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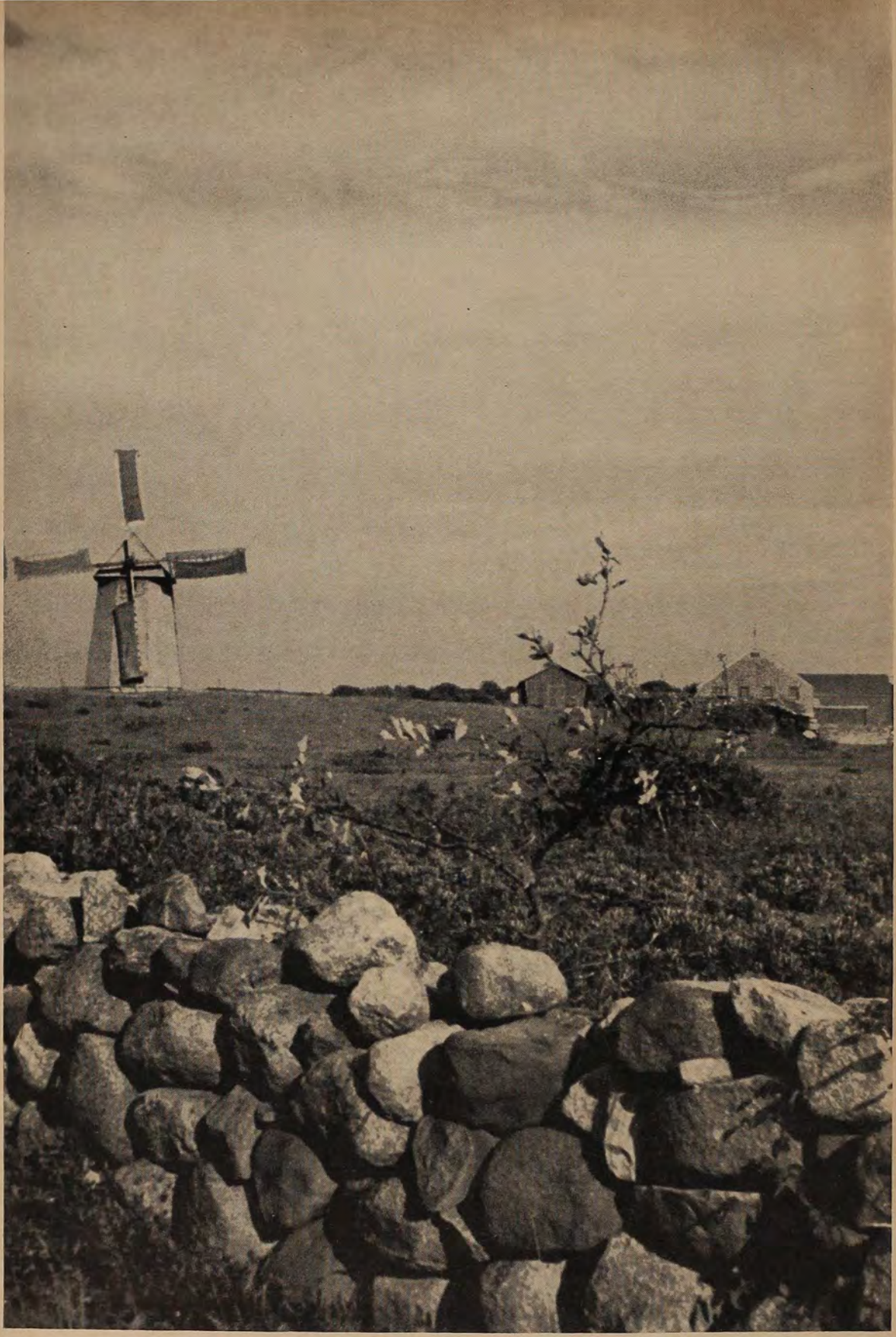
Sargent hemlock used as a low foundation hedge at the U. S. Plant Introduction Station, Glenn Dale, Maryland. English boxwood in background (see p. 183). J. J. HIGGINS



Pastoral landscape on Martha's Vineyard Island.

Tuberous Begonias From The Hybridizer's Viewpoint

BARCLAY BROWN*

The plant hobbyist who includes tuberous begonias among his favorites will do everything necessary, short of stealing from his neighbor's garden, to have the best and biggest begonia blooms on every plant he grows. This is not the case for the commercial grower who has large fields and lath houses of begonias devoted strictly to the production of tubers. But the commercial grower, if he is also a hybridizer, is very interested in the potential quality of the flowers he grows. If he is a hybridizer, he regularly checks his crop to be sure that he is getting the results desired from his work with the parent plants. The plants are in full bloom eight to nine months after the seed is sown. Each year some new possibilities are seen in some of the seedling plants; these are taken in with the parent stock for further hybridizing work.

The begonia flower-types seen today are almost entirely the achievement of commercial hybridizers. These hybridizers, both in America and England, have brought about startling results during the last fifty years. The tuberous begonia seems to have an exceptional capacity for improvement. Much of the pioneering work was done by English hybridizers. Later, when the Americans got into the picture, more effort was devoted to large scale hybridizing, with less emphasis on vegetative reproduction. This resulted in types which came true from seed. The American growers eventually were able to produce seedling crops of a quality superior to the European crops. The expanding market for begonia tubers in America, as well as the California climate which allows the hybridizers to take full advantage of the begonia's long blooming season, has made it possible for the American growers to maintain their lead in the production of new and superior types.

The term American Hybrid is now fairly common to those interested in tuberous begonias. The growers in the mid-coastal region of California elected in 1958 to call their strain, which includes many types, by the name American Hybrid. One century before the name came into being, the first begonias were sent to our country. It was at that time also the first true hybrids, actual crosses between species, were evolved. About three hundred species of the genus were then known. Those first species produced flowers which were far from beautiful when compared with some of our present types. They were pale, long-petalled, weak-looking flowers on drooping stems.

At the present time about one thousand species are recognized in the genus. Doctor Bailey says, "The begonias are exceedingly variable, the genus running into about sixty well-marked sections,

Single

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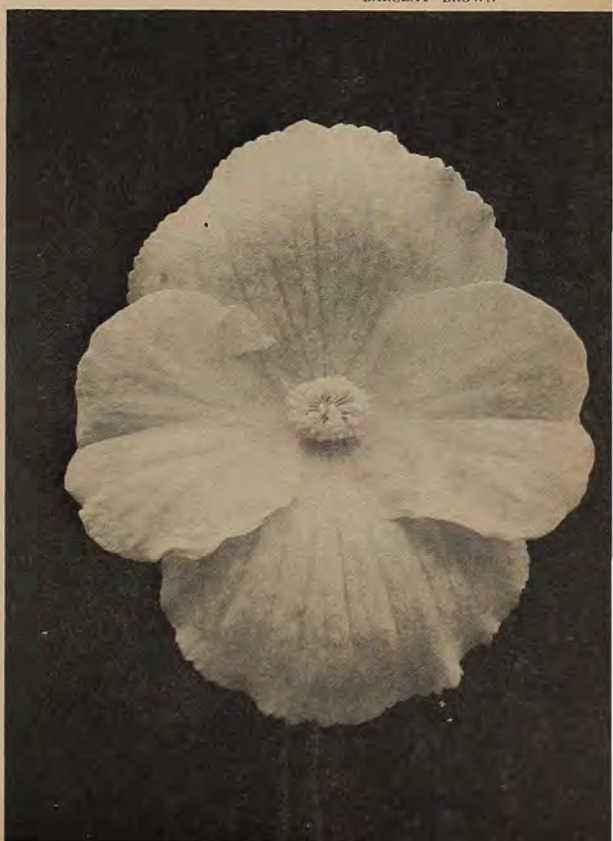

*Brown Bulb Ranch, Capitola, California.

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Semi-double (duplex)

but the intergradations are so many and the essential floral characters so constant that it is impractical to break up the great group into separate genera."

The tuberous-rooted begonias, one of several groups within the genus, consist of a sufficient number of species to thoroughly confuse most beginning enthusiasts. The further fact of extensive crossing between some of these tuberous begonia species and their hybrids to produce *Begonia* × *tuberhybrida,* the garden race of begonias, adds to the confusion. No complete list of the types making up *Begonia* × *tuberhybrida* is apt to be attempted because of the ease with which new and different tuberous begonia crosses can be made. Of course, the public's acceptance, or lack of it, determines whether the commercial grower will include a new cross in his permanent list, to be produced in quantity rather than thrown on the rubbish heap.

Historical Development

Most of the original hybridizing which preceded our present garden strain of begonias, was done in the late 1800's on species brought from the Bolivian and Peruvian Andes. The most important of these species were:

B. boliviensis, sent to England from Bolivia in 1865, with drooping scarlet flowers.

B. pearcei, from Bolivia in 1865, with clear yellow blossoms about 1¼" across.

B. veitchii, introduced in 1867 from Peru with vermilion flowers, is particularly important because it contributed short sturdy stems and round flowers which have been improved and used in most current types.

B. rosaeflora, from Peru in 1867, with pink flowers produced some crosses that were white.

B. davisii, from Peru in 1876, with orange-scarlet flowers with pink coloring on the outside of the petals; this low, erect species produced many plants with good compact form and some crosses bore semi-double flowers.

Many other species were also used to develop the *Begonia* × *tuberhybrida* group. All of the first hybrids were produced in Europe before the Americans had a chance to show what they could do. The English firm of Blackmore and Langdon of Bath deserves much credit for their work in bringing the current types into existence.

The most popular type now grown in California is the ruffled double. The following list shows the development from one type to another which has led to the ruffled double. These are arranged in the order of their introduction to the commercial market. Other types, which are not involved directly in crosses leading up to the ruffled double, will be mentioned later.

THE SINGLE TYPE—This begonia was once among the most popular of all the tuberous begonias; now it has been replaced by many improved types and is not grown by any American commercial grower. It is still sold in Europe as a bedding plant for private gardens and public parks. Its plain four-petal form, unlike the later doubles, shows a distinct resemblance to the smaller flowers of the species plants. The range of colors in this type is the basic white, pink, red, orange, and yellow, and

various intermediate shades. The single type produces blooms up to six inches in diameter. It is surely possible to develop much larger blooms on these since the flower is so light in weight as compared to the doubles. A lightweight flower does not require the usual development of stronger stems which must accompany the production of large flowers of the heavier double types.

THE SEMI-DOUBLE (DUPLEX) TYPE—This can can easily be seen to follow the single as the next stage in the development toward our present popular types. The duplex begonia looks like the single with a whorl of smaller, slightly ruffled petails inside the four large petals. It is the developmental stage preceding the double. The size and color of blooms is the same as the single type. The duplex is completely out of favor with commercial growers, in Europe as well as America, and can be considered an extinct type.

THE CAMELLIA DOUBLE TYPE—The public's enthusiastic acceptance of this type made the tuberous begonia famous. Commercial hybridizers put in many hours developing larger flowers for the camellia double. Blooms of seven inches and eight inches were developed without much difficulty, but obtaining the strong stems necessary to hold these heavier blooms upright took several additional years of hybridizing. This favorite came into existence commercially during the period 1926 to 1932. The American growers were the first to apply the name "Camellia" to this tuberous begonia. The most significant imperfection in this type was the lack of any definite center in the bloom.

THE IMPROVED CAMELLIA DOUBLE TYPE—The eventual development of a double type with a distinct and attractive center composed of numerous smaller petals gave rise to a significantly different form of begonia blossom. The popular camellia name was retained. Hybridizers increased the intensity of their efforts and even larger flowers with correspondingly stronger stems were developed. Many blooms reached a size of seven inches in diameter and eight and nine inch flowers were not unusual in the greenhouse of an expert grower. It was at this point in the development of the tuberous begonia types, about 1928 to 1935, that the Brown Bulb Ranch laid the foundation for America's lead in tuberous begonia production. While European firms were making great strides in selection of improved camellia types for vegetative propagation, this American firm concentrated exclusively on the selection of parent plants which would produce seed for a satisfactory second generation. A great many years were necessary to accomplish this. Demand for plants in an increasing number of intermediate colors made it necessary to select plants for about twelve different shades in the camellia type alone. Many introductions of stock from England were made to improve the form of the American strain, but the English plants, being vegetatively reproduced, tended to require many years of crossing before the desired characteristics would come true in a seedling crop. During these years a distinctly "American" strain of tuberous begonias came into existence; ever since that time commercial dealers have recognized a distinct difference between the types developed here and those in Europe. Eventually the "American" improved camellia begonia was developed into a type with a slightly ruffled petal, looking less like a real camellia flower, but appealing more

Camellia Double

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Improved Camellia Double

to the American buying public. Many less popular types were being developed along with this best-seller; some of these are listed in the following paragraphs.

THE CRISPA TYPE—This is similar to the single, having only four petals, but with the addition of tight ruffles along the edge of the petals. This type is now the most popular single-flowered type of tuberous begonia. The best-liked crispas are now the two-toned crispa marginatas which are edged in a different color, for example—white with pink edge and salmon with copper-red edge. It was the crossing of this type into the camellia which added the slightly ruffled petal to the camellia.

THE CRISTATA TYPE—This single type did not maintain its popularity and is not now grown by commercial growers. The slightly ruffled petals have prominent tufts or crests which are not characteristic of any other type.

THE CARNATION TYPE (Fimbriata plena)—This type looks very much like a true carnation, having many heavily serrated petals. The blooms often reach a size of six inches in diameter, sometimes larger. The many petals make the flower heavier. This, along with an inherited tendency toward weaker stems, has made the development of larger blooms difficult in the carnation type. During the period when the camellia and improved camellia types were making the tuberous begonia one of the most popular garden plants of America and Europe, the carnation type was running a good second place in popularity. At present it has lost ground in America and is seldom seen here. In some countries in Europe, however, it is still ranked as one of the best types available.

THE ROSE FORM DOUBLE TYPE—As American hybridizers introduced more and more of the ruffled petal into the improved camellia type, it became apparent that there was still a good demand for a smooth-petalled type, more like the original camellia. In the 1940's the good demand for tubers of the improved camellia indicated that this type could be split into two new types, both with sufficient commercial value. By 1955, after many years of selection, these two types were available. The rose form was one of these; the ruffled double was the other. In developing the rose form, hybridizers chose flowers with smooth petals and with prominent rose-like centers. The large flower size of the improved camellia was retained, and this type is today the second most popular of the tuberous begonias in America.

THE RUFFLED DOUBLE TYPE—The other type to be split away from the improved camellia is now the most popular of all the types in this country. Here the tendency toward the ruffled petal was emphasized by additional crossing with the carnation type. Because of the great demand for the ruffled double, additional shades of color were commercially desirable. This type now can be purchased in more than fifteen colors, including dark red, red, scarlet, rose, pink, blush, white, salmon-pink, light salmon, salmon, apricot, orange, yellow, and ivory. The hybridizers have also continued to enlarge the size of the flower—nine inch blooms are not unusual, ten and eleven inch blooms are grown by those who have the know-how.

This brings the story of the tuberous begonia up to date. Several interesting types have been overlooked because they have not been involved directly with the story leading up to the ruffled double. One of these is the hanging basket (pendula) type which produces a mass of three to four inch double blooms on drooping stems. This type must be observed from below the plant to get the best look at the mass of color usually produced. This is presently the third most popular type in the United States.

The fourth most popular type in this country is the picotee. The form of the plant is upright and the flower is similar to the roseform double and the ruffled double. The distinguishing characteristic of this type is the color. Picotee begonias are available in various shades of white, yellow, salmon, pink, and apricot, all with a clear red or pink edging on each petal.

The multiflora type is increasing in popularity now. This begonia has a mass of blooms like the hanging basket type but in the multiflora the flowers are held upright on bushy compact plants. This type will stand more heat and direct sunshine and also stands up well under rough handling of potted plants. Multifloras were crossed with the improved camellias to obtain the present large-flowered American multiflora gigantea. It is not unusual for these plants to produce one hundred blooms per plant during one season, each about two and one-half inches in diameter. These make excellent bedding begonias and are presently among the most popular types in several of the cooler European countries.

