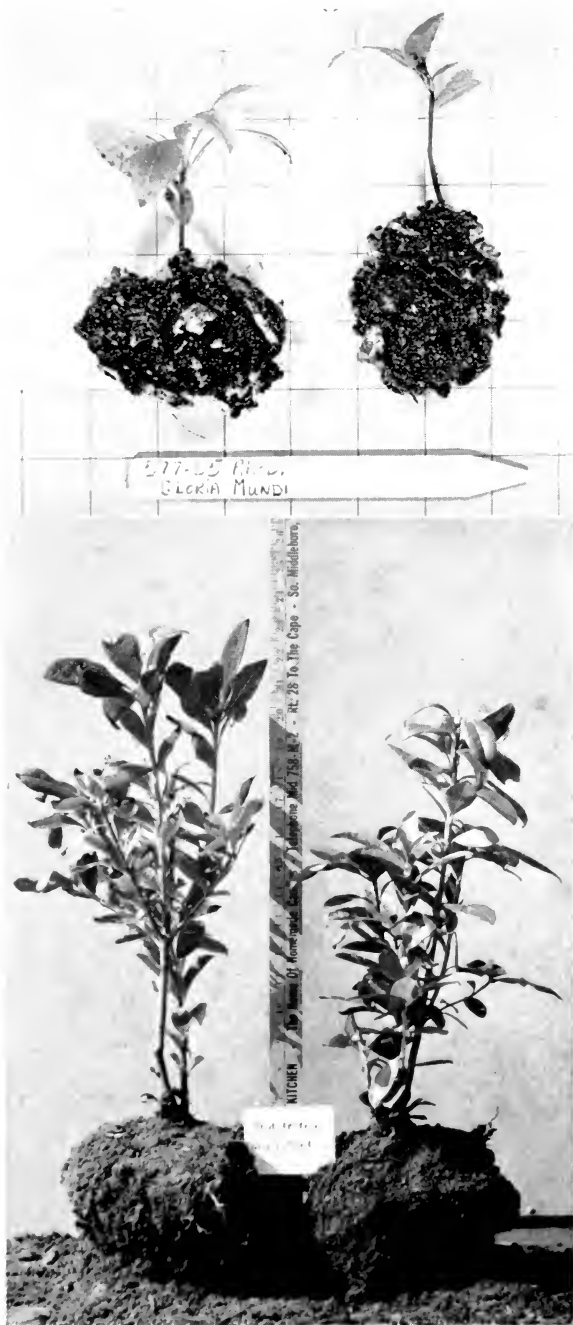


PLATE I

Upper: Type of root system obtained on cuttings under a polyethylene plastic cover.
Lower: Two-year-old cuttings of variety 'Gloria Mundi.'

Cutting Procedure

The cutting material is collected in late May or early June, whenever the new growth is two or three inches long — long enough to make a cutting. Cuttings are placed immediately in polyethylene plastic bags, which contain a small quantity of moistened sphagnum, and stored in a refrigerator at 40 degrees F. until they are used, sometimes five to seven days.

One prepares the cuttings for rooting by stripping the leaves from the bottom inch and making a fresh cut at the basal end. Once the basal end has been re-cut, the cutting is dipped first into water and then into the hormone powder, Hormodin No. 3. Whether or not wounding is advisable depends upon the condition of the cutting material. When soft, succulent material is used, the value of wounding is questionable. However, when firmer cutting material is collected in July and August, a wound is definitely beneficial.

Once treated with Hormodin No. 3, the cuttings are placed in the sand, peat and Styrofoam medium, where they take from two to three months to root. When rooted, they are potted into 2½-inch standard pots and placed on a bench under artificial lights.

Conclusions

1. The asexual propagation of Ghent azaleas is definitely feasible when polyethylene plastic is used.
2. The use of artificial lights is a necessity if these varieties are to be overwintered successfully in commercial quantities.
3. The use of a wound on soft, succulent cuttings is not necessary.
4. A medium of sand, peat and Styrofoam, mixed in thirds by volume, produces a more uniform root system than a half-and-half mixture of sand and peat alone.

ROGER COGGESHALL

Note:—This article appeared in *The American Nurseryman* for June 1, 1958. Many have shown a marked interest in the subject, so it is reprinted here with the permission of the publisher and the author, who wrote the article while still propagator at the Arnold Arboretum.

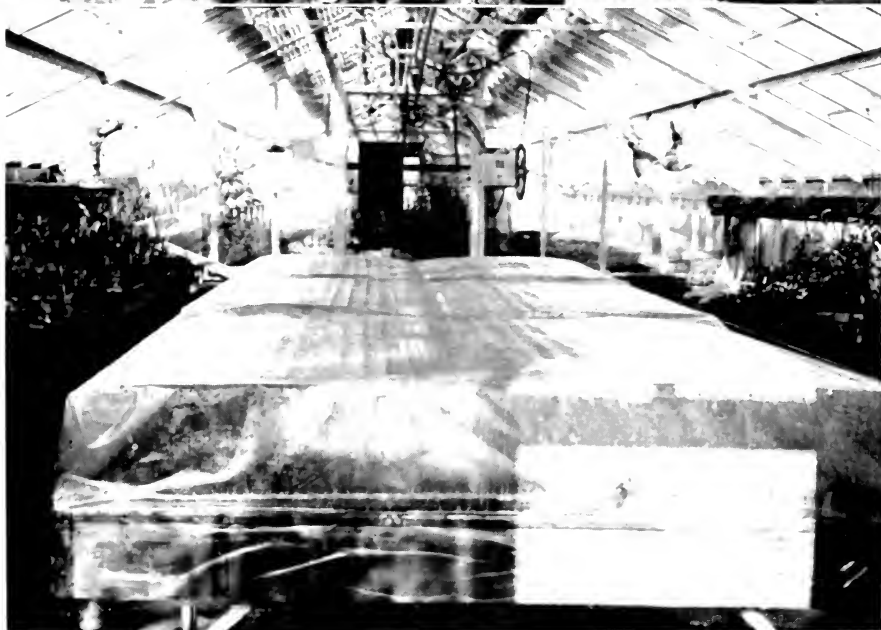
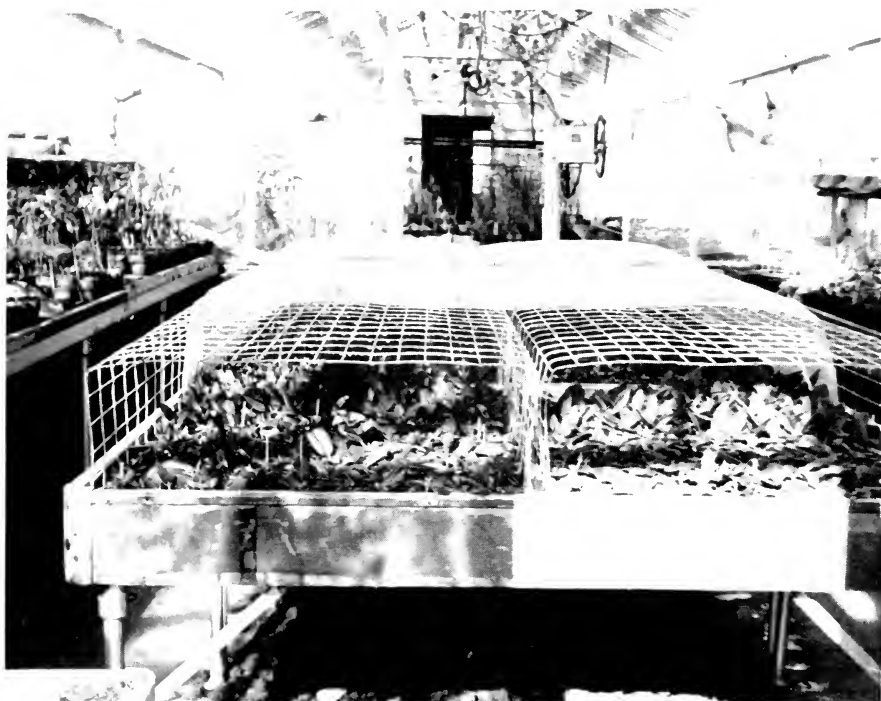


PLATE II

Polyethylene-covered Propagating Bench.

Upper: With wire supports. *Lower:* Completely sealed.

Table I.—Rooting Results Obtained with Open-Bench Type of Propagation.

<i>Variety</i>	<i>Cuttings</i>			<i>Results</i>			
	<i>No. of Cuttings</i>	<i>Date Taken</i>	<i>Treatment</i>	<i>Rooted</i>	<i>Cal-lused</i>	<i>Dead</i>	<i>Date</i>
² Rhod. 'Gloria Mundi'	50	7/1	Hormodin #2	12	32	6	11/26
² Rhod. 'Gloria Mundi'	50	7/29	Hormodin #3 plus wound on one side	43	4	3	9/18
¹ Rhod. 'Narcissi-flora'	50	5/22	Hormodin #2	0	—	50	6/17
¹ Rhod. 'Pallas'	50	5/22	Hormodin #2	0	—	50	7/11
¹ Rhod. 'Raphael de Smet'	50	5/22	Hormodin #2	0	—	50	7/12
² Rhod. 'Raphael de Smet'	50	6/18	Hormodin #2 plus wound on both sides	31	6	13	9/18
² Rhod. 'Raphael de Smet'	50	7/29	Hormodin #3 plus wound on one side	29	13	8	11/26

¹The cuttings wilted and died due to insufficient humidity.

²All the rooted cuttings failed to grow the following spring. In many cases the roots were alive, but the tops were dead.

Table II.—Results Obtained with Polyethylene Plastic Cases.

Variety	Lot No.	Cuttings			Results			
		No. of Cuttings	Date Taken	Treatment	Rooted	Cal- lused	Dead	Date
³ Rhod. 'Charlemagne'		200	5/28	Hormodin #3	104	12	84	8/29
³ Rhod. 'Davisi'		100	5/24	Hormodin #3	91	6	3	8/22
² Rhod. 'Gloria Mundi'		65	7/22	1% Indolebutyric Acid in Tale	58	5	2	9/20
³ Rhod. 'Gloria Mundi'		150	6/16	Hormodin #3	125	19	6	10/18
³ Rhod. 'Gloria Mundi'		100	6/18	Hormodin #3	80	6	14	10/19
³ Rhod. 'Josephine Klinger'		200	5/28	Hormodin #3	149	7	44	8/29
¹ Rhod. 'Narcissiflora'	1	50	5/27	1% Indolebutyric Acid in Tale	46	2	2	8/12
	2	50	5/27	Hormodin #2	48	2	—	8/12
	3	50	5/27	Chloromone (full strength)	46	1	3	8/12
	4	50	5/27	Control (no treatment)	16	9	25	8/12
³ Rhod. 'Narcissiflora'		200	5/28	Hormodin #3	136	14	50	9/23
¹ Rhod. 'Pallas'	1	50	5/27	1% Indolebutyric Acid in Tale	40	—	10	8/12
	2	50	5/27	Hormodin #3	43	4	3	8/12
	3	50	5/27	Chloromone (full strength)	33	1	16	8/12
	4	50	5/27	Control (no treatment)	24	18	8	8/12
⁴ Rhod. 'Raphael de Smet'		145	6/16	Hormodin #3	83	50	12	10/17
³ Rhod. 'Raphael de Smet'		143	6/18	Hormodin #3	109	32	2	9/18

¹ The cuttings in Lots 1, 2 and 3 had approximately the same size root system. The root systems in Lot 4 were very poor.

² The cuttings were taken too late in the year. Heavier and faster rooting would have been obtained if the cuttings had been taken earlier.

³ These cuttings were taken at the optimum time.

⁴ The rooted cuttings had very large root systems (3'' in diameter). The cuttings were left in the medium too long.

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MARCH 18, 1960

NUMBER 2

PLANTS OF POSSIBLE MERIT?

THE Arnold Arboretum is continually introducing new or rare plants from all over the North Temperate Zone. Some of these are new to America; some are new to the collections in the Arnold Arboretum or have been overlooked for a period of years. It might be of interest to glance through the following listing of a very few, all of which are currently growing in the collections. Usually, it takes years before certain woody plants become common and popular, due to many varying circumstances. Some of the following list may continue to be grown in this and in other arboretums, as botanical specimens of little popular interest; however, others do have ornamental possibilities. This list is offered as an indication of what one can find in the Arnold Arboretum with a little browsing among the many collections.

Abies concolor conica

This is a dense growing, pyramidal form of *Abies concolor*, selected by B. H. Slavin of the Rochester Parks, Rochester, New York, prior to 1932 when it was described as being 11 feet high and 8 feet broad. Plants in the Arnold Arboretum are much smaller, but being a variety of *Abies concolor*, it is thoroughly hardy and able to withstand city growing conditions remarkably well. It should be available in the trade by now. Our plants were obtained from the Bay State Nurseries of North Abington, Mass., a few years ago.

Acanthopanax henryi nana

A low, dwarf variety of *Acanthopanax henryi* we obtained from the Kornik Gardens and Arboretum in Kornik, Poland, in 1939, supposedly the first introduction of this plant to the United States. Our plant is now 36 inches high and 42 inches in diameter. Only of merit for its low and slow growth. The thorny, upright branches and the absence of bright flowers, fruit, and autumn color, will limit its usefulness in garden plantings.

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Acer ginnala 'Durand Dwarf'

This arose as a bud mutation on a plant in Durand-Eastman Park, Rochester, New York, prior to 1955. Propagations from this sport are making low, wide, shrubby-type maples. Our plants have been growing here only two years, but are nearly 2 feet tall and as much across. Having the same brilliant autumn color as the species and supposedly being free of insect and disease pests, this should make a nice shrubby, mounded plant of special merit for fall color.

Berberis thunbergii 'Globe'

This plant we received under the name of *Berberis thunbergii nana* from the Hill Top Nurseries, Casstown, Ohio. It was patented August 4, 1936, (#189) and called "Globe" barberry, and is still offered by that nursery. Our plant is dense and globose in habit, 27 inches tall and 4 feet in diameter. It is green-leaved, definitely not the small-leaved variety, *minor*. It is surprising to me that it has not been popular in the intervening years. Because of its dense, rounded form, it should make an excellent low hedge which would not require shearing.

Berberis thunbergii xanthocarpa

These four plants were obtained from the Rochester Parks of Rochester, New York, in 1932. They are similar to the species in every way except that the fruits are yellow and are sparsely borne. Three of these plants are growing together in the planting adjacent to the Larz Anderson Dwarf Conifer Collection by the greenhouses. I have never seen profuse fruits produced, and the autumn color is not a brilliant scarlet, but decidedly yellowish. It will not make a very popular ornamental shrub.

Berberis thunbergii 'Atropurpurea Nana'

This plant originated in Holland prior to 1952 when we first obtained a specimen from Wayside Gardens of Mentor, Ohio. It is also being sold under the name of 'Little Gem,' 'Little Beauty,' and 'Crimson Pygmy,' the last name being supposedly "agreed upon" by several nurserymen growing it. However, once a plant is distributed under one name, it is most difficult to rename it and expect everyone to follow suit, especially if the proper rules of nomenclature in naming new cultivars have not been followed in the first place.

In any event, plants 8 years old are only 2 feet high and 3 feet broad. The foliage is red to reddish—if grown in the full sun. The young foliage has a brighter red color when it first appears than does the mature foliage. This makes an excellent spot of color in the sunny foundation planting, or it can be well used as a most colorful low hedge.

Cercis canadensis 'Wither's Pink Charm'

This redbud we obtained from the Kingsville Nurseries of Kingsville, Md.,

in 1956. It has bloomed several times for us (mid-May) and the flower buds and flowers are a soft pink. They do not have the purplish pink color of the common wild plants. For those people who do not like the flower color of the species, this variety might have merit.

Cornus mas nana

Originally introduced into the United States in 1925 in the form of grafts from Kew Gardens, England, by the Arnold Arboretum. There are few shrubs as sturdily reliable for all types of plantings as is *Cornus mas*. Its only fault, if it should be called a fault, is that it grows too large, hence this variety should prove worth watching. The original plants died, but now we have many young plants one year old, recently propagated from another importation from Kew Gardens in England.

Hamamelis intermedia (#1173-28-B)

In 1928, William Judd, then propagator at the Arnold Arboretum, collected seed from a plant of *Hamamelis mollis* which, in turn, had been grown from seed collected in China in 1905 by E. H. Wilson. This Chinese plant was growing in close proximity to *Hamamelis japonica* and apparently pollen from the Japanese species on the pistils of the flowers of the Chinese species resulted in a cross named by Alfred Rehder, *Hamamelis intermedia*, in 1944.

A number of seedlings were grown, some with reddish flowers, some inferior to both species. The clone which has proved best as an ornamental is our number 1173-28-B. This is hardier than *H. mollis* and considerably more floriferous than *H. japonica*. The plant just coming into bloom March 1 of this year is growing by the Administration Building where it has produced profuse yellow flowers each spring. It is 12 feet tall by 15 feet in diameter, with a generally vase-shaped habit. If other growers like it after satisfactory trial, it might well be deserving of a clonal name.

Juniperus scopulorum 'Grey Gleam'

Originated as a chance seedling at Wheatbridge, Colorado, and selected by Scott Wilmore of Wilmore Nurseries, Wheatbridge, Colorado, in 1944. It was issued Plant Patent #848 in 1949. This has a distinct grey foliage color, supposedly more pronounced in the winter than are some of the other *J. scopulorum* varieties. This is also hardy in Zone 3, and warrants attention because of better winter color than many other *J. scopulorum* varieties.

Juniperus chinensis 'Maney'

A seedling of *J. chinensis sargentii* originating at Iowa State College, selected in 1935 and introduced in 1947. Our plant, about 12 years old, is 4 feet tall and 6 feet across, a female with a few fruits. It is shrubby and flat-topped, with good

bluish-green foliage in the winter at a time when most *J. virginiana* varieties are brownish.

***Juniperus chinensis* 'Mountbatten'**

A seedling of *J. chinensis* originating at Sheridan, Ontario, Canada, and introduced by the Sheridan Nurseries of Sheridan, Ontario, Canada, in 1948. Hardy in Zone 3. Our plant, about 10 years old, is 9 feet tall and 3 feet wide at the base, very dense and pyramidal, with close-growing shoots, all vertical. It is a fruiting plant with bluish-green foliage in mid-winter, at a time when most *J. virginiana* varieties are displaying brownish foliage.

***Leucothoe catesbaei* 'Girard's Rainbow'**

Selected as a clone from among 30,000 seedlings by Girard's Bros. Nursery, Geneva, Ohio, about 1950. The foliage is variegated several shades of pink and yellow, deep red, copper, and orange, as well as green. According to Peter E. Girard, the plant has gone through all the winters without injury. We have grown this since 1957. The plants seem to color better if grown in full sun than in the shade, and there seems to be a slight variation in color from winter to winter. Variegated evergreens are exceptionally difficult to use properly in the garden scheme, and this one is no exception. For those who like variegated plants, this might be an excellent one for trial.

***Lonicera* 'Clavey's Dwarf'**

This originated several years prior to 1955 at Clavey's Ravinia Nurseries in Deerfield, Illinois. Since that time, it has been widely distributed. We have been growing it since 1955, and our oldest plant is now 3 feet tall and 3 feet in diameter. It appears to be closely allied to *Lonicera xylosteum*. It is excellent as a low, thick, quick-growing hedge requiring little shearing. Mature plants are said to grow as tall as 6 feet. Being a honeysuckle, it has the added advantage of being little troubled with insect and disease pests.

***Philadelphus* 'Frosty Morn'**

This plant was patented (#1174) on March 10, 1953, by Guy D. Bush of Minneapolis, Minnesota. The flowers are double and fragrant, appearing in mid-June, and it is one of the few mock-oranges hardy in Zone 3. In Minnesota, it has been noted as withstanding "the coldest Minnesota winters without damage from freezing back." It grows about 4 feet tall and is certainly among the best for cold areas.

Pinus aristata

This is a native pine of the Southwestern United States, a standard tree up to 45 feet tall and sometimes a prostrate shrub. However, in the eastern United

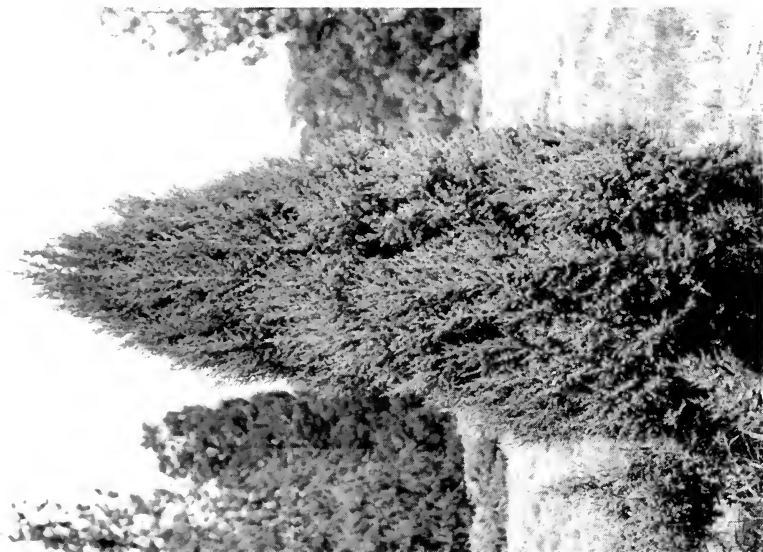


PLATE III

(Left) *Pinus aristata*, bristle-cone pine, is dwarf in the Eastern United States. This plant, growing in the Perennial and Shrub Garden of the Case Estates, Weston, is 16 years old and only about 4 feet tall. (Right) *Juniperus chinensis* 'Mountbatten', a hardy variety of Chinese juniper originating in Sheridan, Ontario, Canada, and perfectly hardy in that area.

