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ARNOLDIA



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ARNOLDIA



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of the Arnold Arboretum, Harvard University

VOLUME 14

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NUMBER 1

JAPANESE DWARFED TREES

VISITORS to Japan will find, in many an old garden, small trees which have been grown and carefully tended in pots for centuries. These are the result of an oriental art termed "Bonsai"—the art of dwarfing trees. It actually is an art, for not only are the trees grown slowly, but they are so pruned and restricted in their growth habits that small plants only a few feet high are trained to produce the same general outline and branching habits of the same kind of trees when grown under normal conditions, trees which may approach 60 or 100 feet in height. This is not the easiest thing to accomplish, for it takes a minute knowledge of pruning, of grafting and of fertilizing and general culture. Many an American gardener does not have the time, the patience, nor even the knowledge to grow trees in this way.

In order that visitors to the Boston Spring Flower Show can see some of these plants as they are grown in Japan, the Arnold Arboretum displayed its collection of dwarfed Japanese trees in the proper setting of a Japanese garden. These trees were all imported to the United States in 1913, by the late Larz Anderson, who became interested in Japanese horticulture several years earlier. He served as Ambassador Extraordinary from the United States to Japan (1912-1913) and it was during this period that he brought these trees back from Japan, all in their original containers, and grew them under the watchful eyes of several Japanese gardeners on his estate in Brookline. This was before the strict regulations of the U.S. Department of Agriculture made it impossible to bring back any plants into the United States with soil about the roots.

These trees were given to the Arnold Arboretum in 1937, by Mrs. Larz Anderson as a memorial to her husband's great friend, Charles Sprague Sargent, the Arboretum's first director. Normally, this unique collection can be seen at the Arnold Arboretum in a shade or lath house erected especially for them. Around this shade house have been planted some of the shrubs and trees one commonly

finds growing in Japanese gardens, and in the display at the Flower Show, the plants were arranged under a bamboo shelter similar to the way they might be grown in a sunny, hot situation in Japan. The names and ages of the various trees in this display at the Boston Spring Flower Show are:

LARZ ANDERSON COLLECTION

Common Name	Botanical Name	Age	Spread	Height
Hinoki False Cypress	<i>Chamaecyparis obtusa</i>	217	6'	30''
.. ..	.. ..	167	5½'	28''
.. ..	.. ..	167	6'	42''
.. ..	.. ..	152	4'	24''
Japanese Larch	<i>Larix leptolepis</i>	142	4'	34''
Hinoki False Cypress	<i>Chamaecyparis obtusa</i>	122	3½'	28''
.. ..	.. ..	132	2½'	29''
Trident Maple	<i>Acer buergerianum</i>	102	3'	33''
Higan Cherry	<i>Prunus subhirtella</i>	102	2¼'	19''
Hinoki False Cypress	<i>Chamaecyparis obtusa</i>	92	5'	18''
Japanese Maple	<i>Acer palmatum</i>	67	2½'	23''
.. ..	.. ..	67	2'	23''
.. ..	.. ..	67	3'	34''
.. ..	.. ..	67	3½'	28''
Japanese Threadleaf Maple	<i>Acer palmatum multifidum</i>	67	4'	36''
Japanese White Pine	<i>Pinus parviflora</i>	67	4½'	30''
Japanese Maple	<i>Acer palmatum</i>	62	2½'	18''
.. ..	.. ..	57	2'	30''
.. ..	.. ..	57	1½'	16''
.. ..	.. ..	57	2'	21''
Moss Retinospora	<i>Chamaecyparis pisifera squarrosa</i>	57	2½'	27''
Cryptomeria	<i>Cryptomeria japonica</i>	..	..	..
Japanese Maple	<i>Acer palmatum</i>	52	1'	13''

“Bonsai,” the Art of Training Dwarf Trees

Century old customs have been handed down by the Japanese regarding the training of the interesting dwarf trees so characteristic of the gardens and homes of that country. There are several reasons for their existence. In the first place, Japanese and Chinese gardens are usually small, for space is at a premium. This is particularly true in the urban areas where the art of making gardens on a very small scale is centuries old. Then, too, the oriental's well known appreciation of the aesthetic value of living plants has been a prime factor in their cultivation. It often takes fifty to one hundred years to grow a worthy specimen dwarf tree, yet it is possible by twisting the trunk and restraining the growth of tops and roots to give a comparatively young plant the appearance of great age. This treatment requires a thorough knowledge of horticulture as well as painstaking patience, but many Japanese are fascinated with “Bonsai” and practice it as a pastime.



PLATE I

Chamaecyparis obtusa. Over 200 years old (Larz Anderson Collection).

Training

Most woody plants can be dwarfed if given the proper training. If the branches and roots of growing plants are vigorously restrained from developing rapidly, the individuals soon become dwarfed and this is the principle underlying all training. Then, too, great care is given to the training of the trunk, the spread of the branches and their shape, and the spread of the roots, since each can be so trained as to give the impression of great age. Many methods have been devised through the centuries for attaining these ends. Maples, bamboos, cherries, pines, hollies, oaks, azaleas, junipers, and many other plants have been used. They are grown in comparatively small containers, kept pot bound throughout their existence, and carefully and judiciously pruned to maintain the desired type of growth.

Whenever possible, the Japanese start with plants that have already been dwarfed by nature. These are searched for in the high mountains, in regions often unfamiliar to the ordinary traveller. Such plants are frequently found growing in high rocky crevices, just barely existing for lack of sufficient nourishment. If these are dug immediately and removed, they might succumb at once for the delicate balance between the amount of root system and bare existence is easily upset. The plant hunter may locate such plants several years before he will venture to remove them from their rocky dwelling. At first he will prune a small portion of the plant and leave it in place for a year; then he will return and root prune another small portion, repeating this process until it is safe to move the plant. In this way splendid specimens are obtained that have already been trained with the assistance of mother nature herself.

If dwarf plants are to be trained from the seedling stage, the smallest and weakest seedlings are selected. Conifers are considerably easier to train, for they do not form adventitious buds as readily as do the broad leaved plants. The seedling is placed in a very small pot. If there is a tap root, it is pruned considerably, and if a central leader is present, it too is cut back. In order to obtain the desired effect, only certain branches are allowed to develop. As an example, *Chamaecyparis obtusa* is ordinarily a very bushy plant, yet the illustration shows only a few picturesque branches. These few branches have been carefully selected and trained, while the others have been entirely removed. If one of these branches should die, eventually a new bud would be allowed to develop a branch to sufficient size to take the place of the dead one.

To give the correct appearance of wind-contorted shape, the main stem is often twisted around a bent upright of heavy wire or metal, and after a formative period the upright is removed. This twisting in itself is a dwarfing process, since frequently it breaks a large number of the conducting vessels in the stem. Branches are twisted in like manner. They may all be trained on one side of the plant, or arranged to droop on one side of the pot, or trained in any one of a dozen different ways. The Japanese gardener usually has a model in mind when he trains his plant, some wind-twisted tree which he is trying to reproduce in miniature



PLATE II

Pinus jeffreyi in Yosemite National Park has been continually dwarfed by nature for an estimated 600 years.

form, and it is surprising to the uninitiated to observe how accurate these reproductions can be.

Often in nature one observes old gnarled trees the larger roots of which are exposed, especially when growing in rocky places where there is still soil. This effect is reproduced by the "Bonsai" artist by growing his seedling in charcoal and moss for a period sufficiently long to induce long roots. When the plant is removed to its permanent container, a part of these roots are left to develop above the soil level, eventually aiding materially in giving the plant the appearance of great age.

Pruning, Repotting and Watering

Not all branches are entirely removed. Some of these century old plants have numerous picturesque stubs, certain gardeners believing that these add to the beauty of the plant. Any diseased tissue on such stubs is carefully scraped, disinfected, and painted. Sometimes in order to gain the appearance of stubby old age rapidly, taller plants that have been growing normally are used. The basal branches are cut back to give the stubby appearance. The top is entirely cut off. The plant is dug and after many of the roots have been removed it is placed in a small pot. Then certain of the adventitious buds are allowed to develop, or else scions are grafted at the desired places.

Grafting is also resorted to when certain shoots die, for if a very important branch has died, it may take many years for a new one to grow to a sufficient size from an adventitious bud. The Japanese are particularly adept at this and take great pains in training an individual branch by pinching the buds back here, or twisting the branch there, and so forcing the latter to grow in the desired fashion. The pruning and pinching operations are done during the active growing period, since the development of branches from adventitious buds is then more frequent.

Dwarf trees are repotted every four or five years for two reasons. In the first place it is necessary to remove some of the newly developed fibrous roots so that the tree will remain dwarfed. Secondly, it is necessary to mix a small amount of fertilizer with the soil, since as these trees are forced to grow in very small containers, there is not sufficient room for enough soil to allow new root development unless the plant be artificially stimulated with nutrients.

It is also advisable to keep a fresh layer of green moss on the surface of the soil. This not only adds the impression of age, but keeps the soil from drying out. The containers are usually provided with a hole in the base for proper drainage. In the hot summer days there is some danger of the soil becoming too dry, and at such times the plants need special attention. Spraying the foliage with water once or twice a day during the hottest spells of summer is advisable in order to keep the plant in good condition.

Dwarf trees cannot be considered primarily as indoor plants. They may be used indoors for short periods, but must be grown in the open a greater part of the

time. Because of their very small root system, and the small containers in which they are grown, these dwarf trees cannot lose much water through transpiration and still survive. Consequently they must be grown in a shaded location. The shade house in which this collection is being maintained at the Arboretum was designed and erected especially for this purpose. Constructed of cypress wood, the top and sides of the house are covered with strips $1\frac{1}{2}$ inches wide with similar spaces left between each strip. This supplies plenty of shade and at the same time keeps the atmosphere considerably cooler and reasonably moist.

Winter Protection

Although many of these trees are hardy, they cannot survive our northern winters because of their shallow root system, unless given some winter protection. A Japanese maple, for instance, growing normally in the ground may survive a winter during which the temperature goes to 20° below zero although the top of the plant may be killed to the ground. However, in these small pots the roots of dwarf trees would be subjected to temperatures almost as low as those of the surrounding atmosphere, and consequently the whole plant would be killed. During the winter in the north, they are best put in cold frames or pits which are well protected with glass and even with boards and mats during the most severe weather. In our pit where these plants were stored last winter the temperature did not go below freezing, although the temperature outside the pit dropped to zero on several occasions. Another danger from freezing temperatures is that with the expansion of freezing soil the containers may break. Although these are seldom ornate, since the Japanese believe that the plant itself should be the point of interest, nevertheless their simplicity alone is beautiful and makes them important adjuncts to any such collection and thus worthy of full protection.

Thus with an exacting knowledge of the numerous rigid requirements of the art of "Bonsai" the painstaking Japanese gardener is able to reproduce dwarf trees that are exact replicas in everything but size, of century old specimens as they occur in nature. The Japanese have developed other forms of dish gardening, but to the American horticulturist perhaps none is so interesting as "Bonsai."

DONALD WYMAN

Note: These plants can also be seen at the Arnold Arboretum by the greenhouses, during spring, summer and early fall, Monday through Friday (9 to 5) except on holidays.

THE NEW DIRECTOR OF THE ARNOLD ARBORETUM

Dr. Richard A. Howard was appointed Arnold Professor and Director of the Arnold Arboretum, effective February 1, 1954, as successor to Dr. Karl Sax. Dr. Howard received the degree of doctor of philosophy from Harvard University in 1942 and following war service was assistant curator at the New York Botanical Garden; assistant professor of botany at Harvard, and most recently Professor of Botany and Head of the Department of Botany at the University of Connecticut. During the years of World War II, Dr. Howard was in charge of the Air Force Survival Training Program and responsible for the establishment of rescue teams and the techniques for living off the land. His botanical interests have been in horticultural and native plants of eastern United States and the tropics of the world.

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ARNOLDIA

A bulletin of popular information concerning woody ornamental plants issued during the growing season about twelve times a year by the Arnold Arboretum of Harvard University. Recent issues have dealt with "Autumn Color," "Crab Apples," "Euonymus," "Forsythias," "Ground Covers," "New Spray Materials," "New Methods in Plant Propagation," "Collecting, Cleaning, and Shipping Seeds of Woody Plants," "Two Months of Azalea Bloom," etc.

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FLOWERING DISPLAYS IN THE ARNOLD ARBORETUM

IT seems that everyone is interested in color photography these days. With the fine films available and the excellent cameras, many a rank amateur photographer, be he young or old, can take beautiful color pictures by paying attention to a few of the rudiments of photography. The Collections at the Arnold Arboretum afford a wonderful laboratory for all those interested in taking pictures, especially in the spring. Beginning about the first of April, there will be some colorful plants in bloom here every week until October when the native witch-hazel blooms and marks the end of the flowering season.

But even then the colorful displays are not over, for the autumn color of the foliage of many plants is just as striking as are their flowers. Also, many are blessed with brilliantly colored fruits, and these too are subjects for many a close-up by color photography enthusiasts.

Each spring the Arboretum staff is questioned by hundreds of people concerning just when the lilacs are going to bloom, or which azaleas will bloom the second week of May, or when do the rich red flowering rhododendrons begin to open their flowers. These dates naturally vary slightly from year to year. Also, the length of time the plants remain colorful depends on the weather at the time, a cool cloudy spell will result in their lasting much longer than during hot sunny weather. In the following list, a single plant may be listed because the planting at the Arboretum is conspicuous. On the other hand, the groups such as hydrangeas and honeysuckles, include many species which bloom over a considerable time. One should not expect them all to bloom together, but rather separately and within the general limits listed. It will undoubtedly be of interest to many a possible Arboretum visitor and amateur photographer, to glance through the following list of dates when the most conspicuous plants are expected to bloom this year:

Amelanchiers
Azaleas (American)

Late April-early May
Mid-May-late June

Azaleas (Asiatic)	Mid-April-late May
Azaleas (Flame)	Early June
Azaleas (Ghent Hybrid)	Late May
Azaleas (Torch)	Mid-May
Brooms	Early May-mid-May
Crabapples	Early May-late May
Dogwoods (Flowering)	Mid-May
Forsythias	Mid-April
Fothergillas	Mid-May
Hawthorns	Early May-mid-June
Honeysuckles	Mid-April-mid-June
Horsechestnuts	Mid-May
Hydrangea (Climbing)	Early June
Hydrangeas	Late June-August
Japanese Quinces	Early May
Lilacs (Common)	Mid-Late May
Lilacs (Preston Hybrid)	Early June
Magnolias	Late April-Early May
Mock-Oranges	Early June-mid-June
Mountain-Laurel	Mid-May
Oriental Cherries	Late April-Early May
Oriental Witch-hazels	March
Rhododendrons	Early June-mid-June
Rose-of-Sharon	August
Rose species	Late May-mid-June
Siberian Pea trees	Mid-May
Spiraeas	Late April-mid-June
Viburnums	Mid-may-mid-June
Weigelas	Mid-may-mid-June

COLOR POST CARDS

This year, for the first time, the Arboretum has available a series of seven post cards in full color made from Ektachromes taken by Mr. Heman Howard, of the Arboretum staff, showing a few of the displays at their best. The black and white reproduction of them, p. 11 (a poor substitute) is the best picture we could make of the actual cards. Many a visitor has asked for such cards in the past, and these make a good selection for a start. In order to acquaint *Arnoldia* subscribers and "Friends of the Arboretum" with these, a sample is included with this issue. **Also, by mailing a dollar to the Arboretum, or making out a check to Harvard University for one dollar and sending it to the Arboretum, three complete sets of these will be mailed immediately.** This is a means of assisting a larger group of friends to become acquainted with a few of the color displays which are to be seen here every spring.

The individual pictures are all regular size $3\frac{1}{2}'' \times 5\frac{1}{2}''$; #5 which is "Jumbo" size $6'' \times 9''$).

	Approximate time taken
1. Magnolias by the Administration Building	(about May 4)
2. The Japanese Flowering Crabapple	(about May 8)
3. The Rhododendron collection	(about June 8)
4. Oriental Cherries in full bloom at Forest Hills Gate	(about May 1)
5. The famous Lilac Path	(about May 20)
6. The Ghent Hybrid Azaleas	(about May 25)
7. The "Mont Blanc" Lilac	(about May 20)

DONALD WYMAN



PLATE III

Natural color post cards available at Arnold Arboretum.