Seed Production

All of the foregoing descriptions omit any mention of the female blossoms on tuberous begonias. The male blossoms are always more showy; many gardeners pinch off the female flowers in hopes of getting larger male flowers. Female flowers under the best circumstances seldom are more than three inches in diameter and are always single.

Because the tuberous begonia is monoecious and because it has been bred to a point where it is completely unlike the wild species, all seed setting on the present *Begonia* × *tuberhybrida* plants is dependent on the assistance of humans to transfer the pollen from the male to the female flowers. This is usually done with a camel's hair brush and occasionally by removing the male bloom and rubbing it against the female bloom. The physical task involved in large-scale pollenization programs is considerable, since frequent visual checks and careful records must be made for each plant.

The commercial begonia growers in this country, because they require considerable quantities of fresh seed for each color and type they handle, must devote much greenhouse space to the production of an annual summer crop of seed plants.

The seed is occasionally held over in storage for one additional year (about 17 months); it will retain its viability this long and sometimes longer if the correct storage conditions are maintained.

The handling of tuberous begonia seed is particularly difficult due to the small size of the seed. It looks like brown dust, and a single seed is often barely visible to the naked eye.

Some mature seed pods, which are less

Crispa

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Cristata

than one inch long, will yield as many as 3,000 seeds. The time-tested method of sowing this small seed in flats involves mixing it with fine clean sand in order to get even distribution.

It is not unusual for a pod to produce only sterile undeveloped seeds. On close inspection these seeds are often seen to be hollow seed skins. Where the effect of inbreeding is strong this failure in seed development seems to be more common, occasionally occurring in over fifty per cent in large groups of parent plants of the same type and color. Such plants would be saved by the hybridizer only if they were producers of pollen needed for use with other plants, otherwise they would be discarded.

Radiation of begonia seeds with gamma rays at 550 r./min. has been tried. The resulting plants produced no progeny of value to the hybridizer. Only about 45% germination resulted from the 10 Kr. dosage tried. Radiation with 20 Kr. and heavier doses resulted in no germination.

As with many other plants, tuberous begonias became much more difficult to hybridize when fully double flowers came into style. Since female flowers are always single, there is usually no shortage of flowers to receive pollen. Most plants will produce twice as many of the small female blooms than male blooms. But the doubleness of the male in most popular flower types prevents the formation of anthers. If pollen is obtained from a semi-double male flower which has formed some anthers at the expense of complete doubleness, the hybridizer runs the risk of producing seedlings some of which will carry the semi-double trait. Many experiments have been made in an effort to solve this problem of pollen shortage. One answer is large quantities of parent plants. The best parent plants can be multiplied by asexual means such as tuber division, bud cuttings, or leaf-stem cuttings. With greater numbers of plants available, so the reasoning goes, the chance of getting some pollen from one good double flower is greater.

The best method of obtaining pollen, however, is based on the plant's inherent tendency to produce a new generation before it dies. Adverse growing conditions which shorten the life-span of the plant result in increased production of reproductive tissues. By creating these adverse growing conditions for a mature healthy plant the hybridizer is often rewarded by the development of double flowers with a few anthers among the center petals. While adverse conditions might be brought about in many ways, the method usually used involves careful withholding of water and complete cut-off of nutrient applications. Excessive dryness would cause too much damage, but controlled dryness which tends to shorten the life of the plant and cuts the total blooming period by about 10% often is sufficient to produce pollen bearing flowers.

Another, less productive, approach to the problem consists of limiting the light intensity. This procedure will also cause a plant to produce a greater number of pollen bearing flowers. Often many of the blooms will have fewer petals. However, this pollen seems to be less viable as it often produces a poor seed set.

Limiting the number of hours of normal light also results in a small degree of success but as the day is shortened the plants tend to produce less flowers. By shortening the day-length sufficiently it is a simple matter to grow begonia plants without any blooms. Such plants will compensate for their lack of flowers by producing much larger bulbs.

The Selection of a Pure Strain

In hybridization of tuberous begonias, as with any plant, it is important for the hybridizer to keep complete records. Score-cards for each parent plant are one of the necessary records. The score-card is a detailed description of the parent plant, carefully brought up to date each blooming season. It lists and describes all of the important characteristics of the plant, as well as the pollen production record and the seed production record, indicating what the quantitative capacity of the plant is in these categories.

Some of the characteristics noted on the score-card and carefully considered by the hybridizer, are: Flower form, flower size, flower color, abundance of blooms, sheen (brightness of flower color), plant vigor, stem strength, angle of flower growth, and disease resistance. In selecting parent plants with disease resistance the hybridizer follows the policy of rejection of any plants which show susceptibility to mildew, the most troublesome begonia disease.

Over the years the tuberous begonia has given hybridizers considerable satisfaction. Through careful selection many completely new flower types have been produced. To the large American begonia growers, however, a new type of begonia is of no value unless it will come true. Much time is spent in efforts to produce parent plants which will supply seed for a crop of perfectly formed begonias.

An early example of careful selection of the best parents is the American improvement of the double Hanging Basket type. While the English growers developed the first doubles from the original Loydii type, the first 100% double pendula was produced in California.

The only efficient and successful way to conduct a hybridization program is by the use of many crosses, each producing a large number of individuals for observation. It was Luther Burbank who proved beyond a doubt that a field of 10,000 seedlings will produce a great many more useful individuals than a plot of 100 plants. (Crosses can be divided into two categories—those made in hopes of obtaining new and different characteristics, and those made in an effort to obtain parent plants which will produce already existing characteristics in a 100% true generation of seedlings. Success with this second group often involves a great many generations. Sometimes the required perfection can never be reached. Each cross requires a twelve month period beginning with pollenization of the female flower in the greenhouse and ending with the last inspection of the seedling plants in the field about one year later. Each cross should consist of 1000 to 5000 seedling plants. From each such group of seedlings the best individuals are selected and used as parent plants for some of the next year's crosses. Eventually, it is hoped, one or more crosses will be made which will produce a group of seedlings which show 100% reproduction of the desired characteristics. The parent plants used to make such a cross can then be marked for future use in the production of large quantities of seed for the commercial crop. Each year these same parent plants will be grown from the dormant tubers; they can be expected to have a useful life of between five and twelve years.

The method outlined above usually results in the determination that two individuals when crossed give satisfactory

Carnation

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Rose Form Double

progeny. The next stage determines if they will also be useful when crossed with other plants in the same group. For instance, suppose the main object of the cross was to obtain 100% true reproduction of an unusual deep yellow-gold color which has appeared in some ruffled double begonias—after many generations several crosses are successful. Pollen from plant A on the female flowers of plant B produces the desired 100% results. The same results are obtained from C crossed with D and from E crossed with F. The next stage, aside from going into commercial production, involves new crosses between these six plants. Does pollen from B work out on female flowers or plant A? How about pollen from B on C, D, E and F? Obviously there are a great many more crosses yet to be made to determine the potential value of each plant. This information can be of utmost importance if only one of the plants produces pollen during any given season, and this would be a normal occurrence when only six plants of the double ruffled type are involved. Ordinarily 20 to 40 parent plants would be needed for each item produced.

The key to the great success that American growers have had in the production of true strains and the introductionu of new types is in the large size of their crops. Large growers can afford to produce more seedling plants from each cross. This provides the best opportunity for obtaining more variations. They can also afford to make a greater number of crosses; this provides the hybridizer with a wider selection of potential parent plants. Every Summer the crop of seedlings blooms about eight months after germination. At that time the plants selected for future breeding experiments are staked out. The balance of the crop will produce millions of tubers which will be sold through retailers and small growers all over the world.

New Types

The success of the commercial operation depends to a significant extent on the regular production of new types and colors which will be accepted by the buying public. Many of the ultimate users of the large commercial crop are hobbyists and well-informed amateurs who are particularly interested in new items. Some of these begonia enthusiasts even send new sports, which appear in their garden, back to the grower in hopes that their specimen may prove useful in the commercial hybridization program.

Because the commercial grower's regular crop of seedlings comes true in form and color of flower, selection for new types and colors is difficult. As a result, the larger growers devote considerable space to crosses between plants which show interesting and unusual characteristics. For instance, we plant a great many separate plots of 1000 to 5000 seedlings each year to obtain potential parents of new types. While 49 out of 50 of such crosses are expected to be worthless, if the 50th one shows several plants which will be the forerunners of a new type, the effort is warranted from a commercial standpoint.

The following were among the more interesting crosses made by us in recent years:

Crosses with *B. martiana*

B. martiana, known as the hollyhock begonia, is a native of Mexico. The species had never been effectively improved. Completely different than other tuberous begonias, this one looks just like a small hollyhock with a single vertical stem about two feet high. The leaves and single pink flowers, which are about two inches wide, are held close to the main stem. The tubes are small, about one half inch in diameter, and round.

Because the hollyhock flowers were held close to the stem, along its entire length, the possibility of a cross between the hollyhock and the hanging basket promised a possible new type with cascades of drooping stems bearing even more flowers than the regular hanging basket. After many crosses it was found that such a new type was not likely to appear. Some of the interesting individuals in these test plots were extremely tall, over three feet high. Others tended to have the desired hanging basket form but bore only stunted flowers which were partially green due to leaf tissue replacing petal tissue. Most of the tubers from these crosses were of intermediate size and shape, not as small and round as the hollyhock, not as large and flat as the hanging basket type. Because the progeny, after several generations, were deemed of no commercial value, all were discarded.

Crosses with *B. baumannii*

Few begonia species have any noticeable fragrance. *B. baumannii* is an exception; the rose-pink flowers are about two inches wide with a distinctly sweet odor. The flowers are single and are borne on an ordinary upright plant, ten to twenty inches high. Crosses with *B. baumannii* were made in hopes of eventually getting a good double-flowered fragrant begonia. This was never achieved. Many crosses were made, as many as 50,000 plants being grown during one season. Large fragrant single flowers, up to four inches wide were developed; but the crosses which gave double blooms lost the fragrance. The fragrance was found to be closely associated with the pollen bearing organs and the effort to produce good double fragrant begonias was therefore abandoned.

Leslie Woodriff, an Oregon hybridizer, later developed a double fragrant begonia by crossing species #1041, collected from the University of California, with *B. baumannii* and with other hybrids; it is not presently being produced in large quantities.

A color mutation of the carnation type

A new type often is introduced to the public as a named variety; this is the case with most of the English introductions, produced by expensive vegetative propagation. The variety 'Frosty', often called 'Silver Tips', is a typical example of excellent results obtained from an individual plant which appeared as a mutation or sport. This unusual plant appeared in one of the experimental crosses at the Brown Bulb Ranch. It was the only plant in the plot to exhibit a white edging on a salmon flower. The balance of the seedlings in the plot were carnation types with more or less solid coloring. Such a color combination is very unusual in begonias; all bicolors of the picotee group have had a dark color on the edges of the petals with the rest of the flower a lighter shade. This new discovery reversed this arrangement.

Ruffled Double

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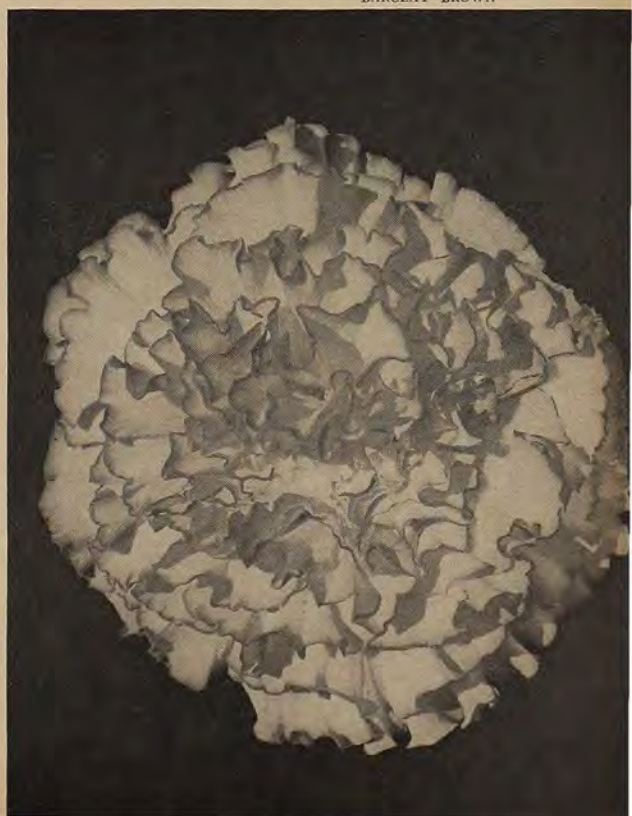

Furthermore, it was the first bicolor in the carnation type.

The crosses made with this first plant of 'Frosty' and with its progeny gave very poor results. From the first 40 crosses, only three satisfactory individuals appeared. Ten years of hybridization were necessary to finally get parent plants which would produce a true strain of 'Frosty'. During these years many disappointing crosses resulted in poorly formed blooms, and flowers with muddy coloring, no white edging, or uneven splotches and markings. Finally, in 1961, with good parent plants selected, the item was offered to retailers as a new begonia. It is not surprising that the price of a tuber of 'Frosty' was slightly higher than the price of the regular types.

Yellow multiflora crossed with red picotee

The most rewarding cross in recent years resulted in the picotee multiflora. Both the multiflora form and the picotee color arrangement have been increasing in popularity, but the two types had not been available in a single plant. An experimental cross between a particular yellow multiflora plant and a standard upright picotee begonia having red edges on white petals produced surprising results. Not just one, but 5% of the seedlings had great quantities of bright yellow blooms with scarlet edges on each petal. None of the crosses of the F_1 generation plants with the original parents produced very good results, but some crosses between the satisfactory individuals in the F_1 generation gave a gratifying 15% true strain of picotee multiflora. A third set of crosses discovered parent plants which would give a 50% true strain. The fourth generation was 85% true, and the fifth generation was 97% true.

During these five years of development, selection was aimed at limiting the size of the flowers to two to three inches in width with abundance of blooms being stressed. The brightness of the color and the clear picotee edge was carefully selected. A great many crosses were made each year to successfully select the best parent in so short a time. The picotee multiflora was available to the public by 1963.

Many interesting crosses are now being made with tuberous begonias. Some of these are not described here for commercial reasons. Many will never have any commercial value. But there is no doubt that new members of the *Begonia* $\times$ *tuberhybrida* group will continue to appear, and with increasing frequency.

Experiences in Introducing Plants to Martha's Vineyard Island

Mary Louisa B. Hill*

Environment

Martha's Vineyard Island, five miles off the heel of Cape Cod, Massachusetts, has been my summer home for 40 years. Since I have also spent some time in Japan and observed a similarity between the climates of Martha's Vineyard and Japan, I have tried to establish examples of its rich flora on the Vineyard. Growing the seeds and plants I received from those islands, I have experimented for eight years with Japanese trees and shrubs, both evergreen and deciduous. Starting them in a nursery, I have transferred the best selections to an arboretum, or have used them to landscape the summer farm. Plants of horticultural merit from other foreign countries and our own natives were included in the tests. I have found that selections of exotic plants, mixed with the finest natives, combine in a lovely way, ornamenting the island scene.

The area of the island is about 100 square miles, and it lies between Long Island and Nantucket. Together with many smaller islands, these form the windswept sea barriers to the southern New England coast. Triangular in shape, the Vineyard is about nineteen miles long and nine and a half miles deep. The farm where I stay lies in the center, over some deposits of the Tertiary Age, the northernmost on the United States' east coast. Thus many thousands of years ago, was deposited the clay that has been added to our sandy soil, making this spot fertile enough for my trials.

The northwest area of the Vineyard, mostly woodland, rising in ridges to over 300 feet, is a glacial moraine; here the retreating ice scattered behind it great granite boulders. In the flatter areas, east and south of us, the soil lacks both the clay and granite, so that large stretches of Vineyard soil are nothing but sand and pebbles in cross-bedded layers.