States, it grows extremely slowly, one tree in the Perennial and Shrub Garden at the Case Estates in Weston being only about 4 feet tall at the age of 16 years. It does not conform to any particular pattern of growth, but grows in a very picturesque fashion, with short, bluish-green needles closely bunched together, remaining on the plant for many years. It is of interest to note that old trees, dwarfed and reduced by age and droughts in Arizona, have been estimated to be 4,000 years old. Small white dots of resin are customarily borne on the needles. In the East at least, this can be considered a most picturesque dwarf.

Rhamnus frangula asplenifolia

This shrub has been grown off and on in the Arnold Arboretum since 1893 when we first obtained it from H. Zabel of Munden, Hanover, Germany. This plant has never proved popular, possibly because it has been thought difficult to propagate, but softwood cuttings taken in mid-June have resulted in 80 percent rooting. The very narrow leaves (giving rise to the varietal name) make the entire plant appear fine textured. Because of its few insects and diseases, and because of its ease of growth in any normal soil, it would seem that this variety might be used considerably more than it is.

Rhamnus frangula columnare

A seedling of *Rhamnus frangula* discovered in 1936 by A. E. Luedy of Bedford, Ohio, and patented (#1388) in 1955. It is being called "Tallhedge" by the Cole Nursery Company of Painesville, Ohio, which is propagating it heavily. It is claimed that this plant grows only 3½ to four feet wide, but 12 to 15 feet tall. It need not be sheared, but submits to shearing very well, indeed. Hedges I have seen of this on the campus of Pennsylvania State University look very well. The variety has dark, glossy, green leaves and fruit of changing colors, similar to the species.

Rhododendron mucronulatum 'Cornell Pink'

Similar to *Rhododendron mucronulatum* in all respects except for its flowers which are a true soft pink, while those of the species are an orchid purple. Originating in a batch of seedlings at Cornell University slightly before 1952, this azalea has excellent possibilities for those who dislike the purplish color of the flowers of the species. The Arnold Arboretum distributed this to many arboreturns and commercial growers in October 1958. We have been growing it in the Arnold Arboretum since 1952, where it flowers in late April.

Rhododendron 'Mars'

This rhododendron is not new by any means, but it certainly is worthy of a trial by those who like red-flowered rhododendrons. It is a *Rhododendron griffithianum* hybrid, originated by Waterer Sons & Crisp in England before 1875. The

flowers are a true deep red, a clearer red than any of the evergreen rhododendrons we are growing at this time, appearing in early June.

There is a question concerning its hardiness in the Boston area. Plants we are growing are only a few years old. Protecting the plants in winter and planting them in very protected places will help, certainly. It should succeed on Cape Cod, Long Island, and from there, south. It definitely should not be considered as hardy as many of the *Rhododendron catawbiense* hybrids, but for gardeners of an experimental nature who like red colors, this might be a very worth-while plant to try in protected situations.

Rhododendron 'Rosebud'

This small azalea is one of several originated by Joseph B. Gable of Stewartstown, Pennsylvania. It was named in 1938, being a cross between 'Caroline Gable' and 'Louise Gable,' has flowers that are $1\frac{3}{4}$ inches in diameter, hose-in-hose, and a strong purplish-pink color, flowering in early June. The name 'Rosebud' is truly well chosen for this plant. Our plants are still small although we have been growing this variety since 1952. In a situation where it obtains some protection from too much winter sun and high winds, this plant should prove a most pleasing variety.

Rosa moyesii 'Geranium'

A selection of *Rosa moyesii* with single, deep-red flowers 2 inches in diameter, during mid-June. The species is native in western China and just hardy in the Arnold Arboretum. This form originated at the Wisley Gardens of the Royal Horticultural Society of England prior to 1950. It is more compact in habit than is the species. The fruits are flask shaped, 2 inches long and a rich orange-scarlet color, hanging on the branches in clusters of from 3 to 6. Some of the English nurserymen have stopped growing the species in preference to this variety. The Arnold Arboretum introduced this into the United States in 1952 and is propagating this form for distribution.

Rosa pteracantha 'Red Wing'

This is a selection from a cross of *R. hugonis* × *omeiensis pteracantha* made in Germany slightly before 1938. The flowers are single and pale yellow, $1\frac{3}{4}$ inches in diameter, appearing in early June; and the thorns on young growth are large, wide at the base, and brilliant red. It was introduced into the United States from Holland by the Arnold Arboretum in 1951, its chief ornamental characteristic being its large and very conspicuous bright red thorns.

Easily budded or grafted on *R. multiflora*, it is extremely hazardous to handle and the chances are that even though the Arnold Arboretum distributed it to commercial growers in 1958, they will not handle it in large amounts.

***Symphoricarpos chenaultii* 'Hancock'**

Originating in the Woodland Nursery, Cooksville, Ontario, Canada, about 1940 and named for Mr. Leslie Hancock, owner of the nursery. It is lower in height than *S. orbiculatus*, being only about 2 feet high (even though a single plant may grow as much as 12 feet across) and makes a much better ground cover because it spreads rapidly by underground stems. Our plants have been killed back during the past winters by low temperatures, but it may have been that these plants were still pretty small and not thoroughly established. This shrub might well deserve further trial, for I have seen it used to splendid advantage as a ground cover on a steep bank in central Pennsylvania.

Syringa tigerstedtii

The Arnold Arboretum originally introduced this species to the United States in 1949 as seed from Hortus Botanicus, Bergianus, Stockholm, Sweden. It resembles *S. yunnanensis* and is a privet-looking plant with flowers not the least ornamental. Apparently perfectly hardy under our conditions, it has no ornamental value, whatsoever.

***Syringa* 'Primrose'**

Originated in Holland prior to 1949 and patented (#1108) in 1952, this was first called 'Yellow Spek' after Jan Spek of Boskoop, Holland. Later, when it was patented in the United States, the name was changed to 'Primrose.' The Arnold Arboretum has been growing it since 1951. At first it appeared that the flowers were merely a "creamy white," but in the last few years, it must be admitted that the flower color is a pale yellow and when the plant is covered with flowers in May, it does stand out from all the many other lilacs in bloom at that time.

Viburnum carlesii compacta

There may be three forms of this variety in the trade, but observations up to the present time seem to point to the fact that Mr. C. Hoogendoorn's selection is best. This originated several years ago in his nursery at Newport, Rhode Island. It is slower growing than the species and has dark green, shiny leaves. The size, color and fragrance of the flowers are identical with those of the species, but because of its dwarf, compact habit, it may have merit.

DONALD WYMAN

ARNOLDIA



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APRIL 22, 1960

NUMBERS 3-4

MAGNOLIAS HARDY IN THE ARNOLD ARBORETUM

THE magnolias comprise our most conspicuous flowering trees. There are some that can be grown in all but the coldest sections of the United States. Forty-six species and varieties are currently being grown in the Arnold Arboretum, but there are a few more that will prove hardy, too. They are valued chiefly because of their large and showy flowers, which start to appear at the end of April, with some plants still in bloom by early summer. Few have much to offer as far as autumn color is concerned, but all have bright red and interesting fruits during late summer and early fall.

Some of these interesting trees are native to North America, indeed some like *Magnolia acuminata* and *M. virginiana* are native to the state of Massachusetts. Those with colored flowers are mostly native in the Orient, except *M. cordata* which has canary yellow flowers. It should also be noted that there are quite a few excellent species native or hardy in the South that are not hardy in New England. Some of the most beautiful of all, namely *M. sargentiana robusta* and *M. sprengeri diva*, are natives of Asia, but not hardy in the North. When one has once observed the large, delicate, rose-colored flowers of these species, one does not soon forget them.

In height, magnolias range from large shrubs or small shrubby trees to standard trees maturing 90' tall. The tallest in the Arnold Arboretum are the two splendid specimens of *M. acuminata* in front of the Administration Building. This species, as well as *M. obovata*, will eventually grow to 90' high. The smallest is *M. liliflora nigra* which is actually a shrub of 9' but never has been hardy for more than a few years at a time for us here.

Among the lowest would be the extensive *M. soulangiana* clan, which contains the many varieties to be discussed later. In the eastern United States, *M. stellata* seldom grows over 20' tall, although I have seen it at "Bodnant" in Wales close to 40' high.

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Admittedly, the foliage of most of the magnolias is coarse. The exceptions are probably *M. salicifolia* and *M. stellata* with leaves $1\frac{1}{2}$ -4" long. On the other hand, there are several species which may have leaves 12" long or even longer, namely *M. fraseri*, *macrophylla*, *obovata*, *officinalis* and *tripetala*. On occasion, *M. macrophylla* will have the largest leaves of all, sometimes nearly 3' long. Foliage such as this greatly restricts the usefulness of the species, for, in a windy spot, the leaves are ripped and torn and thus can look disreputable for a great part of the season. On the other hand, when used properly in protected places, such trees create tropically exotic effects which can not be created in any other way.

The blooming period in the Arnold Arboretum extends from late April until early summer, depending on the species. Some years the *M. soulangiana* varieties make an attempt to bloom a second time in the late summer, but usually, when this occurs after a very wet summer, only a few flowers are produced. Because the flowers are so large, and come so late in the season, they frequently make a great impression on the gardener.

The order in which the species in the Arnold Arboretum bloom, is as follows:

Late April—**denudata, salicifolia, stellata, kobus, loebneri, proctoriana**

Early May—**soulangiana** and many varieties

Mid-May—**fraseri**

Late May—**acuminata, cordata, liliflora nigra, soulangiana lennei, tripetala, watsonii, virginiana**

Early June—**obovata, sieboldii**

Mid-June—**wilsonii**

Early July—**macrophylla**

It is interesting to note, that in the warmer parts of the southern United States some magnolias will bloom as early as February, and *M. wilsonii* has been known to bloom in August.

The major number of magnolias in the Arnold Arboretum have white to creamy white flowers. The exceptions to this are *M. cordata* with creamy yellow flowers, *liliflora nigra* with very dark purplish-red flowers, *soulangiana* with its many varieties with pinkish to purplish flowers, *stellata rubra* with reddish flowers and *watsonii* with pinkish flowers. In the following list of recommended magnolias, those in hardiness Zone 6, namely *M. liliflora nigra*, *sieboldii*, *thompsoniana* and *wilsonii* are not thoroughly hardy in Boston, for they have died out several times in the Arnold Arboretum (which is Zone 5) and no large plants are in the collections now. However, they should prove fairly hardy in Rhode Island and the warmer parts of Connecticut.

Recommended Magnolias

acuminata 90' Zone 4 New York to Arkansas Cucumber Tree

A pyramidal tree, becoming spreading at maturity, chiefly of value for its foliage. The small flowers are greenish yellow and none too conspicuous, appearing

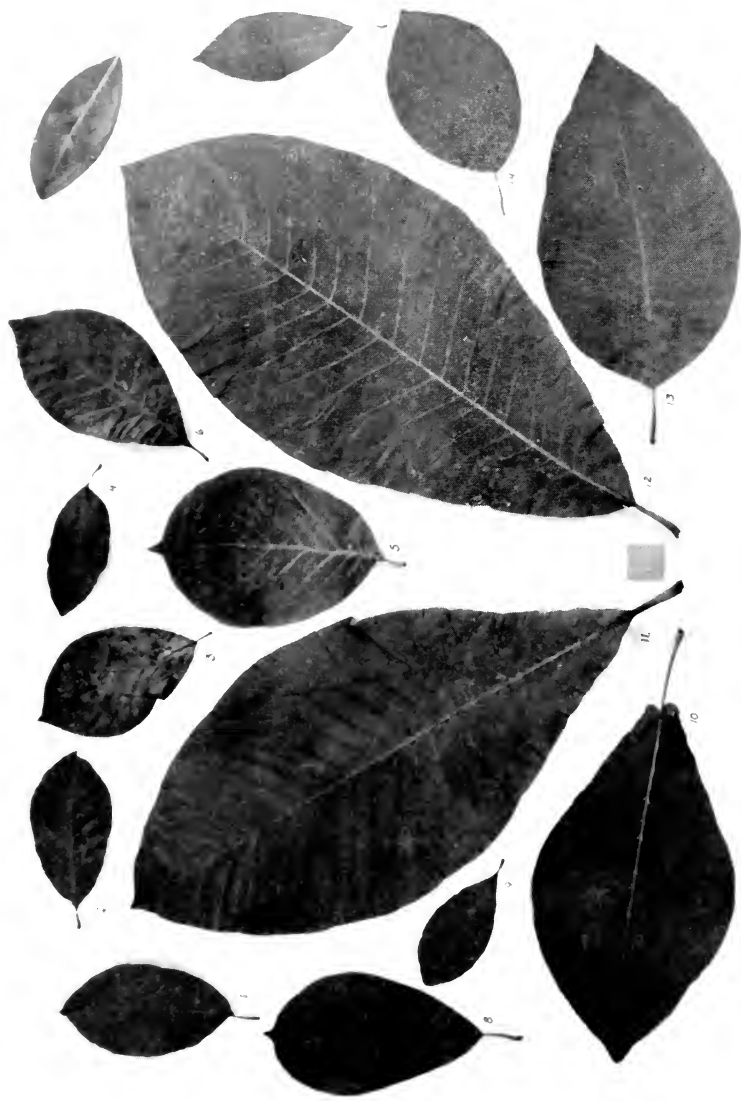


PLATE IV

Magnolia species—fifteen different leaves: 1, *kobus*; 2, *loboceri*; 3, *sicholdii*; 4, *praetoriana*; 5, *soulangiana*; 6, *liliflora*; 7, *virginiana*; 8, *dendrata*; 9, *stellata*; 10, *fraseri*; 11, *tripitata*; 12, *obovata*; 13, *acuminata*; 14, *cordata*; 15, *salicifolia*.

after the leaves are fully developed in late spring. The leaves are 5-11 inches long. This is often used as understock in grafting other magnolias. There is a magnificent old specimen on the Hunnewell Estate in Wellesley, and two younger pyramidal trees in front of the Administration Building in the Arnold Arboretum.

cordata 30' Zone 5 Georgia Yellow Cucumber Tree

A smaller tree than *M. acuminata*, sometimes shrub-like, this has 4-inch canary yellow flowers, much better than those of *M. acuminata*. The leaves are 3-5 inches long. This might be used as the substitute for *M. acuminata* on the small place.

denudata 45' Zone 5 China Yulan

Formerly termed *M. conspicua* this tree produces beautiful creamy white, fragrant, flowers 6 inches in diameter in early May before the 4-6 inch leaves appear. An excellent tree, one of the best of the magnolias, it blooms at the same time (late April) as *M. stellata*.

fraseri 45' Zone 5 Virginia to Georgia Fraser Magnolia

The leaves are large, 8-15 inches long, and the milky white, fragrant flowers are about 8-10 inches in diameter, produced in May and June when the plant is in leaf. Because of large coarse foliage and flowers, this plant is difficult to use properly in the small garden.

liliflora nigra 9' Zone 6 China Purple Lily Magnolia

This variety has darker reddish-purple flowers than does the species, the flowers being 4-5 inches long and larger than those of *M. liliflora*. This is the hardiest of the *M. liliflora* varieties, but does not seem to last indefinitely in the vigorous climate of Boston, Massachusetts. It is actually a bush, not a tree. The flowers appear over a period of several weeks starting in late May or early June, usually with the leaves.

× **loebneri 'Merrill'** 50' Zone 4 (*stellata* × *kobus*)

This cross was made in the Arnold Arboretum in 1939 and the resulting hybrid is a vigorous growing tree, the original seedling now being over 25 feet in height with a sturdy trunk. It blooms before the leaves appear, at the same time as *M. kobus* and *stellata* (late April) with larger white flowers (often 15 petals) than either species, and may start to bloom when only five years old. One of the best and most vigorous of the early white flowering magnolias.

macrophylla 40' Zone 5 Kentucky to Arkansas Bigleaf Magnolia

This has the largest leaves and flowers of any of the hardy magnolias (in fact larger leaves than any hardy native tree in North America), and because of this should not be used in any planting exposed to winds where the leaves can be easily ripped and torn. The leaves are 15-25 inches and sometimes up to 36 inches long, as much as 7-12 inches wide. The creamy white, fragrant flowers

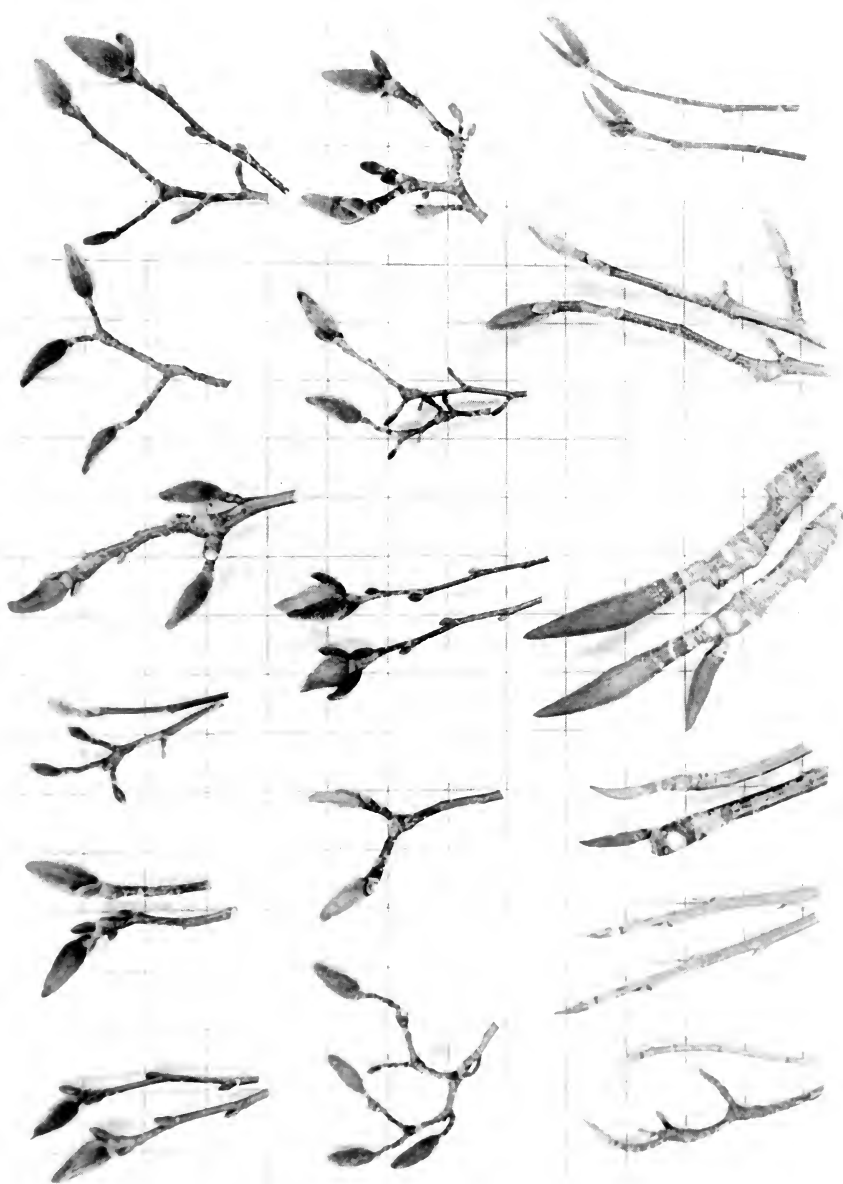


PLATE V

Magnolia buds. Left to right. Top row: *kobus borealis*, *denudata*, *cordata*, *soulangeana*, *kobus*, *bohnari*. Middle row: *stellata*, *virginiana*, *virginiana australis*, *trilobata*, *obovata*, *acuminata*, Merrill. Bottom row: *nigra*, *proctoriana*, *salicifolia*, *liliflora nigra* × *stellata rusca*.

may be 8-14 inches in diameter, appearing in early July after the leaves are fully developed. It should be used with extreme care, chiefly for exotic or tropical effects.

obovata 90' Zone 5 Japan Whiteleaf Japanese Magnolia

Although flowering after the leaves have developed in early June, the creamy white, strongly scented flowers, 8 inches in diameter, are most conspicuous. There is an excellent 40 foot specimen of this species at the rear of the Administration Building. The leaves 8-18 inches long and half as wide, are bluish white on the under side. This is better for garden use than the native *M. tripetala* which has flowers of a disagreeable odor. Still, it is a coarsely leaved tree, not good for wind swept situations, but most useful in creating exotic effects.

salicifolia 30' Zone 5 Japan Anise Magnolia

The aromatic odor of the leaves when crushed is what gives this densely branched, pyramidal magnolia its common name. The leaves are narrow, 1½-4 inches long; the flowers white, 3 inches in diameter before the leaves appear in late April or early May. A good foliage tree as well as a good ornamental in flower.

sieboldii (*parviflora*) 30' Zone 6 Japan, Korea Oyama Magnolia

Small white waxy flowers 3-4 inches in diameter, with the center a mass of magenta purple stamens, and distinctly fragrant, are borne on this small tree in May or later. The leaves are 3½ inches long. The plant is not long lived (25 years), but the branches root readily wherever they touch moist ground.