SPRING 1954
Arnold Arboretum Field Classes

Once again the Field Classes will be conducted in the Arnold Arboretum this spring by Dr. Donald Wyman. These will meet in front of the Administration Building at the Jamaica Plain Gate at 10 A.M. **Friday mornings, starting April 30th**, and ending **May 28th**. Two hours are spent in walking about the grounds (cars will be permitted for class members) studying the various plants of interest as they come into bloom and discussing their relative merits. Special information will be given on culture and pruning, and if desired one meeting will be held in the greenhouses. In case of rain, the class will meet indoors. Both men and women are welcome. A registration fee of \$1.00 is requested in advance by mail, and checks should be made payable to Harvard University. Since it may be necessary to limit the size of the class this year, registrations will be accepted in the order in which they are received.

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SOME SHRUBS AND TREES WITH COLORED FOLIAGE GROWING IN THE ARNOLD ARBORETUM

ONCE again we publish in *Arnoldia* a series of notes made about some of the trees and shrubs with colored foliage growing here in the Arnold Arboretum. Other studies were undertaken years ago, and many notes were published in 1942 (*Arnoldia* 2: Nos. 11-12). The notes appearing in this issue were made last year both in the Arboretum and in the nurseries of the Arboretum at Weston. The plants were mostly observed by Mr. Heman Howard of the staff, at six different times from May 20 until September 10. In periodically observing these plants, the color of their foliage was noted and the approximate time it changed to another color or to a normal green.

We often read glowing accounts of a certain tree (take as an example the old-fashioned Schwedler's maple) which may have bright red foliage early in the spring. This may be perfectly true, but for many a plant and this one in particular, there comes a time when the bright color of the foliage gradually turns to a normal green. Certain other plants (like the new "Crimson King" maple) retain their bright foliage color until fall. Just which plants do retain their color, and when do some of the others lose theirs? In planning a garden in which such plants are featured, it might prove helpful to know just how long their colors will last.

All the plants noted here are not prominently important ornamental varieties, nor is this a complete list of all the woody plants with colored or variegated foliage. Of the approximately 100 plants listed, there will be found some popular favorites and some others which should never be grown for their "ornamental" qualities in any garden. Many a gardener will not have a variegated leaved plant in his garden, while others carefully select a plant with gray or blue foliage to relieve the "monotony" of an otherwise green foliated border. Also, it is of interest to note that different soils may affect the foliage colors of some of these

plants in different ways; a variegated plant tending to have more white and yellow in its leaves when grown in poor soil, than when grown in a good rich soil. Be that as it may, here are some of the changes noted between May and September on the following plants in the Arnold Arboretum last year.

Foliage Colors of Certain Trees and Shrubs Growing in the Arnold Arboretum

Abies pinsapo glauca — foliage a good blue green throughout the year.

Acer japonicum aconitifolium — leaves a good deep red all summer.

“ *negundo elegans* — each leaf about 50% yellow (outer edge of leaf) all summer.

“ *palmatum* — at first reddish in spring, but turning green by July.

“ “ *atropurpureum* — best red foliage of all Japanese maples throughout summer.

“ “ *dissectum* — greenish red foliage turning green by August.

“ “ *hessei* — good dark red foliage until August when brilliance goes.

“ “ *ornatum* — excellent feathery dark red foliage, bronze by July 15, green by August.

“ “ *sanguineum* — upper side of leaves dark red (under side green) until mid-August when it turns bronze green, but fruits bright red until September.

“ “ “Burgundy Lace” — good deep red foliage throughout summer turning a deep dull red by mid-August.

“ *platanoides* “Crimson King” — foliage a good deep purplish red throughout summer.

“ “ *rubrum* — leaves dark green by end of June turning bronze in mid-July — not outstanding.

“ “ *schwedleri* — dark red until mid-June when it begins to lose color, changing to green by mid-August.

Berberis thunbergii argenteo-marginata — slight yellow variation in leaves on new wood only, remaining through most of summer.

“ “ *atropurpurea* — twigs and leaves dark red, especially those exposed to the sun — throughout summer.

“ “ *nana* “Little Beauty” — same as above.

“ *vulgaris* “Sheridan Red” — the best red foliage of any barberry we have — throughout summer.

Buxus sempervirens albo-marginata — white margin throughout summer — not outstanding.

Chamaecyparis obtusa aurea — young growth a good yellow all summer.

“ “ “tetragona aurea” — foliage yellow to yellow green.

“ *pisifera aurea* — tips of young growth slightly yellow at first, turning green by mid-June. Not outstanding.

- Chamaecyparis pisifera* "filifera aurea" — young tips good yellow throughout summer and fall.
- " " *lutescens* — tips of shoots pale yellow to mid-July when they turn yellow green — not outstanding.
- " " "plumosa argentea" — tips of young shoots a pale yellow to mid-August when they turn a yellow green — not outstanding.
- " " "plumosa aurea" — young growth an excellent bright yellow during summer and fall.
- " " "plumosa flavescens" — young tips a striking yellow until mid-August when color is no longer prominent.
- " *thyoides glauca* — tips of shoots a good gray green throughout summer.
- Cornus alba argenteo-marginata* — leaves with creamy white margin through summer until early September.
- " " *gauchaulti* — foliage dark green with a thin ivory white margin.
- " " *spaethi* — leaves with yellow green center and pale yellow green irregular margin until September.
- " " *variegata* — foliage green, but 50% of each leaf is a wide ivory margin.
- " *alternifolia argentea* — foliage medium green with an ivory margin — good.
- " *kousa variegata* — dark green leaves, 50% of them having an ivory white margin, sometimes tinged with pink. The pink tint is gone by mid-June, but white variegation remains until September.
- " *sanguinea viridissima* — young twigs green throughout year.
- Corylus maxima purpurea* — foliage a rich dark red until end of June and by mid-August foliage is green.
- Cotinus coggygria purpureus* — first young foliage reddish but turns green by mid-June.
- " "Notcutt's Variety" — young reddish foliage retains good red color until mid-July when it turns green.
- Euonymus fortunei gracilis* — leaves with cream colored border throughout year, but inferior to "Silver Queen" in effect.
- " " "Silver Queen" — wide creamy white leaf border throughout entire year — excellent in effect.
- Fagus sylvatica atropunicea* — a good dark red foliage through mid-July, when brilliance starts to disappear, leaves turning a dull red bronze.

- Fagus sylvatica riversi* — slightly darker red in June, than variety *atropunicea*, but by August not much difference between the two. Both are excellent.
- Forsythia intermedia variegata* — foliage dark green with 50% of leaf an ivory white margin — good.
- Hibiscus syriacus variegatus* — foliage dark green with 50% of leaf an ivory yellow margin.
- Hippophae rhamnoides* — foliage gray throughout summer.
- Juniperus chinensis aurea* — foliage a bright yellow through entire summer and fall — best of this color in the junipers.
- “ “ “aureo-globosa” — about half the young tips are yellowish, but color is not outstanding.
- “ “ “pfitzeriana argentea” — all young tips are pale yellow and excellent, but lose brilliance by late June, and by mid-July a normal green.
- “ “ “plumosa aurea” — foliage greenish yellow in May, turning to dark yellow green in late June, then to golden yellow in mid-July, retaining this color throughout the summer and fall.
- “ *horizontalis douglasi* — steel blue foliage throughout the summer.
- “ *scopulorum* “Blue Moon” — foliage a good light bluish green throughout year.
- “ “ “Chandler’s Blue” — same as above.
- “ “ “Gray Gleam” — same as above.
- “ “ “Hills Silver” — same as above.
- “ “ “Marshall’s” — same as above.
- “ “ “Moonlight” — same as above.
- “ “ “North Star” — same as above.
- “ *virginiana burki* — foliage a good light bluish green throughout year.
- “ “ *glauca* — same as above.
- Kerria japonica aureo-vittata* — green branches striped with yellow.
- Ligustrum ovalifolium aureo-marginatum* — leaves variegated with greenish yellow throughout summer and fall — good color.
- “ “ *variegatum* — foliage green with margin of lemon yellow to bright yellow orange.
- “ *vicaryi* — young foliage starts as light yellow green, but turns to a brilliant yellow by mid-June (in full sun) for remainder of summer and fall.
- Liquidambar styraciflua aurea* — most leaves heavily speckled with golden yellow on green throughout summer.



PLATE IV

Juniperus horizontalis douglasii photographed in the Morton Arboretum, Lisle, Illinois. This evergreen makes an excellent ground cover.

- Liriodendron tulipifera variegata* — dark green center with wide yellow green margin.
- Lonicera japonica aureo-reticulata* — foliage speckled yellow and green giving yellow appearance from a distance throughout summer and fall.
- Malus* with reddish bronze leaves throughout the summer:
M. purpurea aldenhamensis; *M. purpurea eleyi*; *M. pumila niedzwetzkyana*; *M. floribunda atropurpurea*; *M. moerlandsi*; *M. purpurea lemoinei*; *M. "Crimson Brilliant"*; *M. "Oakes Rosy Bloom"*; *M. "Profusion"*; *M. "Redford"*; *M. "Red Silver"*; *M. "Strathmore"*; *M. "Timiskaming."*
- Philadelphus coronarius aureus* — brilliant greenish yellow foliage until early August when it turns a light yellow green.
- Physocarpus opulifolius luteus* — at first brilliant yellow, yellow green early June to early July, after that about a normal green for remainder of summer.
- Picea abies argenteo-spica* — young shoots bright yellow green, but gradually loses color until late June when it is a normal green.
- “ *orientalis aureo-spicata* — new growth brilliant yellow green, turning to light green by early June and normal green by late June.
- “ *pungens glauca* — a good blue throughout the year.
- “ “ *globosa* — a very fine silver blue throughout the year.
- “ “ *kosteriana* — same as above.
- “ “ *moerheimi* — same as above — this is the best blue of the *P. pungens* varieties.
- Prunus bireiana moseri* — foliage a good dark red throughout the summer and fall.
- “ *cerasifera atropurpurea* — foliage dark purplish red throughout summer and fall, one of the best red leaved trees.
- “ “ *nigra* — foliage dark red throughout summer and fall.
- “ *cistena* — foliage dark red entire summer and fall.
- “ *spinosa purpurea* — foliage deep reddish purple until early August, when it gradually turned a dull reddish purple.
- “ “Newport” — foliage a glossy deep red entire summer and fall.
- “ “Royal Red Leaf Peach” — leaves of new growth a brilliant dark red, rest are bronze green.
- “ “Shubert” — foliage green until early July when leaves start to turn a dull dark red retaining this color the rest of the summer and fall.
- “ “Thundercloud” — leaves a good deep purplish red.
- Ptelea trifoliata aurea* — good glossy yellow foliage till late July; by mid-August a normal green.

- Quercus robur concordia* — young foliage yellow, turning to yellow green by end of July.
- “ “ *variegata* — young leaves speckled with white on green, but appearance is of diseased foliage.
- Sambucus canadensis aurea* — 50% of leaves are yellow to yellow on green, remainder are speckled with yellow throughout the summer.
- “ “ *nigra variegata* — leaves with yellow margin entire summer.
- Syringa vulgaris aucubaefolia* — most leaves spotted with yellow, some more than others, retaining this color the entire summer.
- Taxus baccata aurea* — new growth bright yellow, brightest of all *Taxus*; by mid-July gradually losing some of its brilliance; turning dull yellow by mid-August and retaining this throughout fall.
- “ “ *elegantissima* — foliage a brilliant greenish yellow until mid-August, gradually turning yellow green by mid-September.
- “ “ *variegata* — foliage a pale yellowish green until mid-July when it gradually turned a normal green.
- “ *cuspidata aurescens* — new growth bright yellow until mid-July when it gradually turns to yellow green by mid-August when it is no longer outstanding.
- Thuja occidentalis alba* — young foliage spotted with dirty gray and unattractive. By mid-July tips of young foliage are creamy white holding this all summer but not attractive.
- “ “ *aurea* — new growth bright yellow turning to yellow green by late June and by mid-July about a normal green — not outstanding.
- “ “ *ericoides* — golden brown foliage until mid-July gradually turning a yellow green with golden tips the remainder of the summer.
- “ “ *lutea* — young growth a brilliant yellow, retaining this the entire summer and fall. This is the most brilliant yellow in our *Thuja* collection.
- “ “ *lutescens* — foliage only slightly lighter than a normal green — not outstanding.
- “ *orientalis conspicua* — tips of new growth bright yellow, turning yellow green by mid-July.
- Ulmus carpinifolia variegata* — leaves light green with speckled yellow green, retaining this throughout summer. General appearance is of tree with diseased foliage.
- “ “ *wredii* — 90% of leaves are bright yellow. Maintained throughout most of summer.
- Weigela florida variegata* — dark green leaves with yellow green margin, retaining this through summer and fall.

DONALD WYMAN

NOTE

Mr. David Leach of Brookville, Pennsylvania, has called my attention to an article published in the Home Garden (Vol. 19, No. 5, 26-28. May 1952) in which he described a propagating unit similar to the one I described in *Arnoldia* (Vol. 13, No. 10. Sept. 1953). My unit was developed independently and without knowledge of Mr. Leach's work. However, they differ only slightly, my unit utilizing cheesecloth to prevent excessive sun from reaching the plants and to eliminate dripping in a concentrated area by promoting an even distribution of moisture throughout the unit. Many others have seen the advantage of plastic film over the older glass frame and cloches used by horticulturists for hundreds of years. Mr. John L. Creech of the U.S.D.A. was one of the first to use plastic film in horticulture in air layering. Mr. Dale Sweet of Michigan State College has used polyethylene film with success in propagation. Horticulturists in general agree that a tent of plastic facilitates the rooting of cuttings of woody plants.

LEWIS LIPP

ARNOLDIA



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FIFTY OF THE BETTER GROUND COVERS

PLANTSMEN everywhere are becoming increasingly interested in ground covers, and because of this the extensive demonstration plot of 150 kinds of ground covers was planted by the Arnold Arboretum in 1950, on its Case Estates in Weston (see Map, Plate V). Although many of these plants are yet young, experience during the past few years, as well as notes made in the widely dispersed plantings throughout the East have shown that the fifty ground covers mentioned in this bulletin are among the best available. Certainly there are others, for plantings in other parts of the country contain many another, but these mentioned here might be the first to consider when contemplating a planting in the East.

Some young gardeners hope to find a "good substitute for grass," thinking, no doubt, that there must be some plant that will look as well, grow as well, and withstand the abuse as well as grass, without requiring the care given most lawns. Of course there is no such plant. Even ground covers need some attention occasionally, and those that need no cutting or pruning or fertilizing (yellowroot is one) differ from a grass cover in that they may grow considerably taller or can not be walked on. Most of these listed have interesting flowers and some have bright colored fruits as well.

However, many a gardener is at a loss when it comes to selecting a ground cover for a bank or very dry slope where grass will not thrive. Even though these plants will not replace grass in every respect, nevertheless, there are many situations where ground covers are needed. Some special purposes for which ground covers are needed might be:

1. **For Shade:** There are frequently shady spots in the home landscape where grass fails to grow well. If this shade is not augmented by poor soil and competing tree roots, as is so often the case, there are some plants which will withstand shade and make a better cover for the ground than will grass.

2. **For Dry Soil:** Plants for poor, dry soil are usually vigorous growers that can easily become garden pests in good soil, and can quickly outgrow their garden limits. Such plants may be needed, but they should be used with caution in the general flower border. *Polygonum Reynoutria* can be a pretty plant in its place, but on the other hand one can easily spend all one's spare gardening time rooting it out of the flower border where it becomes established in good soil.

3. **For Rapid Increase:** When funds are slim and space is large, plants are wanted which can be expected to grow rapidly and cover the ground. One Pachysandra plant may cover less than one half a square foot of ground, but one plant of the memorial rose can quickly cover many square feet.

4. **Plants less than 6 inches high:** These are wanted for the neatly kept areas, often close to the house. Sometimes they are to be walked on, but none are as serviceable in this respect as grass.

5. **Evergreen:** It is these that are most desirable for they supply a green cover over the ground the entire year. They are usually more expensive than the deciduous woody plants and perennials, and are slower in growth.

6. **Plants needing special attention:** Some of the ground covers listed die to the ground in the winter (like *Epimedium*) while others may become too tall over a five year period and have to be cut to the ground occasionally (like *Rhus aromatica*). Others, like the heather, may die back in some situations or during some winters and so require a severe pruning every spring. There may be some good reason for using such plants as ground covers, but their failings should be known.