*Wilmington, Delaware

Rainfall is 35 to 50 inches annually. June is the driest month and the first frost-free month. Sometimes even May is dry, and the drought may not end until late July or August. When a Vineyard tree or shrub puts on its spring surge of new growth it quickly uses all the soil moisture, so it must suffer through the summer drought until there is rain. Finally, in the beautiful autumn days, with moist roots and sparkling air, the plant has ideal conditions for growth. Unfortunately, come years when a hurricane defoliates the trees in September, other years when a hard freeze occurs in early December, catching active growth unawares. Such conditions are hard on young nursery stock, but do serve to thin out the weak individuals.

Temperature at the Vineyard can drop to 0° F or below, though some years plus 10° F is the lowest recorded. It seldom stays low for long, fluctuating as much as 20° between day and night. After one to three weeks of extreme cold, accompanied at some point by winds from 50-80 miles per hour, the low temperature will be in the 20°s for the remainder of the three cold months of the year. Unfortunately on the Vineyard it is unusual for the plant to have adequate snow protection when it is coldest, and the snow that falls does not last very long.

The prevailing winds blow from the southwest in summer and from the northwest in winter. Our severest storms "breeze" from the northeast, to use a local expression, and our hurricanes from the southeast. The Vineyard air is nearly always moving.

On the farm the soil ranges from a pH of 4.8 in the open fields to 5.3 close to the stone walls. It is extremely low in nitrogen, phosphorus, potash, calcium, and every element tested for except aluminum, of which there is too much. We dig five-year-old rotted woodchips

into the beds, borders, and nursery rows as soil conditioner, and spread them as a mulch. We build up soil nutrition with lime, bone meal, cottonseed meal and superphosphate, while cow manure, happily available in our area, we toss around established plants as a winter dressing. Our own mulch pile of weeds, leaves, and kitchen greens, turned over once, is dug into the vegetable garden annually. Six inches of seaweed were worked in one year, resulting in excellent tilth. I have worked with both heavy clay and poor sandy soils, and the latter I find much easier to work into good condition.

Drainage is excellent, since coarse open gravel lies below the sod at depths varying from one to three feet or more. As might be expected, broom, heather, corema, pixie moss, sandwort, sand myrtle, bird's foot violet, and all the plants of the dry pine barren association thrive in Vineyard soil, and are easily moved while small. We were surprised to find that the bird's foot violet in cultivation produces some bloom from August until frost, in addition to its main flowering in May.

Pests, Diseases, and Allies

We have our share of pests. Mice girdle trees under the snow, or eat terminal buds of small tree seedlings. Rabbits, destructive and prolific, particularly like to nibble yew, China fir, azalea, holly, pagoda tree, euonymus, and dogwood. They do not seem to bother larch, umbrella pine, box or andromeda. They may be thwarted by a two foot chicken wire fence of one inch mesh. White tail deer and red deer are a constant nuisance and highly destructive. Although I have seen deer on the Vineyard, I have yet to see them on the farm. Only the hoof prints and the chewed up branches remain to identify them morning after morning as I make my rounds.

I spray some plants with "Arasan 42-S" to discourage rabbits and deer. I have lost some plants to mice chewing up the roots and trunks at ground level. Deer are curious creatures, and whenever new earth has been plowed or planted their feet roam all over it, exploring. After a while the plants no longer cast unfamiliar moon shadows or interfere with old deer trails and the animals no longer bother them. Besides exciting the ani-

Road to South Beach from South Road taken at early morning. Martha's Vineyard Island.

WILLIAM O. RICHARDS

mal's curiosity, a shrub or tree transplanted to new surroundings seems to be actually sweeter or more delicious for about a year. A pine, such as *Pinus thunbergii,* after its first twelve months in the field, must be tougher, rougher, or in some way bitter or unpalatable, for it is apt to be unmolested once well established; the first year it may be unmercifully chewed, both bark and branch.

An anti-deer device that has proved a help to me is to run a wire, only one foot off the ground, surrounding a bed I wish to protect. This low wire tangles the deer's feet and trips them until they soon avoid the area. The great trick with deer is to try to throw the high strung creatures off balance nervously, make them anxious, hoping to send them on some other trail, on some other field than mine.

The worst pests in the insect world, the Japanese beetles, which are in an abundant stage on the island, love everything in the rose family, also *Larix, Metasequoia, Carpinus, Betula,* and *Cornus;* while in the vegetable garden they are ravenously hungry for asparagus, rhubarb, and raspberries. To combat the beetles we have spread milky-spore disease.

Plant diseases are few, due to cold and wind, I suppose; while the abundant heart-rot and necrosis might be accounted for by unfavorable cultural factors. White oak is the most abundant species of tree on the island. Some superb heavy, wide-spreading specimens can be seen. But many a tall oak, blown over by a hurricane or split in a gale reveals a rotten core. I blame much of this on spring or summer droughts, especially when trees are young. The black locust, *Robinia pseudoacacia,* is brittle in the wind, losing large branches or the whole top of the tree. Brittleness may be partly caused by the borers which are present in most young trees. The tree outgrows the borer but keeps the rotted heart wood; in the same way many wild cherries have soft and worthless centers.

Potent allies in Vineyard horticulture, however, are the air and the fog. The air is clean and pure, a delight to breathe, the fog is frequent and beneficial. Vineyard mists are as much a part of the landscape as brilliant sunshine. Consequently, by the end of summer broad-leaved evergreens have glossy, clean and luxuriant foliage, while the narrow leaves of pines expand, with a shiny opulent appearance.

The summer farm of 45 acres is about half woods and half open fields, bounded by stone walls. The arrangement of walls and gates in our fields was dictated by the needs of sheep raising and farming and the need for wind barriers. Sheep raising also accounts for the deep richness of the soil in certain limited areas. Winds up to gales and hurricanes blowing from the sea, which is about four miles away in any direction, account for the bare, thin-soiled centers of the fields and the lush accumulation of leaf mold along the walls.

In the past the sheepmen were also farmers. When the fields were used for crops they could not plow too close to the walls, so weed plants grew, and the wall strips gradually widened. Locust, wild cherry, red cedar, viburnum, bayberry, blueberry, poison ivy, cat briar, sassafras, sumac, red chokeberry, shad bush, black alder, black gum, gray birch, and many species of oak competed for the undisturbed space, until the walls became invisible. The rocks along the top tumbled down, unbalanced by the action of frost on the foundations or by being kicked over in the deer paths. The thickets around the walls provide cover for rabbits, shrews, moles, quail, pheasants, feral cats and field mice; but not always enough cover to prevent happy hunting for hawks and owls. The jungle moves in quickly where neither man nor beast keeps it down.

I shall mention just three of our wild flowers. By clearing the undergrowth in some of the woods we have permitted the spread of Pipsissewa (*Chimaphila maculata*); in the sun we have cultivated a showy bed of *Asclepias tuberosa,* the butterfly weed, and another of *Lysimachia punctata,* dotted Garden-Loosestrife. I raised some plants of *L. punctata* from Royal Horticultural Society seed, hoping for something still showier than our Loosestrife, but found that the Vineyard strain was the one we preferred. The flowers measured actually wider, were held more open and upright and were more abundant in the whorls. They even had less dark coloring to detract from the clear yellow of the petals. However the Vineyard strain produces no seed and must be propagated by divisions.

Near the old buildings were planted lilacs, boxwood, rambler roses, and old-fashioned shrubs, a white mulberry, elms, a pecan tree (a specially hardy grafted *Carya illinoensis,* now 15 years old and healthy), some old apple trees, and several sycamore maples (*Acer pseudoplatanus*), now fine specimens and among the very best wind and weather-proof trees for the Vineyard.

Plenty of wild birds feed on the farm. When I go to the nursery early in the morning twenty robins may be disturbed and flutter off. At their appointed hour morning and evening fifteen Canada geese fly up from nearby, gaggling, and circle low over my head. To live by goose's time is more pleasant than clock watching.

Summer Schedule

As to my opportunities to garden, I am obliged to be completely absent from the month of November to April. I am usually present from late June to early September, paying visits of varying length spring and fall. Especially the weeds enjoy my absences.

With the time available to me I have followed a program at the farm of experimenting with different plant groups, testing for hardiness and suitability to Vineyard environment, and of landscaping with the best results of my tests.

Hollies

Hollies were my first love, and I find them very well adapted to seacoast planting. At present *Ilex opaca,* the native, and *I. aquifolium,* the English holly, are rather widely planted on the island. They should be moved in spring, not fall, and need wind shelter when young. I am growing the red and yellow-berried opacas, 4 or 5 named clones, and some seedlings. For dry woods planting only the seedlings have survived, because of their more rangy root system. Of the aquifoliums I am growing 'Camelliaefolia', the hardiest of all, of 'Angustifolia', and some others; several form of *I. crenata,* such as 'Compacta' 'Convexa', and 'Helleri'; then *I. perneyi, I. pedunculosa, I. cornuta, I latifolia, I. sugerokii, I. mutchagara, I. glabra, I. rotunda,* × 'Lydia Morris', *I. ciliospinosa* and some others; as well as the deciduous species *I. verticillata, I. montana,* and *I. macropoda. I. aquifolium* 'Aureo-marginata', Foster's hybrid, *I. cornuta* 'Burfordii', and *I. cornuta* 'Rotunda', did not prove hardy in my trials. I have seen handsome large plants of *I.* × 'Eldridge' in other gardens.

About two miles north of our farm on the Vineyard Sound, is a remarkable grove of *I. opaca.* It is flat-topped, being levelled off at about seven feet by the sea winds, as it is growing virtually on the beach. Buffeted and bent over, the bare and twisted trunks reach horizontally away from the coast, and have at the ends of their branches tufts of fresh green leaves. On the other hand, inland, in a sheltered woods, not a mile away, stands a holly more than thirty feet tall, symmetrical, and handsomely furnished with leaves from top to bottom.

Pines

My second loves are the pines. It is easy to see from the air or the highways that many pines are native or naturalized on the island, such as *Pinus rigida, P. strobus, P. sylvestris,* and *P. banksiana.* Also many hundreds of *P. thunbergii, P. resinosa,* and *P. nigra* have been planted, either in private places, by the State Forester or by the Highway Department. The following species of pines are on trial in my nursery or are already planted out: *Pinus aristata, P. armandii, P. aya cahuite, P. bungeana, P. cembra, P. cembroides* var. *edulis, P. contorta, P. coulteri, P. densiflora* and its form *umbraculifera, P. flexilis, P. halepensis* var. *brutia, P. jeffreyi, P. koraiensis, P. mugo, P. nepalensis, P. nigra, P. palustris, P. parviflora, P. pentaphylla, P. peuce, P. ponderosa, P. rigida, P. sabiniana, P. strobus* and its form *pendula, P. sylvestris, P. taeda, P. thunbergii,* and *P. virginiana.* These have wintered in the open one or more years. Those species that died of the cold include *P. halepensis, P. muricata, P. montezumae,* and *P. pinea.*

The loblolly pine when once established can take a severe winter like last, '62-'63, without any setback. Although somewhat subject to salt burn, it is one of the pines able to send out new shoots from an internode in the stem and thereby rejuvenate itself very quickly. I recommend it highly for Vineyard planting. Cones of the loblolly have been found in a peat bed on nearby Noman's Land. Once the primeval woods were cut down by man the loblollies have not returned. *P. contorta* also grows very fast and has

a rich deep green color. *P. densiflora* and *P. nepalensis,* two favorites, I prize for beauty, speed of growth, and their adequately proven resistance to cold and salt. *P. sabiniana,* barely able to stay alive, is not recommended. *P. palustris,* still in the bushy seedling stage, has been in the open ground since '59. *P. ayacahuite* seedlings, the Mexican white pine, give great promise of becoming bushy vigorous trees. *P. thunbergii,* the Japanese black pine, is of course the most consistently recommended for direct exposure to the sea or for windbreaks, but it is short lived on the Vineyard, coarse and subject to borer, and I shall not plant any more of them. Loblollies outgrow the Japanese black pines in height and are more graceful in appearance. They will also grow in wet places or in dry, and can take some shade in the early years without reaching.

In 1959 I started a pine grove of 85 one-year-old seedlings of *P. flexilis,* the western limber pine. Other species have been added. Rates of growth of various species differ conspicuously. So far the limber pines have failed to outgrow meadow grasses in height, while the tallest loblollies of the same age rise over my head.

Other Conifers

Two Japanese conifiers, outstanding in ease and success of culture, are *Cryptomeria japonica,* and its variety 'Elegans', and *Sciadopitys verticillata,* the Japanese Umbrella-pine. They both develop compact and bushy silhouettes and expand their individual leaves luxuriantly in the moist clean air. The three true cedars are doing well (I am using *C. deodara* 'Kashmir'). I am growing three different spruces and six different firs: *Picea orientalis, P. glauca,* and *P. glauca 'Conica'; Abies firma, A. procera (nobilis)* var. *glauca, A. nordmanniana, A. numidica, A. pinsapo* var. *glauca, A. veitchii.* The enemies of spruce and fir are red spider in a dry summer and deer with itchy velvet horns in winter.

Two other conifers interest our visitors: the giant redwood, *Sequoiadendron giganteum,* from California, now reaching four feet and stocky, having been in the Vineyard ground three winters, and dawn redwood, *Metasequoia glyptostroboides,* from a 1959 cutting, nine feet tall in four years. Given plenty of food and water the metasequoia is a tree of light green almost fern-like grace and beauty in the Vineyard climate. The Japanese larch, *Larix leptolepis,* has outreached the golden larch, *Pseudolarix kaempferi,* by several feet, though why I am not yet sure. Both came from seed in 1959. *Taxus* × *media* and its relative *Torreya nucifera* grow well. *Chamaecyparis lawsoniana* must have wind shelter, but it is a lovely bushy plant, enjoying the seacoast climate. *Chamaecyparis obtusa* and forms are fully hardy. The Irish juniper is not hardy enough; it neither grows nor dies. But horticultural selections of the Chinese juniper thrive and are rather widely planted. *Juniperus pachyphloea,* a beautiful blue, is a shade more spectacular than *J. monosperma.* They both grow fast and are from Denver seed.

Beeches and Other Trees

A beautiful and available large tree, the native beech, growing in unmixed groves, has been known on the island since earliest times, and here and there can be found majestic individual specimens. There are also some very large specimens of the European purple beech. I am trying *Fagus sylvatica* 'Aspenifolia', 'Laciniata', 'Heterophylla', 'Cuprea', 'Fastigiata', and 'Purpurea Pendula'. Although I have tried, I have failed to grow small plants of *F. sylvatica* 'Tricolor', while my young graft of 'Roseomarginata" was stolen. It seems that the climate is really too rugged for the semi-albino plants of the genus *Fagus* or *Ilex.*

A shrubby tree, enormously successful on the island, upright in shade and spreading in the sun, is *Photinia villosa.* A vigorous grower of the rose family it offers a dainty white flower, showy red to orange fruit, and brilliant red to yellow autumn foliage; *Photinia* even tolerates some nibbling by rabbits and deer. But for all its virtues it does not seem to be well known.

Another favorite of mine, if planted near a wall or other wind break, is *Oxydendrum arboreum,* the slender Sorrel-tree. It is beautiful at all times of year, the large leaf giving it character. Native further south, it grows well with *Pieris japonica,* now widely planted on Martha's Vineyard. *Pieris* has a way of growing easily to a good size and then capriciously dying, whether for lack of water or for some other cause I have not yet found out.

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Shadows in the lake—left foreground—tell of late afternoon in this charming scene. Martha's Vineyard Island.

Halesia and *Corylopsis* in several species, also *Pterostyrax* are plants I am growing with no difficulty, except for mice and rabbits. *Franklinia* grows successfully as a multi-stemmed shrub, and all the *Stewartia* species flourish. I am growing *S. pseudo-camellia, S. monadelpha, S. koreana, S. malacodendron, S. serrata,* and *S. sinensis.* Stewartias branch in a dainty and orderly fashion and sport a brilliant fall coloring. Placed in partial shade they seem content with the existing amount of moisture. Most of them bloom in summer.

Magnolia grandiflora grows in several places on the farm, all chosen with an eye to wind and shelter. I lost a young one, branch and root, to a hungry mouse during the winter. Since the largest one outgrew its protective cage, I rely on "Arasan 42-S" and "Wiltpruf" to keep the deer from it. A number of my small seedlings of *M. grandiflora* have succeeded in other island gardens. *M. macrophylla, M. virginiana, M. kobus,* and *M. sieboldii* are also on trial. *M. virginiana* has proved hardy for the longest period. The lovely pink blooms of *Magnolia* × *soulangeana* can be seen in several island towns in early spring.