×**soulangiana** 15' Zone 5 (*denudata* × *liliflora*) Saucer Magnolia

A cross made by one of Napoleon's retired soldiers, about 1820. Undoubtedly many other crosses of these two species have been made since, most of the plants being large shrubs or small trees with vari-colored, large cup-shaped flowers, blooming just after *M. stellata*, *kobus*, *salicifolia* and *denudata*, but just before *M. liliflora*. It is best to select the better of the named clones for asexual propagation.

Varieties of *M. soulangiana*

'Alba' (syn. 'Superba,' 'Alba Superba') introduced 1867 by Louis Van Houtte, Belgium. Flowers white, outside of petals colored very light purplish. The tree is very compact.

'Alexandrina' introduced 1831, Paris, France. Flowers flushed rose purple outside, inside of petals pure white. One of the larger and earlier flowering varieties.

'Andre LeRoy' introduced 1900, Barbier, Orleans, France. Flowers are dark pink to purplish on the outside (color close to that of 'Verbanica'). The petals are white inside and the flowers are decidedly cup-shaped.

'Burgundy' introduced 1930 by W. B. Clarke, San Jose, California. Flowers are the deep purple color of Burgundy wine, appearing earlier than those of most other varieties.



PLATE VI
Magnolia obovata.

'**Brozzoni**' introduced 1900, Barbier, Orleans, France. When wide open the flowers are 10 inches across making this one of the largest flowered varieties of the *M. soulangiana* group. The outside of the petals are tinged a pale purplish rose, but all in all it is considered one of the best of the white flowered varieties.

'**Grace McDade**' introduced 1945, C. McDade, Semmes, Alabama. Flowers are white with pink at the base of the petals.

'**Lennei**' introduced 1852, originated in Florence, Italy. This has the darkest purplish magenta flowers of this group (not as dark as *M. liliflora nigra*). 'Rustica' has more red in the flowers

'**Liliputin**' originated in the Semmes Nurseries, Crichton, Alabama, a few years ago with small flowers and a smaller habit than most *M. soulangiana* varieties. It is slow in growth. The variety sold under the name "Late Soulangiana" is similar in every way, although this supposedly came from England. We have not yet had the opportunity to observe either of these in growth.

'**Lombardy Rose**' introduced before 1957 by C. McDade, Semmes, Alabama. Lower surface of the petal is dark rose, upper surface white. This is a seedling of *M. soulangiana lennei* with flowers continuing to bloom for several weeks.

'**Rustica**' (syn. 'Rubra' or 'Rustica Rubra') introduced about 1893, Boskoop, Holland. Flowers are more rose red than those of 'Lennei' but they are somewhat similar, being $5\frac{1}{2}$ inches in diameter. The inside of the petal is white but the general effect is more red than 'Lennei.'

'**San Jose**' originated about 1938, San Jose, California. Flowers are larger than many other varieties, rosy purple, and fragrant, and the plant is vigorous growing. This blooms earlier than most other *M. soulangiana* varieties and is said to be deeper colored than most, with the exception of 'Lennei.'

'**Speciosa**' introduced before 1830 in France. The flowers are almost white, 6 inches in diameter, very close to 'Alba' but just a trifle more color than 'Brozzoni.' It is important because it is the last of this group to bloom. Upright, tall and fast growing.

'**Verbanica**' - Flowers outside a clear rose pink, inside white. This blooms late, making a beautiful effect when most of the other varieties are dropping their petals. Its one drawback is that it is slow growing.

stellata (*halleana*) 20' Zone 5 Japan Star Magnolia

Double, white fragrant flowers, 3 inches or more in diameter, and appearing in late April before the leaves. The flowers contain 12-15 narrow petals. One of the hardiest of the Asiatic magnolias, usually more of a tall shrub than a tree, it makes an excellent and very popular ornamental specimen. We have grown many seedlings of *M. stellata*, as have others, and it must be said that many of the seedlings are inferior plants, growing much more like *M. kobus* and the flowers have fewer petals as well. Hence this species, if it is a species, should not be grown from seed but from cuttings taken from a good clone.

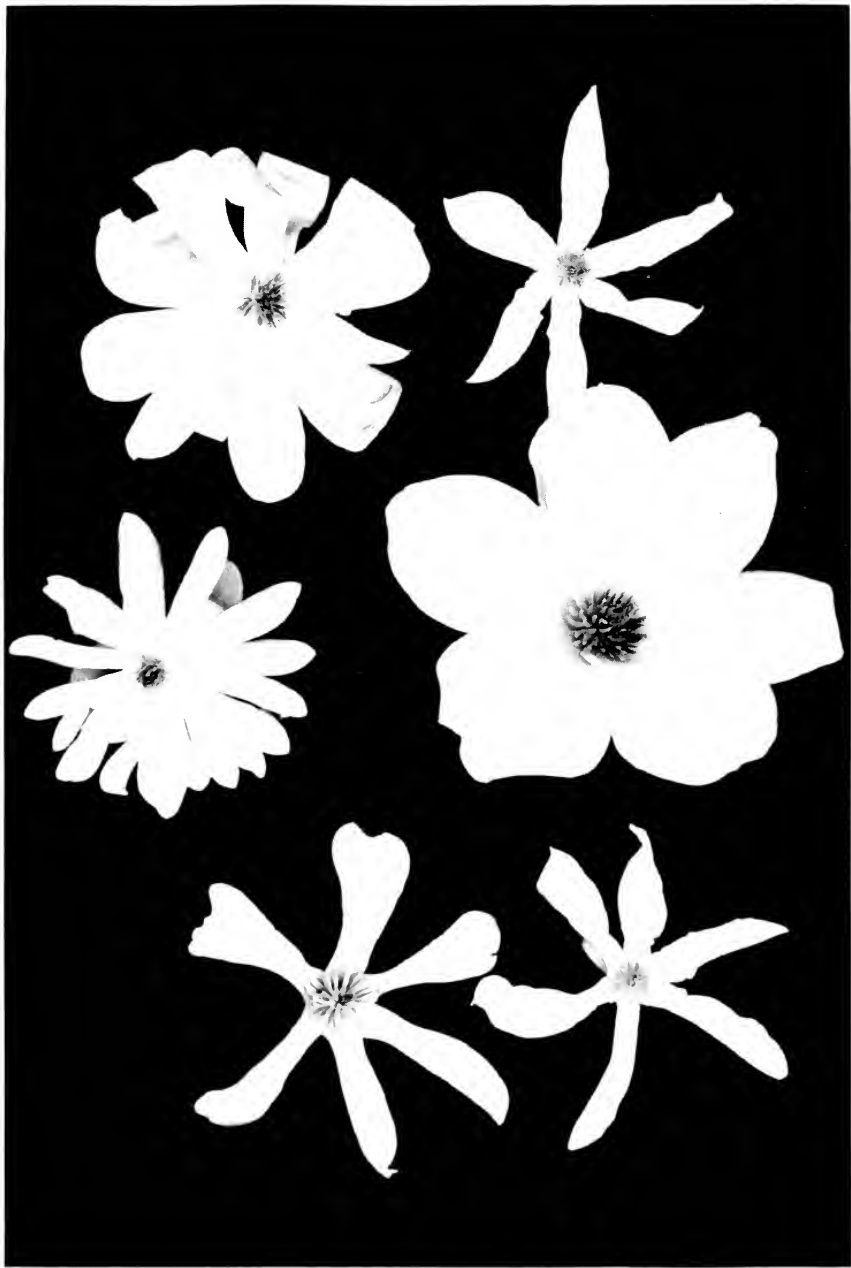


PLATE VII

Magnolia flowers. Left to right. Top row: *kobus*, *stellata*, *tochneri* 'Merrill'. Bottom row: *salicifolia*, *deudata*, *praeflorata*.

stellata rosea – Pink Star Magnolia

Flower buds pink, flowers usually white. This is mostly disappointing in flower, since by the time the flowers are fully open they have faded completely white.

stellata rubra – Red Star Magnolia

Flowers purplish rose, imported from Japan about 1925. There is another form of this which was raised in Boskoop, Holland, by Messers Kluis, before 1948. The flower color was noted as being fuchsia purple 28/3 in the Royal Horticultural Colour Chart. It is said to have been a chance seedling in a batch of *M. stellata*. I have not yet seen this in flower, but J. H. Johnstone notes that the flower color is vastly superior to that of *M. stellata rosea*.

There are several other seedlings of *M. stellata* with purportedly "red" flowers which may well merit further trial. Mr. K. Sawada of the Overlook Nurseries, Mobile, Alabama raised one in 1946 and calls it 'Red.' The flowers are 3-4 inches in diameter with 10-16 petals. The outside of the petals is a dark purplish red, the inside is white, but he says that when the tree is in bloom the general appearance is of more red than some that are being sold under the varietal name of *rubra*. The Arnold Arboretum is growing these forms together, and sometime will be able to say just which is best. Since the early flowering magnolias, in the North at least, all have white flowers, a premium should be placed on the best of these with colored flowers.

stellata 'Waterlily'

Originated at Greenbrier Farms, Inc., Norfolk, Virginia, prior to 1939. It is more upright, bushy and twiggy than *M. stellata*. The flower buds are pink, the flowers eventually white and are slightly larger, with more narrow petals. It has always been assumed to be a cross of *M. stellata* × *soulangiana* but it looks very much like *M. stellata*. Mr. Paul Vossberg writes that 1,000 seedlings of 'Waterlily' were grown on Long Island and not one showed any traces of *M. soulangiana* or its parents *M. liliflora* and *M. denudata*.

× **thompsoniana** shrub Zone 6 (*tripetala* × *virginiana*) Thompson Magnolia

Originating about 1808, this hybrid has leaves 4-10 inches long, glaucous beneath and otherwise similar to those of *M. virginiana*. The creamy white flowers are 4½-6 inches in diameter, hence larger than those of *M. virginiana* and they are more globular as well, appearing in late June and July after the leaves have been fully developed.

virginiana (*glauca*) 60' Zone 5 Eastern U.S. Sweet Bay Magnolia

A native shrub or tree from Massachusetts to Florida, one of the most fragrant of all the magnolias, with 3-5 inch leaves, whitish on the underside and white, waxy, very fragrant flowers in late June and July. In the far South the leaves are evergreen, but the plant is deciduous in the North, and more shrubby.

× **watsonii** 30' Zone 5 (*obovata* × *sieboldii*) Watson Magnolia

First known in France in 1889, but originally from Japan. This small tree has leaves 4-8 inches long and fragrant, saucer-shaped flowers that are pink with a ring of prominent crimson stamens in the center. It has larger flowers and leaves than *M. sieboldii*, a closely similar magnolia. The flowers are borne in late June and July after the leaves have been fully developed.

wilsonii 24' Zone 6 W. China Wilson Magnolia

A magnolia very easy to grow, blooming normally in mid-June, but often with a second crop of white, saucer-shaped, fragrant and pendulous flowers in August. They are 3½-4 inches in diameter with a ring of red stamens in the center. The leaves are 4-6 inches long.

Magnolias which might be Considered Mediocre as Ornamentals

cylindrica - extremely rare, closely related to *M. kobus*.

kobus
" **borealis** - the hardiest of the Asiatic magnolias, but not free-blooming. Sometimes it takes 22 years before the first flowers are produced. The species is frequently used as understock on which other magnolias are grafted.

liliflora - flowers not as large as those of *M. liliflora nigra*.

" **gracilis** - smaller than species, not as desirable a plant.

× **loebneri** - (*stellata* × *kobus*). Select named clones only. 'Merrill' is the best at present.

officinalis - Zone 6 with large leaves (14-21 inches) and flowers (6-8 inches), but *M. obovata* is hardier and has better foliage.

officinalis biloba - a variety merely with notched leaves.

proctoriana - poor flowers, blooms with *M. stellata* and *kobus*.

slavinii 'Slavin's Snowy' - 'Merrill' has larger flowers.

soulangiana - use the better named clones.

" 'Amabilis' - differs little from other varieties.

" 'Candolleana' - differs little from other varieties.

" 'George Henry Kern' - Plant Patent #820 - with us, this does not have as large flowers as some of the other varieties.

" Highland Park #2636; AA 885 - flowers brownish.

soulangiana 'Lennei Alba' - mediocre flowers.

“ 'Norbertiana' - mediocre flowers.

“ *purpurea* - probably a name applied to mediocre seedlings.

“ 'Spectabilis' - 'Brozzoni' is better.

“ 'Triumphant' - resembles 'Rustica,' not rated outstanding by W.B. Clarke Co., San Jose, California, which has discontinued it.

tripetala - *M. obovata* has better flowers.

“ *variegata* - poor variegated foliage.

virginiana australis - differs little from the species.

wilsonii taliensis - differs little from the species.

Magnolias Needing More Trial

kobus 'Nana Compacta' (?) - originated in the old Kohankie Nursery of Painesville, Ohio, before 1950. A slow growing, compact plant with flowers as yet unknown.

grandiflora × *virginiana* - several hybrids now being grown at the National Arboretum deserve further trial.

× *kewensis* (*salicifolia* × *kobus*) - originated as a seedling at the Royal Botanic Gardens, Kew, England, in 1938 and first flowered in 1951. The flowers are pure white and the leaves are 4-5 inches long.

DONALD WYMAN

Still Time to Register for the Following Spring Classes

Spring Field Classes in Ornamental Plants Instructor: Dr. Donald Wyman
Six meetings, Friday mornings, 10-12, April 29-June 3. Fee: \$2.00

Contrib. de l'horticulture française aux jardins américains
Cinq asénces. Vendredi après-midi 2-4 h, 29 avril au 27 Mai.
Instructrice: Madame C. Weber Prix: \$10.00

Field Botany II Instructor: Dr. Burdette Wagenknecht
Five meetings. Tuesday afternoons, 2-4, May 3-31. Fee: \$2.00

Reminder

Arnoldia Subscriptions for 1960 not paid by May 1 will be discontinued.

ARNOLDIA



A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 20

JUNE 3, 1960

NUMBER 5

SHRUB HONEYSUCKLES WITH PINK TO RED FLOWERS

WALKING through the shrub collection in the Arnold Arboretum during mid-May of this year, many visitors noticed a very deep-red-flowered bush honeysuckle named 'Arnold Red.' This was the deepest-red-flowered one of the entire group. Past correspondence with plantsmen has repeatedly brought up the question concerning just which is the deepest-red-flowered form. At one time, it was considered to be *Lonicera tatarica sibirica*, later *L. korolkowii zabelii*; but now with these and others growing side-by-side in the same soil and exposure here at the Arboretum, it seems that, under our conditions at least, *Lonicera* 'Arnold Red' has the deepest red flowers.

An interesting review is made here of some of the better bush honeysuckles with pale pink to red flowers in the spring. Those with pure white flowers are always valued; the vines with red or yellow flowers are outstanding ornamentals; and some of the shrubs like *L. syringantha* and *L. thibetica* with lilac flowers are also much used. Here is a brief discussion of the bush honeysuckles with pink to red flowers growing in the Arnold Arboretum, listed in the order of deepening color from very pale pink to strong purplish red as measured with the Nickerson Color Fan.

Very Pale Pink

Lonicera bella rosea is listed in the catalogues and it is undoubtedly mixed with others of this hybrid species. The true variety *rosea* has flowers which open a very pale pink, almost white; unfortunately, they have the poor habit of fading quickly to yellowish in a day or two, before the rest of the pink flower buds on the same branchlet have opened. The flowers are small, being only about one-half inch in diameter; consequently, this does not merit wide use.

Lonicera notha is not much better although the flowers are slightly larger.

Lonicera tatarica, being grown widely from seed and hybridizing a great deal, will vary considerably but can be considered as having good, very pale pink to white flowers.

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Both *L. korolkowii* and its variety are probably mixed in the trade but both apparently have very pale pink flowers and do not make the display that the deeper pink variety *aurora* does.

Pale Pink (2.5 R 9/3 Nickerson Color Fan)

Varieties in this group include *L. tatarica rosea* and *punicea*. We obtained the latter from E. H. Hillier & Sons in England in 1939. Both are good varieties, the flowers of *rosea* being $\frac{7}{8}$ inch in diameter and those of *punicea* being one inch in diameter. The color is more or less uniform through the flowers. There is a third variety of *L. tatarica* named *elegans* which we obtained years ago from the Morton Arboretum, which has flowers identical in size and color with those of *punicea*. This was named nearly a century ago and was listed by some German nurseries in the 1890's.

Two others in this group should be mentioned: *L. amoena* and its variety *arnoldiana*. Both have flower buds a pale pink. As they open, the flowers of the variety *arnoldiana* turn almost white. These are large, $1\frac{1}{4}$ inch in diameter, and the leaves of the plant are very narrow and grayish-green. The flower buds of *L. amoena* are the same color, but the flowers open to a very pale pink and are only $\frac{3}{4}$ inch in diameter. The leaves are wider (up to $\frac{5}{8}$ inch) but are also a grayish-green color. The species is the more vigorous; the Arnold honeysuckle is much more delicate and of a finer texture.

Petals Striped Deep Pink and White

The over-all effect of the flowers in this group is deep pink, but on close examination the white on the petal margin is seen. *Lonicera tatarica angustifolia* is one variety, but the flowers are only about $\frac{1}{2}$ inch in diameter, so this might be overlooked. *Lonicera tatarica lutea*, on the other hand, has slightly larger flowers and, of course, bright yellow fruits, hence it has more ornamental value.

Lonicera tatarica sibirica has flowers $\frac{3}{4}$ inch in diameter with a tinge of white on the margin of the petals, so that actually, nearly one half of the petal surface is white to light pink. This lightens up the flowers considerably, and although the actual color of the stripes in the petals is a strong purplish red, the effect of the flowers over-all is only a deep pink. Hence, for landscape use, the flower color is much lighter than that of either *L. korolkowii zabelii* or 'Arnold Red.'

In 1941, Mr. E. C. Hilborn of the Northwest Nursery Company, Valley City, North Dakota, sent a hybrid (*morrowii* × *tatarica*) with flowers about the same color but larger. It is of interest to note that the true *L. morrowii* (flowers white to yellow) with a densely-rounded habit is very difficult to locate because it was hybridized so freely with *L. tatarica* and has been grown consistently from seed.

L. tatarica leroyana has flowers $1\frac{1}{4}$ inches in diameter, striped a moderate purplish pink (2.5 RP 7/8) with white petal margins, but blooms sparingly and so can be overlooked as far as flowers are concerned.



PLATE VIII

Lonicera 'Arnold Red' in the Arnold Arboretum grows rapidly and makes a densely-branched shrub full of deep purplish red flowers every spring, followed by bright red fruits in the summer and fall.

Moderate Purplish Pink (2.5 RP 6/10)

Lonicera korolkowii aurora is better than either the species or the variety *floribunda*, for it has deeper pink and slightly larger flowers (up to $\frac{3}{4}$ inch in diameter).

Deep Purplish Pink (7.5 RP 6/12)

Lonicera bella atrorosea is the clone of this hybrid species to use for its deep pink flower color. Without a question, it is mixed in the trade with *L. bella rosea*, but *rosea* is the lighter of the two, so light that one sometimes does not notice the pink color.

'Sheridan Red' originated in the Sheridan Nurseries of Ontario, Canada, a few years ago, but was discontinued later because it was not as dark as *L. tatarica sibirica*. 'Hack's Red' originating in the Hack Nursery near Winnipeg, Manitoba, Canada, is slightly darker (7.5 RP 5/12) but is not the darkest red.

Still another in this deep purplish pink group (5 RP 6/10) is *L. amoena rosea*. It is a well-rounded shrub, dense in habit, with deep pink flowers, making this a good shrub for its habit, but the flowers quickly fade yellowish.

Strong Purplish Red (7.5 RP 4/11)

Lonicera korolkowii zabelii has flowers a darker red than any mentioned so far, these flowers being $\frac{7}{8}$ inch in diameter with narrow petals. It is widely grown now in nurseries and gives a darker effect in full flower because the color is uniformly distributed over all the petals.

Lonicera maximoowiczii and its variety *sachalinensis* also have strong purplish red flowers, but they are so small ($\frac{1}{4}$ inch) that ornamentally they have no value.

Deep Purplish Red (10 RP 3/10)

'Arnold Red' is without question the darkest red of all the shrub honeysuckles that are growing together on our soil. This originated as a chance seedling at the Arnold Arboretum, first blooming in 1947 at the Case Estates. (*Arnoldia* 16: 44-45, 1956) It was distributed to commercial growers in October 1954. The flowers are one inch in diameter and the dark red fruits are about $\frac{3}{8}$ inch in diameter. When in full bloom, it is a handsome plant. Like other varieties of the Tatarian honeysuckle, pruning of older plants is often necessary in order to maintain a neat appearance.