7. **Plants needing no attention:** Such plants, of course, are greatly desired, but they may grow too tall, or too rampant, or be too coarse for use in every situation.

(In the following list, the numbers to the right of the common names, refer to the above categories, where each plant can easily be placed. This is merely a rough grouping of possible uses to aid the inexperienced gardener in making his first list from which to choose a ground cover for some particular situation.)

	<i>Height</i>
Aegopodium podagraria	14'' Goutweed, 1,2,3,7
Ajuga reptans	3'' Carpet Bugle, 1,3,4
Akebia quinata	Vine Akebia, 3,4,7
Arctostaphylos uva-ursi	4'' Bearberry, 2,4,5,7
Calluna vulgaris	10'' Heather, 5,6
Cerastium tomentosum	6'' Snow-in-Summer, 3,4
Convallaria majalis	6'' Lily-of-the-Valley, 1,3,4,7
Cotoneaster horizontalis	36'' Rock Spray, 7
Cytisus purpureus	18'' Purple Broom, 2,7
Diervilla lonicera	36'' Dwarf Bush-honeysuckle, 3,7
Epimedium grandiflorum	9'' Longspur Epimedium, 1,6
Euonymus fortunei colorata	3'' Purpleleaf Wintercreeper, 1,3,4,5,6

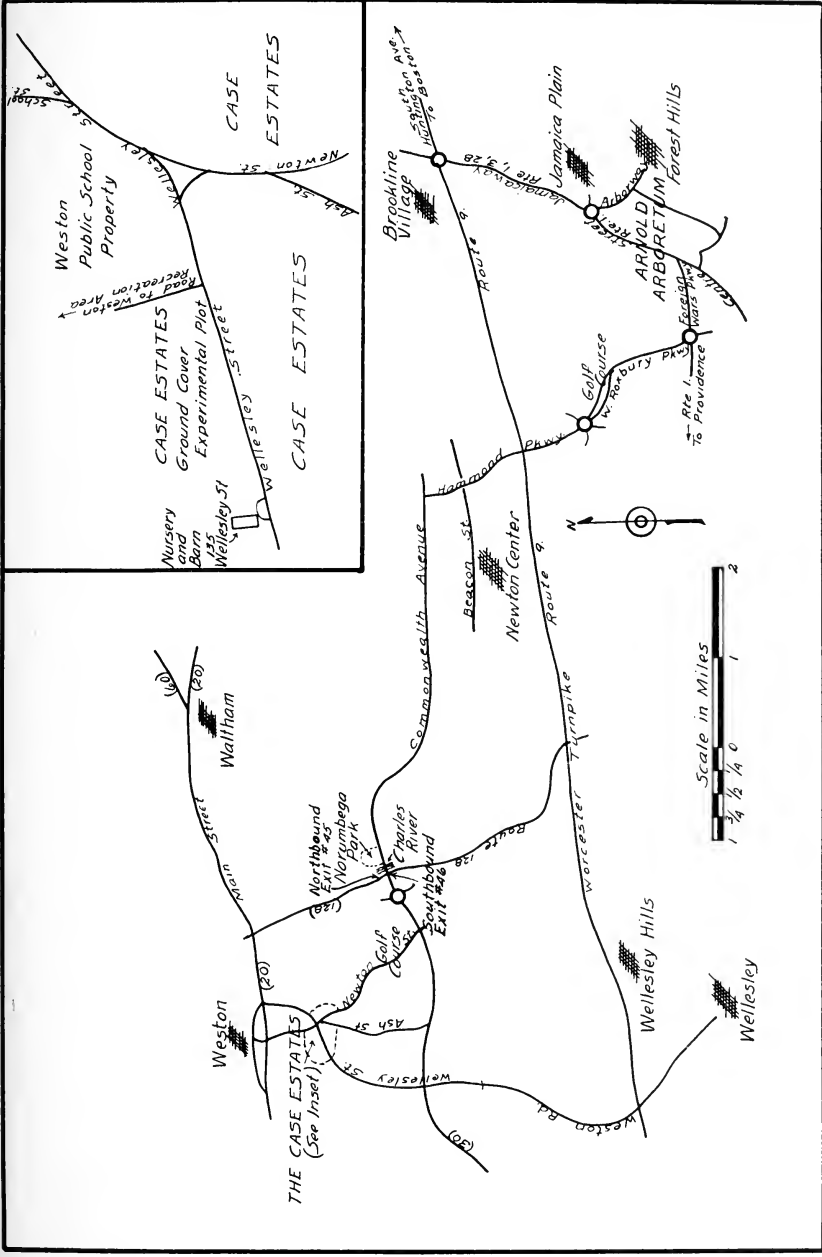


PLATE V

Map showing location of the Arnold Arboretum Case Estates in Weston, and the Ground Cover Demonstration Plots.

<i>Euonymus fortunei</i> kewensis	3''	Kew Wintercreeper, 1,4,5,6
“ “ minima	3''	Baby Wintercreeper, 1,4,5,6
<i>Forsythia</i> “Arnold Dwarf”	36''	Arnold Dwarf Forsythia, 1,3,7
<i>Gaultheria procumbens</i>	4''	Checkerberry or Wintergreen, 1,2, 4,5
<i>Gypsophila repens rosea</i>	6''	Rosy Creeping Gypsophila, 4,7
<i>Hedera helix</i>	Vine	English Ivy, 1,3,4,5,7
<i>Hosta</i> sp.	12''	Plantain-lily, 1,2,7
<i>Hypericum buckleyi</i>	12''	Blue Ridge St. Johnswort, 7
<i>Iberis sempervirens</i> “White Gem”	12''	White Gem Evergreen Candytuft, 5,7
<i>Indigofera incarnata</i> alba	24''	White Chinese Indigo, 3,6
“ kirilowi	48''	Kirilow Indigo, 3,6
<i>Juniperus horizontalis</i>	6-12''	Creeping Juniper, 4,5,7
“ “ plumosa	12''	Andorra Juniper, 5,7
“ chinensis sargentii	6-12''	Sargent Juniper, 4,5,7
<i>Leucothoe catesbaei</i>	36''+	Drooping Leucothoe, 5,7
<i>Liriope spicata</i>	8''	Creeping Liriope, 1,3,5,7
<i>Leiophyllum buxifolium</i>	24''	Box Sandmyrtle, 5,7
<i>Lonicera japonica</i> halliana	Vine	Halls Japanese Honeysuckle, 3,7
<i>Lonicera henryi</i>	Vine	Henry Honeysuckle, 3,7
<i>Lysimachia nummularia</i>	2''	Moneywort, 1,3,4
<i>Nepeta hederacea</i>	4''	Ground Ivy (Gill-over-the-Ground) 1,2,3,4,7
<i>Pachistima canbyi</i>	12''	Canby Pachistima, 5,7
<i>Pachysandra terminalis</i>	12''	Japanese Spurge, 1,3,5,6
<i>Parthenocissus quinquefolia</i>	Vine	Virginia Creeper, 2,3,7
<i>Phlox subulata</i> “Emerald Cushion”	6''	Emerald Cushion Moss Pink, 4,7
<i>Phalaris arundinacea</i> picta	18''	Ribbon Grass, 2,3,7
<i>Polygonum Reynoutria</i>	18''	Dwarf Lace Plant, 2,3,6,7
<i>Rhus aromatica</i>	36''	Fragrant Sumac, 2,3,7
<i>Rosa</i> “Max Graf”	36''	Max Graf Rose, 3
<i>Rosa wichuraiana</i>	6''	Memorial Rose, 3,7
<i>Saponaria ocyroides</i>	3''	Rock Soapwort, 1,2,4,7
<i>Sasa variegata</i>	36''	Variegated Bamboo, 1,2,3,7
<i>Sedum</i> species	5''	Stonecrop, 2,3,4,6
<i>Teucrium chamaedrys</i>	12''	Chamaedrys Germander, 6
<i>Vaccinium angustifolium</i> laevifolium	8''	Lowbush Blueberry, 1,7
<i>Veronica officinalis</i>	18''	Drug Speedwell, 1,3,7
<i>Vinca minor</i>	3''	Periwinkle or Myrtle, 1,3,4,5,7
<i>Xanthorrhiza simplicissima</i>	24''	Yellowroot, 1,3,7

DONALD WYMAN

ARNOLDIA



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PROPAGATING SOME RARER PLANTS FROM SEED

SEED propagation, as all nurserymen know, is by far the easiest and cheapest way to produce salable plants, assuming of course, the plants to be propagated come true from seed. Taking this fact into consideration, let us consider the methods used in producing some of the more uncommon plants from seed. These are plants that have been recommended as new additions to the group of plants that are now already in use in street tree plantings, specimen plantings, etc.

First, let us consider the method used at the Arnold Arboretum, in handling seed that require no pretreatment for germination. The following plants bear such seed :

Cercidiphyllum japonicum

Phellodendron amurense

Evodia danielli

Phellodendron lavallei

Evodia hupehensis

Phellodendron sachalinense

For an example of the procedure used let us take the seed of *Phellodendron amurense*. The fleshy fruit of this species is collected during the latter part of October, brought into the greenhouse and cleaned immediately. We use a machine called a Waring Blendor for cleaning the fleshy fruits. This is the same type of machine used by house wives in every day cooking, with the following modifications. We found that the steel blades the machine comes equipped with are much too sharp to be used in seed cleaning. If used, the steel blades will cut the seed all to pieces. To overcome this cutting effect, a piece of rubber cut from a truck tire was inserted in place of the steel blades. This piece of rubber was $1\frac{1}{2}$ " square and was $\frac{1}{2}$ " thick. It was bolted onto the shaft that whirled the steel blades, in such a way that when it spun, it revolved in a horizontal plane. The rubber is tough enough to stand up under the terrific battering it takes, yet it does not injure the seed. Also, it was found that a proportion of two thirds water to one third fleshy fruit was necessary to give good clear seed with the least injury to the seed.

Once the seeds have been cleaned they are either sown immediately in pans and then spotted off into flats as they germinate, or they are stored dry in

bottles until spring, at which time they are planted out in prepared beds.

In regard to *Cercidiphyllum* and *Evodia*, the seed of which dehisce, we collect the seed capsules just prior to their dehiscing, place them on sheets of paper in the greenhouse to open and then sow them immediately in pans in the greenhouse, or store them in a dry place until spring, at which time they are sown outdoors in prepared beds.

We also have plants, the seed of which, require exposure to a cold stratification period before they will germinate. This treatment is necessary in order to overcome internal dormancy in the seed. This is probably the most common type of dormancy and is caused by internal conditions of the stored food or of the embryo itself.

Inside the seed certain chemical changes in the stored food, or in the embryo, must take place before germination can begin. Also, the embryo is sometimes unusually small at the time the seed is dispersed, so that it must undergo some growth before germination can begin.*

To overcome this internal dormancy we expose the seed to an abundant supply of moisture and oxygen, at a constant temperature of 41° F., for a period of three months. The following is a list of plants having seed with this type of dormancy.

	Treatment Recommended
<i>Acer capillipes</i>	3 months 41° F.
<i>Acer griseum</i>	“ “ “ “
<i>Acer rufinerve</i>	“ “ “ “
<i>Acer tataricum</i>	“ “ “ “
<i>Acer triflorum</i>	“ “ “ “
<i>Acer truncatum</i>	“ “ “ “
<i>Carpinus cordata</i>	3-4 months 41° F.
<i>Carpinus japonica</i>	“ “ “ “
<i>Carpinus orientalis</i>	“ “ “ “
<i>Carpinus turezaninowi</i>	“ “ “ “

Seeds requiring low temperature stratification are handled as follows: the seeds are collected from the latter part of September, through the early part of October. Following collection, the seeds are mixed in thoroughly with old rooting medium, which is saved from the previous summer's bench cleaning. This rooting medium consists of 50% sand and 50% peat, by volume, and is thoroughly moistened.

After the seeds have been thoroughly mixed with this rooting medium, we bag the mixture in polyethylene plastic bags. Once bagged the combination of seed and rooting medium is placed in the refrigerator. The seed remains in the refrigerator for three months in the case of the above *Acer* species and for four months in the case of the above *Carpinus* species. The temperature of the refrigerator is kept at a constant 41° F.

Following this three or four month period at 41° F. the seeds are either sown in flats and spotted off as they germinate, or they are sown directly outdoors in prepared beds.

* Woody Plant Seed Manual; U.S.D.A.; Misc. Publ. No. 654; pp. 35-36 (1948).

Having considered the treatment given those seeds which require no pretreatment and those which require only exposure to cold to bring about germination, let us now consider those plants, the seeds of which require exposure to a period of high temperature followed by exposure to a period of low temperature, before they will germinate.

Seeds requiring such pretreatment are said to have "double dormancy," a term used to indicate that the seeds have two different types of dormancy. One is a dormancy caused by the impermeable seed coat, which can be made permeable, allowing oxygen and water to pass through, by subjecting the seed to a fluctuating day and night temperature of 60° F. to 85° F. This high temperature treatment should be carried out for from three to five months depending on the kind of seed. Some seeds require a longer period of high temperature to break down the seed coat than others.

The second type of dormancy is the already above mentioned internal dormancy, which can be overcome by subjecting the seeds to a temperature of 41° F. for a period of three months.*

Listed below are plants, the seeds which require such pretreatment before they will germinate.

	Treatment Recommended
<i>Cotoneaster bacillaris</i>	4 months at 60°-85° F. Followed by 3 months at 41° F. Same as above
<i>Cotoneaster dammeri</i>	“ “ “
<i>Cotoneaster disticha</i>	“ “ “
<i>Sorbus alnifolia</i>	3 months at 60°-85° F. Followed by 3 months at 41° F. Same as above
<i>Sorbus japonica</i>	5 months at 60°-85° F. Followed by 3 months at 41° F. Same as above
<i>Viburnum hupehense</i>	“ “ “
<i>Viburnum lobophyllum</i>	“ “ “

Seed of the above plants are collected during the first week in October, cleaned of their pulpy flesh in the Waring Blendor, mixed thoroughly with old rooting medium and bagged in polyethylene bags. This procedure is the same as was previously described for those seeds which required a cold stratification period. However, instead of placing the bags in the refrigerator at a temperature of 41° F., such as was done with the maple seed, the bags are placed right out on the open bench in the greenhouse.

Here the seeds are subjected to a day and night fluctuating temperature of 60°-85° F. : for three months in the case of the *Sorbus* species; four months in the case of the *Cotoneaster* species, and for five months in the case of the *Viburnum* species.

Following this treatment of exposing the seeds to 60°-85° F., for a prescribed

* Woody Plant Seed Manual; U.S.D.A.; Misc. Publ. No. 634; p. 38 (1948).

length of time, the bags are removed from the greenhouse bench and placed in the refrigerator at 41° F. where they remain for an additional three months. At the end of this period the seeds are either sown in flats in the greenhouse and spotted off as they germinate, or they are sown directly in prepared beds outdoors.

By using these polyethylene plastic bags, seed propagation has been made much easier and even more important, much faster. Once placed inside these plastic bags, with the medium suitably moist, the seeds are in no danger of drying out. After they have been placed either on the open bench, or in the refrigerator, depending on the type of seed, they require no further attention other than being changed from the hot to cold temperature at the proper time.

By using these plastic bags for seeds which require a high temperature period followed by a low temperature period before germination will occur, a great deal of time can be saved. For example, *Sorbus japonica* seed handled the way described above will germinate in six months. Whereas, on the other hand, the same seed planted outdoors in the fall, immediately after it has been collected and cleaned, will not germinate until one year and a half later, or not until one year later if it has been stored dry all winter and is sown in the spring.

This long delayed germination is due to the fact that the seeds require a period of high temperature, followed by a period of low temperature.

Therefore, if you planted the cleaned seed in the fall they would not receive a long enough period of high temperature to break down the seed coat before winter, so that they would lie dormant all winter long until summer came, during which the seed would receive the necessary high temperature to break down the seed coat. Following this exposure to high temperature the seed would then have to go through the next winter before they would receive their cold period. It is this exposure to cold that overcomes the internal dormancy in the seed. Once these two conditions have been fulfilled, in the right sequence, high temperature followed by cold temperature, the seeds will germinate the following spring.

Cold stratification prior to the warm stratification will be of no use, as witness the fact that no germination occurs the first spring following fall planting. The impermeable seed coat must be broken down first by the high temperature, which allows water and oxygen to penetrate into the seed. The presence of these two plus the cold stratification period which follows, will bring about the necessary physiological changes in the seed so that good germination will occur the following spring.