Disappointments have been many due to a lack of hardiness: *Liquidambar styraciflua* (from Delaware seed), *Acer japonicum* (if too exposed), *Laburnum* × *watereri* 'Vossii' (only if too exposed), *Davidia involucrata* (the plants were probably too small for testing), *Eucalyptus gunnii* (it regrows from the ground each year), *Pernettya* (after succeeding two winters), *Daboecia cantabrica* and others, all failed.

Our native dogwood, *Cornus florida,* will not grow well on the island unless pampered. Much more successful, and blooming through the whole month of July, is the Japanese dogwood, *Cornus kousa.* A group of these have been given a major place in our landscaping. As I have experienced on a number of occasions, the seedling variation provides enormous interest as the trees develop. One plant in my collection of *Cornus kousa* grown from seed has leaves of the smoothest velvet texture, the richest coloring, and the finest form of any of the 40 or so I have raised. It even seems to repel the Japanese beetle, suffering the least damage of all its sisters from those pests.

The tulip poplar, *Liriodendron tulip-*

ifera, with its massive bole unbranched for several tens of feet above the forest floor, has always seemed to me the straightest and tallest of our nearby trees. It is not this form that one finds on the Vineyard. In the village near us, on Music Street, an old tulip tree, with a stocky wide-spreading habit, has more the look of a live oak on the Ashley River. The tree is rare on the Vineyard, if not unique. In 1958 I gathered 225 seeds from Delaware and planted them. Only three seedlings emerged but they grew prodigiously in the nursery. In May, 1960, when a year old, they were planted strategically, one north of a house, one in the arboretum, and one on a south wall. When four years old from seed, the last one had achieved five feet, and in the winter a mouse chewed it completely through at ground level. The one in the arboretum had not been watered through the summer and suffered die-back in 1962-63, but has since come back to be most sturdy. The third, with the help of food and water, seems in good health and balance. I hope this one will become established as a major shade tree.

Azaleas and Other Shrubs

After hollies and pines, my third specialty is the azalea. My objective with the evergreen azaleas is to develop a thoroughly hardy plant, prostrate or dwarf in habit, with large, clear-colored flowers, blooming during the vacation season of late June and July. I have been fortunate to obtain many seeds of special crosses from Japan. For example, one parent may be the dwarf species *Rhododendron nakaharai* or *R. yakuinsulare,* the other parent a showy 'Gumpo' or satsuki selection with outstanding color and size of bloom. The seedlings, when two years old or more, are put on trial in the nursery. I have also received named clones of Japanese dwarf selections with 3 to 5 inch blooms that are being tested for adaptability, first in Delaware, then on the island. Some deciduous species are also being tried, for instance our own native, *Rhododendron atlanticum,* quickly grown from Delaware seed, is now established in large beds. Fragrant and graceful, they make an attractive picture against a stone wall in the shade of an oak tree. There they are planted in a mixture of sandy loam and oak leaves. Again, the seedling variation is most interesting; for example, some seedlings have especially bluish foliage. As rabbits chew up the young plants, they must be protected. *Rhododendron* × *kosterianum* ("Mollies hybrids") and the Glenn Dale selections 'Sea Foam' and 'Treasure' are quite at home. *Rhododendron linearifolium* 'Seigai' has proved hardy in semi-shade. As in other localities some evergreen azaleas have proved to be more plant hardy than their flower buds, for example, 'Helen Close', another Glenn Dale.

Although I have not planted the large-leaved rhododendrons, others have, and with good success. The plants are thrifty and the deer do not bother them after the first year or two.

Kalmia, Enkianthus, and *Leucothoë* are contented Vineyard subjects; *L. fontanesium* (*L. catesbaei*) thrives in the dry woods and is not attractive to predators, its only requirement shade. *Aucuba japonica* and *Daphne odora* do well in the shade, too, seeming to stretch their leaves luxuriously in the morning mists; in the former the concolor has proved more hardy, and in the latter the variegata. *Hamamelis mollis,* after winter's natural selection and elimination process, has come to bloom in five years from seed. *Zelkova serrata* is adapting itself satisfactorily as is *Sophora japonica.* However, *Sophora* appreciates wind shelter and extra moisture. Crepe myrtle did not survive, though sheltered from wind, but the plants were very young for the severe winter of 1962-63. *Pyracantha crenulata* 'Rogersiana' needs the protection of a wall, also *P. atalantioides.* I would think them hardly worth promoting, their hardiness is so insecure; *P. coccinea* is hardy enough. *Poncirus trifoliata,* four years old from seed, and still in the nursery, is growing satisfactorily and ready to move. Again, the winter thinned out the weaker seedlings.

A really long-range project is the Shagbark Hickory grove, *Carya ovata.* My husband and I toured the nut regions of nearby Pennsylvania in two consecutive autumns, tasting from every wild tree we found. Only the largest and most delicious nuts were saved. After stratification they were germinated in a flat. In summer they were transplanted to a ploughed strip hoping to produce a closely spaced grove. Each plant is caged for the winter, since their terminal buds are ideal mouse and rabbit winter

diet. Admittedly, they are slow growing, for the best height we can expect is ten feet in ten years. Once they were well known on the island, but now are no longer seen.

Another pleasant grove will be *Nyssa sylvatica,* the Black Gum, planted along a wall between two fields. Notoriously tap-rooted and hard to move, three one-year-old seedlings were planted in each of 20 permanent positions inside a wire cage. When about 5 feet tall one of the three will be selected to continue. Their truly brilliant scarlet and purple fall coloring and graceful horizontal habit of growth make them a much admired native tree. Occurring naturally in wet places, they can also grow where it is dry.

Camellias

I shall conclude this cataloguing with my fourth and best love, the *Camellia.* First a word of background experience; camellias are already known to grow on the island. Several plants of *C. japonica* have bloomed in a sheltered Edgartown garden each year since 1945, or thereabouts, and with no extra water or food. In a wilder area, but also sheltered, a camellia survived the winter except for severe deer damage, I was told. So, in April 1960, I planted 33 young plants, all named varieties of *C. japonica,* in a bed to the north of a stone wall. The area was too exposed in winter, they were too small, their root systems too limited, and by the fall of 1963 only one or two were left, and those not too flourishing.

In October of 1960, I began to parallel my April test of named varieties with an experiment looking toward a hardy new race in several species. Seeds were obtained from three Japanese localities: Tokyo, Miyagii Prefecture and Aomori Prefecture, (*C. japonica*) ; from the Royal Horticultural Society in England (*C. saluenensis* and *C. japonica*) ; and from the United States, (sasanquas from Alabama, oleiferas from Washington, D. C. and japonicas from various sources). Those that arrived before December were planted outdoors three inches deep in my nursery in a peaty seed bed under lath. The others were germinated indoors in Delaware, grown on in pots or boxes and transplanted in the spring of 1961 to the island nursery, with snow fence four feet above them. From the nursery sown seed good germination resulted by June, but those started in Delaware were already a year's growth ahead. The rewarding thing in both cases was the vigor of the root, its deep penetration and wide branching, a marked contrast to the tight and meager root systems of my named clones grown from cuttings.

The winter of 1962-63 came along to prove the value of the tests. The story may best be told in chart form.

Column 1 gives the species and source of seed.

Column 2 shows the number of plants after a summer of growth following germination.

Column 3 shows the number surviving at the same time the next year, depleted by the winter of '61-62.

Column 4 shows the number of plants that looked green and healthy the following April, further depleted by the winter of '62-63. Criteria for selection were sound terminal buds and a large majority of undamaged leaves. Among the Kessennuma were a few in greenhouse condition.

Column 5 shows the percentage of survival from the beginning until April '63. At this point the plants are beginning their third year of growth.

Species	Fall '61	Fall '62	April '63	%
C. sasanqua Tokyo	37	20	0	0
C. oleifera Washington, D. C.	47	38	1*	2
C. japonica Natsudomari	428	70	20	4.5
C. japonica Tokyo	25	12	3	12
C. japonica R.H.S.	32	25	4	12
C. saluenensis R.H.S.	70	54	17	24
C. japonica Kessennuma	58	43	22	37
Total	697	262	67	9

*The one good *C. oleifera* was left in the small bed where it had been transplanted in 1962.

I hope that now I have 67 plants truly on their way to success. They are being given the most suitable spot on the farm for their permanent place.

Roughly 30 ft. by 300 ft., the camellia bed was three years in preparation. It was improved from a stony yellow soil to a humus-filled brown loam, by means of lime, manure, two crops of soy beans ploughed under, one of winter rye and bales of peat moss all worked in. The bed is shaded by tall spreading oaks on the south and west. To the north I have planted mixed pines which will soon grow up to provide wind shelter. My 66 surviving japonicas and saluenensis were moved to this spot in April, planted on eight foot centers. The bed was treated with "Simazine" for weed control, mulched with pine needles, and watered each week through the summer. After one more year of watering I hope this will not be necessary.

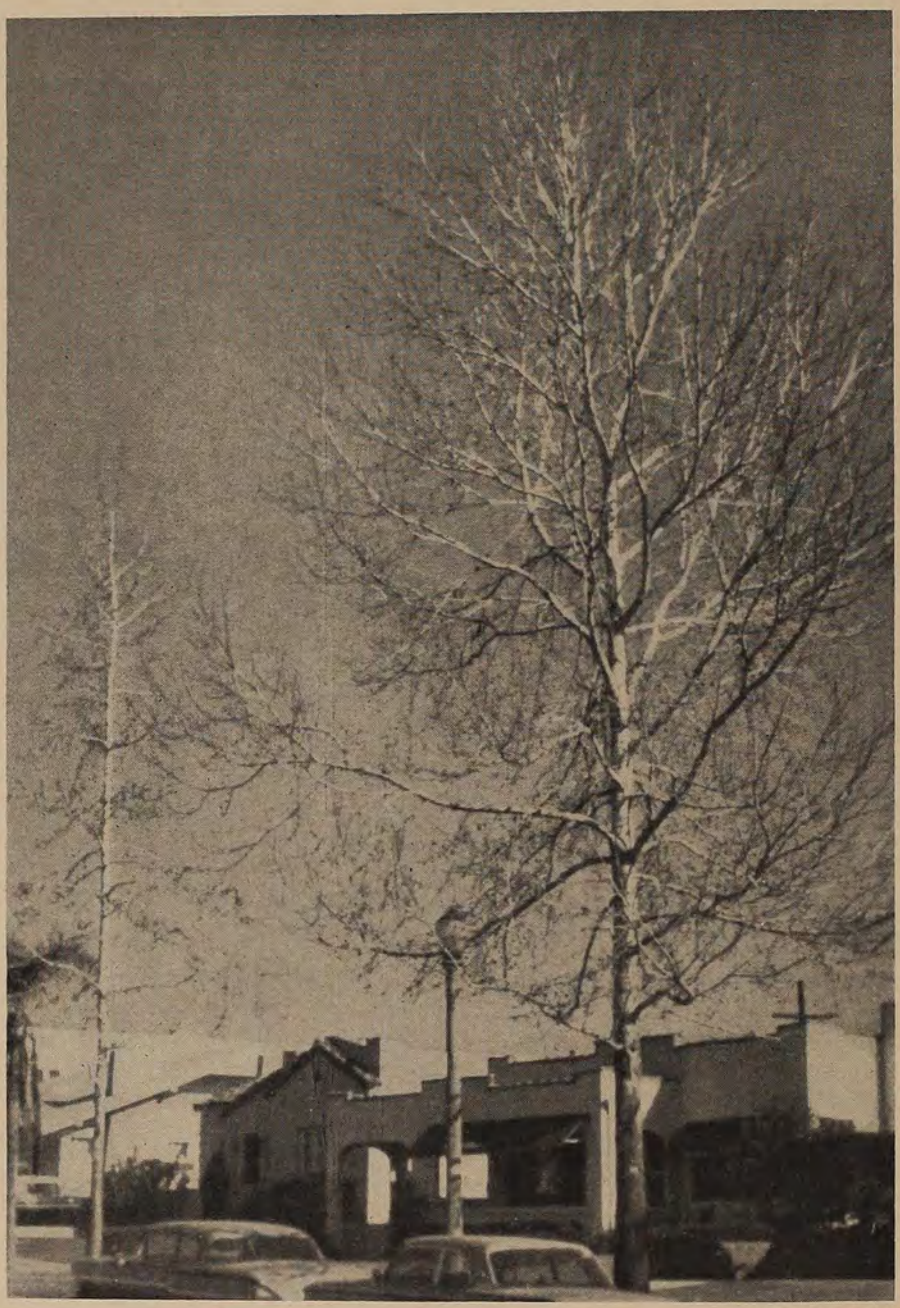
I am eager to see what flowers will result from the various seed sources. It may be interesting to repeat this description of the flower type, soil and climate from the Natsudomari area where the most northern Japanese *C. japonica* seed originated. I quote, "From #1 seeds, you can expect the flower are usual size about 7 cm. in diameter, fine red in color, with half paten petals. They grow on the soil of pH 6.0-6.5. The character of the soil is the silty loam with a little humus on the surface of the ground. The annual rainfall at Aomori near Natsudomari is about 1,300 mm. A period below 32° F is about three months, and a period below 0° F about one week, but the snow depth is 1 meter or more, then they are protected under the snow from heavy windy cold weather in winter."*

There may be a few surprises for camellia growers in this report: temperature is not unlike the Vineyard; pH is definitely less acid than the normal recommendation of 5.5-6.0 that I find in most of the camellia literature; rainfall, between 50 and 51 inches, is higher than the Vineyard, but much lower than some of the other camellia areas in Japan; "half paten (t)" I believe is meant to describe the somewhat tubular form of the flower, similar to 'Magnoliaflora' (Syn. 'Hagoromo'), but smaller.

The saluenensis plants appear to be of two kinds: one is typical in foliage and habit; the other, four special individuals, appears to be intermediate between saluenensis and japonica. Those four plants are outstanding in vigor and may prove to be hybrids. Bronzy red winter color exists in the leaves of some of the Natsudomaris (*C. japonica*) and all the *C. saluenensis*. The Kessennumas have the tallest growth of the japonicas, with longest internodes and the glossiest green leaves, winter and summer. The Natsudomaris are stocky and shorter plants. None of the seedlings of any species were budded this year.

Vineyarders have been travelers since the days of the whalers, bringing home foreign objects of all kinds. I hope that some of the foreign plants I have had so much pleasure in growing will take hold in the island soil and become permanent Vineyarders.

*Letter from Mr. Kobee Hosoi of the Forest Experiment Station at Okidate, Aomori, dated November 27, 1963.



PHILIP A. BARKER

Interruption of the central leader type of growth and development of a more spreading limb structure represents a variation of merit in an American Sweetgum in Glendale, California.

Tree Selection And Use

PHILIP A. BARKER*

One would not ordinarily plant a tree without considering what he expects from the tree—and then selecting a particular kind accordingly. In the process of being selective, a person may, for example, accept an evergreen tree and thereby reject a deciduous tree, perhaps narrowing it further down to a broad-leaved evergreen rather than a narrow-leaved evergreen tree, one with an ultimate height of 45 rather than 20 feet, one that grows rapidly in fine-textured, poorly-drained soil, and so forth. Finally, out of the myriad of possibilities, he makes his choice, probably satisfied that he has selected the ideal tree that was available for his particular needs.

A person's degree of selectivity is influenced by his awareness of the variability of trees. Assuming that the quality of trees used in the landscape will be directly proportional to the degree of selectivity, then a knowledge of variability in trees by whoever is responsible for planting them, is seen to be highly important. This paper, therefore, will be principally a study of the variability of trees.

Even though, within certain limits, each tree species (or taxon[1] of any rank) retains a relative constancy of characteristics from generation to generation, all of the individuals within a species vary one from another just the same as human beings. The over-all variability of the whole population of a species follows a bell-shaped curve. The significance of this is that a few of the individuals within a species, those at either end of the curve, will be quite dissimilar to the bulk of the population for that species; possibly so much as to suggest that they belong to another species. Since this pattern of variation is the expected thing, there is nothing magical about an individual tree that differs markedly from others of the same species. Such exceptional variation is, however, significantly interesting because of the slight probability of its occurrence, or, to say the same thing differently, because of such a tree's relative rarity.