Summary

So, after checking all these shrubs in flower, the best of the *Loniceras* for pink to red color as they bloomed in the Arnold Arboretum this year, were:

<i>L. tatarica</i> varieties <i>rosea</i> , <i>punica</i> , <i>elegans</i>	Pale pink
<i>L. amoena</i> and variety <i>arnoldiana</i>	Pale pink
<i>L. tatarica</i> varieties <i>lutea</i> , <i>sibirica</i>	Petals striped pink and white
<i>L. korolkowii aurora</i>	Moderate purplish pink
<i>L. bella atrorosea</i>	Deep purplish pink
<i>L. korolkowii zabelii</i>	Strong purplish red
<i>L. tatarica</i> 'Arnold Red'	Deep purplish red—darkest of all

DONALD WYMAN

ARNOLDIA



A continuation of the
BULLETIN OF POPULAR INFORMATION
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VOLUME 20

SEPTEMBER 16, 1960

NUMBER 6

PROPAGATION OF WOODY PLANTS BY SEED

SEED, nature's most common method of plant reproduction, provides a means by which an amateur can propagate many woody plants. Facilities needed are simple and inexpensive. By the use of polyethylene plastic bags, seeds requiring periods of pretreatment can be handled in an almost carefree manner.

Germination is defined as: "The process of the development of a seed into a perfect plant." Before this takes place conditions must be favorable and the seed must be ready to germinate. Many kinds of seed germinate on being provided with conditions such as moisture, air and warmth. Other kinds of sound seed refuse to germinate when given these favorable conditions. Such seeds are not prepared to develop and are termed dormant. This word stems from the Latin word *dormio* which means to slumber or sleep. Until the inhibiting conditions of dormancy are overcome, the seed is prevented from development. Dormancies are protective adaptations which prevent germination at times unfavorable to seedling survival. If these safeguards did not exist and germination occurred during a warm spell in winter, the seedlings would perish in a subsequent cold period. This situation, together with others, is prevented by these natural inhibitors. Nature has furnished these protections to insure continuance of the species.

Immediate Germination

Many woody plant seeds have no inhibiting factors and will germinate shortly after having been sown. Among these are:

Seeds Without Inhibiting Dormancy

Buddleia sp.	Clethra (summersweet)
Calluna (heather)	Deutzia
Catalpa	Diervilla
Cercidiphyllum (katsura tree)	Enkianthus

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Erica (heath)	Philadelphus (mock orange)
Hypericum (St. John's wort)	Pieris (andromeda)
Kalmia (mountain-laurel)	Potentilla (cinquefoil)
Kolkowitzia (beauty bush)	Rhododendron and Azalea)
Leucothoe	Spiraea (bridalwreath)
Oxydendrum arboreum (sourwood)	Weigela
Phellodendron (cork tree)	

After cleaning, seeds in this group are stored dry until sowing time. When handled indoors or in a greenhouse they are best sown in late winter or early spring so that they will germinate and grow with the lengthening days.

Complex Dormancy

Some dormancies are simple, others are complex. Germination of most woody legumes, for example, is retarded by seed coats which are impervious to water. A dormancy of this kind is relatively simple to overcome. To obtain prompt and uniform germination the entry of water becomes necessary. Several procedures will accomplish this. Large type legume seeds, handled in small quantities, can be perforated with a file or sharp knife. Smaller type seeds or large seeds handled in volume can be treated with hot water or sulphuric acid. Sulphuric acid treatments are not recommended for amateurs because of the hazards involved. Accidental splatterings of sulphuric acid could be destructive, if not disastrous.

Hot water provides a simple, safe and effective means of obtaining rapid germination. Seed is placed in a container; water at about 200 degrees F. is poured over the seed and allowed to cool. Permitting it to remain in the water over night before sowing is advantageous. The amount of water should be about five times the volume of seed. On being removed, the seed must be sown at once. If permitted to dry before sowing, the dormancy can recur. Should this happen, the process would have to be repeated.

The second method is to sow the seed in a can, flat, or other container and pour boiling water over it. In the event that an insufficient number of seeds germinate, the seedlings which have developed may be removed and the ungerminated balance retreated with hot water. A second treatment will usually stimulate further germination.

Stratification

Many seeds have internal conditions which inhibit germination. Often this is caused by an immature embryo, which is not ripe although the seed appears mature. Exposure to a period of cold overcomes this dormancy. In nature, such seed would germinate in the spring after being provided with cold by the winter. A period of artificial cold works equally well. Stratification is the term commonly used to define this procedure. This word is derived from the practice of placing

seed between layers, or strata, of medium for storage or pretreatment. It is now interpreted as any process used to facilitate the germination of dormant seeds which require pretreatment by time and temperature. This cold stratification is accomplished by placing the seed in a refrigerator at about 40 degrees F. for the required time. Forty degrees is a recommended temperature, but this has latitude. Within reason, whatever temperature the household refrigerator is set for should be effective. Freezing is unnecessary and seed should not be placed in the freezing unit. The container for these seeds should be a polyethylene plastic bag.

Polyethylene has the property of allowing air to pass through it, but is vapor-proof. A medium composed of one-half sand and one-half peat moss is suitable. This is mixed together and dampened. Dampened is stressed as it must be moist but not wet. In proportion, the medium should be two or three times the volume of the seed. Advantages in keeping the bulk small will be obvious at sowing time as the entire contents of the bag is sown. Twisting the top of the bag and binding it with a rubber band makes it vapor-proof for the period of cold stratification. If properly sealed it can be left until time for sowing, be this a month or a year. The following list shows some plants whose seeds respond to this type of stratification, together with recommended periods of time :

Seeds to be Stratified

	Approximate stratification time in months
<i>Abies</i> sp. (fir)	2-3
<i>Acer</i> sp. (maple) most kinds	3
<i>Aesculus</i> sp. (horsechestnut)	4
<i>Berberis</i> sp. (barberry)	2-3
<i>Betula</i> sp. (birch)	2-3
<i>Campsis</i> sp. (trumpet creeper)	2
<i>Carpinus</i> sp. (hornbeam)	3-4
<i>Carya</i> sp. (hickory)	3-4
<i>Cedrus</i> sp. (true cedar)	1-2
<i>Celastrus</i> (bittersweet)	3
<i>Chamaecyparis</i> sp. (false cypress)	2
<i>Clematis</i> sp. (virgin's bower)	2
<i>Cornus florida</i> (flowering dogwood)	3
<i>Cornus kousa</i> (Japanese dogwood)	3
<i>Fagus</i> sp. (beech)	3
<i>Fraxinus</i> sp. (ash)	2-3
<i>Ligustrum</i> sp. (privet)	3
<i>Liquidambar</i> sp. (sweetgum)	3
<i>Magnolia</i> sp.	3-4
<i>Malus</i> sp. (apple)	1-3

Nyssa sp. (tupelo)	3
Picea sp. (spruce) most species	1-3
Pine (most species)	2
Prunus sp. (cherries, etc.)	3
Pseudolarix (golden larch)	1
Pyrus sp. (pear)	3
Ribes sp. (currant and gooseberry)	3
Sorbus sp. (mountain ash) most kinds	3
Syringa sp. (lilac)	2-3
Thuja sp. (arborvitae)	2
Tsuga sp. (hemlock)	3
Vitis sp. (grape)	3

These recommendations cover most species in the genera listed. In the maples and mountain ashes, for example, there are some exceptions that will not respond to this treatment. Many of the conifers will germinate when sown without pretreatment, but do so erratically. Cold stratification tends to stabilize this condition and provide a uniform stand of seedlings. This can be important as many conifer seedlings are susceptible to damping-off diseases. When induced to germinate quickly and in unison, they can be potted or boxed in a matter of days. By quickly separating them the spread of these diseases is minimized.

Double Dormancy

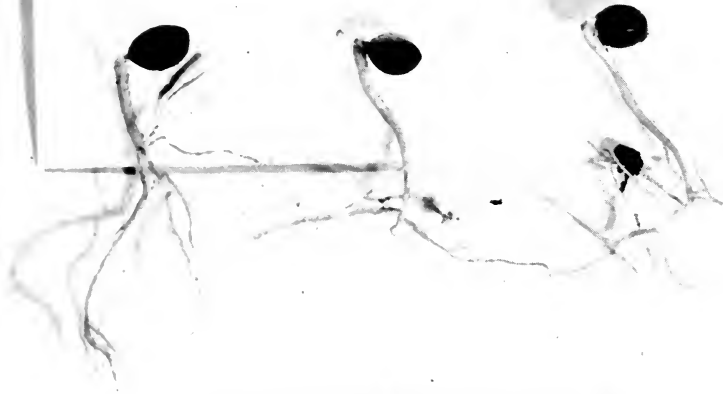
Still other seeds have conditions of double dormancy. They require warm, fluctuating temperatures followed by a cold period to be prepared for germination. Dormancies of this kind are caused by reasons such as hard seed coats and immature embryos. The endosperm (food storage tissue) can also be responsible for this. Due to the length of time required for germination, they are called two-year seed.

In nature, after being shed in autumn, such seed would go through the first winter without benefit from the cold because water had not penetrated the seed coat. Through the following summer the seed coat decomposes and permits the entry of water. Consequently, the second winter can provide the cold requirement. With the advent of favorable conditions in spring, the seed, thus prepared, can germinate. Some plants produce seed in a given seed crop which germinate each year for a period of years. Apparently variations in structure cause some of them to require more seasonal cycles than others to overcome inhibitors. This again is a survival adaptation. Should the flora of an area be destroyed, there would be dormant seed remaining which would germinate and furnish replacements. Some examples of these two-year seeds, together with suggested pretreatment, are as follows:

CHIONANTHUS RETUSUS

TREATMENT

FIVE MONTHS WARM STRATIFICATION FOLLOWED
BY THREE MONTHS AT 41° F



VIBURNUM SARGENTII FLAVUM

TREATMENT

FIVE MONTHS WARM STRATIFICATION FOLLOWED
BY THREE MONTHS AT 41°

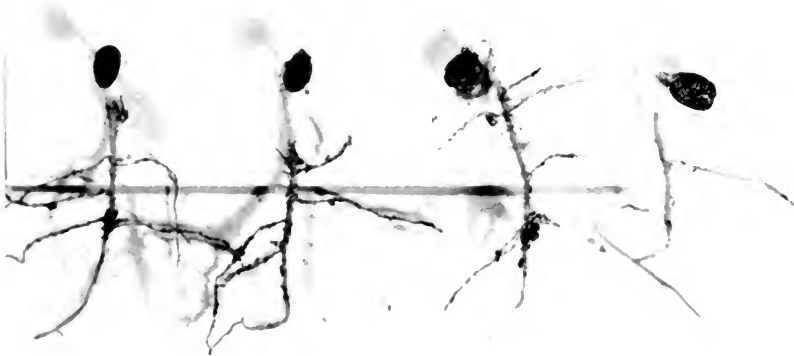


PLATE IX

These seeds of *Chionanthus* and *Viburnum* have been exposed to a period of warm stratification and roots have developed. They are now ready for the second requirement consisting of a 3-month cold treatment. If this is not provided to ripen the shoot bud, they will never go beyond this stage.

Seeds with Double Dormancy

	Stratification Time	Stratification Time
	in months	in months
	<i>Warm</i>	<i>Cold</i>
* <i>Chionanthus</i> sp. (fringe tree)	5	3
<i>Cotoneaster</i> sp.	5	3
<i>Crataegus</i> sp. (hawthorn)	4	3
* <i>Davidia</i> (dove tree)	5	3
<i>Halesia</i> (silver bell)	5	3
* <i>Paeonia</i> (tree types)	4	3
<i>Stewartia</i> sp.	7	3
* <i>Viburnum</i>	5	3

* These have a dormancy in the shoot bud after seed germination.

Pretreatment of seeds in this group must be done in two stages. They are mixed with medium and placed in polyethylene plastic bags as previously described. For warm stratification they should be provided with a location where the temperature will fluctuate. In some controlled experiments temperatures varying between 68 degrees at night and 86 degrees in the daytime have been used to provide this. Again there is latitude. Bags of seed placed on a greenhouse bench where the temperature ranged between 60 and 100 degrees have produced good results. Any location such as a window sill or similar situation where the day and night temperature varies would be suitable. A place in full sun, however, could result in a build up of high heat which would be detrimental. After the period of warm stratification has been completed, the bag is placed in a refrigerator for its cold requirement. Keeping track of this is easily done by labeling each bag and marking on a calendar the dates they are due to be moved.

Those preceded by an asterisk (p. 38) have a dormancy in the shoot-bud. Toward the end of warm stratification, roots will appear. These signify that the seed is ready for the second or cold stage of stratification. It is well to check this as the time required might vary in different species and with different seed lots. By carefully lifting the bag and looking for roots in the part which faces downward, this is done.

Roots travel down and will be found spreading in the bottom of the bag. When it appears that most of the seeds have produced roots, the bag can be moved to the refrigerator. If this is not done, the root will continue to grow until food stored in the seed is expended. When this happens, the seed will die. The period of cold must be provided to condition the shoot-bud or the seedling will never develop. Plate IX shows examples of seed in this class. Warm treatment has been completed and roots are down. They are now ready for the second treatment consisting of a three-month cold period.

Method of Sowing

Containers for sowing seeds in these different categories may be greenhouse flats, tin cans with drain holes or any suitable container. Tin cans make very satisfactory containers and the supply is inexhaustible. Size of the can will be determined by the amount of seed to be sown. A small soup can would be adequate for small amounts of seed, while a standard coffee can would accommodate larger quantities. The container is prepared by putting an inch or more of broken flower pots, stone, or some such coarse material in the bottom. Sphagnum moss, leaves or such is put over this to prevent the soil from filling the spaces and blocking drainage. Drainage is very essential. Loose-textured potting soil is added, firmed and leveled to fill the can within an inch of the top. A topping of milled or screened sphagnum moss about one-half inch deep, completes preparation for the sowing of fine seeds, such as rhododendron, spiraea and mountain-laurel.

The container is now placed in a vessel with water deep enough to be above the material used for drainage. Capillary action will conduct water upward, wetting the contents. It is well to do this a day in advance of sowing as sphagnum moss wets slowly. Fine type seed is sifted over the layer of sphagnum and is left uncovered. Crevices in the uneven surface catch and hold the seed in place. Judgment must be used in sowing as it is a common error to sow too thickly. Larger-type non-dormant seed is distributed over the surface and covered with sphagnum. The rule of thumb recommendation being to cover two or three times as deep as the seed diameter. A favorable time for sowing seed which has no dormancy is late winter or early spring so it will germinate and grow with the lengthening days.

In sowing seed which has been stratified by the plastic bag method, the entire contents is sown and topped with about one-quarter inch of sphagnum. Again this is planned so that one-half inch of space remains at the top when the job is finished. This half inch of space provides for watering.

Completed containers are now placed in polyethylene bags, closed at the top or inverted and tucked underneath. Water should not be needed until the seed has germinated and the bag removed, but it is well to check this occasionally. After germination, the plastic cover must be removed as the seedlings become too succulent when grown in this close atmosphere. Rather than remove this at once, it must be removed in stages for lengthening periods each day, for several days, to harden off the seedlings. They are now ready for the care required in good management of seedlings.

It is not customary to raise hybrids or varieties from seed unless it is known what their performance will be. Usually they do not provide plants with characteristics similar to the parent. Those which are grown because of deviations from normal, such as weeping forms or those with unusual fruit or flower color, often reproduce a percentage of offspring true to type. Examples would be Sargent's

weeping hemlock and the pink-flowered mountain laurel which are reputed to come about 90% true from seed. However, many years would elapse before they were ready for segregation. When raising mountain-laurel in commercial work, it would be of advantage to gather seed from only the deepest colored specimens. Premium prices would be justified at time of sale for those with superior flower color.

Plate IX shows *Viburnum sargentii flavum* a variety which has yellow fruit. Ordinarily a variety such as this does not duplicate the parent, and therefore would not be grown from seed. In this instance, those with yellow fruit can be separated from those with red by the pigmentation in the petioles while the plants are small.

Although it is not customary to raise hybrids and varieties from seed, many new plants occur in this way. One with curiosity and adequate growing space would find interest in raising these to see the outcome.

A. J. FORDHAM

Classes at the Arnold Arboretum

Fall Program, 1960

Economic Botany	Instructor: Dr. Joab Thomas
Six meetings. Tuesday evenings, 7:30-9:30, Oct. 4-Nov. 8.	Fee \$10.00
Fall Field Class in Ornamental Plants	Instructor: Dr. Donald Wyman
Five meetings. Friday mornings, 10-12, Sept. 30-Oct. 28.	Fee \$2.00
Field Botany I*	Instructor: Dr. Richard Howard
Five meetings. Tuesday afternoons, 2-4, Sept. 27-Oct. 25.	Fee \$2.00
Plant Propagation †	Instructor: Mr. Alfred Fordham
Ten meetings, the first on Saturday, Sept. 24, 9:30 a.m.	Fee \$25.00
Plant Structures	Instructor: Dr. Burdette Wagenknecht
Six meetings. Thursday evenings, 7:30-9:30, Oct. 6-Nov. 10.	Fee \$10.00

Applications will be accepted now for all classes, and should be addressed to Miss Stella Whitehouse, Arnold Arboretum, Jamaica Plain 30, Mass.

* Class meets at the Barn, 135 Wellesley Street, Weston, Mass.

† Class meets at the Arboretum Greenhouse on South Street, Jamaica Plain, Mass.

ARNOLDIA



A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 20

SEPTEMBER 23, 1960

NUMBER 7

ILEX CRENATA AND ITS VARIETIES

THE Japanese holly was introduced into cultivation in the United States in 1864 and has proved popular in all types of ornamental plantings. Its small, evergreen leaves and the dense, twiggy character of its branching give it qualities that make it useful as a specimen, a background planting or a hedge, since it withstands shearing very well indeed. American nurserymen have grown it from cuttings for a long time and have found that when seed is planted, numerous variations arise. In fact, there are so many now that if one studies the nursery catalogues carefully, one will find some 40 names purporting to be different varieties of this useful species and one nurseryman is known to have as many as 200 selected seedlings.

In order to assist those interested in making a selection among these plants, this issue of *Arnoldia* is devoted to a cursory study of the varieties. Some are so new that definite information concerning their performance is not available, and will not be for several years. Because many people are interested in the lower-growing types of shrubs, especially those which require no special care or spraying to combat insects and diseases, this is a group well worth noting.

Forty years ago there were only the species, the variety *microphylla*, and possibly one or two others available in the trade. Now there are forty names being listed, the most recent being one named 'Glossy' offered in an advertisement in the August 1, 1960, issue of the *American Nurseryman*. Certainly all are not outstanding ornamentals; some are not worthy of planting, and some of the names listed are merely synonyms of older, recognized varieties, or are so similar that from the standpoint of their use in the landscape, there is no appreciable difference.

Recommended Varieties

convexa: A variety introduced into America by the Arnold Arboretum in 1919 and hardier than the species. Until the peculiar winter of 1958-59, this had not

[41]



suffered much injury, but during that winter it was badly killed over a wide area of the northern United States. Even at that, I think it is still an extremely worthy specimen, with small, convex leaves and rather widespreading habit, flat on top. Our forty-year-old plant is 9 feet high and 24 feet across. It will withstand clipping and makes an excellent substitute for box in the North.

helleri: Originating in Newport, Rhode Island, in 1925, this variety is very dwarf and compact. In fact, it is so compact and rounded in habit that it looks as if it had been sheared. Our 26-year-old plant is only 4 feet tall and 5 feet across, a splendidly moulded specimen. The leaves are about one-half an inch long. This was probably the first of the dwarf compact types of Japanese holly to be widely grown by nurseries in the United States.

latifolia: This is so popular that apparently it is offered in the trade under several names such as *fortunei*, *major* and *rotundifolia*. Actually these are all synonyms which should be dropped in favor of *latifolia*. The plant has rather large leaves for an *Ilex crenata* variety, they being about $1\frac{1}{2}$ inches long and $\frac{1}{2}-\frac{5}{8}$ inches wide and a glossy green. It is vigorous in growth, sometimes reaching a height of 20 feet.

mariesii: This is a dwarf variety with the small leaves bunched near the ends of the twigs and growing less than an inch a year. Sometimes it is listed as var. *nummularia*, but it is rather difficult to find commercially and thus is rare in cultivation.

microphylla: Low in habit with small leaves $\frac{1}{3}-\frac{3}{4}$ inches long, this has been in cultivation in America for fifty years or more and has proved to be the hardiest of the older varieties. How its hardiness compares with that of the many newer varieties remains to be seen. Certainly it is as hardy as *convexa* and it is harder than the species.

'Compacta': Dense and compact in habit, with leaves about $\frac{1}{2}$ inch long, our three-year-old plant is 3 inches high but 12 inches across.

'Glass': A male clone of *Ilex crenata microphylla* differing only slightly in that the leaves are slightly smaller. It is compact and upright while young but can become rather open with age.

'Green Island': Our eleven-year-old plant is loose and open (3 feet tall and 6 feet across), not nearly so compact as older plants of *helleri* and 'Stokes.' It was discovered in 1935 and introduced (Plant Patent #817) in 1949 by the Styer's Nursery of Concordville, Pa. It is said to be more rapid growing than either *helleri* or 'Kingsville.'