By treating the above mentioned species in the manner described, salable plants can be produced much faster and much cheaper than was previously possible.

In conclusion then, it is safe to say that polyethylene plastic film has made seed propagation much easier and much more profitable.

ROGER G. COGGESHALL

Note: This article is reprinted here from the March-April 1954 issue of "Trees Magazine" by permission of its editor.

ARNOLDIA



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SOME OLD FASHIONED ROSES AT THE ARNOLD ARBORETUM

A few years ago, Professor Stephen Hamblin (Assistant Professor of Horticulture Emeritus, Harvard University) gave the Arnold Arboretum a group of old fashioned roses which he had collected over the years, at the Lexington Botanic Garden.

It was impossible to find sufficient room at the Arboretum in Jamaica Plain to display these properly, so they were arranged in a long row in our experimental nurseries at the Case Estates in Weston. Here, they have been growing well ever since, and were at the height of their bloom this year, the week of June 22nd, most of them being literally covered with blossoms. Growing as they are in the nursery row, they receive no individual attention, and it is necessary to prune them back severely every few years. Even with this little care, they respond remarkably well with a large amount of bloom every year.

At the time this collection was given us, these varieties were selected because they were among the best of many growing in the Lexington Botanic Gardens. We are listing them below, not because they may be superior (or inferior) to others that are currently available, but merely because of the fact that they are alive here, and have been growing well under our treatment since 1948. There are many interesting stories told about some of the old fashioned roses, and some have been valued garden plants for centuries. Regardless of their relative merits as landscape plants, here are some of the ones which have bloomed at the Arnold Arboretum during the past six years:

<i>Name</i>	<i>Approx. Year Introduced</i>	<i>S,SD,D</i>	<i>Diam. of Flower</i>	<i>Color</i>	<i>Type</i>
alba	—	SD	3½"	White	
alba incarnata	1738	D	3"	Blush pink	
"Alika"	1906	D		Red	Gallica
"Amadis"	—	SD	2¼"	Crimson purple	Alpina
"Annie Crawford"	1915	D	2½"	Bright pink	Hy. Perpetual

"Arthur Young"	1863	D	2''	Dark purple	Moss
"Barronne Prevost"	1842	D	2 $\frac{3}{4}$ ''	Rose pink	Hy. Perpetual
"Baroness Rothschild"	1868	D	2 $\frac{3}{4}$ ''	Very soft rose tinted white	Hy. Perpetual
"Belle Isis"	—	D	2 $\frac{1}{2}$ ''	Pale flesh pink	Gallica
"Blanc Double de Coubert"	1892	D	3''	White	Hy. Rugosa
"Brenda"	1894	S	1 $\frac{1}{2}$ ''	Peach Blossom pink	Eglanteria
"Capitaine John Ingram"	1854	D	2''	Reddish purple	Moss
"Captain Hayward"	1893	SD	3 $\frac{1}{4}$ ''	Light crimson	Hy. Perpetual
"Cardinal de Richelieu"	1840	D	2 $\frac{3}{4}$ ''	Dark red violet	Gallica
"Catherine de Wurtemberg"	1843	D	3 $\frac{1}{4}$ ''	Soft pink	Moss
centifolia	1596	D	3''	Pink	
centifolia cristata	1827	D	3 $\frac{1}{4}$ ''	Deep pink	
"Comte de Nanteuil"	1852	D	3''	Crimson purple	Gallica
"Coupe d'Hébé"	1840	D	2 $\frac{1}{2}$ ''	Deep pink	Hy. Bourbon
"Crimson Globe"	1890	D	2 $\frac{1}{2}$ ''	Deep crimson	Moss
"Cumberland Belle"	—	D	2 $\frac{1}{4}$ ''	Silvery pink	Climbing Moss
damascena	1573	D	2 $\frac{1}{2}$ ''	Red, pink or white	
damascena versicolor	1551	SD		White, red and some flowers white and red	
"Désirée Parmentier"	—	D	2 $\frac{3}{4}$ ''	Vivid pink	Gallica
"Duchesse d'Istrie"	1855	D	2 $\frac{1}{4}$ ''	Crimson changing to slate	Moss
"Duchess of Sutherland"	1912	D	4 $\frac{1}{2}$ ''	Rose pink	Hy. Tea
"Dormortier"	—	D	2''	Light red	Gallica
"Elizabeth Rowe"	—	D	2 $\frac{1}{4}$ ''	Deep pink	Moss
"Eos"	—	SD	2''	Sunset red	
foetida bicolor	1590	S	2 $\frac{1}{2}$ ''	Orange scarlet and yellow	
gallica	1500	D	2-3''	Deep pink to crimson	
gallica officinalis	1500	D		Brick red	
"Gloire des Mousseux"	1852	D	3 $\frac{1}{4}$ ''	Pink	Moss
"Goethe"	1911	S,SD	1 $\frac{1}{2}$ ''	Crimson	Moss
"Green Mantle"	1895	S,SD	2 $\frac{1}{2}$ ''	Rosy red	Eglanteria
"Grussan Teplitz"	1897	D		Dark velvety scarlet	Hy. Tea
"Henri Martin"	1863	SD		Crimson	
"Hypathia"	—	D	2''	Bright rose pink	Gallica
"Jeanette"	—	D	2 $\frac{1}{4}$ ''	Bright light red	Gallica
"Jeanne de Montfort"	1851	SD		Clear pink	Moss
"Julia Mannering"	—	S,SD	2 $\frac{1}{2}$ ''	Pink	Eglanteria
"Königin von Dänemark"	—	D	2 $\frac{3}{4}$ ''	Flesh pink	Centifolia
"Lady Penzance"	1894	S	1 $\frac{3}{4}$ ''	Coppery	Hy. Eglanteria
"Lanei"	1854	D	3''	Crimson	Moss
"Maiden's Blush"	1797	D	3''	Soft blush	Hy. Alba
"Marie Louise"	1813	D	3''	Rich deep pink	Damascena
"Marie Tudor"	—	D		Cherry red	Gallica
"Meg Merrilies"	—	S	2''	Rosy crimson	Eglanteria
"Mercedes"	1847	D	2 $\frac{1}{2}$ ''	White and lilac	Gallica
"Mme. Hardy"	1832	D	2 $\frac{1}{2}$ ''	Pure white	Damascena
"Mme. Louis Lévêque"	1873			Carmine rose	Hy. Perpetual
"Mousseline"	1880	D	1 $\frac{3}{4}$ ''	Pinkish white	Moss
"Mousseux Anciens"	—	D	2 $\frac{3}{4}$ ''	Pink	Moss
"Mrs. John Laing"	1887	D	2 $\frac{1}{2}$ ''	Soft pink	Hy. Perpetual
"Oeillet Parfait"	1841	D	2 $\frac{3}{4}$ ''	Striped red and crimson	Gallica
"Oskar Cordel"	1898	D		Bright carmine	Hy. Perpetual
"Pepita"	—	D	3''	Soft rosy pink striped white	Gallica
"Pergolèse"	1860	D	2 $\frac{1}{2}$ ''	Bright purplish crimson	
"Persue de Gossart"	—	D		Velvety cerise	Centifolia
"Petite de Hollande"	—	D	2''	Rose pink	Centifolia

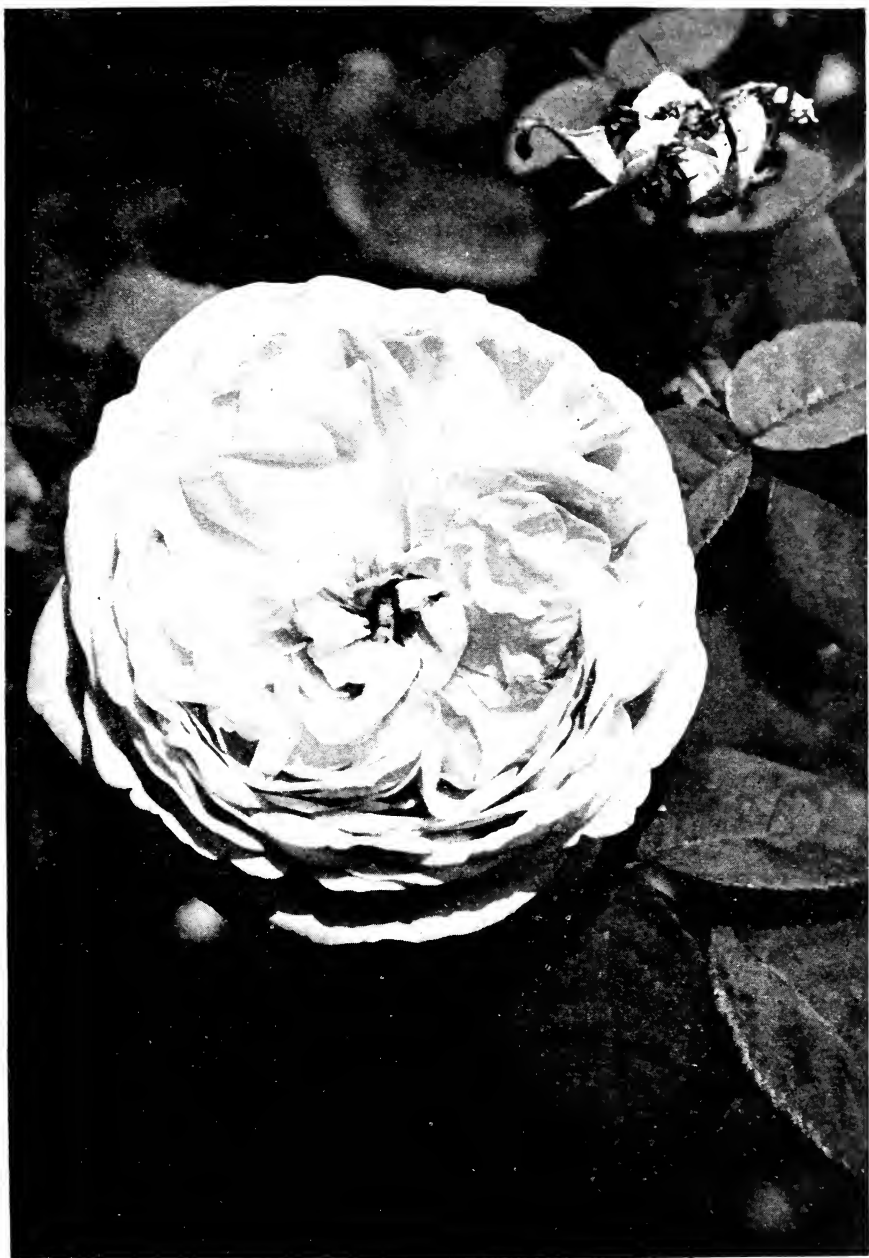


PLATE VI

The old fashioned Cabbage Rose (*Rosa centifolia*) has been a popular garden plant for nearly 400 years.

"Phénice"	1843	D	2½"	Striped red and light red	Gallica
"Prolifera de Redouté"	—	D	2"	Deep pink	Centifolia
"Red Moss"	—	D	3"	Reddish rose	Moss
"Red Provence"	—	D	1¾"	Clear crimson red	Centifolia
"Rose des Peintres"	—	D	2¾"	Purple pink striped white	Centifolia
"Salet"	1854	D	2¾"	Rosy pink	Moss
"Tuscany"	—	SD	2¾"	Velvety blackish crimson	Gallica
"Ulrich Brunner"	1882	D	2½"	Geranium red	Hy. Perpetual
"Waldtraut Nielsen"	—			Clear deep pink	Moss

DONALD WYMAN

NOTE

NEW APPOINTMENTS AT THE ARNOLD ARBORETUM

Dr. Carroll E. Wood, Jr. has been appointed Associate Curator at the Arnold Arboretum effective September 1, of this year. Dr. Wood, currently Associate Professor of Botany at the University of North Carolina, received his B.S. degree from Roanoke College in Salem, Virginia, and the M.S. degree from the University of Pennsylvania before entering the Army in 1943. During the Second World War he served first as lecturer in the Moroccan Arabic language area program, and later in the Field Artillery in Europe. Following his war service Dr. Wood entered Harvard Graduate School and received the Ph.D. in 1949. He was an instructor at Harvard from 1949 to 1951 before accepting an invitation to join the staff of the University of North Carolina.

An active field botanist and worker in horticulture, Dr. Wood has traveled widely in connection with his research in the southeastern United States, northern Michigan, California, Mexico, and Cuba. His publications deal with the cytology, genetics, and classification of flowering plants. In his new position at the Arboretum Dr. Wood will continue this work, utilizing the extensive living and herbarium collections of the Arboretum, and will in addition take part in the Adult Education program of the Arnold Arboretum.

Mr. Roger G. Coggeshall has been appointed Propagator at the Arnold Arboretum effective July 1, 1954. Mr. Coggeshall is a native of Acushnet, Massachusetts, and a graduate of Bourne, Massachusetts, High School. He attended Northeastern University for a year before interrupting his education for military service with the Army in Japan. Upon his return he entered Stockbridge School of Agriculture at Amherst, Massachusetts, where he specialized in ornamental horticulture. After his graduation in 1950 he was appointed Assistant Propagator at the Arnold Arboretum. His work with problems of propagating woody plants has been reported before the Plant Propagators' Society and the American Society for Horticultural Science. Recent articles by Mr. Coggeshall have been published in the AMERICAN NURSERYMAN, TREES, and ARNOLDIA.

Mr. Coggeshall is appointed to the position left vacant by the resignation of Mr. Lewis Lipp, who served as Propagator at the Arboretum from 1952 to 1954. Mr. Lipp joins the staff of the Cleveland Garden Center and the Holden Arboretum.

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AN EDUCATION PROGRAM AT THE ARNOLD ARBORETUM

STARTING this fall the staff of the Arnold Arboretum will offer, twice a year, a program of classes to allow the "Friends of the Arnold Arboretum" and others interested in horticulture and scientific botany an opportunity to become familiar with the staff members and the resources of the Arboretum. To the Field Course which has been offered in the spring and fall for a number of years there will be added this fall three courses, Basic Botany for the Home Gardener, Plant Propagation, and Tropical Botany; and will consist of illustrated lectures, demonstrations and laboratory or practical work, to be taught by the staff of the Arboretum. The courses are all informal and no academic credit will be given. All are open to anyone with an interest in the topics and willing to attend regularly; however, priority of enrollment is being offered to members of the "Friends of the Arnold Arboretum." The courses will be elementary in the approach to the subjects and no technical knowledge or special background is required in order to join the courses. Some of the classes will be repeated in the spring of the year and additional topics and courses will be added in succeeding semesters. Advanced courses will be offered in future years.

A nominal fee will be charged for the course work offered and the funds so obtained will be used to meet the expenses of the courses, to further the work of the Arboretum in the field of adult education and to offer a series of public lectures on topics of general interest pertaining to the work of the Arboretum in horticulture, plant exploration, dendrology and plant geography.

The course in plant propagation to be offered this fall will be conducted in the Arboretum greenhouses. The others will be offered in the new lecture-demonstration hall in the Administration Building. The Arnold Arboretum is reached from Boston by elevated trains or surface cars to Forest Hills station. The greenhouses are located on South Street just beyond the Bussey Institute Laboratories. The Administration Building is at the Jamaica Plain Gate about ten minutes'

walk from the Forest Hills subway station. Parking space is available for cars at both locations.

Registration must be made by mail in advance or at the first meeting of the class. Enrollment is limited in all courses and priority will be established on the post office date of application. Fees are payable in full in advance. Members of the "Friends of the Arnold Arboretum" may receive a 50% discount of the fee for one course each semester. Applications for registration or questions regarding these or the future courses should be addressed to Dr. Carroll E. Wood, Jr., who is in charge of this program. Checks should be made payable to Harvard University.

RICHARD A. HOWARD

The Staff

Mr. Roger Coggeshall is propagator for the Arnold Arboretum. A graduate of Stockbridge School of Agriculture at Amherst, Massachusetts, Mr. Coggeshall joined the Arboretum staff in 1950 and was appointed head propagator in 1954.

Dr. Richard Howard is Arnold Professor of Botany and Director of the Arboretum. With a long-standing research interest in tropical America, Dr. Howard calls upon personal field experience to present the plant life of the warmer areas in the course of Tropical Botany.

Dr. Carroll Wood joined the Arboretum staff in 1954 as Associate Curator and will be in charge of the adult education program at the Arboretum. Dr. Wood has enjoyed considerable success in teaching elementary botany at Harvard University and more recently at the University of North Carolina. His familiarity with the science and his knowledge of ornamental plants will allow him to present Basic Botany in terms of plants with which the student is familiar.