It is the sorting out of certain of these trees of exceptional variation and perpetuating them as clones that continues to hold immense promise as a source of "new" kinds of trees. Some of these variations, while unusual within the species population, constitute an appearance difference primarily. Others, especially the ones that have superior performance, represent distinct improvements. A consideration of the relative importance of exceptional variations in trees will follow.

Variations in Leaves

At least four characteristics of leaves of trees have exceptional variation, namely 1) shape and size, 2) surface texture, 3) color, and 4) retention.

1. *Shape and size.* An unusual variation in shape is a leaf that is divided into narrow linear lobes that gives the leaf a fine textured laciniate or fern-like appearance. Even though a clonal tree with such finely dissected leaves may not be of superior performance, its unique appearance is impressive. Clones of European Birch,[2] European Beech, and Japanese Maple have this leaf shape variation.

Ordinarily, variation in leaf size is not so great or unusual as to be a striking feature. Also, size variations are less articulately comprehended in a person's mind than shape of leaves. Recently,

*Department of Landscape Horticulture, University of California, Davis.

[1]*Taxon* and *taxa*, its plural, may be applied to any naturally occurring and reproducible category of plants such as variety, species, genus, etc. The horticultural counterpart of taxon is *cultivar*, which is any plant propagated by a method other than the natural seed method. When a cultivar is vegetatively propagated, i.e., by a cutting, by budding, or by grafting, as practically all cultivars of trees are, it is more precise to call it a *clone*.

[2]Common names of trees are used throughout this paper. The scientific counterpart to these names is given in the appendix.

however, a clone of the southern magnolia has been introduced on the basis of its unusually large leaves.

From an appearance viewpoint, shape and size variations offer possibilities of modifying the texture of a tree species; particularly through variation in leaf shape for a finer texture and variation in leaf size for a coarser texture.

2. *Leaf surface.* Numerous species of trees have a pubescent or hairy leaf surface. Such leaves, being a haven for dust particles, often become seriously blemished during periods of no rain. Then, too, these hairs, like those on the leaves of the London Plane, are suspected contributing to hayfever symptoms. For these and other reasons, clones with leaves absent of any pubescence, of those species that normally have pubescent leaves, would be valuable.

3. *Color.* Leaf color is one of the variations in trees that seems to attract the greatest interest. The exceptional ones are those that contrast sharply with green. Some of these are permanent during the life of the leaf. Others are transient, present only during part of the leaf life span. Again, any of these color changes represents an appearance variation. They are spectacular, however, and so are greatly admired. Each of these variations are significant for different species of trees.

The so-called blues or white-blues, apparently permanent in the leaf, are found in the conifers. In the blue Colorado Spruce this characteristic segregates out often enough for it to be profitably produced by seed propagation by roguing the unwanted green seedlings. A clone of the Atlas Cedar has a similar color variation.

Various hues of purple is another color variation that is often permanent in leaves. Familiar examples are some, though not all, of the purple-leaved clones of the Myrobalan Plum, such as

Variation in winter retention of dead leaves on a pair of Pin Oaks growing near Lodi, California. The abundance of leaves on the left tree is typical of most trees of that species. The right tree, which was defoliated at least one month before the picture was taken on January 11, 1963, would be more desirable for landscape purposes.

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the 'Krauter's Versuvius'. The purple leaf characteristic seems to be so outstanding a feature in this species as to preclude the landscape use of the green-leaved counterpart. Notwithstanding this colorful feature, green-leaved clones of the Myrobalan Plum should be equally useful, especially if they bore no fruit.

Trees that have transient leaf color differences are of two kinds. On some, the leaves have a color other than green as they expand from the bud, fading into the more normal green color as the leaves age. Numerous purple-leaved clones of various species exhibit this color variation, including the Myrobalan Plum, European Beech, Japanese Maple, and Norway Maple.

Secondly, there is the transient leaf color variation that occurs in the autumn shortly before leaf drop. The colors that occur then are well-known; reds, oranges, and yellows predominating. Sweetgum is a familiar example—beautiful green throughout the summer and ablaze with the traditional fall color for a couple of weeks in September or October. Not all of the individuals in this species, or any of the fall-coloring kinds for that matter, color equally well. Because of this, clones that are consistent in coloring are much in demand. However, even these must be predisposed to certain environmental conditions if they are to color well. It follows then, that under environmental conditions that are optimum for fall coloration of tree foliage only certain species of trees will color and within each of these certain individuals will color better than others.

In addition to the Sweetgum, other tree species that have the inherent capacity for fall foliage coloration are many of the maples including the sugar, red, Japanese, purpleblow, and vine maples; Tupelo; Chinese Pistache; Sassafras; and Japanese Zelkova. All of these are noted for colors of burgundies, reds, and oranges. On the other hand, the leaves of the Ginkgo and at times the Modesto Ash and the Norway Maple turn to a dazzling golden yellow. Add to this, too, the beauty of a carpet of yellow leaves under the ginkgo a few days later.

Contrast the aforementioned trees with other tree species whose leaves display a dismal senility by fading to various bleached shades of greenish yellow before falling. Seldom is the change of sufficient magnitude to invite a "second look." The Silver Maple is an example. Some others are the so-called fruitless mulberry, the elms, London Plane, the Honeylocust, and the Catalpa.

4. *Leaf retention.* Some interesting questions about trees seem to have had little study. One concerns the life expectancy of leaves of broad-leaved evergreen trees, and the time of year and length of time during which they drop. Presumably, the leaves of the southern magnolia, for example, begin dropping about May and continue to dribble down through August. A survey of home-owners, along whose street this tree grew, revealed that the leaf residue was the feature they disliked most about it. Conceivably, trees could be found of the southern magnolia, and of any other broad-leaved evergreen, on which the period of leaf shedding would be significantly shorter than usual. An improvement of this nature should represent superiority of performance at least in terms of reduced maintenance requirements.

The deciduous trees, those that have complete defoliation annually, require a dual consideration of leaf retention. The first is that of leaf shedding throughout the summer, which may be prevalent for trees like the Tuliptree, London Plane, and occasionally the Silver Maple. Seldom if ever does this occur in some other species, notably the Ginkgo, the elms, and the hackberries. To many homeowners, no tree problem is more acute than to have a tree, deciduous or evergreen, that sheds leaves throughout the summer. The residue or litter that it creates is an unacceptable maintenance item.

The second consideration of leaf retention on deciduous trees is the abruptness of defoliation. The ideal trees, using the ginkgo again as the example, defoliate entirely within a two to three week period. Contrast this with a typical Pin Oak on which the leaves may turn brown in late fall and remain attached to the twigs throughout the winter. This latter condition is also found in several of the oak species, the European Hornbeam, and the European Beech.

In a review of his research findings on this problem, de Muchadell (1) report-

ed that there is much difference between individuals of the above named trees regarding their leaf retention characteristics. Working with two species, the Durmast Oak and the English Oak, he found that the first great difference was a pronounced individual variation. Many individuals of both species never retained leaves in the winter; on the other hand, others retained the dead leaves during the winter even at great age. He reported that the Durmast Oak was more inclined to leaf retention than the English Oak, hence the former was called "winteroak" and the latter "summer oak." He succeeded in showing, by controlled crossing, that leaf retention is a hereditary characteristic in these two oaks.

There is reason to again stress that the variations in leaf retention characteristics represent a fertile field for investigation to develop clones of superior performance.

Variations in Thorns

Numerous species of trees have some form of thorns or spines, a characteristic that is often an exceptional variable. De Muckadell (4) found a definite drop in the thorniness of the Black Locust with tree age. By vegetatively propagating from high up on in an old tree, where the branches were relatively thornless, he obtained new plants that were essentially thornless. Whitehouse, Creech, and Seaton (3) have developed a clone of a Chinese pear that is free of the characteristic thorny spurs. The tree, which they have named *Pyrus calleryana* 'Bradford', should be more suitable for landscape use as should any other thornless clone of typically thorny species.

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Vertical limb and branch growth and effective longevity of tree characterize this highway center strip planting of an upright selection of English oak in Eugene, Oregon.

Variation in Branching

All tree species ordinarily have a well recognized branching characteristic. This characteristic contributes more than any other one to the over-all shape for which each species is known. The variation between species is from the wide-spreading flat-topped Silktree to the unusually narrow Silkoak. The Silktree has no central leader whereas the Silkoak has a very pronounced central leader with branches growing horizontally out from it. Ordinarily the Sweetgum has a prominent central leader, too, yet in Glendale, California, in a street planting of upwards of 200 trees of this species, the central leader on a few is essentially absent. As a result, their crown shape is considerably wider than in the others.

Considerable merit attends the use of narrow or columnar trees in various landscape situations. For this purpose there are already several columnar-growing clones of various tree species and undoubtedly many more will be developed. The Lombardy Poplar is a well known example, though, for numerous other reasons, its use is seldom justified. Of far greater value is the columnar form of the English Oak. Many others could be described. All of them, represent a distinct improvement over the species for an extensive array of landscape situations.

A pendulous branch habit is still another variation in branching, as, for example, the Chilean Mayten and the weeping willow. Pendulous-branching clones exist in such trees as the Japanese Pagodatree, English Elm, and the White Mulberry. Trees with such novel branching often have a place in parks and home gardens. Their grotesque appearance interests adults and children alike.

Variation in Tree Size and Growth Rate

Tree size and growth rate are so interrelated that a combined discussion seems desirable. Both are influenced by a tree's genetic status, by the environmental conditions under which it is grown, and by its root stock and/or other human-induced aberrations. In a well-controlled study Squillace and Silen (2) found that, during a 30 year period, the growth rate in height in Ponderosa Pine from one seed source varied from 60 feet in a forest planting near Corvallis, Oregon, to less than 10 feet in a forest planting near Bend, Oregon. They also found that the seed source also greatly influenced the growth rate and ultimate height. This is not an unusual example. Evidence is accumulating that confirms the viewpoint that the growth rate and ultimate height is exceptionally variable for each tree species and that the reputation that a tree may be "slow growing" often is based on incomplete evidence. A reputation for "fast growth" can, in all probability, be assigned to some individual or individuals of all species of trees. The development of such clones in the better quality tree species will be one of the more important horticultural contributions in the next 40 years. Such clones may not have appearance differences but they will have the more important attribute — superior performance.

Flower Variation

To fully appreciate the potential variation in flower characteristics, requires an understanding of the inherent sexual differences of each tree species. Understanding these differences is greatly simplified by becoming acquainted with a few terms. With reference to their sexual differences, trees may be divided initially into two large groups and named accordingly.

One group is the so-called *monoclinous* trees in which each flower contains both sexes, namely the male and female. The Silktree, Silkoak, London Plane, Sweetgum, the hawthorns, the elms, the *Eucalyptus* and the magnolias are notable examples. Every tree in this category ordinarily has the capacity for eventually bearing fruit. However, the fruitfulness of these trees is a distinct variable and the possibility exists of developing non-fruiting clones with sterile flowers.

In the second group of trees, called *diclinous,* each flower contains only one sex, or, to better anchor the meaning to the name, two flowers are required in the reproduction process. This group is again divided. One of these subgroups is the so-called *monoecious* trees. In them, both the male and the female flowers are ordinarily borne on the same tree. These trees, like the monoclinous ones, all have the capacity for bearing fruit. Some trees in this subgroup are the oaks, walnuts, alders, birches, and pines. Development of non-fruiting clones of these would be achieved by procedures similar to those used with the monoclinous trees and also by developing trees that bear only male flowers, like, for example, the non-fruiting clones of the Honeylocust and the White Mulberry.

The second subgroup of diclinous trees is called *dioecious.* In them the male flowers are borne on one tree and the female flowers on another, or, again to anchor the meaning to the name, two trees are required in the reproductive process. Obviously, sorting out non-fruiting trees from this group is no problem. One needs only to multiply by vegetative propagation any tree bearing the male flowers. The ginkgo is a familiar example. Included in this group also are the Persimmon, the Chinese Pistache, and the Papermulberry.

The possibility has already been mentioned of developing a clone with flowers of only one sex from species that ordinarily are diclinous monoecious (trees that have flowers of different sex on the same tree). Somewhat the reverse of that situation obtains naturally in some tree species which would be declinous dioecious except that a few flowers of the other sex are also borne on each tree. The Chilean Mayten is one. In such species, the normal pattern is for some trees to be essentially female, but have a few male flowers. These bear an abundance of fruit. Other trees of the same species will be essentially male but will bear fruit from the few female flowers borne on them. These species would be called diclinous polygamo-dioecious.

The flower variations that have been described above represent normal differ-

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Few trees have a more graceful weeping character combined with modesty of size (45 feet), strong limb structure, and attrative ½ by 1 inch evergreen leaves as does the Chilean Mayten.

ences in tree species. The most exceptional of these variations is not to be established in this study. However, the one that offers the greatest ease in developing non-fruiting clones is the diclinous dioecious group. Unfortunately though, trees in this group do not have showy flowers. Development of trees in the other groups will therefore be desirable in catering to the desires of the many people who cherish the beauty of trees with flowers.

In conclusion, this study has only hinted at the great number of variations that are present in trees. Those that have horticultural interest, for one reason or another, can be perpetuated as clones. Wih the U. S. plant patent law providing a remunerative assistance, the sorting out of these variations will continue to be stepped up by those interested in trees. Each clone resulting from these efforts will be heralded as being of royal uniqueness. Distinguishing between the worthy and the unworthy of these—the clones that are merely different in appearance and those that have distinct performance superiority—will be the role of the consumer.

Appendix A

Nomenclature of Trees Referred to in Text

Ash, Modesto; *Fraxinus velutina* 'Modesto'
Beech, European; *Fagus sylvatica*
Birch, European; *Betula verrucosa*
Cedar, Atlas; *Cedrus atlantica*
Elms; *Ulmus* spp.
Gingko; *Gingko biloba*
Hackberries; *Celtis* spp.
Honeylocust; *Gleditsia triacanthos*
Hornbeam, European; *Carpinus betulus*
Magnolia, Southern; *Magnolia grandiflora*
Maple, Japanese; *Acer palmatum*
Maple, Norway; *Acer platanoides*
Maple, Purpleblow; *Acer truncatum*
Maple, Red; *Acer rubrum*
Maple, Silver; *Acer saccharinum*
Maple, Sugar; *Acer saccharum*
Maple, Vine; *Acer circinatum*
Mayten, Chilean; *Maytenus boaria*
Mulberry, Fruitless clones of *Morus alba*
Mulberry, White; *Morus alba*
Oak, Durmast; *Quercus petraea*
Oak, English; *Quercus robur*
Oak, Pin; *Quercus palustris*
Papermulberry; *Broussonetia papyrifera*
Persimmon; *Diospyros virginiana*
Pistache, Chinese; *Pistacia chinensis*
Plane, London; *Platanus* × *acerifolia*
Plum, Myrobalan; *Prunus cerasifera*
Pagodatree, Japanese; *Sophora japonica*
Poplar, Lombardy; *Populus nigra* 'Italica'
Silkoak; *Grevillea robusta*
Silktree; *Albizzia julibrissin*
Spruce, Blue Colorado; *Picea pungens*
Sweetgum; *Liquidambar styraciflua*
Tuliptree; *Liriodendron tulipifera*
Tupelo; *Nyssa sylvatica*
Willow, Weeping; *Salix babylonica*

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Maguey Del Cumbre

HOWARD SCOTT GENTRY*

Agave mirabilis Trel. is one of the less known big maguey plants of the Mexican highlands. Trelease (1) found it cultivated in 1905 at "Las Vigas, Interoceanic Ry.," a small settlement in the mountains of Veracruz. This agave is still to be seen about Las Vigas lining the small fields that tilt toward the traveler as he passes along the highway, Route 140, from Puebla to Jalapa near the crests of the Sierra Madre Oriental. Although planted among other large magueys, *A. mirabilis* with its very light gray leaves is conspicuous at Las Vigas. As with many other agaves, Trelease described a cultivated form or clone of the species. Recent plant explorations in the sierras of Veracruz, Puebla and Oaxaca have located additional wild and cultivated stands of the species. It is the freely seeding wild populations that disclose the natural variability of the species. These populations include light gray and green-leaved forms, and some specimens are among the largest agaves to be found anywhere. A distinguishing characteristic of *A. mirabilis* is the tightly balled form of the umbels of flowers borne in the upper third of a tall straight shaft. This effect is given by the lack of branching and spreading of the lateral peduncles common to other species of the large magueys.