'Hetzi': A dwarf clone of *Ilex crenata convexa* originating in the Fairview Evergreen Nurseries of Fairview, Pennsylvania, and proving rather popular.



PLATE X

(Above) *Ilex crenata bellota*. (Below) *Ilex crenata congesta* as a low hedge between two plants of *Ilex crenata latifolia*.

'Kingsville': A dwarf clone of *Ilex crenata longifolia* discovered in Maryland in 1912. The Kingsville Nurseries of Kingsville, Maryland, purchased this plant in 1926 and later introduced it. Mr. Henry Hohman has the original plant which is now 4 feet tall and 7 feet across, with leaves $\frac{1}{2}$ inch long. The plant has a low, rounded habit and is flat on top. It has not been known to bear fruit. It appears to be quite hardy, having withstood winter temperatures of -15° F. without injury.

'Kingsville Green Cushion': A very dwarf clone with spreading habit. A 10-year-old plant was noted as being only 8 inches tall and 32 inches across. It makes a solid, cushion-like mass. The leaves are similar to those of *Ilex crenata helleri*, but the plant is much more dwarf and compact.

'Stokes': This plant was originally selected from a batch of seedlings by Warren Stokes of Butler, Pennsylvania, and was issued Plant Patent #887 in 1949. Our 12-year-old plant is 3 feet tall and 4 feet across, flat-topped and not quite so globose as is the variety *helleri*, but it is slightly hardier. This is a male clone.

Varieties Worthy of Further Trial

'Canton' *

'Changsha' *

'Chengtu' *

'Foster No. 1'—A selection of Mr. E. E. Foster, Bessemer, Alabama, said to be very low, compact and spreading.

'Glossy'—First introduced in 1960. Noted as being slightly faster and more compact in growth than *convexa*. Also noted as "extremely hardy," according to advertisement of Gerard K. Klyn Nursery, Mentor, Ohio.

'Green Thumb'—A dwarf female clone selected by John Vermeulen & Son, Inc., Neshanic Station, New Jersey, in 1950 and introduced in 1956.

'Howard'—A possible hybrid.

'Kunming' *

'Maxwell'—A possible hybrid.

'Morris Dwarf'—A clone of *Ilex crenata microphylla* with very dwarf habit and leaves $\frac{1}{3}$ - $\frac{3}{4}$ inches long.

'Nanking' *

'Peking' *

'Red Lion'—Said to be similar to the variety *helleri*.

'T-one'—A low-growing, small-leaved variety selected by the Tingle Nursery of Pittsville, Maryland, said to be very compact.

'Shanghai' *

'Willow Leaf'—A clone of *Ilex crenata longifolia*.

'Yunnan' *

* These are seedlings named by the Styer's Nursery of Concordville, Pennsylvania. Of these, J. F. Styer thinks that 'Chengtu,' 'Peking, and 'Yunnan' will eventually prove best after the full trial period.



PLATE XI

Ilex crenata varieties. 1, *Ilex crenata latifolia*. 2, *I. c.* 'Green Island'. 3, *I. c. conrca*. 4, *I. c. helleri*. 5, *I. c.* 'Glass'. 6, *I. c.* 'Compacta'. 7, *I. c.* 'Kingsville'. 8, *I. c.* 'Green Cushion'. 9, *I. c.* 'Stokes'.

Plants and Names to Discard

crenata fortunei—Synonym for *Ilex crenata latifolia*.

“ *grandifolia*—Probably synonymous with *Ilex crenata latifolia*.

“ *longifolia*—Lanceolate leaves.

“ *luteo-variegata*—Leaves variegated, probably similar to *Ilex crenata variegata*

“ *macrophylla*—Probably synonymous with *Ilex crenata latifolia*.

“ *major*—Synonym for *Ilex crenata latifolia*.

“ *paludosa*—Only for use in swampy places.

“ *radicans*—Leaves coarse when compared to those of other varieties.

“ *rotundifolia*—Synonym for *Ilex crenata latifolia*.

“ *variegata*—Leaves variegated.

“ ‘Buxifolia’—Originated and named at Tom Dodd Nurseries, Semmes, Alabama, a few years ago, not particularly outstanding and unfortunately named ‘Buxifolia,’ which name in its varietal form has been determined a synonym for *convexa*.

“ ‘Lindleyana’—Originated in the Lindley Nurseries, Greensboro, North Carolina. Of dense growth, but differs little from other good selections.

“ ‘Longfellow’—Leaves rather large, male clone, poor grower, closely resembles *Ilex crenata microphylla*.

“ ‘Oleafera’—Not superior to recommended varieties.

“ ‘Tennyson’—Closely resembles *Ilex crenata latifolia*, but a “ragged” grower

“ ‘Upright’—Not outstanding, subject to chlorosis, somewhat similar to var. *latifolia*.

“ ‘Vaseyi’—Closely resembles var. *latifolia* but foliage loose and open.

DONALD WYMAN

Hurricane 'Donna'

'Donna' came to the Arnold Arboretum on Monday, September 12, preceded by considerable radio warning. The 3.64 inches of rain dumped on the Arboretum were very much appreciated. The winds were not. Although two gusts of 140 miles per hour were registered at the Blue Hills Observatory in Milton, only a few miles in a direct line from the Arboretum, it is most fortunate that damage to trees in the Arboretum was not serious. Altogether, 39 trees were blown down. Of these, 23 were pulled back into position, staked, pruned, watered and mulched immediately. Two were propagated immediately. Fourteen were varieties duplicated elsewhere in the collections.

Less than twenty-four hours after the winds stopped, the trees which were salvageable had been pulled back into place or were propagated. Sixty loads of brush have been picked up and hauled away, representing the branches that were broken.

As is usual after such storms, injury could be found in the weak-wooded trees (*Cladrastis lutea*, *Acer saccharinum*, *Ulmus pumila*), especially if they happen to be growing where the gusts of wind were worst. The hickories and locusts showed considerable splitting (especially in poor crotches) and close observation of almost every large branch broken from other trees showed a weakened or decayed situation which had long existed. Apparently there was much thrashing around of the smaller branches in the oaks, evidenced by many small twigs about one foot long on the ground.

Steps taken after any such storm should be prompt if the trees are to be saved. First, those that are down or leaning (if the roots are not all broken) should be pulled back into position immediately and securely staked before the exposed roots have an opportunity to dry out.

If the essentials of pruning are not well understood, one can learn a great deal by carefully studying each broken branch to determine why it was broken. It may be due to the vagaries of the unpredictable wind, but more often it is due to decay that has been allowed to creep into the trunk or to a weakened crotch which should have been properly pruned years ago. Occasionally, as in the case of several 55-year-old *Phellodendron lavalleyi* trees, it is due to old age — the branches have grown so far out from the trunk that they are very heavy and will not withstand the whipping effects of an unusually strong wind.

Broken branches should all be cut off smoothly and cleanly, the wood painted at once with some good tree paint, of which there are several on the market.

Trees that were blown over and obviously had roots broken in the process might well be pruned, sometimes heavily (to compensate for the loss of roots), when they are pulled back properly into place and staked. Occasionally trees that are split may be kept alive if bolted together properly. Such trees should

never be repaired by wrapping wire completely and tightly around the branches or trunks.

The quicker such repairs can be made to the trees after a storm, the better are the chances for survival.

Corrections:

In the last issue of *Arnoldia* there are three errors in the printed copy, due entirely to the editor and not the author.

Page 34: The heading **Complex Dormancy** should read, **Seed Coat Dormancy**

Page 35: *Clematis* stratification time should read, "3 months."

Page 38: In the table of seeds with double dormancy, the following comment should be added after the last item (*Viburnum*) in the column: (This applies to many but not all the *Viburnums*.)

Page 38: Beneath the table, delete the words, "after seed germination" following "*These have a dormancy in the shoot bud."

D.W.

ARNOLDIA



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FORSYTHIA 'KARL SAX'

TWENTY years ago a tetraploid *Forsythia* was produced by treating a seedling of *F. intermedia spectabilis* with a colchicine emulsion. The colchicine acts as a poison and disrupts normal cell division, but permits chromosome division temporarily. In this manner the chromosomes in a cell can divide without a subsequent division of the cell itself, so that after such a division a cell will have twice the normal number of chromosomes. By producing tetraploid cells in the growing point of a young plant, one can occasionally obtain entire plants which have twice the normal number of chromosomes.

The tetraploid *Forsythia*, developed in this manner, has thicker leaves, larger and darker flowers, and is more erect in growth habit than the original species, *F. intermedia spectabilis*. This plant, which was given the cultivar name 'Arnold Giant,' was awarded the Lindley Medal by the Royal Horticultural Society in 1952, but has not proved to be very popular in this country.

In 1944 Professor Karl Sax crossed *Forsythia* 'Arnold Giant' with nearby diploids, including *F. ovata* and *F. intermedia spectabilis* in order to obtain triploids. Several progeny were obtained from this cross and two were selected as superior types. One of these, under the number 6445-6, was named in honor of Mrs. Beatrix Farrand. It has extremely large flowers which tend to be somewhat pendulous and are a lighter yellow than those of 'Arnold Giant.' It is a very vigorous plant but has never become very popular due to the long, robust canes which it produces, giving the plant an ungraceful appearance.

The second selection (6445-13) differs from 'Arnold Giant' and 'Beatrix Farrand' in several respects, and is here described as a new cultivar, *Forsythia* 'Karl Sax,' in honor of Professor Karl Sax who was responsible for originating the plant.

Forsythia 'Karl Sax' is a moderately compact shrub, 2-3 meters tall. The branches tend to be somewhat robust, but they are not so rigidly erect as those of 'Arnold Giant' or 'Beatrix Farrand,' giving this shrub a more graceful habit.



The plant is short-styled and flowers profusely, with large flowers up to 4.5 cm. across. The flowers are deep yellow, darker and more golden than those of 'Beatrix Farrand,' but still brilliant. The fruit is 1-1.5 cm. broad and up to 2.5 cm. long, very similar to the fruit of 'Arnold Giant.' The opposite leaves are ovate, 7-10 cm. long, 3.5-4.5 cm. broad (occasionally up to 12 cm. long, 6 cm. broad in shaded leaves). The leaves are strongly toothed along the margin and are a dull, dark green above, lighter beneath. As in all polyploid forsythias, the leaves are noticeably thickened and somewhat rigid.

Probably one of the more desirable features of this new shrub is its extreme hardiness. Reports from nurserymen in the Midwest, where the past winter was unusually severe, indicate that *Forsythia* 'Karl Sax' came through better than any of the other forsythias. It is said to be particularly good where late spring frosts destroy the bloom of many forsythias.

One disadvantage of the polyploid forsythias is that they tend to be rather difficult to propagate by means of cuttings. However, Mr. H. L. Greenwood of Interstate Nurseries has written that their results in propagating *Forsythia* 'Karl Sax' have shown that softwood cuttings in cold frames do very well, although hardwood cuttings in the open field do poorly.

Genetically, the origin of this new *Forsythia* is still something of a mystery. In contrast to the other progeny of 'Arnold Giant,' this plant has proved to be quite fertile. Cytological examination has revealed that *Forsythia* 'Karl Sax' has the same chromosome number as 'Arnold Giant,' and is therefore, a tetraploid—not a triploid as is the case with 'Beatrix Farrand.' Since forsythias are normally self-sterile, it was surprising to learn that a lone tetraploid plant could give rise to tetraploid progeny, with only diploid plants available to serve as the pollen parent. It could have originated from the fertilization by an unreduced pollen grain from a diploid plant, but unreduced pollen grains are very rare in *Forsythia*. The other possible explanation is that this plant originated from a self-pollination of 'Arnold Giant.' In a self-sterile group one would not expect this, unless tetraploidy has induced some degree of self-sterility. This is known to have occurred in other self-sterile plant groups and it is certainly possible that this is what has occurred in *Forsythia*.

Preliminary tests have been conducted to determine the degree of self-compatibility in both 'Arnold Giant' and 'Karl Sax,' by placing bags over some of the branches to prevent cross-pollination. So many bags and labels were lost, however, that the results were inconclusive. Possibly later experiments can be more carefully guarded and will give more conclusive evidence on the breeding behavior of polyploid forsythias and on the origin of this interesting plant.

JOAB L. THOMAS



PLATE XII

(Above) Close-up of flowers of *Forsythia* 'Karl Sax.' (Below) *Forsythia* 'Karl Sax' as it is growing in the Arnold Arboretum.

Ornamental Fruits, 1960

Autumn color in the Arnold Arboretum is good this year. Hurricane "Donna" did not dry out much of the foliage here, and of course the Arboretum is sufficiently inland so that salt water, picked up by the winds, did not have any serious effect on the foliage as it did to a great extent along the shore of southern New England.

Unfortunately, many of the viburnums have few if any fruits, probably due to poor weather conditions when the flowers were open last spring. The same is true of the apple crop in this area — the McIntosh which is the favorite variety and widely grown, has produced extremely few apples. Some of the later-blooming varieties such as the Baldwin, have fared better. Incidentally, Baldwin is one of the few apple varieties which can produce a commercial crop without cross pollination; McIntosh practically requires it.

Cornus kousa and its variety have fruited very well indeed, as did *Cornus florida*. Winterberry (*Ilex verticillata*) is literally loaded with fruit, and many of the early flowering oriental crab apples are also well laden with fruits. On the other hand, the Lowbush Blueberry produced very few fruits in this area.

This can all be traced directly to weather conditions during the flowering period. A look at the "Local Climatological Data" received from the U.S. Weather Bureau shows that there was some rain on every day but four from May 8-24, and the rain was well distributed over each twenty-four-hour period, showing that the weather was damp and moist much of the time. It was also cold a greater part of the time — very poor weather for fertilization to take place.

Plants such as the early flowering crab apples, which are fruiting well, flowered before the cold rainy weather set in, or after it was over (*Cornus kousa* and its variety *chinensis*, *Ilex verticillata* all of which flowered in June when the weather was warmer and sunny). Those plants not fruiting well (McIntosh apples, many of the viburnums, Lowbush Blueberry, etc.) flowered when weather conditions were poor for pollination.

DONALD WYMAN

ARNOLDIA



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THE HILLCREST GARDENS, WESTON, MASSACHUSETTS

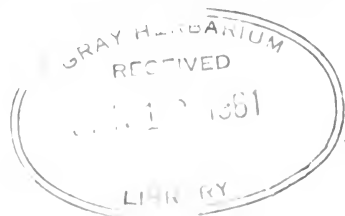
FOR thirty-three years, from 1911 until 1944, Miss Marian Roby Case conducted a practical school of agriculture and gardening on her estate in Weston for children of Weston and the surrounding towns. The activities of the school, with the exception of the last two years, as well as the development of the farm and bits of Miss Case's own philosophy, are recorded in the annual "green books,"¹ which thus comprise a history of the estate and a record of the land's use. The year 1960 marks the fiftieth anniversary of this farm, now known as the Case Estates of the Arnold Arboretum. The following brief history is intended as a tribute to Miss Case and a summary of a remarkable philanthropic enterprise.

Marian Roby Case (1864-1944) was the daughter of James Brown Case (1826-1907), originally of Providence, Rhode Island, and Laura Lucretia Williams Case (1833-1918), the daughter of Moses Williams of Roxbury, Massachusetts. Prior to 1909 the Case family spent the winters in their home at 468 Beacon Street, Boston, and the summers in Weston. James Case purchased the General Darby property in the geographic center of town, dismantled the existing frame house and built the well-known Case house. It was the third dwelling to stand on the property and today houses the kindergarten and offices of the Weston School system.

There were four children in the Case family, all girls: Louisa (1862-1946), Caroline (1856-1919), Mabel (1858-1883), and Marian. Mabel died in early maturity and Caroline was the only one to marry.

Following the death of her parents, Louisa inherited the Case house on Wellesley Street and lived there until 1942. Her sister Marian Roby inherited a small tract of land lying between Wellesley and Ash Streets and east of Newton Street. On this land, to become the original section of Hillcrest Gardens, was located

¹Bibliographic Data on the Hillcrest Gardens Books, 1911-1941. *Jour. Arnold Arb.* 41: 318-320. 1960.



the Dorgan House, occupied by a gardener and dismantled in 1935. In the spring of 1909 twenty-three acres of land adjacent to the Case family property came on the market. Miss Case bought this land, including the Barker House, later known as the Williams House or the Sentinels (101 Wellesley Street) on Memorial Day, of that year. A red barn next to the house was torn down and the first rose garden was established on the filled-in cellar. These properties surrounded a small amount of land on which was the Cooper House (102 Wellesley Street). In 1910 Miss Case bought this property, renamed it Appletree Cottage for a famous set of apple trees surrounding it, and made the house her home.

The entire property was known as Hillcrest Farm, although the origin of the name cannot be determined from available records. In the first Hillcrest Farm booklet, published by Miss Case in 1911, she wrote: "Hillcrest is an experimental farm where we wish to work up the scientific side of agriculture as well as to employ boys of the town through their long summer vacation." The land was called Hillcrest Farms until the eleventh summer (1920), when the name was changed to Hillcrest Gardens. Miss Case attributed the change of name to the influence of Charles Sargent and John Jack of the Arnold Arboretum.

It is interesting to note that Miss Case's interest in horticulture and the development of Hillcrest Gardens never exceeded her desire to contribute to the boys who worked on the land, and, in fact, all children interested in nature.

In horticultural activities Miss Case was extremely active and used the developing gardens to this end. In the winters she frequently travelled the Mediterranean, partly for her health and partly for the horticultural interest of the area. She established many contacts in Italy, Sicily, Greece and Egypt, where she not only collected seeds herself but she had seeds of potentially useful ornamentals sent to Weston for trial. In 1924 Miss Case became a fellow of the Royal Horticultural Society and received seeds from the Kew Gardens and similar sources. She was a life member of the Botanical Society of South Africa and received many packets of seeds from that area. Hillcrest Gardens became the first spot in New England to try many South African herbaceous plants as garden annuals. In addition, Mr. Chittenden, director of the Royal Horticultural Society gardens at Wisley, was a personal friend and sent her some of the best plants grown at these gardens.

In New England her influence in horticulture extended to many areas. One of her most important roles came about as a result of her active participation in the Massachusetts Horticultural Society. Miss Case joined the Society with a life membership in 1911. In 1921 she was elected a trustee and so served for over a decade. She also served actively as chairman of the Childrens Gardens Committee. She established the Hillcrest Medals for children's gardens and these were awarded from 1918 to 1933. In 1927, thirty-seven bronze medals were awarded to children who prepared outstanding gardens or exhibits. Other special awards or functions of the Massachusetts Horticultural Society bore the Hillcrest name,

such as a silver cup for the best collection of iris and the Hillerest Gardens summer lectures sponsored by Miss Case. In 1926 Professor Sargent, on behalf of the Massachusetts Horticultural Society, awarded a gold medal to Miss Case with the citation, "Since 1910, Miss Case has financed and energetically conducted a vocational gardening school for boys between the ages of nine and eighteen. Equipped with this knowledge in the art and practice of raising first-class flowers, fruits and vegetables and taught to appreciate the book of Nature, these boys go forth worthy, capable and practical. Miss Case's deep love of Nature has found expression in this most useful work and in her the art of garden craft has a staunch and generous friend." Miss Case was very proud of the award and its citation and it is only surprising that she did not mention the Centennial Gold Medal of the Massachusetts Horticultural Society awarded to her in 1930 for her educational work within the Society.

Horticulture Magazine, now a publication of the Massachusetts Horticultural Society, began publication in 1920 as a weekly, privately published journal with Edward Farrington as its editor. It came under the sponsorship of the Massachusetts Horticultural Society in August 1923, and continued as a semi-monthly periodical. Apparently this magazine proved a financial burden to the Society and was the subject of much discussion at the meetings of the trustees. Professor Sargent and Miss Case were its strongest defenders, firmly anticipating its present success. Quietly, but not without official notice, Miss Case contributed generous financial support to meet its deficits. Miss Case regularly contributed articles and short horticultural observations, thirty alone in 1920, and sent many copies to her friends and correspondents abroad to make the publication more widely known internationally.

Miss Case was in close association with the Arnold Arboretum and the Botanic Gardens of Harvard University. She received many plants from the Arboretum for trial in Weston and today some of the outstanding specimens of plants introduced to American Horticulture by E. H. Wilson of the Arboretum staff are growing on the Case Estates. Miss Case was appointed a member of the Overseers Committee to visit the Harvard Botanic Garden in 1922, and in 1924 she sponsored a private viewing of these gardens. Tea was served and over 4000 invitations were sent, of which 3000 were accepted. Elsewhere in the Boston area the Benevolent Fruit and Flower Mission received her support with regular contributions of cut flowers and plants.

Miss Case was an active member of the Woman's National Farm and Garden Association and served in many of its offices, including that of president in 1927-28 when this national organization met at Hillerest.

In Weston her generosity found many avenues of expression. She was an active member of the First Parish Church, Unitarian, and many benefits were held at Hillerest Gardens for this parish. In the same manner she supported the Society for the Prevention of Cruelty to Children. Likewise the local school system re-

ceived her attention. She offered prizes for the best essays written on topics which she suggested. Prizes were offered from 1921 until 1932. In the latter year forty-two prizes were awarded (generally books of poetry) in grades seven through twelve. She was an active participant in the Weston and Wayland Grange and for at least one year (1929) was president of the Wayland Garden Club.