Dr. Donald Wyman, horticulturist at the Arnold Arboretum, is well known to garden clubs and horticulturists in New England. His personally conducted field classes of the spring and autumn have enabled many persons to enjoy more fully the beauties and the collections of the Arnold Arboretum. His several books and his many articles in "Arnoldia" have reported to many the work of the Arnold Arboretum.

FALL COURSES

Basic Botany for the Home Gardener

Instructor: Dr. Wood

How plants live, grow and reproduce is discussed in this course and an explanation of modern botanical classification and of plant names is given. The subject matter will be discussed in terms of plants you grow or use in or around your home. If you have ever wondered why your efforts at gardening succeed or fail, you may find the answers in the fundamentals of plant structure and growth, or the relationship of the plant to its environment. This course may also serve as an

introduction to you for the parts of the plant and the proper names to be applied to each. Lectures will be illustrated with kodachrome slides and will be followed by laboratory periods of practical study and examination of plant parts.

8 sessions. Tuesday evenings, 7-9, beginning October 5th. Fee \$10.00

Fall Field Class in Ornamental Plants

Instructor: Dr. Wyman

Informal outdoor talks and field trips on the Arboretum grounds under the supervision of Dr. Wyman and the horticultural staff make up the Fall Field Class. Different plant groups are studied on each trip. The class sessions will consider the berried trees and shrubs, autumn color, the evergreens and similar topics. Opportunities are afforded for questions and answers relating to the identification and culture of ornamental plants as seen in the Arboretum or as suitable for culture in New England. In case of rain or cold weather, meetings are held indoors.

6 sessions. Friday mornings, 10-12, beginning October 1st. Fee \$2.00

Plant Propagation I

Instructor: Mr. Coggeshall

An introductory course to the principles and practices of reproducing flowering plants. The work is designed for the amateur or home gardener who may wish to propagate plant materials for his own garden. The proper methods of selecting, collecting, storing, starting and handling seeds, corms, bulbs and tubers will be considered. Lectures, demonstrations and practice will be given in techniques of making soft and hard wood cuttings for rooting. The techniques of budding, grafting, air layering and the use of hormones and plastics will also be included in the course.

8 sessions, meeting once a week. Three sections will be offered, one on Tuesday afternoon (2:30-4:30), one on Wednesday morning (9:30-11:30) and one on Wednesday evening (7-9). Enrollment limited to twenty students per section.

First meeting October 5th at the greenhouses. Fee \$10.00

Tropical Botany

Instructor: Dr. Howard

This course is planned particularly to answer the desires of men and women who have been in the tropics or the near tropics during the past few years, as well as for those contemplating trips in the near future. The lectures will be illustrated with kodachrome slides and will consider such topics as food plants, agricultural crops, ornamentals, forest types, epiphytes and orchids. Supplementary studies will be made of herbarium specimens and tropical plant products. A consideration of the literature of the area will also be given.

If you are planning a trip to Florida, any of the Caribbean Islands or even further South, you will profit from these discussions of the geography of the

American tropics, the various types of plants that make up the native and introduced vegetation and the tips on where to go and what to see.

6 sessions. Thursday evenings, 7-9, beginning October 14th.

Fee \$10.00

Cut along here

Dr. Carroll E. Wood, Jr.
Arnold Arboretum
Jamaica Plain 30, Mass.

Advance registration for the Fall courses at the Arnold Arboretum

Basic Botany for Home Gardeners _____

Field Class in Ornamental Plants _____

Plant Propagation — Tuesday afternoon section _____

Wednesday morning section _____

Wednesday evening section _____

Tropical Botany _____

A check made payable to Harvard University for \$ _____ is enclosed.

I ^{am} not a member of the "Friends of the Arnold Arboretum."

Name _____

Address _____

ARNOLDIA



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HURRICANE "CAROL" IN THE ARNOLD ARBORETUM

THE morning of August 31 dawned with rain-laden clouds and moderate winds. By 9 A.M. the hurricane warnings were coming over the radio, but in the Arnold Arboretum the winds did not build up until near noon. At 11 A.M. a quick trip through driving rain disclosed little damage. A half hour later a few branches were noted as broken and one or two trees were blown over. During the next hour, the lights in the administration building went out and telephone connection was severed. Once again I took a quick trip about the grounds shortly after noon. This time there were many trees blown over and the Arboretum road became blocked during the few minutes I drove around. Most of the serious damage to the Arboretum plantings occurred at about this time for shortly after 12.30 the sun appeared for a few minutes and the winds, although strong, were not the previous heavy hurricane gusts of about 125 miles per hour.

There had not been much rain prior to this storm for the soil under the roots of fallen trees was very dry. This was just the reverse of the situation in the 1938 hurricane when heavy rains of nearly a week had preceded the storm and trees were easily blown over because of the muddy soil about the roots.

Hurricane "Carol" did a great deal of damage to the trees in the Arboretum and it will take many months of pruning to correct the damage done to trees still left standing. The "whipping" damage done to branches of standing trees seems to have been greater this time than it was in 1938, but otherwise the statistics concerning the fallen trees are heartening.

Approximately 300 trees were blown over or otherwise irreparably damaged in the Arboretum in Jamaica Plain, as compared with 1490 in the 1938 hurricane. An additional 43 trees were blown down (with roots exposed) but were replanted, staked, watered, pruned and fertilized within three days after the storm. An additional 63 trees were tilted over by the high winds, but had no roots exposed. All these were staked and watered within ten days after the storm. Consequently,

of approximately 400 trees severely damaged, 25% were salvaged and properly cared for by the regular Arboretum crew of eight men within ten days, and all should live. These were all it was possible to salvage.

Other figures are even more heartening. Seven of the downed trees that were not duplicated in the collections, were propagated at once so that the clonal line would not be lost. Of all the trees which must be removed, only 7 are not duplicated in the collections and none of these are valuable clones. Duplicates, or propagation material can be found in other arboretums if we want to grow them again.

Trees that grow with dense branching, and in exposed situations were most susceptible to the freak gusts. Most trees were blown down in a northerly or northeasterly direction. Trees with rotted trunks or poor crotches were of course susceptible to injury. Firs, spruces and lindens seemed to suffer most because of their dense branching habit, and the poplars were badly injured, not because of their weak wood but also because the areas in which they were growing were exposed to the south. One interesting fact appeared however, and that was that in the *Malus* collection, in the same exposed area where poplars, firs and spruces were blown over, few of the *Malus* were broken off or blown down. Many had their roots loosened but were saved by the prompt attention of the grounds force.

It is impossible to estimate the damage done in the Arboretum in dollars and cents. Suffice it to say that with the purchase of two additional chain saws and a brush chipper, it is estimated that the fallen trees and branches can be removed by the present grounds force of eight men, within the current year's budget. It is true that many beautiful trees have been destroyed, but it is most fortunate that no valued species and varieties have been lost, and that the immediate damage can be repaired by the present grounds force and within current Arboretum funds available.

The removal of this debris will take most of the time of the grounds force during the next weeks, and battered trees left standing will be evident for months to come, so that other work planned for this fall must be put off. However, the damage could have been far worse. No beautiful vistas have been irreparably damaged, and after the debris has been cleared away the Arboretum will still remain America's greatest garden.

DONALD WYMAN

P. S. Since writing the above, Hurricane "Edna" has blown through but did only 15% of "Carol's" damage.

Note—The next bulletin will contain information on the caring for injured trees, and a list of some which seem to be more resistant to wind breakage than others.



PLATE VII

A white fir (*Abies concolor*) the trunk of which was 36" in diameter, broken off in the Arnold Arboretum by hurricane "Carol," August 31, 1954.

HURRICANE LOSS

Some of the trees blown over or so badly damaged they will have to be removed

- | | |
|--|--|
| <p> <i>Abies amabilis</i> (1)
 <i>Abies cilicica</i> (2)
 <i>Abies concolor</i> (10)
 <i>Abies nephrolepis</i> (1)
 <i>Abies sachalinensis</i> (2)
 <i>Acer grandidentatum</i>
 <i>Acer platanoides</i> vars. (3)
 <i>Acer rufinerve</i> (1)
 <i>Acer</i> "Weir Maple" (1)
 <i>Aesculus hippocastanum</i> (2)
 <i>Amelanchier canadensis</i> (1)
 <i>Carya buckleyi arkansana</i> (2)
 <i>Carya cordiformis</i> (1)
 <i>Carya glabra</i> (1)
 <i>Carya tomentosa</i> (1)
 <i>Carya</i> "Small Nut" (1)
 <i>Carya</i> "Weiker Hickory" (1)
 <i>Castanea mollissima</i> (1)
 <i>Catalpa speciosa</i> (2)
 <i>Cedrus libani</i> (1)
 <i>Celtis bungeana</i> (1)
 <i>Cercis canadensis</i> (1)
 <i>Cladrastis lutea</i> (1)
 <i>Cornus controversa</i> (1)
 <i>Cornus florida</i> (1)
 <i>Cotinus americanus</i> (1)
 <i>Crataegus crus-galli</i> (2)
 <i>Crataegus phaenopyrum</i> (1)
 <i>Crataegus punctata</i> (1)
 <i>Elaeagnus multiflora ovata</i> (1)
 <i>Eucommia ulmoides</i> (2)
 <i>Evodia danielli</i> (our oldest plant)
 <i>Fagus sylvatica atropunicea</i> (1)
 <i>Fraxinus americana</i> (2)
 <i>Fraxinus pennsylvanica</i> (2)
 <i>Fraxinus tomentosa</i> (1)
 <i>Gymnocladus dioicus</i> (2)
 <i>Hamamelis intermedia</i> (1)
 <i>Juniperus virginiana</i> (1)
 <i>Larix leptolepis</i> (1)
 <i>Liriodendron tulipifera</i> (2)
 <i>Magnolia acuminata</i> (1)
 <i>Magnolia fraseri</i> (1)
 <i>Malus fusca integrifolia</i> (1)
 <i>Malus</i> "Excellenz Thiel" (1)
 <i>Paulownia tomentosa</i> (2)
 <i>Picea abies</i> (3)
 <i>Picea asperata</i> (1)
 <i>Picea glauca</i> (3)
 <i>Picea mariana</i> (2)
 <i>Picea obovata fennica</i> (1)
 <i>Picea omorika</i> (2) </p> | <p> <i>Picea pungens</i> (1)
 <i>Picea rubens</i> (1)
 <i>Pinus echinata</i> (2)
 <i>Pinus lambertiana</i> (1)
 <i>Pinus nigra</i> (1)
 <i>Pinus resinosa</i> (1)
 <i>Pinus strobus</i> (1)
 <i>Populus acuminata</i> (1)
 <i>Populus alba</i> (1)
 <i>Populus berolinensis</i> (1)
 <i>Populus canadensis</i> (4)
 <i>Populus canadensis regenerata</i> (1)
 <i>Populus candicans</i> (2)
 <i>Populus generosa</i> (4)
 <i>Populus jacki</i> (1)
 <i>Populus nigra</i> (1)
 <i>Populus robusta</i> (2)
 <i>Populus trichocarpa</i> (1)
 <i>Prunus padus alberti</i> (1)
 <i>Pseudotsuga taxifolia glauca</i> (3)
 <i>Ptelea trifoliata aurea</i> (1)
 <i>Pyrus ussuriensis ovoidea</i> (1)
 <i>Quercus alba</i> (1)
 <i>Quercus bicolor</i> (2)
 <i>Quercus heterophylla</i> (1)
 <i>Quercus imbricaria</i> (2)
 <i>Quercus lodoviciana microcarpa</i> (1)
 <i>Quercus macrocarpa</i> (1)
 <i>Quercus mongolica</i> (1)
 <i>Quercus montana</i> (1)
 <i>Quercus schuettei</i> (1)
 <i>Quercus velutina</i> (2)
 <i>Rhus copallina</i> (1)
 <i>Robinia hispida x pseudoacacia</i> (1)
 <i>Robinia kelseyi floribunda</i> (1)
 <i>Sorbus hybrida</i> (1)
 <i>Syringa</i> "Ellen Willmott" (1)
 <i>Tilia americana</i> (3)
 <i>Tilia amurensis</i> (1)
 <i>Tilia flavescens saethi</i> (1)
 <i>Tilia moltkei</i> (1)
 <i>Tilia oliveri</i> (1)
 <i>Tilia petiolaris</i> (1)
 <i>Tilia platyphyllos sphaerocarpa</i> (1)
 <i>Tilia platyphyllos tortuosa</i> (1)
 <i>Tilia tomentosa</i> (1)
 <i>Tsuga caroliniana</i> (5)
 <i>Ulmus americana</i> (1)
 <i>Ulmus parvifolia</i> (1)
 <i>Viburnum</i> "Hahs" (1)
 <i>Salix</i> (15) </p> |
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REHABILITATION OF TREES INJURED BY HURRICANES OF 1954

THE hurricanes, this fall, did great damage to the trees of New England, but it must be admitted that many a tree came down that was rotten at its heart, or large branches were broken off which had never been properly pruned. The hurricane of 1938 did five times as much damage to trees, one of the reasons being that it had been nearly 100 years since a previous hurricane in this area. In the few years since 1938, many another decayed limb or tree has been allowed to stand too long by the responsible property owner. A close scrutiny of the trees which are down now proves the old adage that "It is an ill wind which blows no one good."

I speak from experience, because in front of my house were two large horse-chestnut trees at least two feet in trunk diameter. They supplied much needed shade and acted as a screen between the house and the street, but we knew they were rotten in the center and that they should have been taken down several years before these hurricanes. As a result, they were both toppled over by the first strong gusts of "Carol" and took the electric and telephone wires with them. Undoubtedly, many another home owner found himself in the same predicament.

Many lessons were learned about plants as a result of the 1938 hurricane and it is not amiss to list a few of the highlights resulting from a close study of plants made after that storm, for the lessons learned then are certainly applicable now.

Salt Water Damage

Many plants showed a remarkable ability to withstand immersion in salt water for a twenty-four hour period and even longer. This may have been because the soil was saturated with water from the heavy rains (1938) before it was immersed in salt water. Be that as it may, lawns were then submerged in salt water (as in 1954) and the Rhode Island Experiment Station received hundreds of soil samples from anxious property owners the following spring, who wanted to know what to

do about their soil which they thought might be made sterile by high salt accumulations. In no case was a sufficiently heavy accumulation of salt found to cause permanent injury to the soil. There were many cases where either the grass foliage or the grass roots had been killed by immersion in salt water.

Standard practice to renovate immersed lawns was to apply ground limestone immediately at the rate of 20-50 pounds per thousand square feet and thoroughly water the limestoned area after the application. If the grass roots were not killed, new growth appeared in the spring. If the grass roots were killed, the soil was dug up and reseeded, standard applications of regularly recommended fertilizers being made at the time. Different grasses reacted in different ways. Bent grass and Kentucky Bluegrass were easily killed, while the omnipresent crab grass was not. Several of the lawns observed around Woods Hole the spring after the '38 hurricane were a nice green from a distance, although on close examination the grasses were sometimes those of a more coarse texture than were originally there. Nevertheless, the fact remains that they were not killed and made an excellent recovery.

Injury to trees and shrubs differed widely in that study after the '38 storm undoubtedly due to variations in soils, drainage, exposures, together with wind velocities of the storm and the height, age and condition of the plants in question. Many commonly grown plants were not observed in this survey so that numerous additions to the following lists can easily be made from first hand observation. The following lists do include those plants that can and should be planted in seashore areas where a recurrence of salt water injury is always a possibility. Those who are wondering about the injury to foliage of deciduous and evergreen trees now (1954), should be interested in going through these lists. The foliage of deciduous trees and shrubs was due to drop anyway a few weeks after the storms hit, so the chances are that few deciduous plants will be permanently injured from salt water spray alone. With evergreens it is more important to wash off the salt spray from the foliage unless heavy rains have already done it. Also during the '54 storms, salt spray damage probably did not appear nearly as far inland as it did in 1938.

The following plants were submerged in salt water for at least 24 hours after the hurricane (of '38) and were recovering satisfactorily when observed one year later

(In all cases the roots were submerged, and in many cases the plants themselves or portions of them. Satisfactory recovery means that, although injured, these plants were sending out vigorous suckers from the base or from the larger stems, or the tops were sending out new shoots. It should be noted here that if the inundation had come after a long drought and the soil had not been saturated with water, there might have been a considerably greater injury.)