At Las Vigas the people call this agave "maguey blanco" or "maguey cenizo." A native near Acatepec in Oaxaca called it "tuah," a local Indian name. Near Ixtlan de Juarez in Oaxaca the name was given as "maguey del cumbre," or maguey of the mountain top, appropriately so, as the rocky heights of the sierras are its natural habitat.

The accompanying photographs show some large glaucous green variants on the Sierra de Juarez in northeastern Oaxaca at about 9,500 feet altitude. Pale glaucous plants were found in the same small population scattered over 10 to 15 acres, where the road to Acatepec branches off the new road from Oaxaca to Tuxtepec. The imperfectly known distribution of the species is outlined by the presently known occurrences in the accompanying map. These localities are all between 7,000 and 10,000 feet elevations, with rainfall varying from 60 to 100 inches as annual averages; light winter frosts are common.

More ponderous herbs are scarcely to

*Botanist, New Crops Research Branch, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Plant Industry Station, Beltsville, Maryland.

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Arthur Barclay in the axil of Maguey del Cumbre. Note the soft glaucous variegations on the leaves.

be found in the plant world. By counting the number of leaves on a large plant and weighing two or three of them, the following estimate of a mature flowering specimen was calculated.

80 leaves	× 70 lbs. each	5,600 lbs.
stem or "head"	(ca. 3.5 ft. diam.)	1,800
inflorescence		400
	Weight of total plant	7,800 lbs.

Large mature plants appear to weigh between 3 and 4 tons. The rosettes are 10 to 12 feet tall and 15 to 20 feet broad, and the tree-sized inflorescences reach 40 feet in height. These are impressive growth attainments, but perhaps the long life of the agave leaf is even more exceptional. On magueys the central full-sized leaves commonly continue green and functioning for 8 to 10 years, and when flowering is detained or inhibited, as in cooler climates, the leaf endures for 15 to 20 years or even more. *Agave pedunculifera,* the oldest in my live plant collection, started as a sucker in 1940. Although now (1964) the small basal leaves are dried and withered, the mature central leaves of the rosette have been green and functional for more than 15 years! This is a greater span than that of palm and cycad leaves. Can you think of other leaves with longer life spans?

The legitimate name of this handsome and distinctive *Agave* is somewhat in doubt, as are so many botanical names of agaves. It is *A. mirabilis* as described by Trelease in 1920 (1), but it may also be identical with *A. atrovirens* as described by Salm-Dyck in 1834 (2). If the latter is the case, Salm-Dyck's name would have priority and Trelease's name falls into synonymy. Salm-Dyck's botanical description of *A. atrovirens* was drawn from immature plants growing in his garden at Dusseldorf, Germany. Hence, his description is insufficient to distinguish this particular "maguey del cumbre" and several other magueys growing in central Mexico, to which the name *A. atrovirens* has been applied since Salm-Dyck's time. Salm-Dyck's plants were collected in Mexico by Karwinsky. Salm-Dyck with his description of *A. atrovirens* reported it as coming from "in Imperio Mexicano in summo monte Tanga." It is known that Karwinsky about 1830 traveled from Puebla south into the state of Oaxaca. "Tanga" is probably a misspelling of the Mixtecan "Tongo," which as suffix, meaning

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The small compact flower heads on the tall straight flowering shaft are diagnostic of this truly sexual species.

holy place or place of the Gods, is frequent in many place names through the Mixtecan highlands of northern and central Oaxaca. However, I have been unable to locate a mountain by that name on the Mexican maps reviewed. If Karwinsky's original locality could be revisited, the question of the identity of *A. atrovirens* could likely be solved. If any reader could inform the author regarding Karwinsky's locality "monte Tanga," it would be appreciated. Karwinsky also collected the spectacular agavoid tree, *Furcraea longaeva* Zucc., on top of the same mountain, as reported by Zuccarini (3). Two such

Agave mirabilis ***renewing the genetic code identically.***

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The distribution of wild (W) and cultivated (C)* Agave mirabilis *as now known in Mexico.

spectacular plants on one mountain should make it botanically famous and provide a strong lead to its specific location.

So far as observed, *A. mirabilis* does not form bulbils in the inflorescence nor suckers at the base of the rosette. Normally it is not apomictic as the capsules examined bear a varied number of normal, black, apparently viable seeds. The variable wild populations also indicate freely seeding, cross-pollinating individuals. However, if the flowering shaft is broken or cut off, numerous plantlets proliferate around the base of the shaft in the crown of the rosette. After a year or so these plantlets form calloused bases, fall from the rosette, and may strike root about the old dying parent. Such plantlets form vigorous propagules for perpetuating individuals genetically identical to the parent. Such planting stocks are used by the native peoples for terracing their steep sloping fields, for fence plants, and as a source of pulque, a fermented drink made of the juice welling from the "heart" of the plant after the large conal bud is cut out. A native near Ixtlan reported that only a few of the wild plants are sweet enough for making pulque or mescal. Such information from in illiterate Indian indicates a basic knowledge, which a foreigner disciplined in science could only assume on the basis of genetic theory. Most of the cultivated clones of the commercial agaves appear to have been selected on the basis of this first-hand knowledge by the people living intimately in the range of the plants. Once in cultivation the superior clones were passed from hand to hand and some have attained world-wide distribution, e.g., *A. sisalana, A. americana, A. fourcroydes.*

There is a growing interest in agaves as ornamentals for landscaping. As there are many striking agaves not previously cultivated in the United States, some with superior cultural characteristics, their use should increase through the warmer climates. *Agave mirabilis* appears to have good characteristics as a landscape plant on estates and about larger residences or where it would have room to grow, an area 4 to 6 yards in diameter. It can use plenty of water, but needs well-drained soil, and will withstand light winter frosts, acid or neutral soils. This plant does not throw aggressive suckers around the base like many agaves, and will endure as an evergreen for 15 to 20 years before flowering and dying. Some of the larger, softly variegated forms are of novel beauty.

Editor's Note:

Seeds of Agave mirabilis will be distributed on the Society's next seedlist.

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The buds are strongly tinged with reddish purple and apparently will not open until February.

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***Hedera helix*, showing leaf changes from seedling to adult stage.**

Juvenility and Flowering Potential in Woody Plants

V. T. Stoutemyer*

The breeding of woody plants, especially tree fruits and forest trees, is generally slow and expensive. Highly trained, ambitious plant breeders and geneticists frequently avoid this group of plants and tend to turn to the herbaceous crops. Short cuts are urgently needed. Unquestionably some progress has been made in accelerating flowering and fruiting but successes are reported more often with clonal materials than with seedling progenies. The breeding of ornamental trees and shrubs is likewise one of the great undeveloped frontiers of horticulture and more rapid evaluation of progenies would also be helpful here.

Plants commonly progress through a series of morphological changes as they go from the seedling to the mature fruiting stage. Sometimes the differences are so slight and gradual that they are not apparent to the casual observer but in other cases they are striking. Some Australian acacias have pinnate leaves in the seedling stage, but after a few months or years lose them and produce only phyllodes in place of the leaves. On the other hand, in some conifers, the change to mature foliage may require many years, and a substantial part of a century may be required in some New Zealand species. Sometimes two different binomials have been given to the same species by taxonomists who were deceived by the varied expressions of growth.

There are often transitional stages between juvenile and mature plants. Frost (1952) was unable to observe that with nucellar citrus lines which originally exhibit pronounced juvenile characters, more thorniness resulted from taking budwood from a low position on trees with the younger nucellar clones, but not with the older. This observation seems to support the traditional view that the lower part of the tree tends to remain more juvenile in character. Cameron and Soost (1952) stated that a few juvenile characters still were observable in some nucellar lines 22 years old.

The German plant physiologist Goebel (1900) was probably the first to systematize and formulate the concept of distinct growth phases in plants. The German botanist Diels (1906) wrote one of the few books on the subject which,

*Department of Floriculture and Ornamental Horticulture, University of California, Los Angeles, California.

however, was descriptive rather than experimental. Diels was much interested in precocious flowering and emphasized that there was great variability in the expression of this character. He observed early flowering in seed pans of mahogany and noticed other cases in dwarf forms of some plant species. Apparently his great interest in plant polymorphism arose from his studies of Australian plants.

Juvenility and Flowering

Usually there is a definite correlation between the attainment of the juvenile foliage type and readiness to produce flowers and fruit. However, certain conifers, olives, and eucalyptus have been observed to bear fruit on shoots bearing juvenile characters. Citrus seedlings sometimes flower exceedingly early in life and then do not flower again for a number of years. On this basis, a number of European pomologists such as Kemmer (1947) (1950) and Natividade (1943) (1957) do not recognize close relationships between type of vegetative growth and flowering. Observations pertinent to the possible relationship of juvenile foliage types to flowering were made on the olive by Natividade (1943), who represents the type of view presented by Kemmer. He found that the suckers which often develop abundantly on the bases of trunks of olive trees on the root-bearing mammillae exhibited some striking similarities in their foliar characters to seedlings of similar age. The seedling leaves were much more rounded than the leaves of the mature tree which are long and slender. Heavy applications of fertilizer and severe pruning tended to accelerate their production and to augment the period of time during which this form of growth is stabilized. Natividade did not believe that this reversion to seedling types of leaves represented a recapitulation of ancestral forms. He believed that the frequent occurrence of juvenile type shoots on the upper parts of the tree, together with the observance of abundant fruit formation on these reversion shoots in the live variety 'Galega', disproved the classic conceptions of Goebel on the juvenile form. He believed that these idiosyncrasies of growth represented merely changes in the nutritional and hormonal balances within the tree. Another possible reason for the divergence of his concepts from those which were formulated by Goebel was that, in his experiments, the relative ease of rooting of cuttings was not related closely to the expression of juvenile growth characteristics.

The subject has not been reviewed comprehensively. Stoutemyer (1937) treated certain aspects of the problem in relation to pomology. Sax (1962) has recently covered the same field. Probably the most comprehensive review available is that of Schaffalitzky de Muckadell (1959) who incorporated much of the work by foresters on the problem. Higazy (1962) has also made a similar review, but with particular emphasis on herbaceous plants.

Schaffalitzky de Muckadell (1959) uses the term "meristematic aging" to express the gradual transformation from an early growth stage to a later. This may be a desirable term as long as it is not used in a way which would suggest that the process is entirely irreversible. Recent work in our laboratory has revealed convincing evidence that the changes of growth phase are associated with changes in cell behavior which are relatively stable and which can be carried on through many generations in tissue cultures.

Reversion to Juvenility

The reversion to juvenility or the prolongation of juvenile growth is highly advantageous in propagation. However, since this response is not pertinent to our subject we shall treat it very briefly in outline without reviewing the literature.

Reversion shoots come most readily from the roots or the base of the trunk. Reduced light and low nutrient levels both tend to prolong juvenility in plants. Severe pruning or heading back and reduced light and low nutrient levels are helpful. Grafting on juvenile understocks or treatment with gibberellin sometimes produces reversions. Sprouts from adventitious buds on sphaerblasts seem to be juvenile. These are small woody structures which arise in the bark of some trees from independent meristems. The juvenile stage of growth reappears both in the normal seedlings and also in those citrus seedlings resulting from nucellar embryony and may persist in transitional stages for many years.

The principal treatments which have been observed or claimed to favor reversions or the prolongation of juvenility may be listed as follows:

1. Grafting on juvenile understocks.
2. Treatments with gibberellins.
3. Severe pruning or heading back.
4. Elevated temperatures.
5. Reduced light.
6. Low nutrient level.
7. X-ray treatments.
8. Cold treatments.
9. Growth from basal sprouts.
10. Growth from adventitious buds on sphaeroblasts.

These treatments are of interest to those who are trying to propagate difficult plants such as rubber, but would defeat the objectives of the breeder and will not be discussed here.

Acceleration of Flowering

Treatments which favor early termination of juvenility are of much greater importance in fruit breeding and we shall list the principal methods which have been used. The critical evaluation of the degree of success of some of these treatments is difficult. The flowering of young plants of mature, well-established clones can often be hastened, but responses with young seedlings have been discouraging in many instances. Seedlings used in some reported experiments had often made considerable progress toward the production of flowers.

The following treatments have been claimed to accelerate flowering in seedlings of woody plants. No attempt will be made here to do more than to list treatments systematically and to give a few examples of each.

Use of extra or prolonged growth periods

The theory has sometimes been advanced that certain number of growth cycles must take place before the mature growth stage can be attained. Potapenko (1939) described an experiment in which seedlings of cherry were subjected to two cycles of growth in one year together with suitable adjustment of photoperiods and provision for chilling during the periods of dormancy between cycles of vegetative growth. The seedlings were started into growth in February, and were grown through the first season without interruption. Dormancy was broken on December 27 and the plants were grown to April 1. After a cold treatment the plants were grown from July until late October under an artificially lengthened photoperiod. Growth was started in the following January and some of the seedlings flowered, but no flowering was observed during that year among the control plants.

The value of this method is not well substantiated, and other researchers have obtained contradictory results, notably Smeets (1956) who grew seedlings of cherry in a phytotron, giving 3 or 4 growth cycles in two years. All of the control plants flowered, but only one of the treated seedlings.

Dr. Walter E. Lammerts in California obtained early flowering of camellia seedlings through the use of supplementary artificial lights to provide continuous illumination 24 hours per day. Fertilizers were applied liberally and this procedure resulted in blooming at the end of the first year. Longman and Wareing (1959) speeded flowering of birch seedlings by growing under long photoperiods in a glasshouse. Doorenbos (1955) observed that seedlings of rhododendron and azalea likewise respond to supplemental light. Doubtless the list could be extended.

Transplanting and Root Pruning

According to Passy (1909), the French pear breeder Nomblot secured earlier fruiting by transplanting every two years, without pruning or heading back except for light pinching of lateral branches. Scions can be removed with assurance of good results only after the first flowering of the trees.

Geschwind (1880) recommended pruning the roots of young seedlings, cutting back to one half to produce a finer and better branched root system. He stated that frequent subsequent transplanting into richer and better soil induced earlier blossoming.

Root pruning has been observed by foresters to promote cone production on coniferous trees, but sometimes this treatment needs to be combined with heavy nitrogen feeding. Some strains of *Wisteria* are notably slow in flowering. They frequently respond to root pruning.

Fertilizer Applications

Kolomiec (1952) stated that seedlings of fruit trees must pass through a succession of stages in order to attain the flowering stage. He believed that a lack of nutrients may delay this development.

Foresters have noticed that excess fertilization with ammonium nitrate or root pruning may promote flowering in pine. Spruce responded best if the two treatments were given together. A reduction in shoot vigor frequently results in lessened formation of female pine cones and an appearance of male cones. In general, a high level of nutrition is needed for the development of female cones and a lower level for the male.

Geotropic responses

Bending stems to a horizontal or descending position frequently aids flower bud formation. A system of training pear tree limbs was once developed by bending branches down and weighting bricks. Espalier training of conifers has been observed to aid seed production.

De Silva and Chandrasekera (1959) ring-banded six inches above the graft union and bent the budshoots and secondary shoots into a horizontal position. This treatment induced flowering in several *Hevea* rubber tree clones two years after planting.

The use of a klinostat in which the plants are rotated in a horizontal position usually results in increased flowering.

Mound layering

Kuzmin (1940) claimed to be able to accelerate the flowering of seedlings of grape by mound layering the seedlings when they were three to four years old. In this way fruiting was obtained in three to four years in place of the usual five to eight years or more. The main shoots were not headed back at the time the plants were transferred from the seed flats to the field. This treatment is difficult to evaluate.