The school at Hillcrest Gardens received her constant attention. She personally selected the boys and watched their work and development, keeping in touch with them even after they had left Hillcrest. As one student wrote in 1913, "It seems to be a settled policy with Miss Case that when a boy has entered the work here and as long as he continues here that he is never out of her reach." Miss Case personally selected many of the leaders from among the boys, encouraged the development of others and disciplined those who needed it. During the school term she met with the boys in study periods to watch their work and regularly took a period each week to read to them from the works of challenging authors. No summer was complete unless Miss Case read to the boys Sill's "Opportunity," Longfellow's "Fiftieth Birthday of Agassiz," Lowell's "Vision of Sir Launfal" and Wordsworth's "Happy Warrior." Others of her favorite readings included Van Loon's "The Story of Mankind" and "The Americanization of Edward Bok."

Although there was no lack of applicants from whom Miss Case might select boys for her school, she reported on at least one occasion that her "chief trouble has been to find a man to take charge, who liking boys knew something about agriculture or a man wide in farm knowledge who would have patience with the boys." Three men of her choosing, Thomas Park, Jack Williams and Dennis Crowley, were largely responsible for the signal success of Hillcrest as a school for boys.

Each summer began with having pictures taken of the boys. These pictures hung on the wall of the clubhouse throughout the summer. One year Miss Case wrote, "One boy coming into my studio to have his picture taken asked me if I thought he had grown since last summer. I was able to tell him I thought he had grown in everything that makes a boy worth while."

Today many of these same graduates a number of whom still live in Weston, speak with pride and pleasure of the influence of Miss Case and Hillcrest on their youthful years.

Since Hillcrest was a truck farm, it operated in competition with other farmers in the area. But the income from the produce grown at Hillcrest never equalled the cost of the school and Miss Case's many horticultural philanthropies. The wages paid to the boys were low and perhaps for this reason Miss Case feared criticism. In several of the "green books" she questioned the appreciation of the townspeople in Weston for her efforts. In 1917 she wrote, "Sometimes I wonder if the good people of Weston who buy these vegetables at low market prices

delivered to their doors, ever stop to wonder who pays for raising them and the berries, plums, apples and peaches which three times a week are sent around town." There follows a bit of homely philosophy in which she musingly writes of herself in the third person, "She can have boys trained to teach other boys to grow food for the people. Is she willing to pay the cost? She needs the interest and appreciation of her neighbors." This appreciation came shortly after the publication of the booklet in the form of a petition signed by sixty-four of her neighbors. It read, "The accompanying petition will, I hope, assure you how greatly Weston people appreciate Hillcrest Farm. We the undersigned desire to express our appreciation of the service rendered to the townspeople during the past by Hillcrest Farm and to request that its products will continue to be distributed in Weston." The boys, however, needed no encouragement to express their appreciation. They wanted to work successive summers and one was finally told, after twelve years, that he should seek employment elsewhere for his own benefit. The following year, however, he returned to be in charge of the boys. Another reported, "The selling of the produce brings the boys in contact with the customers and is very instructive to them. It is one branch of the farm work which gives the boys a good business training and also helps them to develop patience and tact as they meet so many different kinds of customers."

The Land and its Buildings

The land comprising the Hillcrest Gardens was purchased by Miss Case in five pieces, supplementing her original inheritance of land. The first purchase in 1909 was twenty-three acres and included the Williams house. About 1910 Appletree Cottage was purchased and in 1912 an additional forty-six acres known as the Milton lot was added. This included the Milton house and garage and an old gray barn, later dismantled. In 1916-17 the five acres between Wellesley Street and Ash Street known as Crosslots were purchased from the Hastings family and brought under cultivation. Apparently the Hastings House at 131 Wellesley Street was included in this purchase. The final purchase, another five acres between 127 and 163 Wellesley Street, contained a pine woods and a large swamp and was purchased to screen Hillcrest from the real estate development along Chestnut Street.

The first summer at Hillcrest was spent clearing the rather poor farm lands of rock and pruning the neglected apple and peach trees. Large boulders were hauled to one side and used to make two outstanding examples of the wall builders' art. The large, freestanding wall, ten feet high, six feet thick and 200 feet long is the longest of its kind known in New England. The inspiration for such a wall came when Miss Case, on a visit to Tokyo was deeply impressed with a vista "where pines towered over grey stone walls," as they were to do at Hillcrest.

The clubhouse, now 133 Wellesley Street, was under construction as a private residence in Crosslots when purchased by Miss Case in 1914 and moved to its

present location, formerly the site of a "yellow barn." A bell cupulo was added and in 1927 the large veranda was constructed. The second floor of the clubhouse was partitioned to accommodate a toilet and a darkroom for the boys' use. The first floor was used as a display and sales area for produce and the second floor, with its dias, served as a study hall and classroom. During the many benefit open houses held at Hillcrest, the veranda was used for serving lunches and teas, and as a platform for instrumental or choral groups.

Another item constructed from native stone was the large incinerator built in 1924 to the rear of 137 Wellesley Street. Brush and debris from the farm was burned in this massive structure to secure ashes for fertilizer.

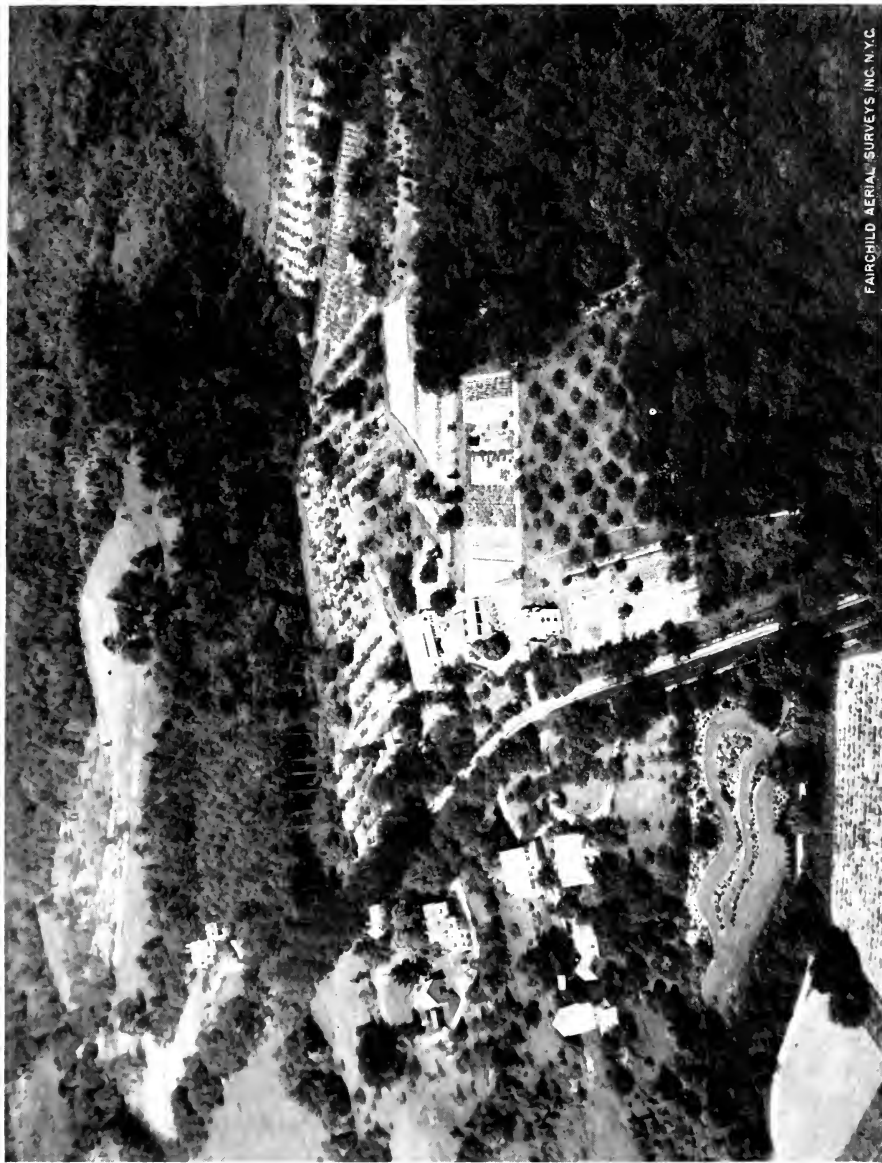
The large yellow barn at 135 Wellesley Street was started on the 18th of April, 1927, and was dedicated in the late summer with a reception for the National Farm and Garden Association and later with the Labor Day exercises. The barn, designed by Samuel W. Mead of Weston, and constructed by William Kellar, was an outstanding structure for its time. The cold rooms for storage of fruits and vegetables and the special facilities for storage of manure were advances in design.

Throughout her travels, Miss Case accumulated figures or objects of art for inclusion in the garden. A few of these remain, such as the Italian bird tiles built into the cellar window of an old barn and now seen next to 133 Wellesley Street. Some were commissioned by Miss Case, such as the painting representing Demeter and Triptolemus by Alberti Angeli of Florence, Italy, which was hung on the wall of the clubhouse. A special stone settee with a wrought iron back bearing a design of two Hillcrest boys in uniform and an oval spray of roses and pansies, as well as an iron chain of 250 links can still be seen next to 101 Wellesley Street near the ground cover display.

Two concrete benches, copies of an original built by Russell G. Crook of Lincoln in 1921, feature Puck playing with a goat and some Byzantine birds. One of these benches is in the perennial garden and the other is between the yews near 101 Wellesley Street.

The Farm and the Gardens

From the beginning, Miss Case maintained high standards based on her broad knowledge of gardens in many parts of the world. The Hillcrest farm and gardens, she felt, must be outstanding in every way and she would tolerate no lesser aim. The original land purchase consisted of neglected agricultural land. Subsequent purchases, increasing the land area to 100 acres, added not only more agricultural land, but also a forest and a swamp. By 1917 approximately twenty-five acres were under cultivation and in 1930 there were forty acres of crops and gardens. Every year, as a result of her many contacts and memberships, Miss Case received new seeds or plants for trial. These were carefully tended and regular reports were sent to official sources when these were required. The first introductions mentioned were three rows of espaliered fruit trees im-



FAIRCHILD AERIAL SURVEYS, INC. N.Y.C.

PLATE XIII

Aerial photograph of the Hillcrest Gardens, June 30, 1930. The barn and the clubhouse are in the center of the picture. Behind them the many beds of flowers, fruits and vegetables. The vineyard is in the upper right hand corner and the peony garden in the lower left. *Photo by Fairchild Aerial Surveys, Inc.*

ported from England in 1910 and grown on trellises near the big stone wall. An interest in native herbaceous plants culminated in the development of a woods garden and special attention was given to the selection of seed from the best of the New England wild flowers or berried plants such as blueberries and blackberries. These selections were distributed in exchange for seeds from other sources.

Much of the produce was custom grown. When townspeople expressed interest in a particular fruit or vegetable or in a certain variety, Miss Case often obtained these seeds or plants and the produce was soon supplied. Many grape varieties were reserved for special customers. The old apple and peach trees on the original land formed the first produce offered for sale, but expansion was rapid. In 1914, 800 grape plants were purchased and the famous vineyard of forty varieties became productive in 1916. Wild blueberries were picked from the land and the best plants were dug and brought under cultivation. In the early years Miss Case offered a prize to the boy who found the first plant producing blueberries the size of a dime. Such a plant was not found at Hillcrest, so the prize was offered to all members of the Massachusetts Horticultural Society and in 1931 was finally awarded to Mr. Albert C. Burrage. Anticipating a market among the people of Italian descent, Miss Case introduced plants of European dandelions. In 1918, partly due to the wartime need to produce foodstuffs, Hillcrest had sixty varieties of vegetables under cultivation. Notwithstanding this effort to produce vegetables in quantity, the school proudly maintained its high standards of quality, as is attested by the many awards received for its fruits and vegetables. Ninety-seven awards and votes of thanks were received from the Massachusetts Horticultural Society in 1920 and fifty-two awards were received at the Weston grape fair in 1922.

Hillcrest Gardens used the latest methods of cultivation and followed closely the agricultural developments of the day. Both surface and overhead irrigation was used, the Skinner overhead system being tried there for the first time in Massachusetts. The animals of the farm supplied manure, but chemical fertilizers and sprays were also employed generously. The original horses and plows gave way to the first Fordson tractor in the Weston area in 1920 and that to the Rototiller and Farmall tractors in 1933.

Originally the produce was sold to residents of Weston but deliveries to Waltham and Boston proved even more profitable. A bicycle express provided delivery service in Weston in 1911 while the Hillcrest team and wagon carried produce to greater distances. A Ford truck replaced the horse and wagon in 1913. By the year 1918, produce was sold at the farm, though deliveries were still made twice a week to Waltham and Boston and three times a week in Weston. However, in 1920 Miss Case noted that it was no longer necessary to make commercial deliveries, for merchants were willing to come to the farm for the fruits and vegetables. In 1921 a Hillcrest teahouse and market was started in a yellow barn

near the village smithy in Weston center. A woman was hired to run the tea-house with the help of the boys from Hillcrest, who also operated the stand. The tea-house and market operated until 1933. After that all produce for Weston was sold directly to a local market.

To Mr. John Wister, who came to Hillcrest as a lecturer to the boys, and to Mr. Arthur Williams, belong the credit for the horticultural developments at Hillcrest Gardens. After Mr. Wister's first visit he sent to Miss Case a number of *Iris versicolor* varieties for the swampy areas at Hillcrest. In 1923 Mr. Wister spent most of the summer planning the roads and paths, the special woods gardens and a test garden for the American Iris Society. He also made a catalogue of all the ornamental trees and shrubs under cultivation and suggested that a peony garden be established. Thus, in 1924 between 500 and 600 iris cultivars were planted in approved form next to Appletree Cottage and in 1925 an old potato patch was replanted to peonies. The woods garden was established the following year and the spring garden in 1931. By 1934 the iris garden, having outgrown the existing beds, was replanted with over 700 cultivars. Mr. Williams and his family came to Hillcrest in 1922 and his deft touch with plants, together with his constant search for better cultural methods produced the outstanding horticultural specimens for which Hillcrest became known.

Hillcrest Gardens flourished in the 1930's, but on the afternoon and early evening of September 21, 1938, a disastrous hurricane swept through the area. Much damage was done to the fine specimen trees on the grounds, many of which stood alone without the protection of mass plantings. In the orchards seventy-four large apple trees and twenty-nine other fruit trees were destroyed. The woodlands behind the gardens were severely hit and the Sentinels, those famous pines standing guard behind the high stone wall, were toppled. In the forest 2500 pines, some exceeding three feet but all averaging at least eighteen inches in diameter were felled, as were 500 oaks and 250 maples. Many trees and shrubs in the garden were hauled erect and staked into position but many others were lost. During the winter months the woods were cleared and logs salvaged from the tangle which nature had created. The government established a saw mill in Wayland and by team, truck and tractors, logs from Hillcrest were hauled to the mill. The resulting 130,000 board feet gave ample evidence of the hurricane's destruction.

The Boys at Hillcrest

During the first summer at Hillcrest in 1910, six boys were hired to help on the farm. This number was increased to eight the second summer and to eighteen in 1912. Twenty was the maximum number enrolled in the school. Originally, Miss Case planned to divide the boys into two groups according to age, a younger group which would work mornings only and an older group to work all day. Work began at Hillcrest in the middle of June, after the close of the public schools and at a time when the strawberry crop was ready to be picked. During

the early years the boys were all photographed individually and, foreshadowing the group health plan later to cover all Hillcrest employees; all received a physical examination from Dr. Wood, a family physician of Weston. In 1911 each boy was supplied with two khaki "uniforms," consisting of a Norfolk jacket with the Hillcrest emblem on the left sleeve, the Hillcrest hat and a tie. By 1937 the uniform had changed to two green sweaters, one for dress, each with a gold felt shield bearing the name "Hillcrest" in green letters, and a green tie.

At the first assembly of the season Miss Case presented each boy with a diary in which to make daily entries of the weather and of his activities. Pencils and notebooks were also supplied for his drawings and observation papers and the notes to be taken for the required Labor Day paper. Then Miss Case outlined what was expected of the boys in diligent work habits on the farm and in their studies. For the first several years the boys worked from eight in the morning until noon and from one to four-thirty in the afternoon with two half-hour recesses and on Saturdays from eight until noon. A one-hour lecture was given on alternate Mondays and the boys prepared a program of entertainment for themselves on the intervening weeks. On Wednesdays there was a study hour of drawing or reading and on Fridays Miss Case read or heard the boys read or speak. Eventually the educational aspects became more significant under the guidance of the various men in charge of the school. For the greater part of its existence, the school consisted of one hour a day for drawing, reading or study, with a program featuring a guest lecturer one full afternoon each week and an earned outing on Saturday afternoons. The younger boys drew leaves, the older ones flowers and whole plants. At one time the younger boys studied agriculture and farming, the middle group studied botany from Gray's "How Plants Grow" and the older boys studied from Bailey's "Nursery Book." Bird identification was an important part of their education and one boy made a list of sixty-five different birds observed at Hillcrest in the summer of 1918. Elocution lessons were offered at times under the direction of a Mr. Gifford of the Emerson College of Oratory, who gave the boys regular "vocal calisthenics." Observation papers were required and the best were published in the green books.

Discipline was strict, enforced by the teachers and by Miss Case herself. A system of demerits was imposed for infraction of rules and the boys with most demerits were threatened with being dismissed or with being ineligible for employment the following year, yet no boy was ever guilty of sufficient infractions for either of these punishments. On the other hand, good work was rewarded with Miss Case's praise and prizes of photographs, books or money.

The chores for the boys were varied. The clubhouse must be kept clean; the vegetables and fruits must be picked and washed for market and peddled from door to door; the donkey needed care; the barn must be swept and the vegetable and flower garden must be weeded.

The outings during the year were eagerly anticipated, reported upon and long

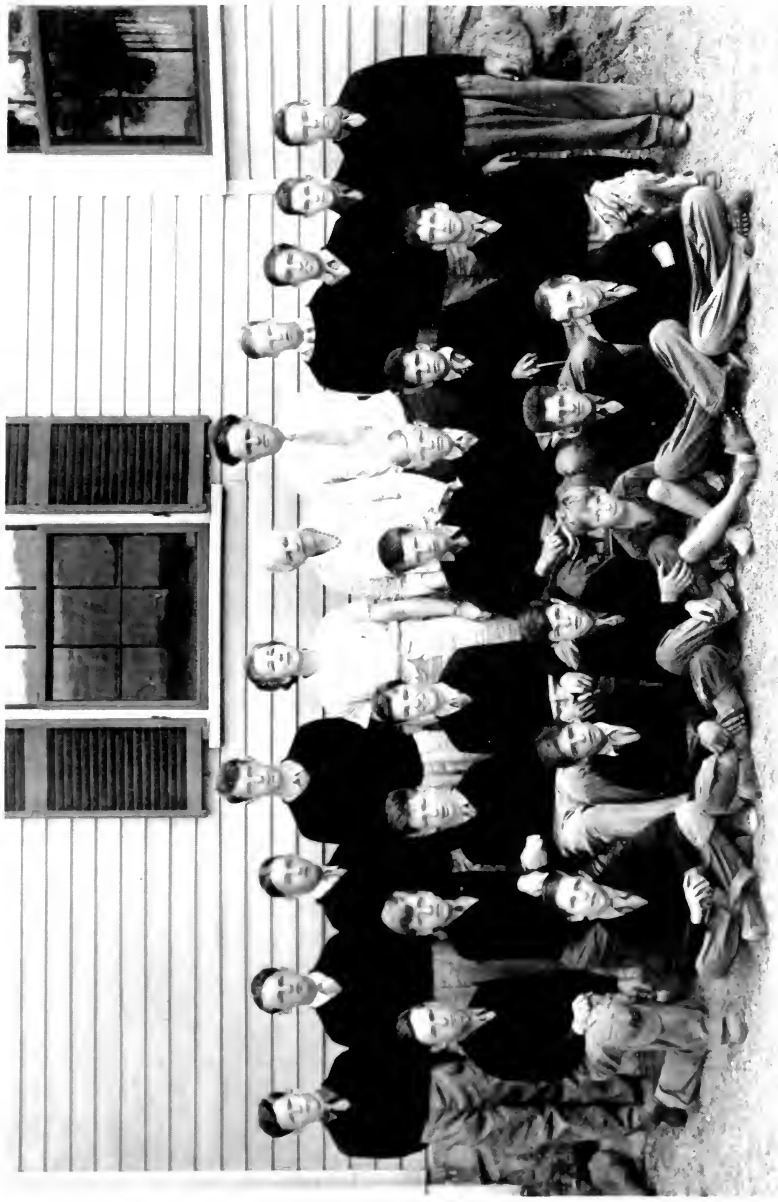


PLATE XIV

The Hillcrest Boys and Staff, July 30, 1937. Front row, left to right: Thomas Williams, Basil Aliseo, Douglas Schofield, Hugh Chandler, Frank Tomao, George Olsen.
Middle row, left to right: William Caney, John Nomer, Robert Perkins, Peter Mulrey, Maurice Subelia, Elliot Leaf, James Gregoriens, Raymond Benotti.
Back row, left to right: William Chandler, Donald MacDonald, Emanuel Benotti, James Pender (in charge of boys), Mrs. Sterling Winslow (house keeper), Miss Marian Roby Case, Mr. Thomas Parks (superintendent), Edward Mattson, Gaetano Aliseo, Daniel Evans, Arthur Turcotte.

remembered. When the first motor car was bought, a ride to Concord, Salem, Sharon (Moose Hill Sanctuary), the Navy Yard, Franklin Park, Waltham Field Station, Benson Animal Farm, East Boston Airport, Walden Pond, the Proctor estate, or even a trip to Boston to see Buffalo Bill, rewarded the boys, yet combined education with pleasure.