Acer pseudoplatanus
Aesculus hippocastanum

Ailanthus altissima
Aronia arbutifolia



PLATE VIII

This Norway Maple never had a main leader, but several grew equally large, making very weak crotches which easily split with the strong wind.

<i>Calluna vulgaris</i>	<i>Prunus virginiana</i>
<i>Campsis radicans</i>	<i>Pyrus communis</i>
<i>Catalpa speciosa</i>	<i>Quercus alba</i>
<i>Clematis paniculata</i>	<i>Rhododendron viscosum</i>
<i>Clethra alnifolia</i>	<i>Rhus aromatica</i>
<i>Comptonia asplenifolia</i>	<i>Rhus copallina</i>
<i>Corylus americana</i>	<i>Rhus glabra</i>
<i>Cryptomeria japonica</i>	<i>Rhus toxicodendron</i>
<i>Hibiscus syriacus</i>	<i>Rhus typhina</i>
<i>Ilex glabra</i>	<i>Rhus vernix</i>
<i>Juniperus chinensis pfitzeriana</i>	<i>Robinia pseudoacacia</i>
<i>Juniperus virginiana</i>	<i>Rosa (Ramblers)</i>
<i>Juniperus virginiana glauca</i>	<i>Rosa rugosa</i>
<i>Ligustrum amurense</i>	<i>Rosa virginiana</i>
<i>Ligustrum ovalifolium</i>	<i>Rosa wichuraiana</i>
<i>Malus sylvestris</i>	<i>Salix alba</i>
<i>Myrica pensylvanica</i>	<i>Sambucus canadensis</i>
<i>Nyssa sylvatica</i>	<i>Smilax glauca</i>
<i>Parthenocissus tricuspidata</i>	<i>Spiraea prunifolia</i>
<i>Populus grandidentata</i>	<i>Tamarix parviflora</i>
<i>Picea canadensis</i>	<i>Tilia cordata</i>
<i>Picea pungens kosteri</i>	<i>Ulmus pumila</i>
<i>Pinus sylvestris</i>	<i>Vaccinium corymbosum</i>
<i>Pinus thunbergi</i>	<i>Viburnum dentatum</i>
<i>Prunus maritima</i>	<i>Vitis labrusca</i>
<i>Prunus serotina</i>	<i>Wisteria sinensis</i>

**Plants subjected to salt spray and either uninjured
or not injured seriously ('38)**

(The hurricane came only a few weeks before most deciduous trees dropped their leaves; consequently, salt spray injury was comparatively worse on the evergreens. The amount of salt spray varied considerably in different locations, and many of the plants in this list would be injured in one place and uninjured in another. Many other plants weathered salt spray injury satisfactorily but do not appear on this list because they were not observed. These facts should be kept in mind when studying the list.)

<i>Acer platanoides</i>	<i>Baccharis halimifolia</i>
<i>Acer pseudoplatanus</i>	<i>Cedrus atlantica glauca</i>
<i>Actinidia arguta</i>	<i>Cephalanthus occidentalis</i>
<i>Ailanthus altissima</i>	<i>Chamaecyparis pisifera plumosa</i>
<i>Amelanchier canadensis</i>	<i>Chamaecyparis pisifera squarrosa</i>
<i>Arctostaphylos uva-ursi</i>	(damaged somewhat)

Clethra alnifolia
Cornus kousa
Cotoneaster divaricata
Crataegus crus-galli
Cytisus praecox
Cytisus scoparius
Elaeagnus angustifolia
Elaeagnus longipes
Elaeagnus umbellata
Euonymus alata compacta
Fagus sylvatica
Forsythia species
Gleditsia triacanthos
Hippophae rhamnoides
Hydrangea macrophylla
Ilex glabra
Ilex opaca
Juniperus communis
Juniperus communis depressa
Juniperus excelsa stricta
Juniperus horizontalis
Juniperus virginiana
Juniperus virginiana glauca
Kalmia angustifolia
Ligustrum amurense
Lonicera japonica halliana
Lonicera morrowi
Lonicera tatarica
Malus sylvestris
Myrica pensylvanica
 (M. carolinensis)
Parthenocissus tricuspidata
Physocarpus opulifolius
Picea abies
Picea asperata
Picea canadensis
Picea glauca
Picea orientalis
Picea pungens kosteri
Pieris japonica
Pinus mugo mughus (varied responses
 on different soils)
Pinus nigra
Pinus thunbergii
Populus alba
Prunus maritima
Pyrus communis
Quercus marilandica
Rhamnus cathartica
Rhus copallina
Rhus glabra
Rhus toxicodendron
Rhus typhina
Robinia pseudoacacia
Rosa (ramblers)
Rosa blanda
Rosa humilis
Rosa nitida
Rosa rugosa
Rosa virginiana
Rosa wichuraiana
Salix humilis
Sambucus canadensis
Spiraea species
Syringa vulgaris (if submerged, it was
 killed)
Tamarix parviflora
Taxus species and varieties (even took
 submergence for 2-3 days in some
 instances though they did not re-
 spond as well as Pfitzer's juniper)
Tilia americana
Tilia cordata
Tilia vulgaris
Thuja occidentalis varieties
Ulmus pumila
Vaccinium corymbosum
Viburnum cassinoides
Viburnum dentatum
Wisteria sinensis

Plants killed or very seriously injured by salt water ('38)

(If salt water stood on the soil long enough it would kill all the roots of most trees and shrubs, except a very few like *Baccharis*. The plants listed below were killed or seriously injured by salt spray, by submergence in salt water, or by both.)

<i>Abies concolor</i>	<i>Liriodendron tulipifera</i>
<i>Abies pinsapo</i>	<i>Lyonia ligustrina</i>
<i>Acer rubrum</i>	<i>Parthenocissus quinquefolia</i>
Azaleas (evergreen types)	<i>Pinus rigida</i>
<i>Berberis thunbergii</i>	<i>Pinus strobus</i>
<i>Betula papyrifera</i>	<i>Pseudotsuga taxifolia</i> (<i>P. douglasi</i>)
<i>Betula populifolia</i>	Rhododendrons (evergreen types)
<i>Buxus sempervirens</i>	<i>Rosa</i> —(any grafted or budded rose)
<i>Buxus sempervirens suffruticosa</i>	Injury may have been due to sud-
<i>Cephalanthus occidentalis</i>	den freeze late in the fall, more than
<i>Chamaecyparis</i> species and varieties	to salt water injury.
<i>Clematis virginiana</i>	<i>Sassafras albidum</i> (<i>S. officinale</i>) but
<i>Euonymus</i> species and varieties	coming up from roots
<i>Ginkgo biloba</i>	<i>Tsuga canadensis</i>
<i>Hedera helix</i>	<i>Ulmus americana</i>
<i>Larix decidua</i>	<i>Ulmus fulva</i>
<i>Liquidambar styraciflua</i>	<i>Weigela</i> species and varieties

WIND DAMAGE INLAND

The home owner should have carefully inspected the trees and branches which were blown down on his property, after the recent hurricanes, to note and understand the reasons why those particular plants were injured. It must be admitted that sometimes the vagaries of the wind only could be blamed. More often however, those that were rotten in the center, or those with weak crotches or in very exposed situations, were the ones most injured. It was easily evident too, that those species like *Abies concolor* and *Tilia cordata* which are densely branched, presented easy targets for strong gusts to topple over—if the strong gusts came that way: while other open-branched types like the honeylocust and tupelos were not so susceptible.

All plants that could be pulled back into position should have been cared for properly. Those with roots exposed should have been cared for within two days after the storms. It is a simple matter to dig under the roots of small trees that have been tipped up, and then slowly and carefully pull the tree back into position, wiring it to stakes in three different directions. Trees over 10" in diameter are usually too heavy and too difficult to pull back into position and stake permanently without the expenditure of considerable money, and the use of power equipment. Of course, the heavier and taller the tree pulled back now, the easier it is blown over again by the first gust of wind that strikes it. Wires used in staking



PLATE IX

A brush chipper, new equipment in the Arnold Arboretum, clips brush up to 3" in diameter, and is a great labor saver.

small trees should be No. 8 gauge at least, and should be passed through a piece of rubber hose where they encircle the tree in order that the wire does not bite into the bark. No wire should be wound around the tree trunk tightly, but rather loosely to allow for the future growth of the bark tissues.

Stakes hammered in the ground deeply are sufficient anchorage for most small trees. Larger ones require several "dead men." A deep hole is dug and a sturdy timber or heavy branch several feet long is placed in the hole at right angles to the tree trunk. The wire is attached to this branch or timber, the hole filled in with stones and soil. Such an anchorage serves for the heavier trees.

The tree might well be watered and mulched with manure or compost, or fertilized with a reasonable application of commercial fertilizer. If many of the roots have been broken, the top should be trimmed back accordingly. A good rule, when in doubt, is to remove one third of the linear branches of a tree being transplanted unless it has a ball of earth about the roots. Certain proportionate deductions can be made when only a small proportion of the roots have been broken.

PRUNING

After all trees have been salvaged in this manner, then the pruning should be started. From the standpoint of tree growth, the pruning can be done any time between now and when growth starts next spring. However, in the case of jagged wounds, there is the possibility that the longer these are left uncared for the more the opportunity for water and disease spores to find their way into the trunk and start decay. So, the sooner the pruning can be done, the safer the tree is from disease troubles. All dead, broken or diseased branches should be removed.

HOW TO PRUNE

1. Make all cuts clean with sharp tools.

2. Never leave any stubs. A short stub may never heal over and is always a source for infection. Make all cuts back to a bud, branch or main trunk. The removal of a large limb should be done in three cuts. First, an undercut is made by sawing up one fourth or one third through the limb about a foot from the trunk of the tree. Then the uppercut is started one to two inches beyond the first cut away from the trunk on the top of the branch and sawed down until the limb falls. As the two cuts near each other and the limb begins to sag, its weight will break the wood at the center and the limb will jump clear without stripping and tearing the bark down the tree trunk. Finally the stump is removed by a cut flush with the trunk of the tree.

3. Paint all cuts over 1" to 2" in diameter with a protective paint.

One should always keep in mind the type of tree being pruned. Most trees like the birches, lindens, hickories and most of the conifers, grow best with a

single trunk as leader. In such cases, never allow two equally vigorous leaders to develop on exactly opposite sides of the trunk. This would always be a weak crotch and susceptible to breaking or splitting in the center the first time a strong wind hits it just right. Such breaking can easily spoil the symmetry of the entire tree, so these obvious faults should be sought out early in the life of the tree and corrected by prompt pruning. One of the leaders should either be removed entirely when it is young, or else cut back severely so that it will never grow as fast as the main leader.

Transplanting trees in New England can be done either now or next spring. Some of the harder-to-move plants like the magnolias, tupelos, white oaks, etc., might best be moved in the early spring. The soil has plenty of moisture now, so transplanting might well be undertaken this fall for many other kinds of plants.

It might be well to keep in mind some of the trees that are notorious for weak wood, and can be expected to split in any heavy wind storm. In fact, some towns have passed laws which prohibit some of these from being used as street trees.

TREES THAT CRACK AND SPLIT EASILY IN WIND OR ICE STORMS

<i>Acer rubrum</i>	Red Maple
<i>Acer saccharinum</i>	Silver Maple
<i>Aesculus hippocastanum</i>	Horse-chestnut
<i>Albizia julibrissin rosea</i>	Silk tree
<i>Carya species</i>	Hickories
<i>Catalpa species</i>	Catalpa
<i>Cladrastis lutea</i>	American Yellow-wood
<i>Fraxinus species</i>	Ashes
<i>Liriodendron tulipifera</i>	Tulip Tree
<i>Paulownia tomentosa</i>	Royal Paulownia
<i>Populus species</i>	Poplars
<i>Salix species</i>	Willows
<i>Ulmus pumila</i>	Siberian Elm

TREES TO PLANT

There is always a question of what to plant. Since losses have been sustained in so many different places, it is most difficult to give one list of trees which are suitable for all situations. Instead there follows a list of some of the best ornamental trees for the New England area, with index numbers denoting what they might be first considered for. These are all available from New England nurseries with one or two exceptions. Sources where they might be purchased were listed in *ARNOLDIA* 12: No. 1, March 7, 1952, which is unfortunately now out-of-print. (The numbers after each tree name refer to the uses for which it might be planted.)

1. Street Trees
2. With Ornamental Flowers
3. With Ornamental Fruits
4. With Interesting Bark
5. For City Conditions
6. Usually Pest-Free
7. Best Small Shade Trees for Small Properties
8. Height: 20'-35'
9. 35'-75'
10. over 75'

These are not all perfect trees for every situation, but they all have special qualifications for one or more particular situations. Included in this are many excellent evergreen trees and many with outstanding autumn color.

<i>Abies concolor</i> 5, 10	White Fir
<i>Abies homolepis</i> 10	Nikko Fir
<i>Abies koreana</i> 9	Korean Fir
<i>Acer circinatum</i> 1, 3, 7, 8	Vine Maple
<i>Acer ginnala</i> 1, 3, 7, 8	Amur Maple
<i>Acer griseum</i> 1, 4, 8	Paperbark Maple
<i>Acer palmatum atropurpureum</i> 7, 8	Bloodleaf Japanese Maple
<i>Acer platanoides</i> 1, 5, 10	Norway Maple
<i>Acer platanoides columnare</i> 1, 10	Columnar Norway Maple
<i>Acer platanoides</i> "Crimson King" 1, 10	
<i>Acer rubrum columnare</i> 1, 10	Columnar Red Maple
<i>Acer saccharum</i> 1, 10	Sugar Maple
<i>Amelanchier canadensis</i> 2, 3, 4, 9	Shadblow Serviceberry
<i>Amelanchier laevis</i> 2, 3, 4, 9	Alleghany Serviceberry
<i>Betula lenta</i> 10	Sweet Birch
<i>Betula papyrifera</i> 4, 10	Paper Birch
<i>Cedrus libani</i> 6, 10	Cedar of Lebanon
<i>Cercidiphyllum japonicum</i> 1, 6, 9	Katsura Tree
<i>Cercis canadensis alba</i> 2, 7, 8	White Eastern Redbud
<i>Chamaecyparis obtusa</i> 6, 10	Hinoki Falsecypress



PLATE X

The Siberian elm (*Ulmus pumila*) is one of the first trees to break up in wind, snow or ice storms.

- Cornus florida* 1, 2, 3, 7, 9
Cornus kousa chinensis 1, 2, 3, 7, 8
Crataegus crus-galli 1, 2, 3, 5, 7, 8
Crataegus oxyacantha pauli 1, 2, 3, 5, 8
Crataegus phaenopyrum 1, 2, 3, 7, 8
Elaeagnus angustifolia 4, 5, 6, 7, 8
Evodia danielli 1, 2, 3, 8
Fagus species and vars. 4, 10
Ginkgo biloba 1, 5, 6, 10
Gleditsia triacanthos "Moraine" 1, 5, 6, 10
Halesia monticola 1, 2, 10
Ilex opaca 3, 9
Ilex pedunculosa 3, 8
Juniperus virginiana 3, 4, 6, 10
Kalopanax pictus 1, 2, 3, 6, 10
Koelreuteria paniculata 1, 2, 3, 5, 6, 7, 8
Laburnum vossii 2, 6, 8
Larix leptolepis 10
Liquidambar styraciflua 1, 6, 10
Magnolia denudata 2, 3, 5, 9
Magnolia soulangeana 2, 3, 5, 7, 8
Magnolia stellata 2, 3, 5, 6, 7, 8
Magnolia virginiana 2, 3, 8
Malus arnoldiana 2, 3, 5, 7, 8
Malus atrosanguinea 2, 3, 5, 7, 8
Malus "Dorothea" 2, 3, 5, 7, 8
Malus "Eley" 2, 3, 5, 8
Malus floribunda 2, 3, 5, 7, 8
Malus "Hopa" 2, 3, 5, 7, 8
Malus hupehensis 2, 3, 5, 8
Malus purpurea aldenhamensis 2, 3, 5, 7, 8
Malus purpurea lemoinei 2, 3, 5, 7, 8
 Flowering Dogwood
 Chinese Kousa Dogwood
 Cockspur Hawthorn
 Paul's Scarlet Hawthorn
 Washington Hawthorn
 Russian Olive
 Korean Evodia
 Beech species and varieties
 Ginkgo
 Moraine Honey-locust
 Mountain Silverbell
 American Holly
 Longstalk Holly
 Eastern Redcedar
 Golden-rain tree
 Japanese Larch
 American Sweetgum
 Yulan Magnolia
 Saucer Magnolia
 Star Magnolia
 Sweet Bay
 Arnold Crab Apple
 Carmine Crab Apple
 Japanese Flowering Crab Apple
 Tea Crab Apple
 Aldenham Purple Crab Apple
 Lemoine Purple Crab Apple



PLATE XI

A huge branch was broken off this elm and the cavity was cleaned out and painted as well as possible. This will not make the tree perfect, but will help preserve it for a longer time.