Bark inversion, ringing, and notching

The inversion of rings or bark on fruit trees has been observed by horticulturists in a number of countries to cause a dwarfing effect on fruit trees. Apparently the abnormal phloem and xylem conducting tissue formed under such circumstances is responsible for the reduction of growth. The effect is apparently temporary since normally polarized conducting elements form at the vertical seam of the ring and in a few years gain sufficient size to function normally.

Sax (1962) reported that by inverting a ring of bark before early July and fastening with a rubber band to heal, ordinary nursery apple trees two or three years old formed flowers and fruit the following year. Sax however did not try the technique with seedlings and thought that it would probably be ineffective.

Girdling, ringing, and notching have been used also with some success. An unusual treatment which Sax used has been to tie the young seedling plants in a knot at about crown level. The effects of these treatments while sometimes not permanent were often sufficient to establish initial flowering.

A possible explanation of the many discrepancies in the literature here has been furnished by Murawski (1957) who found that the response was strongly related to the position of the bud on the seedling, those from near the base showing much more juvenile tendency than those near the tip of the seedling. Murawski also stressed the importance of permitting apple seedlings to pass through the juvenile stage before budding them on a dwarfing stock such as Malling IX.

Grafting or budding in crowns of mature fruiting trees

The experiences of those who have tried this method of hastening fruiting have been highly contradictory. Apparently much depends on the stage attained by the seedling before the scion is removed and inserted. Nutritional conditions on the tree into which the scions are placed undoubtedly would also be important. This variability of response has been characteritsic of results both with dwarfing and standard understocks.

The question has been studied by Spinks (1925) who found a variety of treatments, both alone and in various combinations, did not seem to advance the period of first flowering appreciably in apple seedlings. Among the factors included were pruning in two degrees of severity, shaping and light pruning, in contrast with no pruning; spring application of mixed complete mineral fertilizers, ringing of branches in May, root pruning, topworking into bearing trees and growing in pots. None of the treatments were effective.

Zaharov and Potapenko (1939) were not able to advance the fruiting of apple seedlings by grafting two-year scions in-

to the crowns of bearing trees. However, scions from older seedlings which had attained the fruiting stage came into bearing in the second year.

Sen (1942) observed precocious flowering of mango seedlings between two and three years of age used for inarch grafting and suggested that this may have been due to the influence of the mature trees. Normally seedlings would not be expected to flower until at least six years old.

Sorensen (1943) stated that by budding of *Hevea* in the crowns of trees of an age of 4 to 10 years, flowering could be induced in three years in contrast to the six or seven years ordinarily required to flower one year budlings. Similar results have been claimed with coniferous evergreens.

Grafting on related species

Another variation of grafting which has been successful involves grafting seedlings on understocks of an entirely different species. A striking illustration is provided in the experiments of Campbell (1961) who by budding on apomictic seedlings of *Malus sikkimensis* produced flowering in 15 per cent in three years and 53 per cent in four years. Fruiting was obtained in one-third of the trees in the fourth year. The normal length of time for bearing in these seedlings was 7 to 14 years and the use of the Malling IX understock only shortened the period one year and frequently introduced virus.

This seems to be a promising technique which could be investigated thoroughly although it may cause some problems in delayed incompatibilities. However, these can be ignored if the combination will survive long enough to be evaluated by the breeder.

Grafting on Dwarfing Stocks

The vast pomological literature on this subject is highly confusing and contradictory, with many reports of failure. There has apparently been much variability in the results. A certain minimum period seems to be necessary in order to change from juvenile to adult characteristics. Tydeman (1961) found that the length of the juvenile period varied with seedling clones and with different understocks. Seedling apples on the Malling IX understock flowered 43 per cent at six years in contrast to only 3 per cent on the controls. Flowering was 38 per cent on understock No. 3431 and 9 per cent on the controls.

This technique does not seem to be as promising as grafting on related species, and the accelerations which have been claimed have usually been small.

Grafting mature scions into seedlings

The Russian fruit breeder, Michurin, claimed to be able to hasten the first flowering of fruit tree seedlings by grafting scions of mature clones on them. We have not seen experimental data presented to support this contention. This is doubtless an outgrowth of his "mentor grafting" theories which are still widely supported by many plant breeders in the Soviet Union.

Climatic factors

Seedling fruit trees have been observed to bear earlier in localities having most favorable climate and growing conditions. Cone formation on certain conifers has been observed to be correlated with sufficiently high summer temperatures.

Chemical growth regulators

The recent use of chemical growth depressants to set flower buds uniformly in azaleas suggests that this type of chemical may eventually be used in the solution of these difficult problems.

The outline above is intended to indicate the present day approaches to the question of flowering in woody plants which has been much neglected as a consequence of the greater emphasis on the biology of flowering in herbaceous annual and biennial plants. One of the few experimenters who has worked with woody plants is Wareing (1959), who has formulated an interesting theory. He believed that the basal regions of the tree tend to remain permanently juvenile. The attainment of the adult flowering stage does not usually occur until the tree has attained a certain age, depending on the species in question, and, in his view, requires either (1) the completion of a minimum number of annual growth cycles, or (2) the attainment of a certain minimum size and morphological complexity. In the juvenile condition the annual growth increment is at first high, but it typically decreases markedly as the mature type of growth appears. Wareing suggested that in some species flowering depends on the attainment of the required threshold

size during the juvenile phase, and in other species on a certain degree of aging of the shoot system. In plants in which flowering is dependent on aging, the juvenile period will naturally be longer than in those which initiate reproduction in the rising phase. Wareing suggested that the transition from the juvenile to the adult state involves differences in the state of the cell cytoplasm. Some recent investigations of Stoutemeyer and Britt (1963) suggest that the transition involves detectable changes in the cells, since the characteristic growth rates of juvenile and adult tissue culture are maintained through many subcultures. Recognized facts regarding carbohydrate nitrogen relationships in the flowering of woody plants fit easily into the framework of Wareing's scheme. Robbins (1957) has also postulated a chemical basis for the phenomenon of juvenility.

English ivy we find to be a particularly good test subject for studies on juvenility. It has a flattened vining habit with opposite deeply lobed leaves and abundant anthocyanins and aerial roots in the more juvenile growth stages. With maturity, it has entire pointed leaves on a spiral arrangement and rarely forms aerial roots. Tissues or cells from English ivy are comparatively easy to culture in White's (1943) medium with additions of coconut milk, casein hydrolysate and naphthaleneacetic acid.

The significant findings of these studies are that the tissue cultures from vine-type shoots have a considerably higher growth rate than those from the shrubby stems. Those from young seedlings are even more rapid growing. Juvenile tissues will grow at lower temperatures. Also, the juvenile cultures form roots much more freely. These differences have persisted two years with monthly subcultures. We believe that this shows that the differences between juvenile and adult growth are profound and are apparently on a cellular basis. Elucidation of the action of the trigger mechanisms which control this change is urgently needed.

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Reading Other People's Gardens

Gertrude B. Fiertz*

"Reading the Landscape" is a popular book by a distinguished naturalist that opens one's eyes to interrelationships between plant life, climate, topography, and people. These relationships become all the more revealing when traveling. Narrow "Landscape" to "Gardens," combine with a British historian's comment, "The traveler sees what is behind his eyes," and you have a recipe for gardeners who travel. What they notice about plants and plantings may not have found its way into travel folders, but it may speak clearly to other gardeners.

*Manhasset, New York.

GERTRUDE B. FIERTZ

A courtyard has become a garden packed with bloom in the ancient castle of Gruyère, Switzerland.

Just north of us in Canada, for instance, my husband and I have motored many times through small towns where gardens resemble one another like peas in a pod. But not like corresponding "pods" below the border. Up there we have not come upon the kind of planning and garden style-trends that often characterize suburban gardens down here. Something is different, and after awhile one notices what it is.

These Canadian gardens are all packed brimful of bloom. There is little regard, it seems, for the kind of flowers grown, the combination of colors, shape and size of the lot, or all the rest that garden publications advise. No, just lots and lots of bloom, and often as not, the windows behind the garden proper, are full of flower pots that blaze with still more color.

Isn't it all a little much? we wondered at first. Wouldn't it be better to space things out, have a design, plan for "accent" and all the rest we are advised to do? Then we remembered the longer winters of the North, the brief but all the more glorious blooming season, when long daylight hours bring plants to quicker maturity, bring, too, nearly everything into bloom all together and all at once. Those summers know much less of what we call succession of bloom. Wouldn't we too, then, want everything possible packed into that short season? We concluded, probably yes.

GERTRUDE B. FIERTZ

In tiny outports of northern Newfoundland and Labrador, the Barrens press down to the sea, and a potted geranium at a window is all a fisherman's "garden."

We might even—daring thought—find such gardens exhilarating. We thought back to some small towns north of Winnipeg—Dauphin, for instance, or The Pas, that old rendezvous for the fur trade. There in August, snapdragons blaze in hot reds and yellows, great bursting sweet peas climb a wall, hollyhocks and glads forget to hug a fence and keep properly in the rear of a border. Glowing nasturtiums raise leaves clean of aphids and ready, as we like them, for sandwiches and salads. Delphiniums and larkspur top a man's shoulder.

But there are other gardens, too. Some to make you weep, edge cottages in Flin Flon, a mining town built on rough outcrops of "The Shield," approaching Hudson's Bay. Any garden there must first be propped up with stones to something more or less level over underlying rock, fenced in somehow to hold it in place, and every spoonful of soil brought in. Store supplies are expensive, but the surrounding muskeg does provide rare spots—if you can find them, if you can get there, and get back—where soil occurs. These tiny gardens are clearly bought with perseverence, patience, care, and probably, many times, with pennies squeezed out hard for seed and fertilizer.

These small but cherished gardens of Flin Flon reminded us of other tiny, meager gardens in outports along the northern coast of Newfoundland and Labrador. Here where more often than not the Barrens press down to the sea, and wind, cold, and poor soil make any cultivation difficult, we found touching evidence of what plants and greenery mean to human beings. Here it never occurred to us, for instance, to dismiss an occasional red geranium in a window as old-fashioned. Rather, we too felt a lift at its sudden color. We remember one bare island, too, where we stepped ashore while the ship unloaded winter supplies in August. Here we passed a polar bear skin swinging from a clothesline beside one house, two sealskins stretched on frames beside a second, and then came a third house which sheltered on one side, a lilac bush. So far as we could see, this was the only bush or "tree" on the island, and it was neither large nor vigorous, but it looked old, it grew in a family's "garden" and must have been cared for and winter-protected through many seasons.

Almost at the tip of that northern coast—near L'Anse aux Meadows, where that very summer Viking ruins were being uncovered — the mooring ropes pulled us to another dock. When I stepped off, I noticed across the small arc of harbor, two bands of bright, dark blue edging the walk to a church. Through the glasses I took them to be monkshood or aconite. Under the bright sun and above the grey limestone of that rugged land, they flared with unexpected, astonishing brilliance. A Newfoundlander stopped overseeing cargo, stepped over. "You like them?" he asked. "The story goes that they were brought from France 150 years ago."

Pictures too of wild plants, uncultivated "arrangements," crowd our memories: patches of "cotton plants" (*Eriophorum*) seemingly astray up north, mountain ash berries sunlit in a grove of paper birch, clusters of bright Red Elder (*Sambucus pubens*) bordering the one long, dusty road across the "Great Island," the morning we lingered on a cliff to pick rosy cloudberries from their green mat high above the blue Atlantic, the raspberries, blackberries, even currants we gathered, as from a wild garden, by the roadside of lovely Terra Nova Park, little visited and silent except for breakers far below us.

And elsewhere, too, in Canada. Those

same tall, intensely blue delphiniums curve around the lake at Kapuskasing, and front the lake at Jasper. Up on Quebec's Lake Kipawa what a natural florist's terrarium of partridge berries, jewel-green moss, wintergreen, and bunchberry we found readymade along an island's edge! Nor will we forget the huge rock garden at Hornpayne, where flower patches and unidentified tufts of green prick out the ledges and pockets of the steep grey hillside that ripples down almost to the railroad tracks. Near Beavermouth, in the West, stands another smaller, natural, but no less lovely rock garden. Here "bouquets" of bright yarrow and deep blue asters bloom together, pushing out from rootholds in old grey rock.

Take a big jump and move to Switzerland. Over there when my husband and I visit relatives in Küsnacht near Zürich, we find ourselves in practically the same type of suburban community that occurs so frequently around New York. Every house has its plot of ground, planted similarly to the neighbors' plots, but with a few differences from our own. Privacy is more valued, and fences and hedges are more popular, for one thing. For another, plots invariably contain several small fruit trees — apricots, peaches, pears, quinces, apples—with at least one of them, or perhaps a grapevine, espaliered against the sunniest wall. These fruit trees are functional, not just grown for pretty blossoms, and each household can count on a generous family harvest.

Among cultivated flower plots, in general similar to ours, I smiled to see rich stands of goldenrod (Hay Fever is considered a mysterious, American ailment). In vegetable gardens and at the weekly open-air markets which every town and city has maintained for centuries, the popularity of certain vegetables differs sharply from their ratings over here. Leeks, for instance, are a stand-by—and a delicate, delicious vegetable they are too—and salsify, celery root, and red cabbage appear weekly on most tables. Certain American natives—squashes, tomatoes, and of course "Irish" potatoes—have long since become naturalized, but a few others, notably yams, sweet potatoes, and corn on the cob, we never found. At these markets, incidentally, where every thrifty housewife shops for fresh produce, a staple on every list along with vegetables is a fresh flower bouquet. That, in spite of window boxes everywhere—for window or living room would appear almost unpresentable without flowers. Up in the Grisons, small carnation plants traditionally grow on the wide window sills. Elsewhere variety rules the window box, though red geraniums are popular—but always flowers!

Farther west, along the upper Rhone and its side valleys, one thinks again of Flin Flon. Here again are rocks, scarce soil, harsh living. And sure enough, here again we found those carefully-tended, handkerchief-sized gardens, supported by dry-walls built up by who knows how many back-bending hours of search and carrying! And here, more often than not, the precious soil supports not utility vegetables, as one might expect, but gentians, primroses, and alpine rose! Mountaineers and pioneers—the urge is the same.

We find an even broader base. Last summer we met the same phenomenon in still another area. Tiny fishing villages of Alaska and British Columbia often cling to cliffs without room for roads, but only for plank streets on stilts and stairways between dwellings. But here again appeared those tiny, built-up patches of soil supporting a few gladiolas, a few roses (for the climate is milder than one might expect), and here again window boxes come into their own, flourish with triumphant, bursting bloom!

A Book or Two

Pictorial Plant Guide for Mild Region Landscaping

Paul J. Pearl. Montvala Publ. Co., Monterey Park, Calif. $19.75. (Library).

This 200-page indexed hardback volume of superb black and white photographs shows clearly the characteristics of the selected material and how it may be used artistically in landscape design in a sub-tropical climate. There is practically no text; the pictures tell the story. An additional valuable feature is the "overlay" drawings that suggest companion plant material that is compatible with the selected plants. The book fills a need of many amateur gardeners who want help in developing planting plans. Designs for patio, pool, planter, and bonsai are included. Plant lists for special situations include gravel and rock peeble beds, screening plants, container plants, embankments, entryways, espaliers, fences and walls, trellises, and plants for both shady and sunny sites.

C. M.

The Miniature Rose Book

Margaret E. Pinney. Published by D. Van Nostrand Co., Inc. Princeton, N. J. 149 pages. Illustrated, 1964. $5.95. (Library).

A book describing the miniature roses. The author attempts to trace the confusing history of the miniature roses, their origin and varieties. Present day varieties have a known history, but many of the older names and kinds are difficult to trace both as to their history as well as sources of plants.

The varieties are described in a simple but rather complete manner so as to be able to identify them, often with a sketch included to illustrate a special characteristic.

Cultural information is given for these roses both as garden plants and as a house plant.

Ladies Home Journal Book of Landscaping and Outdoor Living: The Homescapers Guide to Good Looks and Good Living on His Grounds

Richard Pratt. S. B. Lippincott Company, Philadelphia. 1963. 225 pp., Illustrated (part colored), Indexed Library.