An annual all-day picnic was also held for all of the boys. The favorite spot was Paragon Park at Nantasket, but one trip to Hampton Beach was timed so that the boys could see an eclipse of the sun.

Extra activities found their way into the program as well. Eager to march in the parade celebrating Weston's 250th anniversary, the boys formed a marching unit complete with drums made of cheese boxes with paper-and-curtain heads. Later Miss Case bought six snare drums, a base drum, eight fifes and a pair of cymbals for the unit, so impressed was she with their efforts. During the period of the First World War, patriotism became the motivating force at Hillcrest. The boys collected money from door to door to have a plaque placed in front of the library during an appropriate ceremony. The need for growing and conserving food was impressed on the farm boys, who labored long and hard to grow good crops. One kitchen on the farm was devoted to canning. Jars were solicited and finally purchased by the carload and during 1917 over 900 jars of fruits and vegetables were preserved to meet an anticipated food shortage in the winter. Since vegetable seeds were difficult to obtain, the Hillcrest boys saved seed from their crops in 1918 for the following season and made available the surplus to others.

For these and similar efforts the boys received wages. In 1911 Miss Case thought that one dollar a week for the younger boys and twenty dollars a month for the boys working full days was appropriate. By 1925 the standard was ten dollars a month, increasing five dollars each month for each year's service to a maximum of twenty-five dollars. In addition, the boys received produce from the farm. Few there were who went home empty-handed. Only during the depression year of 1933 did Miss Case find it difficult to finance the farm. This was reflected by more stringent rules of behavior and a decrease in the maximum wage to twenty dollars. While most of the boys were from Weston in the early years of the school, boys were accepted from adjacent towns and a few came even greater distances. Miss Case insisted that applications come from the boys and not from their parents. Most boys commuted to the farm every day but a few boarded at Hillcrest. For this they were charged \$8.50 a week while earning \$10.00 a month. Obviously there were parents who recognized the value of this unique training ground and were anxious to give this opportunity to their sons. Yet rarely did the farm meet its expenses. Hillcrest and its school proved to be one of Miss Case's many charities.

Perhaps one of the best known activities of Hillcrest Gardens was the summer lectures, generally held on Wednesday afternoons. The clubhouse was swept and an attractive display of flowers, fruits and vegetables were offered for sale on the

first floor. The local papers and the magazine *Horticulture* announced the speakers who were outstanding men in science or in public life. Special groups from settlement houses, the Perkins Institute, the garden clubs or churches and schools were often invited. These lectures, six each summer, were offered from 1911, when the speakers were William F. Denton (butterflies), F. W. Barret (bees), B. F. McDaniel (soils), Wilfrid Wheeler (apples), W. G. Kendall (grapes) and John T. Nichols (birds) until 1941 when the speakers were the Reverend Miles Hanson, Jr. (English composition), E. D. Merrill (Romance of Plant Names), Harold S. Tiffany (Propagation of plants), the Reverend Waitsill H. Sharp (Meaning of German occupation in Europe), Charles F. Whitney (Lore of North American Indians), Lawrence B. Fletcher (public reservations), A. B. Stout (The Plant Breeders Work), Edmund Mezitt (Edible and ornamental berries) and Ernest Little (Use of chemistry on the farm). During these thirty years, 115 men, including college presidents, outstanding scientists and former Hillcrest boys, appeared on the lecture programs. Remunerations up to \$100 plus expenses made the trip worthwhile for the speakers and indicate Miss Case's generosity and interest. As she expressed it, "In order that we may keep in touch with the best work that is being done in agriculture and also interest the boys in nature, we have had lectures through the summer by specialists."

A favorite speaker, Dr. A. B. Stout of the New York Botanical Garden appeared on the program fifteen times. Close runners-up in the popularity contest were John Wister (Arthur Hoyt Scott Horticultural Foundation) and E. H. Wilson (Arnold Arboretum). Such outstanding scientists as Glover Allen, Charles Brues, M. L. Fernald, Richard Fisher, Marshall Howe, John Jack, B. Y. Morrison, Robert Cushman Murphy, Harris Reynolds, Harold St. John, Clark Thayer and C. A. Weatherby joined propagators and poets, ministers and English teachers on the Hillcrest lecture platform.

The summers ended on Labor Day with annual exercises. To these the parents and neighbors were invited. The boys marched up the stairs to the second floor of the clubhouse led by the oldest or the most outstanding boys carrying the American flag and the Hillcrest flag and singing America. The American flag was presented to Miss Case who held it while the audience joined in the singing. This was followed by the pledge of allegiance. The Hillcrest school song was sung and the program introduced by Miss Case. She announced the names of the judges who would decide on the best papers to be read by the boys and the prizes to be awarded for work during the year. Each boy then read his paper and when all were done Miss Case presented first the Hillcrest pin to those boys completing with distinction their first year at Hillcrest and then the Semper Paratus pin bearing the motto of the school, to the boys of three or more summers. Then the prizes were awarded for the best papers read that day and finally the prizes for work during the year: for the best work in the field, in the study hour, the best report of the lectures, the best drawings, observation papers, the

wild flower collection and the bird list. During one year fifteen of the eighteen boys on the farm received prizes. In such a manner Miss Case won the hearts of the boys.

Following the exercises the boys returned home. A few worked on the farm on Saturdays into the fall and for several winters Miss Case had Saturday or vacation work or classes for the boys who wished to attend. Classes in woodworking and weaving were offered at one time and during the First World War, a class in first aid.

During the winter Miss Case usually travelled to the Mediterranean. She found time, however, to edit the reports of the boys and to publish the annual green book, to order seeds and to plan the gardens, to correspond with former Hillcrest boys and to select the ones for the coming summer.

The End and a New Beginning

During 1939, the thirtieth anniversary year of Hillcrest, Miss Case was seriously ill. The summer followed its usual course with twenty boys employed on the farm, fourteen of them having worked previous years. The Labor Day exercises were special, however, for all former Hillcrest boys were invited to return for a reunion or to send greetings. The group gathered at noon for a luncheon, the birthday cake, and special speakers. Dr. E. D. Merrill spoke, as did Thomas Dooley. A roll call of former Hillcrest boys, with responses, was followed by a talk by John Wister on the future of Hillcrest.

Mr. Wister considered the possibilities of continuing Hillcrest to meet the goals which Miss Case had established in 1909 and maintained to that day. He dismissed the suggestion that the land become a park for the town of Weston or even a part of the Boston Metropolitan Park System. Instead, he expressed the hope that some organization such as the Massachusetts Horticultural Society, Harvard College, Wellesley College, or perhaps the state university at Amherst might be able to continue to do the "research work in various fields connected with flower gardens." Mr. Wister, recognizing the improbability of continuing the school, pointed out that "We cannot lay down exact programs for the future. All Miss Case can do is to express her wish that her present work should continue. She and all of us must trust to the intelligence and good faith of the person and organizations who may take over the work here. If they follow the spirit of the founder, there will be many years of usefulness ahead for these gardens started in 1909 by Miss Marian Roby Case." Mr. Wister's talk is published in the green book of 1939.

Hillcrest Gardens and School operated through 1942. On July 4, 1944, Marian Case died. Having determined that the Massachusetts Horticultural Society did not feel capable of operating the estate, she bequeathed the property to Harvard University for the purpose of the Arnold Arboretum.

In this decision, her sister Louisa's influence is shown. Louisa Case was interested in maintaining the family property intact. In 1942 she gave to Harvard

University \$50,000 and some fifty-nine acres of the original Case property, including her residence in Weston, as a memorial to her father, James B. Case. Perhaps the family relationship to President Lowell influenced her in this direction. Perhaps, too, Marian Case felt inclined to follow her sister's lead since, having been on the Visiting Committee for the Arnold Arboretum, she knew something of its needs. In any case, both bequeathed their properties to Harvard University, with endowments to maintain the land.

The two pieces of property, nearly 200 acres, were accepted by Harvard University for the purposes of the Arnold Arboretum and were called the Case Estates of the Arnold Arboretum. Almost immediately Harvard University was approached to release a portion of the Case lands to the town of Weston for the purpose of new school construction. Miss Louisa Case, who outlived her sister Marian, was consulted and by agreement, to avoid eminent domain suit, Harvard sold to the town 43 acres, including the original Case mansion, a barn and extensive ranges of greenhouses. In 1957 the town again required land for a program of school construction, and this time, by an eminent domain suit, another 32.5 acres, mostly land bequeathed by Louisa Case, were lost to Arboretum purposes. The current use of the remaining 110 acres has been described in other issues of *Arnoldia* (16:9-16, 53-59, 1956; 18:41-44, 1958).

The land is used principally as nursery and testing areas for the new plant introductions of the Arnold Arboretum. The Case Estates, offering both room for the growth of such plants and more rigorous environmental conditions than those prevailing in Jamaica Plain, serve this purpose admirably.

Many acres, as well as smaller, casual plantings, are devoted to species of less ornamental value and are grown there permanently so that records of the species may be maintained for future taxonomic studies and for breeding programs. Many other acres of land have been devoted to long-range growth studies of trees. The wooded areas serve as natural zones of vegetation for use of classes. Special display plantings of ground cover plants, shrubs for perennial gardens and small street trees have been established. Large areas have been landscaped for the enjoyment of visitors.

The Case Estates remain open to the public, even as did Hillcrest Gardens, but there could be no Hillcrest School without the vibrant personality of a Miss Marian Case. A few high school students are employed each summer and college students, carrying on graduate research programs, continue Miss Case's goal of scientific leadership in the fields of agriculture and horticulture. Hillcrest Gardens established a standard of excellence in the years of its existence from 1910 through 1944 which we hope the Case Estates of the Arnold Arboretum may successfully maintain.

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HOW TO ESTABLISH AN ARBORETUM OR BOTANICAL GARDEN

NUMEROUS requests are received from time to time by the principal arbore-
tums and botanical gardens of the country for information concerning how
to start an arboretum. Such inquiries clearly indicate that the arboretum idea is
definitely being considered in widely separated parts of the country.

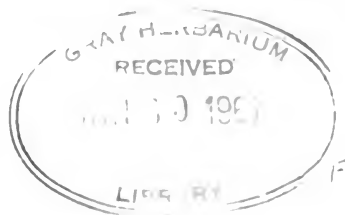
Professor Charles Sprague Sargent, first director of the Arnold Arboretum, long
ago realized the need for arboretums or maintained plant collections strategically
located in the various climatic zones of North America. Many new arboretums
were established during his lifetime. Such institutions are not competitive but
cooperative, and today there is a great need for more of them.

Botanical gardens on the other hand, are much older in this country and abroad.
It is obvious that there is an ever growing desire on the part of the public to have
named collections of plants, both native and exotic, for observation as well as for
study and enjoyment in places where they can best be seen and appreciated.

An arboretum should be carefully planned, well financed, and competently
administered. This article is devoted to some of the ways and means of establish-
ing and maintaining a satisfactory arboretum or botanical garden, many of the
suggestions here offered resulting from observing the successful development of
various institutions in widely separated parts of the country.

Definition:—An arboretum or botanical garden, as considered in the following
discussion, is an ample area set aside for the growing and effective display of all
the different kinds of worthy ornamental trees, shrubs, vines and other plants
which can be grown in a given area, their maintenance, proper labeling, and
study. It does not necessarily have to include all the plants that can be grown
in a region, nor does it necessarily have to include formal beds or borders of
annuals and perennials.

An arboretum differs from a botanical garden in that the emphasis is placed on



the growing of woody plants in the arboretum, whereas in the botanical garden emphasis is not placed on the growing of any particular kind of plant, but all types are grown. Large rock gardens and expensively operated rose gardens are frequently found in an arboretum or botanical garden but these are not essential parts of either.

Both differ from a park in that in the former a serious effort has been made to plant an extensive collection of many kinds of labeled plants not only for the purpose of display but also for critical examination and scientific study. Many parks are planted without the labeling of any plants and with the use of only a small number of locally available plant species. Some parks, it is true, contain a certain number of labeled plants, as for example, the Boston Public Garden; Roger Williams Park in Providence, Rhode Island; Fairmont Park in Philadelphia; and others throughout the country, but no consistent effort is made in most of them to label and keep labeled all the different kinds of plants grown. Both a park and an arboretum or botanical garden can be used for recreational purposes; but the arboretum or botanical garden go beyond the park in that they become highly educational to many of their visitors, demonstrating by means of labeled specimens what good species are available for planting in a given area or can be grown indoors.

The purpose of any arboretum, be it large or small, is to grow (and to keep labeled) the best of the ornamental woody plants which will thrive in a given locality. Many other objectives may be considered, such as the actual introduction of new plants into cultivation, actual exploration of remote regions, the growing of all types of woody plants hardy in the area, scientific investigations of various kinds including plant breeding and hybridization, the maintenance of a large herbarium and library, and laboratories of various types—these may be legitimate functions of an arboretum, depending on the funds available, and the qualifications of the members of its staff.

Botanical gardens may have even wider functions for their aims are wider, including as they do representatives of the whole plant kingdom from the tropics to the Arctic, grown outside or under glass. However, small communities should not be deterred by these weighty and often expensive objectives for they may be omitted altogether where funds for the maintenance of such gardens are unavailable. If an arboretum effectively demonstrates "the best" of the woody plants hardy in its area, this alone will make it a most valuable asset in the community it serves. The botanical garden need not cover a large area. It can be effective on a few acres with a few display greenhouses and display a representative collection of plants from all over the world.

Charles Sprague Sargent used to say that in order to start an arboretum it was necessary to have a thousand acres of land with at least a million dollars endowment: yet he started an arboretum with only 125 acres of land and \$100,000 endowment, and in the early years of the Arnold Arboretum he had only one

third of the income of that modest endowment for annual expenditure. There is still the need for large arboretums placed in different regions representing different climatic conditions where all the woody plants hardy in an area may be grown and which are well endowed for scientific investigations. This is undoubtedly what Professor Sargent had in mind, for the Arnold Arboretum was, and is, that kind of an institution. But times are changing. With the extensive garden club movement and increased tendency away from urban dwelling, more and more people are becoming interested in the growing of plants.

A new conception of an arboretum is coming into being. This is very well expressed in the plantings of the Arthur Hoyt Scott Horticultural Foundation at Swarthmore College, Swarthmore, Pennsylvania. It is adaptable to communities smaller than Boston, Philadelphia, Chicago, New York, St. Louis or Seattle. It is feasible where funds are lacking to finance expensive scientific investigations, but where there is a definite need to grow and demonstrate to the public "the best" plants hardy in a particular area. It is readily seen that this idea is a flexible one for the actual size of the arboretum or botanical garden may vary considerably. The idea is based on the theory that the same old varieties of plants may be superseded by new and better varieties. There are new varieties of cars, of refrigerating devices, of clothes and women's hats, and there are new varieties of plants as well. In the display gardens the "old" varieties are grown side by side with the "new," both often being available to the plant-buying public. But with the best varieties only being displayed, interest and variety in private and municipal planting will be greatly stimulated. With this conception in mind, the committee responsible for planning an arboretum or botanical garden should be so constituted as to give the best advice possible for its usefulness and adaptation to the community.

Functions of an Arboretum or Botanical Garden:—The purposes of establishing a display garden should be carefully considered before the plan is publicly broached. Some of the more important functions of such a garden might be:

- 1) To grow only a few of "the best" plants hardy in the area in order that home owners may become acquainted with their names, their ornamental characteristics and the proper methods of culture.
- 2) To show a complete selection of all that is considered the best from an ornamental standpoint among the woody plants (if an arboretum, or among the perennials, annuals, bulbs as well, if a botanical garden) that it is possible to be grown in the area.
- 3) To serve as a means of introducing new plants into the area, regardless of the source from which they may come.
- 4) To disseminate knowledge of plants to the public. This would include in-

clude information on culture, pruning, fertilizing and possibly a continual study under local conditions of just what varieties are "the best" including cooperation with schools, garden clubs and other organizations.

5) To test the hardiness of untried varieties.

6) To provide a laboratory for students of botany, horticulture and nature study.

7) To increase the productivity, economic importance and beauty of an area, by intelligent and interesting planting, and by introducing plants not grown there before.

8) To provide recreational stimulus to the public by means of walks, drives and beautiful displays, flower shows, etc., and to stimulate the pleasure of learning to know new plants which might be adapted to planting on private property.

Each of these functions should be studied individually with view to the best interests of the community. One of the first decisions to be made is whether the present park system satisfies the needs and desires of the people or whether its scope should be enlarged. Would the people be interested in a garden of woody plants only, or should an expensive display greenhouse for showing material in the winter be included? It is important to consider that an arboretum will always be less expensive to operate even if it includes a large variety of woody plants. On the other hand there are some communities where plant displays in large conservatories fill a real need in the winter. If this is the local situation and funds are available, the construction of display greenhouses filled with exotics must be considered.

If the community is small, the effective functions of the display garden will be largely display. If the community is large and funds are available, the functions may also include scientific investigations, especially if there is an institution of higher learning with which the arboretum may be connected. How far this may be extended will depend upon the community, its nearness to other large institutions, the availability of funds, and on leaders in the municipality.

Methods of Establishing an Arboretum or Botanical Garden:—The first arboretums and botanical gardens started as *private gardens* when individuals became interested in assembling collections of plants. John Bartram has the credit of establishing the first large collection of trees and shrubs in this country when he established his garden in 1728 at Kingsessing on the banks of the Schuylkill River near Philadelphia. Since that time, many private collections have been established at one time or another but many of them have passed out of existence after the death of the original owners. Today there are a few private arboretums worthy of the name. Among them would be the one started by Mr. H. H. Hunnewell in Wellesley, Massachusetts, in 1852, and devoted mainly to conifer-

fers; and that of Mr. Stanley Rowe of Cincinnati, Ohio, which now contains 3000 different kinds of woody plants.

A *local community* can have an arboretum as a result of cooperative effort by various local organizations. The Berkshire Garden Center at Stockbridge, Massachusetts, is just such an example. Funds are raised by local committees of enthusiasts to produce and maintain the type of arboretum wanted by a majority of the community—in this case showing some of the better ornamental plants that can be used in planting home grounds in the area.

The *government operated arboretum* is exemplified by the Dominion Arboretum adjacent to the Experimental Farm in Ottawa, Canada. This is 73 years old and contains about 3300 species and varieties of woody plants. It is owned and operated by the Canadian government. Our own National Arboretum at Washington, D.C. has been developed by government funds. Even national government budgets are frequently the playthings of legislators, and the future of an arboretum under government jurisdiction, though safer than a private arboretum, may still suffer much from a fluctuating annual budget.

An arboretum is sometimes part of the *park department* of the city. Such is the case with Highland Park and Durand-Eastman Park in Rochester, New York. The 484 acres constituting Durand-Eastman Park were originally a gift to the city, made by Dr. Henry S. Durand and George Eastman, but maintenance operations are carried out exclusively by the city Park Department, support being from city taxes. The advantages are obvious, for the park personnel is usually well equipped to maintain a collection of trees and shrubs. However, disadvantages are often evident. In many a park department the annual budget is subject to devious manipulations by politicians who may have no interest in park plantings and in all too many cities in this country the park department budget is the first to suffer reductions when city expenditures are cut.

The best method of establishing an arboretum or botanical garden is to provide a properly safeguarded *restricted endowment*, the income from which may be used only for specified purposes. The endowment should be sufficiently large to provide a reasonably ample annual income, for only in this way can permanence be assured. It will be necessary for the Planning Committee to estimate the annual expenses in advance. Many arboretums today are being operated wholly or in part by income from endowments. The endowment is not sufficient in some instances to cover all expenses and additional funds are necessary from the tax budget or from private sources in order to make it possible to attain the ends desired. When the income from an endowment must be augmented by annual popular subscriptions or by annual grants from the city park department, many difficulties arise. This is, in general, a most unsatisfactory way of operating an arboretum, for projects started one year when funds may be ample may have to be curtailed or even discontinued in another year. Success is most assured when an ample endowment is possible.

Usually a board of directors is formed to oversee the administration of funds in privately endowed institutions. Such is the case with the Morton Arboretum at Lisle, near Chicago, and with Longwood Gardens at Kennett Square, Pa. Frequently it has been found advisable to associate the arboretum (with its endowment) with an institution of higher learning. Such is the case with the Arnold Arboretum (Harvard University), Arthur Hoyt Scott Foundation (Swarthmore College), Morris Arboretum (University of Pennsylvania), each one of which has its own endowment. The Arboretum of the University of Washington (Seattle) is connected with the University with most of its maintenance funds coming from state appropriations. This source is supplemented by membership fees, and an attempt is now being made to secure a restricted endowment.