- Malus robusta* 2, 3, 5, 9
Malus scheideckeri 2, 3, 5, 9
Malus toringoides 2, 3, 5, 9
Malus zumi calocarpa 2, 3, 5, 7, 8
Nyssa sylvatica 10
Oxydendrum arboreum 1, 2, 3, 7, 9
Parrotia persica 4, 6, 9
Phellodendron amurense 1, 2, 3, 4, 5, 6, 9
Picea asperata 9
Picea glauca 10
Picea omorika 10
Pinus bungeana 4, 7, 9
Pinus resinosa 9
Pinus strobus 10
Pinus thunbergi 10
Pinus sylvestris 4, 10
Prunus avium plena, 2, 9
Prunus sargentii 1, 2, 9
Prunus serrulata "Amanogawa" 1, 2, 8
Prunus serrulata "Fugenzo" 1, 2, 7, 8
Prunus serrulata "Kwanzan" 1, 2, 7, 8
Pseudolarix amabilis 3, 10
Pseudotsuga taxifolia 10
Quercus alba 4, 10
Quercus borealis 1, 5, 9
Quercus coccinea 1, 9
Quercus palustris 1, 9
Sciadopitys verticillata 6, 10
Sophora japonica 1, 2, 5, 6, 10
Sorbus aucuparia 2, 3, 9
Stewartia koreana 2, 4, 6, 9
Styrax japonica 2, 6, 7, 8
Cherry Crab Apple
Scheidecker Crab Apple
Cutleaf Crab Apple
Zumi Crab Apple
Black Tupelo
Sorrel Tree or Sourwood
Persian Parrotia
Amur Cork Tree
Dragon Spruce
White Spruce
Serbian Spruce
Lace-bark Pine
Norway Pine
Eastern White Pine
Japanese Black Pine
Scotch Pine
Double Flowered Mazzard Cherry
Sargent Cherry
Golden Larch
Common Douglas-fir
White Oak
Northern Red Oak
Scarlet Oak
Pin Oak
Umbrella Pine
Japanese Pagoda Tree
European Mountain-ash
Korean Stewartia
Japanese Snowbell

<i>Syringa amurensis japonica</i>	1, 2, 4, 7, 8	Japanese Tree Lilac
<i>Thuja plicata</i>	10	Giant Arbor-vitae
<i>Tilia cordata</i>	1, 2, 5, 10	Littleleaf Linden
<i>Tilia platyphyllos pyramidalis</i>	1, 2, 5, 10	Pyramidal Bigleaf Linden
<i>Tsuga canadensis</i>	7, 10	Canada Hemlock
<i>Tsuga caroliniana</i>	5, 7, 9	Carolina Hemlock
<i>Viburnum prunifolium</i>	1, 2, 3, 6, 7, 8	Blackhaw Viburnum

Monetary Losses

It is important to note that hurricane losses, for removal and clearance of broken or downed trees (due to wind but not salt water), will be deductible from income tax returns. One should keep copies of all bills for clean-up work and submit them with the regular tax information. It is well to include pictures of the damage done if these are available.

As far as the intrinsic loss to the landscape is concerned, due to a tree being blown down by the hurricane, we have just been informed by the U. S. Bureau of Internal Revenue that it will be necessary to have a competent real estate man make a **fair appraisal of the property before and after** the hurricane. The difference between these figures is the amount deductible (plus of course the figure discussed above for removal and clearance).

There are several so-called "tables" used to estimate the value of trees in the landscape. One of the best and most frequently used, takes into consideration the size, age and kind of tree, the assessed land valuation and the distance of the tree from the house. However, because value is going to be based on a fair appraisal of the property as a whole, by a **competent real estate operator**, the publication of any "table" here for determining tree values might only confuse the issue.

DONALD WYMAN

NOTE

"The Arnold Arboretum Garden Book"

by Donald Wyman

just published by D. Van Nostrand Company, Inc., New York

pp. 354, illustrated, Sept. 1954

Price \$5.95

From America's greatest garden comes this unique collection of articles on ornamental woody plants. For some eighty years the Arnold Arboretum has produced botanical and horticultural information of great practical value to gardeners everywhere. Its popular bulletin "Arnoldia" goes to every state in the Union and to many foreign countries. Now, over 40 recent issues of this much sought-after bulletin have been gathered together for the first time in book form, including many black and white photographs and four beautiful color plates.

Various different plants are discussed from Rhododendrons, Wisterias, Azaleas, and Lilacs to Forsythias, Roses, dwarf trees, fruits, and nuts. Numerous topics range from recommended propagation, ground covers, and cultivation to pruning, mulching and labeling. The up-to-date story of the Metasequoia is all here, as well as special information on shrubs and trees which prove attractive to birds. Not everyone realizes that plants which are hardy in the Arboretum can be grown in at least 75 per cent of the gardens of the United States and Canada.

Copies are on sale at the Arnold Arboretum, Jamaica Plain 30, Mass.

ARNOLDIA



A continuation of the
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POLYETHYLENE PLASTIC—ITS APPLICATION TO THE PROPAGATION OF HARDWOOD CUTTINGS

POLYETHYLENE plastic film was first used in the propagation of plants by cuttings at the Arnold Arboretum in February 1953. Prior to this, it had been used in making air-layers and also quite extensively used in the shipping of plant material from the Arboretum to distant parts of the world, but it had never been tried in the propagation of cuttings.

The reason that prompted the building of a frame covered with polyethylene plastic film was that the large cutting case then in use was far from satisfactory. It was a large wooden-framed case, enclosed with screen-wire imbedded in cellulose acetate. The size of this case was 6' wide 18' long, and roughly 4' high. An automatic humidifier inside at one end was controlled by a humidistat at the far end. With this humidifier, the cuttings were not kept turgid enough and there was trouble in controlling the temperature even though the screening was opaque.

Realizing that polyethylene plastic had the property of retaining water vapor, thereby keeping the humidity very high, it was decided to experiment with a frame covered with this material.

A frame 15" high, 6' wide and 18' long was erected over a section of greenhouse bench. It was constructed of 1" x 2" boards with plaster laths laid across on top to support the plastic between the cross-pieces. The polyethylene plastic used was 0.002 of an inch thick and measured 52 inches across, so that three sheets enclosed the top and sides nicely when put on lengthwise with two additional pieces needed to enclose the ends. A lead heating cable was installed which was operated by a thermostat set to maintain a bottom temperature of 74° to 76° F.

The bench under the plastic was divided into three sections to contain three different types of media. The first was plain, sharp sand; the second was sand

and Canadian peat, mixed half and half by volume; and the third medium was a mixture of sand, Canadian peat and a plastic called Styrofoam, mixed in thirds by volume.

Styrofoam is a white multicellular plastic manufactured by the Dow Chemical Company, and is added to the medium to provide greater aeration about the bases of the cuttings. It has been shown in the past that the stems of rhododendrons turned black below the surface of the medium due to the lack of oxygen. Therefore, Styrofoam is added solely to increase the amount of oxygen in the medium in order to overcome this blackening of the stems. Styrofoam is inert, does not absorb water, has no nutritional value, but allows air to penetrate readily throughout the rooting medium thus supplying a greater amount of oxygen.

Previously, this medium of sand, peat and Styrofoam had been used primarily for the rooting of rhododendron varieties from stem cuttings and for the rooting of azalea species such as *Rhododendron calendulaceum*. However, both magnolias and stewartias have been rooted in it with results that were good, but no better than the conventional media of sand, and sand and peat.

Once the frame had been erected and covered with polyethylene plastic, the heating cable and thermostat installed and the sections of bench filled with these respective media, the case was ready to receive hardwood cuttings. A great many species and varieties of plant materials were tried, among them cuttings from such plants as rhododendrons, *Acer palmatum* vars., *Juniperus virginiana* vars., *Ilex* species and vars. and *Mahonia* species.

The procedure was as follows:

The cutting wood was collected in the Arboretum, wrapped in a sheet of polyethylene containing some moistened sphagnum moss and brought into the greenhouse. Normally, the material was handled immediately, but if for some unforeseen reason it was not, it would keep perfectly fresh for three to four days wrapped in this plastic when placed in the refrigerator at 41° F. Once the cuttings had been collected and brought into the greenhouse, they were made and treated according to the type of plant material. For example, with stem cuttings of rhododendrons, the cuttings would be wounded heavily at the base by removing a thin piece of wood from one side. They are then treated with a strong hormone mixture, using talc as a base. A good deal of experimental work has been done using many different plant hormones, all stronger than the available commercial preparations. The results have been very promising, so much so, that our grafting program for producing rhododendrons has been discarded. This includes even such difficult varieties as: "E. S. Rand," "Dr. Dresselhuys," and "Charles Dickens." These have all been satisfactorily rooted under the polyethylene plastic and, it might be added, successful, not only from an Arboretum's viewpoint, where only a few plants are needed, but on a basis to make it profitable for commercial nurserymen.



PLATE XII

Rooted cuttings of Rododendron "Charles Dickens." These cuttings were handled as described herein. Note that the flower buds have been pinched off. The white particles, in the ball of roots, are particles of Styrofoam.

Juniperus virginiana and *Juniperus chinensis* varieties are also treated with the stronger plant hormones, with the 1% indole buteric acid in talc giving the best results. Experimental work has also been done as to the advantage of taking large cuttings: 8" to 12" long, or small cuttings: 4" to 6" long. At the present time, the results indicate that the highest rooting percentage results from the smaller cuttings. These are but two kinds of plant material mentioned more extensively here, because they require a little more than average care. Normally, the plant material is handled as soon after collection as possible. The cuttings are made 4" to 6" long depending upon the plant material, treated with a hormone and inserted in the different media under the plastic.

All rhododendron stem cuttings are inserted in the medium of sand, peat and Styrofoam. Such plant material as *Juniperus chinensis* and *virginiana* varieties, and *Ilex opaca* and *aquifolium* varieties are inserted in the medium of half sand and half peat. *Pyracantha coccinea lalandi*, *Ilex crenata* varieties and deciduous hardwood cuttings are inserted in the medium of sand.

Once the cuttings are inserted in their respective media, they are watered heavily. This is all the firming the cuttings receive. *The medium is never pounded down around the cuttings.*

Following watering in, the plastic covering over the case is closed and tightly sealed. This is easily accomplished by leaving a 3" to 4" overlap on each individual sheet of plastic covering the frame. Then, once the cuttings have been inserted and watered in, the edges of the plastic sheets are moistened and overlapped. If the surfaces of the plastic are wet, they will stick very well to one another and that is all that is necessary to seal the case tight.

It is now that the advantages of polyethylene plastic can be shown. After the cuttings have been inserted in the medium, watered in and the plastic closed tightly over them, they require practically no further care.

First of all consider the shading factor: At this time of year, from mid September or early October to the first of April, the sun is not high enough to necessitate the use of shade over the polyethylene plastic case except in unseasonably hot weather. The lath shades which are used on the greenhouse are rolled up all the way to give the maximum amount of sunlight throughout the fall and winter months. Shading is not necessary when propagating hardwood cuttings under plastic.

Second, the watering factor is considered. Following watering in, the case is sealed, and it is not necessary to water the medium again for six to ten weeks. What happens is this: The medium is completely moist when the plastic is sealed, assuming, of course, that the plastic is completely sealed. The moistened medium gives off water vapor into the air increasing the humidity to nearly 100% around the cuttings keeping them fresh and turgid. As the inside of the case becomes filled with water vapor, it condenses on the inside of the plastic, forming droplets, which fall back onto the medium keeping it moist. The cycle is now com-



PLATE XIII

View of the polyethylene plastic case which is used in the propagation of hardwood cuttings at the Arnold Arboretum. This picture was taken in August when shading was necessary, so the shades are down, but these are not down at any time during the propagation of hardwood cuttings. Note the thermostat which regulates the amount of bottom heat. The polyethylene film has been lifted at one end of the frame to show the inside.

plete—the water vapor rises from the moistened medium, condenses into droplets which fall back onto the medium keeping it constantly moist.

The two things which determine the amount of watering needed, once the case has been closed, are the number of sunny days and the bottom heat. In sunny weather the medium tends to dry faster, as a small amount of vapor is lost through the plastic. On cloudy days, the electric bottom heat runs more, tending to dry the medium.

One thing that should be pointed out here is that in three years of operation, falling droplets have never damaged the cuttings. This also holds true for the propagation of softwood cuttings.

Third, consider ventilation: Many people have believed that when the plastic was sealed tightly, it made the case airtight. This is not so, for if it were airtight, the cuttings would quickly die. Polyethylene plastic is actually air permeable, allowing air to pass both in and out though the loss of water vapor is very small.

Considering these factors, the advantages in using polyethylene plastic film for the propagation of hardwood cuttings are:

1. No daily shading is required as the seasonal light intensity is low.
2. No daily or even weekly watering is necessary, as the medium will not dry out for long periods.
3. No ventilation is necessary due to the ability of air to penetrate the plastic.

Once the cuttings have been watered in, and the plastic sealed over them, it should not be necessary to open the case until they are rooted, other than for an occasional inspection.

On the subject of disease, fungus has developed only three times, and in all three cases, it was during the summer when experimenting with very soft cuttings. A spray of Semesan gave complete control.

Plastic is inexpensive, one pound costing sixty-six cents, and covering ten square yards. Once sealed tightly, the case is self operative, allowing all the time which normally would be spent in watering, syringing, shading, etc., to be put to other use.

For plants best propagated by hardwood cuttings, considerable time, money and effort is being saved in the propagation program of the Arnold Arboretum.

To illustrate the results obtained with hardwood cuttings under this polyethylene plastic film, consider the propagation of *Rhododendron* "Charles Dickens"

On the 24th of November, 1953, cutting material was brought into the greenhouse and handled as follows: First, the large flower buds were removed. Flowering wood is not the ideal type of cutting material, however, in this case there were no short vegetative shoots. Following removal of the flower buds, the cuttings were trimmed to three or four leaves, made approximately 4" long. Wound

ing was then accomplished by removing a thin slice of wood, from one half to one inch long, from the basal part of the cutting. In order to obtain a comparison, different concentrations of hormones were used. The cuttings were then inserted in the medium of sand, peat and Styrofoam.

On the 1st of March, 1954, the cuttings were lifted with results as follows:

<i>Rhododendron</i> "Charles Dickens":			Results			
Lot No.	No. of cuts	Treatment	Routed:			
			Heavy	Light	Callused	Dead
1	10	1% Indolebuteric Acid—Wound	7	3	0	0
2	10	2% Indolebuteric Acid—Wound	5	2	2	1
3	10	1% 2-4-D	2	1	3	4
4	10	Control	0	0	10	0

Next the cuttings were potted in 3" or 3½" pots, using a mixture of sand, peat and Styrofoam, which had been saved from the previous year's rooting medium.

Now I realize that the number of cuttings tried here is by no means significant, as far as percentage basis is concerned. However, comparable results have been attained with approximately forty other species and varieties. One exception to this is *Rhododendron smirnowi* which rooted best when treated with 1% 2-4-D.

ROGER G. COGGESHALL

**Exhibition at the Administration Building, Arnold Arboretum,
Jamaica Plain, Mass.**

PAINTINGS OF TROPICAL FLOWERS

November 15 - December 15

An exhibition of tempera paintings by Bernard and Harriet Pertchik. These paintings of colorful tropical trees and shrubs were used to illustrate the book, "Flowering Trees of the Caribbean."

CHRISTMAS SHOW OF HOLIDAY DECORATIONS

December 15 - 31

A display of horticultural materials for use at Christmas time. Evergreens, wreath plants and cones from the Arboretum collections with identifications, botanical and horticultural information make this show of value to everyone.

Open 9:00 a.m. - 5:00 p.m.

Except

November 25 and December 25 and 26

ARNOLDIA



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WILFRID WHEELER—THE HOLLY MAN

THOSE who know something about the native American holly (*Ilex opaca*) have certainly heard of Wilfrid Wheeler and may have had the pleasure of meeting him and hearing him enthusiastically discuss this wonderful American tree. He has been interested in this plant for a long time and has done much, especially in an area where it is at its present northern native limits, to increase its popularity. It is not enough to grow or transplant just any tree, but Mr. Wheeler has spent years in carefully searching for the trees that make the best ornamentals in the northern parts of its range.

Years ago, when he was in England as a much younger man, he became intensely interested in the English holly, the painstaking care the people took with it, the wide popularity of the tree in all sorts of ornamental plantings, and the close relationship of the plant to the customs and spirit of the Christmas time. He, of course, knew of the American holly, but then there was little being done to advance the plant in popular acclaim in America except to mutilate thousands of trees by cutting carloads of branches for Christmas decorations.

Mr. Wheeler's forebears farmed in Massachusetts since the early 1600's and he himself has been associated with farming in the Concord, Massachusetts area practically all his life. Born in 1876 in Concord, Mass., he was made the first commissioner of agriculture for Massachusetts, in 1919. Prior to that time, he was secretary to the old State Board of Agriculture. He was re-elected eight times "the Number One Farmer In Public Service" by the farmers of the State, prior to the reorganization of the old State Board of Agriculture. As secretary of the State Board, he was trustee of the State College. During World War I, he headed several important committees on food production, and in 1920, he took over the 10,000 acre Coonamesset Ranch Project on Cape Cod, for the Cranes of Chicago. In 1925, he bought about 300 acres of land nearby, including a couple of farms that were practically abandoned, mainly in Hatchville and

Mashpee, now called Ashumet Farm, off Route 151, and it is here that he started his holly program.

Today he has nearly 2000 hollies growing here including 200 full sized trees in the woods. He grows them commercially, propagates them and has been experimenting with the growing of several exotic species.

In 1930, a friend sent him a dozen small hollies and he planted them in his woodlands. He was amazed at their rapid growth (some are now twenty and thirty feet tall) and when he found that hardiness was not a problem, he decided to grow hollies commercially, for he realized in order to reduce the vandalism to the trees, they would have to be made far more common in gardens and public plantings as well. At the time, nurserymen were not growing them much as ornamental specimens, for several reasons. First, buyers always shied away from them because of the thought of creating tempting possibilities for vandals in home plantings; they were supposed to be very difficult to transplant and had to be partially defoliated; they required special soil conditions; and finally, since the sexes were separate, there was always the difficulty of placing a known pistillate tree in the right place, by providing a suitable staminate tree in the near vicinity to insure fruiting. Seedlings took nearly 10 years to fruit, and many a northern gardener thought they were not hardy.

Through the years, many people have whittled away at these "barriers" to holly growing in the North, and one of the most enthusiastic has been Mr. Wheeler. He had spent much of his time ferreting out known local stands of hollies on the Cape and in adjacent areas, studying their respective ornamental merits and selecting and propagating some of the better ones for commercial purposes. To date, he has named 21 varieties. Some of the things he has found out about hollies in this part of the country are of help to every northern gardener who might contemplate planting some.

Of course hollies require acid soils, but fortunately, New England is especially rich in these. They like a certain amount of moisture, but the soil must be well drained also. Water is especially helpful if applied during a drought when the trees are in bloom and shortly afterwards, as this will help fruit formation. Planting is done by giving the young plant the best possible soil. The tree may live to be 300 years old (or considerably more) hence a little care at the start is worth while. Even though the plant to be set out is only in a three-inch pot, it is wise to dig a hole three feet wide and two feet deep and remove all the soil, if it is poor. He feels that the trees should be planted about twenty-five feet apart.

Decomposed sod can be placed upside down in the bottom of the hole with six inches of oak leaves on top. These need not be decomposed. Then good acid loam is placed about the roots of the young plant, and a slight depression left in the soil to catch any rain water. No tamping is done to the soil, but the plant is well watered in. After the ground has settled a few days, the soil can be filled in a bit more and a good mulch of well-rotted oak leaves, pine needles, sawdust,



PLATE XIV

Wilfrid Wheeler inspecting one of his many hollies.

Photo courtesy of Massachusetts Horticultural Society

well-rotted manure, or native peat applied. A mixture of well-rotted manure and any of these materials proves excellent.

As a result of wide correspondence and considerable holly hunting in the eastern part of New England, Mr. Wheeler has found *Ilex opaca* as far north as Portland, Maine and even in Amherst, Massachusetts. He has known plants in Groton, Mass., subjected to winter temperatures of -30° F. which were not damaged, and his experiences along the seacoast have led to his remark that he has "never seen a holly yet that has been killed by water or weather." Salt water does not injure them. Many are growing within the reach of salt water spray and, after the 1938 hurricane, he knew of a group which was under nearly 20 feet of salt water for nearly two weeks without serious injury. Hollies on Fire Island, N.Y., are subjected to lots of salt water yet they do not seem to mind it. In the old days on Cape Cod, sheep proved especially destructive for they not only ate the foliage of holly, but chewed off the bark of the trees. Fires, too, have destroyed many a valuable Cape Cod holly plant, even in recent years.

Mr. Wheeler has pointed out the fact that now other growers are shipping the American holly as far north as Nova Scotia and Simcoe in southern Ontario and that a well known tree is growing in West Virginia at an altitude of 3000 feet. A grower in Wales, Massachusetts, at an altitude of 1600-1700 feet, is planting a few every year, and last year some of them fruited for the first time, providing the winter bird food which he was anxious to have. This man wanted to do his bit in assisting the American holly in becoming as popular an evergreen tree in the North, as is the large leaved *Magnolia grandiflora* in the South. One of the biggest trees of which Wilfrid Wheeler knows is in the Lowell Holly Reservation, between Mashpee Pond and Wakeby Pond on the Cape, a 150 acre tract, presented to the Trustees of Reservations by the late President Lowell of Harvard University. The tree is twenty-four inches in diameter and 45 feet tall. There are nearly five hundred hollies in this Reservation twenty to fifty feet tall, and of course thousands of younger ones.

The flowering habits of the American holly have come in for some close observation on Mr. Wheeler's part. He has never seen a tree with perfect flowers, nor has he seen a tree with polygomodioecious flowers. He has found that the pistillate flowers of *I. opaca* can not be fertilized with the pollen of the native black alder, *Ilex verticillata*, which is native throughout the same area, or other *Ilex* species. He has also found that there is as much as two weeks difference in the time certain clones bloom, even though they may be growing side by side. This is a most important fact to be known, for it is, of course, necessary to have male plants in bloom at the same time as the female plants. Even a week's difference might spell the difference between a good crop of fruit and no fruit.

He has noted from personal observations that over 60 kinds of insects visit the holly flowers in his garden. This includes several kinds of wasps and especially the large night flying moths, yellow jackets, common mud wasps, hornets and

ants. The male flowers are very fragrant and the trees beautiful in bloom. Although the general suggestion is one male tree to every twenty-five female trees in a rather close planting, as would be found in a commercial orchard, nevertheless, it is better to err on the side of too many males than too few. Also, when several males are used, they should be of different clones in order to make up for any differences in the time of bloom.

Male trees can still be excellent ornamentals for planting as evergreen backgrounds. Then, too, such trees do not offer much temptation to would-be vandals at Christmas time. The sexes can be determined only when they are in flower.

Well-rotted manure is an excellent fertilizer to apply, when available, and Mr. Wheeler would like to apply it as a mulch to his plants every year if he had it. (He tries not to use what he calls "raw chemical" fertilizers, for he believes these are not as conducive to good growth as some of the organic types.) He has used cotton-seed meal as well as tobacco dust, and found that these materials aid in producing an excellent dark green foliage and brighter berries. He likes to keep a mulch about the base of his trees for this helps conserve moisture all the time. If commercial fertilizer must be used, he has applied one-half pound of nitrate of soda to a big tree about twenty feet tall and has cut this amount in half for trees that are only five feet tall. He has also used hen manure mixed with sawdust or shavings, about a half wheel barrow load for a twenty foot tree.

Pruning hollies becomes a pleasure when it is combined with the gathering of Christmas greens, for young hollies should be shaped a little and when done at the Christmas season, the clippings can be used in the house for decoration. As the trees grow larger, quite a lot of branches may be cut. Care should be taken not to cut too short or too many in one place. Usually a tree can be cut on one side one year, and the other side the next. Some hollies will make a growth at the top of two or three feet and this, if left on, is apt to make a long space without branches. This long growth should be cut back at least one half, for the hollies make much better ornamental specimens when forced into thick growth by proper pruning.

When it comes to the reasons for selecting certain trees in the wild for commercial propagation, Mr. Wheeler has had to be strict. In the first place, he has discarded most varieties with berries less than one-quarter inch in diameter. The way the berries are borne on the branches is most important, for on some trees they are bunched closely together, making an excellent display, and in others they are loosely distributed on the branch. The color of the fruits on different trees varies from yellow to almost black. He has had to keep in mind certain special purposes for which the plants are to be used. For instance, a clone that is to be used as a hedge plant would have different properties from one that was meant to be a fruiting specimen. The hedge plant should have dense, dark green foliage, and because it would have to be clipped a good bit of the time, might even be a male plant.

There is a question about the advisability of using southern varieties (i.e. those clones of *Ilex opaca* which have originated in the South) in the North. Mr. Wheeler feels it is better to use clones that have originated here in New England. The "Howard," originally found by Dr. H. H. Hume, is one of the best for Georgia, and is used in several big commercial orchards in the South, one of these being one hundred forty acres in size, but this variety does not perform as well in the North as some of the New England varieties. On the other hand, some of the New England varieties are doing well in North Carolina, Kentucky and Tennessee, as well as in the North.

He selected the variety "Elizabeth" for its very light colored red berries, lighter than most. "Emily" is one of his best, having berries one-half inch in diameter and being named for his wife. The variety "Perpetual" was selected because of the fact that the fruits remain on the tree a full year, that is, if they are not first eaten by the birds. As a greenhouse pot plant, the variety "St. Mary" has proved popular since it fruits very early in life, and six to twelve inch plants can be greenhouse grown, dusted with "Rootone" or Hormodin" (in lieu of pollen) when in flower, and will then produce berries for the Christmas trade.

Wilfrid Wheeler propagates hollies by cuttings in the greenhouse, taken any time from mid-August to January. Although he has never experimented with grafting on established plants out of doors in the early spring, as is frequently done with apple varieties in order to "make over" a tree from one variety to another, he sees no reason why this could not be done.

As far as transplanting is concerned, he does this on Cape Cod any time from mid-August to April, but prefers the dead of winter when he can move the plant with a frozen ball, presupposing of course, that the new hole has been dug in advance. He does not find it necessary to defoliate the trees in transplanting, for with ordinary precautions, he has obtained at least 90% survival in his transplanting operations.

Other than vandals destroying the fruiting trees, and birds devouring the bright ripe berries just before the Christmas period, the worst pest with which Mr. Wheeler has had to deal is the holly leaf miner. This insect, at one point in its life history, hatches from the egg and as a small worm eats its way in between the upper and lower epidermis of the leaf itself. Until recently, this insect was very hard to control, for once it was inside the leaf, no spray could reach it. Now with "Lindane," he has found that this material not only kills the insect outside the leaf, but the fumes of this spray will kill a goodly proportion of the insects shortly after they have entered the leaf. However, the exact timing of the spray is still highly important, for it is much easier to obtain a good kill of the insects before they enter the leaves. The extensive use of this material has resulted in larger infestations of red spider, so that it is advisable to mix "Aramite" with the "Lindane" to kill both insects. (Note: in the Arnold Arboretum, we have found it advisable to make two applications, one between May 15 and 20 and another between June 1 and 10.)

The hunt for better varieties of the American holly continues, for there is always a chance that a previously unknown tree will be found worthy of propagation. It was only a few short years ago that Mr. Wheeler and J. M. Batchelor of the United States Department of Agriculture were going through some almost impenetrable briar thickets, on the Cape, when they came across a tree they could not reach but which had surprisingly large berries. This happened to be in the path of certain army maneuvers and when Mr. Wheeler visited it again, he found it had been badly mauled by army equipment. He was able to measure the berries and found they were one half inch in diameter. He obtained a few cuttings, and on a third trip found the tree to have been completely destroyed. However, he has raised many trees from those few cuttings and found that the plants have performed remarkably well, one of the largest fruiting forms he has ever found. He named it "Emily" after his wife, and thanks to him and his persistence in maintaining his unceasing hunt, this variety is now available commercially.

During his long horticultural career, Mr. Wheeler has written many articles on holly, which have been printed in the leading horticultural periodicals. He has been active in many organizations and was especially helpful in aiding in the forming of the Holly Society of America a few years ago. The Massachusetts Horticultural Society presented him with the Jackson Dawson medal especially for his work in propagating hollies. He has been awarded citations by both the Massachusetts Federated Garden Clubs and the American Holly Society for his work with these native American plants.

Although he will not be pinned down regarding which individual variety is "best" for New England, it goes without question that among the twenty-one varieties he has named, will be found the best hollies for growing in the northern United States today.

DONALD WYMAN

THE BEST OF THE FRUITING HOLLIES NAMED BY MR. WHEELER

"Amy": One of the best trees for landscape planting. The branches droop somewhat and bear the berries on the upper side so that the effect of the tree when berries are ripe, and from a distance, is as if it were covered with a red blanket, and yet the beautiful green spiny leaves make a background against which the berries stand out. The berries are borne on long stems, very conspicuous—brilliant red. A splendid lawn tree.

"Elizabeth": This tree was collected from a roadside when it had been almost cut to pieces by vandals, and is a very rapid grower. It has large leaves and bears abundant large deep orange colored berries, a color quite like many of the English hollies. The berries are borne in long loose clusters in a very striking way so that the tree gives an effect of being covered with berries against a background of large dark green well-spined leaves. This is a good tree either for cutting sprays or for landscape work. It was named for Miss Elizabeth

C. White, of Whitesbog, N.J., who has also done a great deal of work in selecting outstanding clones of *Ilex opaca*.

“Emily”: So far as size of berries (which often measure $\frac{1}{2}$ " in diameter) and the color of fruit is concerned, this tree ranks best in the Wheeler collection of hollies. It was named by Mr. Wheeler for his wife. The leaves are smaller than many others, but are a dark green and inclined to curve, and are well spined. This is a fast grower and comes into bearing almost the earliest of any. Young trees three years old are usually covered with fruit, and the berries are borne in close, dense clusters giving the effect of great masses of color. This tree is probably the most spectacular one in the Wheeler plantings.

“Freeman”: This variety is a very large rather compact tree growing rapidly under Cape Cod conditions, in a pyramidal shape. The leaves are very large, well spined and a real holly green. Fruit is above average size and a bright glossy red, not as conspicuous as some, but still a very handsome tree. Because of its rapid growth and its good color, it is one of the best, and should be planted as a lawn tree.

“Natale”: This tree is inclined to grow slowly and very compactly, bearing great quantities of berries held closely to the branches on rather short stems. It bids fair to become one of the most popular varieties, originally growing in the colder part of the Cape where it was exposed to winds from every direction. The fruits are very shiny. A very fine tree where space is limited.

“St. Ann”: A fine large holly tree, growing rapidly and making a remarkable landscape tree. The fruit is large on long stems, appearing very early and the foliage is fine. This tree is large enough for a roadside tree or for planting in a border where a definite planting is desired. The original was found growing on the island of St. Mary in Osterville Harbor, and it is named after the mother of the Virgin Mary.

“St. Mary”: St. Mary came from the island of St. Mary in Osterville Bay, and was named for the Virgin Mary. It is a beautiful compact tree with closely growing branches making it a dense tree and bears abundant medium sized berries of bright red color. This tree is becoming one of the most popular among nurserymen because it makes a good growth, bears early, often the first year after rooting.

“Perpetual”: So named because of its habit to carry red berries through the year. The tree is tall with rather short branches, making its use desirable where height is required. It is an annual bearer of good sized berries with fine color. In fact, this variety is often chosen by visitors as the best in the Wheeler plantings, because of the color and appearance of the berries and leaves. A truly fine holly.

Mr. Wheeler has selected and named several male holly clones such as “Annunet,” “Charles,” “Dick,” “John Banks,” “Rick” and “Wilfrid.” He has named several other fruiting clones as well, but the eight fruiting varieties described in his words above, are the eight which he feels will make the best plants for ornamental planting.

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