The association with a university is ideal for it tends to add permanence to the arboretum; sound and intelligent advice on arboretum problems are always available from university staff members, and the arboretum can serve as an ideal out-of-doors laboratory to augment classroom instruction. It is also true that the facilities offered by an arboretum would be used more as a result of this association than might otherwise be the case.

When budgetary items are reasonably fixed from year to year, the work of an arboretum can proceed unhindered by extraneous circumstances. The main object in establishing an arboretum is to make it permanent, to provide for a permanently dependable source of income, and thus insure its usefulness to be continuously available to the greatest number of people. There is no better way to insure this than to provide an ample endowment at the beginning.

Selection of the Site:—Before the plan can be made, a site must be decided upon, and the size of the area to be developed should be determined in relation to the sources and amount of available funds. The site could well be a local spot of beauty, of historical significance, or an existing part of a park if suitable. It will take intelligent discussion and sound advice to decide on the site, for the general plan and the functions of the arboretum also must be considered simultaneously. Arrangements should be made for alternatives in case the amount of money originally hoped for is not eventually forthcoming. A very important factor is accessibility.

Who is to Plan:—Almost any enthusiastic temporary group may be responsible for initiating public interest in the new arboretum, but a planning committee responsible for preparing definite plans associated with a campaign for raising funds should be carefully selected. The planning committee could well include an experienced landscape architect; a representative from the park department who would know about future park plans; a banker; a person well versed in the values of real estate; prominent nurserymen; and representatives from prominent civic organizations who would represent the desire of the people to have an arbo-

return and the will to work for one. A representative from an active arboretum, similar in size to the one contemplated, might well be called in for consultation. Large committees move more slowly than small ones, but somehow all interests should either be represented or heard prior to the time the actual site is decided upon and the plan is completed.

Ways of Initiating Interest and Action:—It is a simple matter to propose the idea of an arboretum in any community lacking one. Except in strictly urban areas, most home owners are interested in planting their properties so as to make them beautiful and enjoyable for as much of the year as possible. In strictly urban areas the people always desire to get into the open for rest and relaxation. Consequently, people in general are receptive to the idea and do not begin to “hedge” until the time comes for asking for increased taxes or donations for endowment or for annual support.

Many community organizations are well equipped to assist in a campaign for an arboretum. The garden club movement is fortunately firmly imbedded in almost every community. Nature clubs, bird clubs, forestry associations, conservationist groups and other organizations by their very nature should be interested in the idea and their members afford an excellent basis for enthusiastic support. Schools, parent-teachers organizations, Rotary and Kiwanis Clubs, women’s organizations, church groups, town park departments, all should be thoroughly canvassed and their support enlisted.

Horticultural experts could give illustrated lectures to show the kinds of plants which might be grown. Local landscape architects could have a field day in discussing possibilities. Staff members from existing arboreta could come and show what has been done in other communities, and discuss frankly the possibilities of a local arboretum. Costs could be discussed by committees representing various organizations. When opinion becomes fairly crystallized, some group could offer a sum to be used for the preparation of a definite plan. This was done in Seattle with excellent results. It was felt by those in charge that a topographic map of the Seattle Arboretum site was necessary, showing the two-foot contour lines. Such a map was prepared by the State W.E.R.A. at a cost of \$5,465.00. Then the Garden Club of Seattle raised \$3,000.00 and under its auspices a plan was drawn by a prominent firm of landscape architects. By the time the plan drawing stage is reached, public opinion should be fairly well crystallized in the form of a planning committee or “Arboretum Committee” which would have the authority to work with the individuals drawing the plan.

It is always advisable to have a well conceived plan on paper, regardless of what the local situation may be. The man or men eventually to be in charge of an arboretum do not just begin to plant trees and shrubs. Roads must be constructed, paths provided for pedestrians, a certain amount of grading done, certain plants placed in situations where they will grow best, a propagating unit

intelligently placed, water pipes laid where they will do the most good, drainage provided for in certain instances—in short, a thousand and one things should be thought of before the actual planting is started. In some instances the soil of the arboretum site may be very poor, and arrangements must be made to grow cover crops on it for several years (this was done on the site of the National Arboretum in Washington), thus preparing the soil over a period of time before any trees or shrubs are planted. Water, in the form of a running brook or pond, can be used to excellent advantage if properly planned for, whereas without planning, such a feature might easily become a liability. Trained horticulturists experienced in arboretum objectives and various professional landscape architects are familiar with these phases of the project. Thus if carefully considered plans are prepared in advance, much money can be saved, and many disappointments avoided by doing the right thing at the right time in the right manner.

How to Plant:—The actual placing of the different groups of trees and shrubs should be done according to a carefully conceived plan in which the individual needs of the plants are harmonized with the requirement of good landscape design and in which the best interests of the public are also considered.

Some of the arboretums have been laid out so that the plantings follow a definite botanical sequence of families and genera. This is not necessary or essential in most arboretums. It is advisable to keep all the plants in a certain genus together if possible, and to so place the important genera that they are easily seen from roads and paths. All projected plantings should be critically considered from the standpoint of landscape design.

Azaleas and rhododendrons, if used, should be given a situation with acid soil where they have some protection from winter winds. Lilacs should be so placed that people can easily walk among them and observe them closely as well as from a distance. A collection of hickory or walnut trees, for instance, might be placed in an out-of-the-way spot, where they can be seen from a distance. Colorful displays that have particular seasonal interest should be easily accessible and where they can be seen from many vantage points. Some plants like wet soils, some do better in dry soils. Each group should be placed where it will grow best.

Special attention should be given to displays of seasonal interest. Lilacs, for instance, are of interest only in the spring and might well be grown near the viburnum collection, which is of interest chiefly in the fall. The oriental crab apples, on the other hand, have seasonal interest both spring and fall and hence might be in a spot by themselves. Certain azaleas and the flowering dogwood bloom at the same time and might be planted adjacent to one another. A bank of red roses that will bloom in late June might be planted near the collection of mock oranges to give it additional color interest when its white flowers appear. Evergreen trees are frequently kept by themselves, but intelligent planting would call for the placing of a few deciduous trees in such a collection, especially

those which color vividly in the fall, to lend color and variety. And in or near plantings of deciduous trees it is usually desirable to place a certain number of selected evergreens.

It may be advisable from a maintenance standpoint to grow many shrub groups together in long beds with grass walks between them. Planted in this manner the shrubs are easily observed closely. A large number can be studied with comparatively little effort, and direct comparisons made. Roses, and representatives of such genera as *Weigela*, *Spiraea*, *Deutzia*, *Philadelphus*, *Chaenomeles*, and several other genera come in this group that can be so treated. Such a collection, though of little landscape interest, has a great deal of interest to the public at all times of year. The "shrub collection" at the Arnold Arboretum contains 800 different kinds of shrubs in parallel beds. It might well be one of the features in any arboretum, placed easily accessible to the main entrance, where people with little time can spend it to best advantage. It is also a most economical method of growing such a large number of shrubs, for machine cultivation can be easily practiced.

What to Plant:—What constitutes "the best" and who is competent to judge which are "the best" is always a debatable question. There are in existence several large collections of woody plants in this country and attempts are continually being made to make reliable lists of "the best" ornamentals in each group (genus or species). Such available lists could be utilized at the start. Let me explain more fully how this might be done, using the collections at the Arnold Arboretum as an example.

At the present time there are approximately 6000 different species and horticultural varieties of woody plants being grown in the Arnold Arboretum. Certain groups are larger than others. Thus in these collections there are 96 viburnums, 107 mock oranges, 159 maples, 270 crab apples, and 574 lilacs. Taking the lilacs for closer scrutiny, there are approximately 400 varieties of *Syringa vulgaris* alone, of which 32 have white flowers! Certainly all do not have outstanding ornamental value. In fact, it is extremely difficult to tell some of the varieties from others. It would be difficult to locate nursery sources for all, and certainly many have been discarded by commercial growers as being unsatisfactory. This large collection of lilacs has its place as a laboratory for scientific study (Mrs. Susan D. McKelvey did much of the work for her monograph on lilacs in this collection) but many of the varieties could be eliminated if scientific study were not one of the functions of this arboretum. The collections would be much more ornamental if the number of varieties were reduced, for then massed plantings of a single lilac variety could be made in space now occupied by twenty different varieties, for the ornamental effect of a massed planting is always greater, especially to the casual observer.

In a small arboretum, a collection of 50 or even 25 varieties of lilacs might be

satisfactory—only those being selected for planting which are considered to be the most ornamental and representative of the entire group. Just as many plants could be used as in our large collection if space were available, but far fewer varieties. The same principle could be used in selecting “the best” in the other groups of plants. The advice of local plantsmen will prove invaluable at the start when considering such points.

The Number of Plants:—The number of plants selected at the beginning will vary with the part of the country in which the arboretum is located, with its size, financial resources, and its propagating facilities. A few examples will illustrate this point. In making a preliminary report of proposed plantings for the Cornell University Arboretum, now called “Cornell Plantations,” there were approximately 2,000 species and varieties of woody plants listed as worthy of trial at the beginning. The Arthur Hoyt Scott Foundation of Swarthmore College listed approximately 2,800 species and varieties of woody plants that were being grown there in 1942. The 6,000 species and varieties now growing in the Arnold Arboretum might be reduced as much as one half or even more if only the most ornamental were to be selected. These figures are, of course, very general but they give some idea of the number of plants worthy for first consideration. The American Association of Botanical Gardens and Arboretums has published three inclusive studies, one on lilacs, one on crab apples, and a third on maples, showing the tremendous number of varieties being grown in this country and offering suggestions for short lists of the best. Such lists should be consulted. The smaller the arboretum, the fewer the number of specimens of any one variety which should be grown.

The first places to investigate as possible sources for plant materials would be the local nurseries. Nurseries at a distance may be able to supply many varieties unavailable locally. It will, of course, be found that some species are unobtainable from commercial sources. Then it is necessary to provide for a propagating unit and grow wanted varieties from cuttings or by grafting, where the propagating material is supplied by other arboretums, private individuals, or in some instances where seed is collected in native habitats primarily for this purpose. The smaller the plants when purchased, the lower the initial expenditure. The larger the plants at the start, the more quickly an initial display can be made for the public to enjoy. The factors here involved are obviously important ones and should be carefully weighed by the local planning committee.

The Amount of Space Required:—This, too, varies with the arboretum, its size, funds available for maintenance, and its functions in the community. Should much space be given over to massed plantings of single varieties? Massed plantings of azaleas, lilacs and crab apples are most ornamental and can be extremely effective, whereas massed plantings of maple trees, for instance, take up much

more space and have little ornamental effect. The enforcing of a rigid rule that no more than two or three plants of any one variety can be planted might be enough to defeat the purposes of an arboretum in the eyes of the public. The Arnold Arboretum proper covers an area of 265 acres, yet there is little room for additional planting, even though nearly half the present area is woodland. This wooded area is considered absolutely essential in setting off the man-made plantings to good advantage, and to serve as an added source of beauty and interest to visitors. Viburnums alone take 30,000 square feet (190 plants), elms take up about $5\frac{1}{2}$ acres (170 trees), while the lindens are given 3 acres for 58 trees. Three and a half acres constitute what is known as the shrub collection—long beds of miscellaneous shrubs with grass walks between, in which about 800 different species and varieties are grown. Almost a third of this is taken by the grass walks. Such a shrub collection affords an excellent means of teaching the public a great deal in a small area, but affords no opportunity for gorgeous displays of massed plant materials.

Another way of approaching a decision on the amount of space necessary would be to take the figure of 2,000 species and varieties as a starting point (the number suggested as the starting point for consideration by Cornell Plantations). If two plants of each of these were planted in long nursery rows, the distance between plants averaging 20 feet, they would take about 37 acres. Would such a planting in nursery rows have aesthetic value and be of interest to the public? Of course not! On the other hand, the proverbial "thousand acres" might prove too much for practical purposes. Here is another opportunity for intelligent planning by the Arboretum Committee, and an opportunity where practical plantmen and landscape architects can lend invaluable assistance.

Costs:—The maintenance of plants in an arboretum need not be expensive. Spraying, pruning, planting, should not be curtailed in any one year. If spraying and pruning be omitted two or more successive years because of lack of funds, the plantings quickly show neglect and it may take several years to bring some of the plants back into vigorous growth. A fluctuating budget does not allow for intelligent annual operation, one of the best arguments against trying to operate too extensively on the basis of funds solicited annually.

The actual amount of money necessary to operate a small arboretum varies with the size of the arboretum, the labor situation, equipment, the objectives and the extent of its formal plantings. A good park administrator who knows park maintenance costs in the locality where an arboretum is to be established can give excellent advice regarding such costs. However, certain things are known. Lilacs, crab apples, quinces, and many other groups are very susceptible to infestations of scale and should be treated annually with a dormant spray to control this pest. They need a certain amount of renewal pruning every few years, without which periodic care they will very quickly turn into unattractive specimens which have

little ornamental value. No collections of these particular kinds of plants should be contemplated unless they can be cared for properly each year.

As an example of the cost for maintaining one group of plants, there are approximately 700 lilac plants in the collection at the Arnold Arboretum. Spraying these with a dormant oil spray takes two men about a half day, and about 600 gallons of spray mixture. Three good pruners spend an average of two weeks in this collection each year, keeping it in excellent condition. The cutting off of flower clusters is a time-consuming operation but should be done for the benefit of the next season's display. Although we cannot do this completely every year, if done properly (as it should be) it would take four men at least two weeks. This will give some idea of how to approach the problem of prospective costs in each of the large collections contemplated.

Viburnums need practically no spraying and very little annual pruning. Elms must be sprayed in this area for elm leaf beetle and the bark beetle. Canker worm, gypsy moth, willow leaf beetle, Japanese beetle—all attack many kinds of plants and must be controlled in various parts of the country. In 1959, 400 man hours were spent in spraying the various collections in the Arnold Arboretum for specific insect and disease control.

Pruning, also cannot be definitely estimated. Young plants, pruned properly at transplanting time, may require no pruning for several years. On the other hand, in an established arboretum with many kinds of mature trees, a wind, snow or ice storm may cause immense damage. The hurricane of 1938 cost the Arnold Arboretum in pruning and the removal of fallen or badly damaged trees and shrubs about \$6,500 above the budget provided. This did not include the irreparable loss of old established specimens. During a recent winter, one fourteen-inch snowstorm with very heavy snow broke so many branches that it took approximately seventy-five man-days to repair this damage alone.

Labor:—This item is the most expensive in any park or arboretum. It can be controlled somewhat by the amount of grass cutting and leaf raking which is done. In some parks all grass areas are carefully cut with a lawn mower once a week. This is a very expensive operation. In the arboretum or botanical garden certain areas are given over to the growth of deciduous trees and conifers the grass need only be cut but a few times each season, providing a few walks are open through these collections. In the shrub collection, which many people visit at all seasons of the year, the walks should be closely cut, as well as certain small areas along the main walks and near main entrance gates. Grass cutting is an essential annual operation to reduce the fire menace and must be provided for. Tractor-drawn rotary mowers are ideal for keeping grass under control at minimum expense.

Hoing by hand takes considerable time. The cost of this operation can be reduced by the use of mechanical equipment in the larger beds, and may be reduced

still further by the use of some of the new weed killers now available. The Arnold Arboretum employs nine laborers with occasional additions during spring and summer, a superintendent with his assistant, for the maintenance of the growing collections, as well as a propagator, his assistant, and a man in charge of labeling and mapping. These are not maximum requirements, probably might be termed the minimum labor requirements for an arboretum the size and age of the Arnold Arboretum. The National Arboretum with 450 acres has 32 men on the grounds crew. The Arthur Hoyt Scott Horticultural Foundation with an area of about 300 acres has seven on the grounds crew.

Equipment:—The more standardized mechanical equipment that can be utilized to good advantage, the less will be the expenditures for labor. Minimum equipment for a 200–300 acre arboretum might be :

Tractor (with rotary mower, plow, harrow, etc.)

Sprayer with tank capacity of at least 300 gallons

At least one ton and a half truck

2 power lawn mowers

2 heavy duty rotary mowers

Rototiller or small motorized cultivator

Gasoline chain saw

The best available hand saws, pruners, pole saws, etc., for the type of work contemplated

Propagation:—Every arboretum large or small should have its own propagating unit. Since many of the plants grown will be rare, they will not be available from commercial sources as plants, hence the arboretum will have to propagate many species from seeds, cuttings or grafts. There are decided advantages in having a nursery well stocked with materials, for plants so grown are easier to dig and move. They should be correctly named, for if they are allowed to grow to sufficient size in the nursery, they can be properly identified before being transplanted. Larger specimens can be handled this way than would be advisable with purchased specimens.

The actual size of the greenhouse will depend on the location of the arboretum, its size, and the amount of material to be propagated. At the beginning a great deal of propagating will be needed to provide material for contemplated plantings. Many of the older arboretums are concerned merely with replacements and material which is new to the collections.

It is amazing what a large amount of material can be propagated and grown to planting size in a well organized space. The Arnold Arboretum has been operating for 35 years with only two greenhouses 50'x18'. A recent reassessment of its space needs showed that though it needed an additional greenhouse for experimental use, it still could carry on with normal propagation procedures with

only two houses. Many a smaller arboretum has considerably less greenhouse space, and a few have more.

A pit house is essential in the North to aid in wintering over young stock and propagation materials. In the South, lath houses are essential, the number depending on the size of the whole arboretum undertaking. In the Arnold Arboretum we have found that saran cloth shade houses are ideally suited for growing ericaceous and other broad leaved evergreens during the hot summer months. We have five houses varying in size, approximately 100'x30'. Frames are also essential for wintering young plants. Nursery space will vary but the young arboretum which is doing a lot of plant propagation will need several acres at least.

It goes without saying that an experienced plant propagator must be employed. Sometimes he can work alone, sometimes he may need assistance, but in order to keep accurate records and to produce good plants, he should be thoroughly trained and experienced. If he is of this type, he will know the approximate size of the nursery and plant bed space needed, as well as the type of greenhouse space required.

Labeling and Mapping:—A most essential function of an arboretum is to keep the plants properly labeled. In order to maintain correct labeling it is essential that the plantings be accurately mapped. An active young man who is really interested in this work—and it takes a great deal of walking!—should be able to keep maps and labels up-to-date, providing he has some seasonal assistance. In the winter some of the labor force could paint and even print labels. In the summer, one or two high school boys might be hired to help with the mapping if this were necessary. Mapping with the alidade and tape is sufficiently accurate. We have found that maps approximately $2' \times 2\frac{1}{2}'$ on a scale of $1'' = 20'$ are practicable, but a few enlargements are necessary on a scale of $1'' = 10'$. It took nearly a year for two men to map all the plants in the 265 acres in the Arnold Arboretum, but once accomplished, the maps are easily kept up-to-date with a minimum expenditure of time.

If plants are not accurately and clearly labeled, the arboretum loses its educational function completely. Labels will disappear, often being appropriated by certain types of visitors, and others will become defaced. Thus a careful mapping of a collection makes relabeling of individual plants simple and accurate, for the critical and sometimes time-consuming matter of reidentification is eliminated. A display label should be clearly visible on every plant except in instances where a large number of a single variety are used in mass planting. On the label, as a minimum, should appear the common name, the scientific name, and the geographic origin of the species.

In the Arnold Arboretum we have a small record label made of embossed zinc tape which is attached to every plant when it is planted in the collections. This remains on the plant indefinitely, and contains the accession number of the plant,

its scientific name, the origin of the plant, and the date of its accession. These cost about five cents per label just for the materials. A large wooden or metal display label is attached to each plant that is large enough to carry one. These cost about twenty to thirty cents per label for the materials (not including the labor of printing) and will remain on the plant in good condition about five years. Certainly a plant worth placing in an arboretum is worth two labels at a cost of thirty-five cents.

Educational Costs:—If a community is large enough, the director or superintendent of the arboretum might be a man who could direct the work in the arboretum and at the same time give lectures to local groups concerning the plant materials in the arboretum and their proper use. He could write articles for local publication, conduct groups through the arboretum, and work with local groups for the general education of the public in better appreciation of the plants and their maintenance. The services of such a man are almost a “must” for the arboretum or botanical garden since a certain amount of educational publicity contributes materially toward a better utilization and appreciation of the arboretum by the residents of a community.

It would serve no purpose to give the actual operating expenses of any arboretum, since methods vary, functions of the arboretum vary, and wages vary. Each expense item should be understood before studying actual maintenance costs. The figures and facts given, however, should serve to help with the general plans of any Arboretum Committee. They should be interpreted by men familiar with maintenance work who at the same time are familiar with the proposed functions of the arboretum under consideration.

For those who are interested in knowing where American arboreta and botanical gardens are, “The Arboreta and Botanical Gardens of North America” is a seventy page booklet published by the Arnold Arboretum, Jamaica Plain, Mass., in 1959. It is available for \$1.50 postpaid. One hundred and nine arboreta are described so that with this as a reference, those wishing to start an arboretum could contact any of these that might have policies and a size similar to that wanted by the organizational group. Such institutions are always glad and willing to help with information and suggestions when a new garden is contemplated.

DONALD WYMAN

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