The author of *Landscaping and Outdoor Living*, who has been the architectural and garden editor of the Journal for many years and who is known for his very fluent and informal style of writing, is the first to admit that this work is in part a distillation of innumerable pages for the Journal. For the majority of the subscribers of the Journal, this book has many helpful hints and places to find more information and advice on the subjects covered.

The illustration are very superb as photographic compositions and many have good ideas that apply to landscape problems; but it seems that if they were keyed into the text as supporting material, both the text and the illustrations would be greatly strengthened. In addition to descriptive lists of useful plants, it would have been helpful to include their hardiness zones (especially since a hardiness map is included) and also the cultural requirements of the plants described. Also it would seem that since this is a book on home landscaping, design principles and placement of items would be thoroughly discussed; however, the subject is quickly dismissed by saying, "I am sure that you will know how to place them yourself." The book is further marred by his rule of spacing ground cover by "How much can you afford" and his implications that foundation plantings and garages have no business in a home but that swimming pools are of utmost importance.

Kenneth Soergel

The First Guide to Wild Flowers

Millicent Selsam. Doubleday and Co., Inc. Garden City, N. Y. 32 pages. 1964. $1.50. (Library).

The First Guide to Insects

Su Zan Noguchi Swain. Doubleday and Co., Inc. Garden City, N. Y. 32 pages. 1964. $1.50. (Library).

These two books are written for children as the titles indicate. They are written in an easily understood manner and tell interesting facts on plants and insects. Thirty-two flowers are illustrated with a simple description. About 45 insects are described with information on life histories and activities.

Garden Plants in Japan

Fumio Kitamura and Yurio Ishizu. Published by Kokusai Bunka Shinkokai, 55 1-chrome Shiba Shirokanedaimachi Minatoku, Tokyo, Japan. 266 pp. 1963.

A well illustrated, carefully described list of 209 selected garden plants of Japan. Although this represents but one-third of the Japanese garden plants, the selection includes those most frequently seen by visitors to Japan.

The book has been made possible by members of the Garden Club of America as an expression of their appreciation for the generous hospitality shown them on their visit to Japan in May, 1961.

Every plant described, includes its Japanese name as well as an appropriate English name.

(Books available ***for loan*** *to the Membership are designated: (Library). Those not so designated are in private collections and are not available for loan. Books available* ***for sale*** *to the Membership are designated with the special reduced price and are subject to the usual change of price without notice. Orders must be sent through the American Horticultural Society accompanied by the proper payment. Please allow two to three weeks for delivery. Those not designated for sale to the Membership at reduced prices can be purchased through the Society, however, at the retail prices given. In these instances the full profit is received by the Society to be used for increased services and benefits of the Membership.)*

In addition to an excellent black and white photographic illustration for each plant described, there are a number of colored photographs of outstanding specimens.

The plants are divided into three groups: Trees and Shrubs; Bamboos and Herbs.

A list of noted places for seeing Japanese flowers is given. Three indexes list plants by Japanese names, English names and botanical names. This would seem to be the answer to the traveler who wants only a small reference book to take along on this trip to Japan.

R. J. Seibert

Shrub Roses of Today

Graham Stuart Thomas. Published by St. Martin's Press, New York. 240 pages, 1963. $8.50. (Library).

This book is somewhat of a sequel to *The Old Shrub Roses* by the same author. In the present book, he continues his story first by describing the species, varieties and hybrids that have no affinity to the China rose. These include Rosa canina, the Dog Rose, the Cinnamon rose, the American wild roses, the yellow species, and others. The China roses and their relatives are included next with the hybrid perpetuals, poly-poms, the hybrid Musk roses and the shrub roses of the Twentieth Century. These chapters are interestingly written with descriptions of the roses mentioned, often including the reference to the first description.

The author has introduced his own experiences with many of the kinds and points out the good and perhaps less desirable characteristics. He traces the development of present day roses and suggests some changes in tastes and demands that may take place. A "Key to the Major Groups of Cultivated Roses" by Gordon D. Rowley is included as well as a Bibliography.

How to Landscape Your Own Home

J. I. Rodale and staff. Rodale Books, Inc., Emmaus, Penna, 1544 pages. $9.95.

The publishers claim "this book is by far the most complete book in its field ever published in which the organic method is followed." Far be from me to disagree.

If you have a home, here's how to plan your own landscaping, plant and take care of your lawn, trees, shrubs, vines, herbaceous flowers, and indoor ornamentals, and save time and money.

Although the advice comes from advocates of organic gardening, you don't need to get rabid in the debate of organics vs. chemicals to find a wealth of valuable, usable information from this voluminous, comprehensive and well illustrated book.

It is a bible-size tome, on fine paper for durability and readability, that exceeds 1500 pages with more than 475 clear photographs, 75 line drawings, 300 pages of informative tables, 500,000 words of explanatory text, fully indexed.

For the cost of a single good evergreen shrub, this how-to-do-it is a remarkable find in gardening lore. It offers much for your home site in the enhancement of pleasure and property value.

A significant omission in the cyclopediac treatise is use of horticultural chemicals. Nature's own methods of plant nutrition, since the Garden of Eden, are strictly adhered to in the doctrine of organic gardening.

For control of insects and diseases the book tells us, "Sanitation is the best disease and pest preventive." And prevention certainly does beat cure. Rachel Carson's gardening cohorts, who exploded with her Silent Spring, can rejoice in the counseling of Rodale's latest contribution to know-how.

Buxton White

Let's Grow Lilies. An Illustrated Handbook of Lily Culture

Virginia Howie, Published by the North American Lily Society, 21 Oakland St., Lexington 73, Mass. 48 pages, illustrated, 1964. $1.00. (Library).

An easily read, authoratatively written, booklet on the culture of lilies in the garden. The author has liberally illustrated the text with cartoon drawings showing the correct ways of growing and caring for lilies, together with the fun and enjoyment of growing them. This is a how to do it book that all can read with profit. And even if you do not grow lilies now, the "lily gardeners" in the illustration may inspire you to become one of them. This booklet shows that they can be grown by all.

C. B. L.

An Annotated Checklist of Cultivated Palms

Harold E. Moore, Jr. Principes. October, 1963. Vol. 7, No. 4, 119-184. (Library). $2.00.

Palms, more than most cultivated plants, are poorly known and the species cultivated more often than not misidentified or misnamed. Fortunately, we now have an Annotated Checklist of Cultivated Palms occupying the full space in an issue of PRINCIPES, the journal of the youthful Palm Society (obtainable from the Secretary of The Palm Society, 7229 S. W. 54th Avenue, Miami 43, Florida). The author, Dr. Harold E. Moore, Jr., is the world authority on the botany and systematics of the *Palmae*. In this publication he supplies a current reference for "correct names, authorities, places of descriptions and more detailed information" for palms presently cultivated. It is to be hoped that anyone concerned with correct palm names will refer to this checklist. Seedsmen and nurserymen especially, besides the amateur palmophile, will find this publication absolutely essential.

W. H. H.

The Trees of Long Island

Supplement No. 1. Compiled by the Long Island Horticultural Society. Publication No. 2. 1963. 32 pages. 50¢. (Library).

This is a big tree census of Long Island which follows one made by this society in 1952. Long Island weather is influenced by the ocean so that it is cool enough for many northern species and yet mild enough for a few normally found farther south. The information on the 491 species of the largest tree of each kind found on Long Island is given in chart form giving scientific and common names; trunk dimensions and where growing. Lists are included

showing the 10 or 20 largest known specimens of White Oaks, Black Oaks, American Elm, Tulip trees, Black Walnut, European Beech and Weeping Beech.

C. B. L.

A Place to Live

The Yearbook of Agriculture 1963, the U. S. Department of Agriculture, Washington, D. C. $3.00. (Supt. of Documents, Wash., D. C. 20025).

A Place to Live, touches the lives of more Americans that previous Yearbooks. In the 69 years since the first Agricultural Yearbook was published, this is, I believe, the first to stress the "interaction of rural and urban influences." It recognizes that "many of the forces of change are most apparent in the urban-rural fringe."

A Place to Live is of factual interest to every home owner, subdivision developer, farmer, planner, gardener, horticulturist, local government official, landscape architect, health department, park official, and suburbanite—in fact, everyone interested in *A Place to Live.*

To the readers of the *American Horticultural Magazine,* I would call attention to the fact that here is an agricultural yearbook which has a great deal for every person interested in the effect of plants and gardens on the individual and the community—particularly, their present and future potential in the lives of Americans.

The 1963 Yearbook of Agriculture summarizes some of the most momentous problems which we, as Americans, have to face. These problems include change in people themselves; the changes in land use; and the changing problems fo water and air. Then too, there is that great change in farming today as compared to a bare generation ago. The chapters on communities and on government will stimulate serious thought on the part of every responsible citizen. Recreation has a prominent place in the book. Results of experience and discussions on proper types of planning suggest what we can do to meet the problems of today's change.

It is in the last section on examples of what is being done to meet the challenge of change that the reader becomes aware of the important potential place of horticulture, gardening, beautification, conservation, planning and education. All are key words and fields in today's effort to preserve *A Place to Live* for the future.

R. J. Seibert

Native Plants of Pennsylvania (A Trail Guide to Bowman's Hill State Wild Flower Preserve.)

Compiled and Edited by the Executive Committee of the Preserve. Kodachromes by the Committee; Line drawings by William D. Dowell and David E. Benner. Pub. Livingston Publishing Co., Narberth, Pa. $1.50. (Library.)

Designed primarily as a guide for visitors to the Wild Flower Preserve located in Washington Crossing State Park, on Route 32, near New Hope, Pennsylvania, this little booklet nevertheless provides a useful, pocket-size guide for other areas in the Middle Atlantic region. Its profuse and accurate illustrations, over a hundred in number, will aid in the identification of species found in many wildflower plantings.

An arbitrary alphabetical arrangement of material has been followed throughout the booklet, which, logical though it may be, does not follow the physical layout of the Preserve. It will be necessary to refer occasionally to the fold-out map on the back cover, if the user wishes to follow the guide book literally. The reviewer has been assured by recent visitors to the Preserve that all trails, and many individual plantings, are well labeled, and this guidebook should add a great measure of enjoyment and fill a long-felt need with its interesting notes on the various areas of the Preserve, sponsorship of many of the plantings, and other informal bits of information.

Of particular value to prospective visitors to the Park whose interest may be of a specialized nature, is the very complete table of Blooming Dates of Native Wildflowers, giving data on species which may be seen from February through October, with a five-day spacing on dates of average blooming.

The Committee directing the operations of the Wild Flower Preserve reads like a Who's Who in Botany and Horticulture, and it is safe to assume that the accuracy of the information contained herein is beyond question.

Mary L. Fisher

Miniature Flower Arrangements and Plantings by Lois Wilson

Color photography by Lockwood Haight 1963 published by D. Van Nostrand Company Inc., Princeton, N. J. Price $6.50. (Library). Members price $5.52. 181 pages & index.

Mrs. Wilson, a Canadian, who writes and arranges deftly, has graciously included arrangements by many of our well-known American arrangers as well. Being one of the legion of lovers of things in miniature, I found it delightful reading. Mrs. Wilson's research into our great American as well as her own fine Canadian museums has rewarded the reader with a most interesting first chapter on antique sculpture and paintings, in miniature, accompanied by many well-chosen illustrations.

The book should be of especial benefit to beginners, teachers and juniors; therapists and geriatric aides. Mrs. Wilson has touched on the forward trend to ikebana and bonsai, and this includes the plantings. To all who are interested in the gentle art of flower arrangement, in all stages, I recommend it highly. You will find it a mine of information on where to find intriguing material both here and abroad. Mrs. Wilson includes a most comprehensive listing of miniature plants and flowers; a most helpful bibliography, ending with "Therapy through Horticulture." There are excellent hints and "how-to's" throughout the book, larded with occasional laughs and full of her own love and knowledge of miniature flower arrangements. There are many black-and-white illustrations and some very handsome colored ones. And for those who enjoy copying to improve on their own, you'll find this book a great help.

Karen Foss

Junior Garden Club Handbook

Fannie H. Peebles, D. Van Nostrand Company Inc., Princeton N. J., 1963. Price is $5.95. 208 pages. Illustrated. Library AHS members price $5.05.

The Junior Garden Club Handbook is an excellent guide for those endeavoring to teach gardening to children. Mrs. Peebles has followed the program set up by the National Council of State Garden Clubs Inc. for the instruction of our youth who are members of Junior Garden Clubs. She has included a comprehensive coverage of materials to be used in teaching children the subjects of horticulture, conservation, nature study, flower arranging and flower show practice.

Junior leaders will find this book full of splendid suggestions for activities to be used in connection with the various units of study. Some of these are accompanied by excellent drawings which help to clarify them.

Junior Leaders will find the Junior Garden —Club Handbook a most welcome addition to their library. It offers invaluable assistance in their most rewarding work with children.

H. P. R.

California Mountain Wildflowers

Philip A. Munz, University of California Press. Price $2.95. Paperback. Illustrated. (Library).

There are drawings of 180 different specimens plus 98 color photographs, with a good description of each plant. It is illustrated and written in language that an amateur can understand, making this a good field guide.

Helen L. Whiting

The Rochford Book of Houseplants

Thomas Rochford and Richar Gorer, The Macmillan Company, New York, New York Price $6.00. ($5.10 to members). (Library).

A very interesting and informative book on growing house plants by English authors. A chapter of Latin names also gives a history of these names. Several house plant families are studied in detail, and much information is given about growing plants in the home. This is a good reference book. There is a list of all the plants described according to their temperature requirements. There are 100 black and white photographs plus four in color.

Helen L. Whiting

The Joyful Christmas Craft Book

Kathryn Holley Seibel. D. Van Nostrand Company, Inc. Princeton, N. J. 186 pages. Illustrated. Price $5.95. ($5.06 to members). (Library).

This is a book full of ideas that may be carried out through the use of simple readily avaliable materials. It is excellent for the unskilled worker, a boon to the Scout leader, craft teacher, and those who like to create.

There are many suggestions for decorations with paper materials, straw, shells, wire screening, and materials from nature. With imagination one may expand on the suggestions presented. It is a book of meritorious value.

Anne W. Wood

Gardener Go Home

Ken Kraft. The Appleton-Century Co., New York, 1964. 152 pages. $3.50.

More than one person has had a hand at finding more humor in the gardener's life than gardeners do themselves. Karel Capek wrote a book that made some stir in this country about 1931; George Chappell and Ridgely Hunt took their turn in 1931; Laurence McKinney, ably abetted by Helen E. Hokinson's familiar drawings took their turn in 1941; Richardson Wright had something of all this in his Gardener's Bedbooks and the delightful thing appears now, that such fabulous fun-making, like gardening itself, never ends, and never falters in its sport.

The great advantage that Mr. Kraft has over all his predecessors, is that garden practice is now on a very different level from its former estates, and more and more kinds of people, make a try at it, so that the possible range of new situations seems endless.

The reviewer found himself in the book, not once, but several times, and believes that most readers will have the same experience. The touch is light, and there is no malice, none of the slightly keen-edged touch, that passes so often now, as humor.

By all means, treat yourself to an hour of quiet laughter, and spot your friends at their various antics as well as yourself.

B. Y. M.

Effective Flowering Shrubs

Michael Haworth-Booth. New Revised Ed. 1962. Collins, St. James Place, London. 350 pages. (Library). $6.50. ($5.52 to AHS Members).

A new revised edition of an excellent book on flowering shrubs for British gardens. After a chapter on the general culture and use of shrubs and one on propagation, the author considers flowering shrubs in groups based on time of flowering. An excellent reference book even for American gardeners.

C. B. L.

The Art of Flower Arrangement

Norman De Kalb Edwards. Photography by Alean and John Miller. 191 pages by The Viking Press. 625 Madison Avenue, New York 22, New York. 1961 (reissued in 1964). $10.00.

This first book on the *Art of Flower Arrangement* by Norman De Kalb Edwards of California, well-known in his field of scenic art and theatrical designing before he left all to devote his time to teaching and lecturing on flower arrangement, is a handsome one, with several hundred exceptional black-and-white photographs and four "tone poems" in color, each worthy of framing. Alean and John Miller who did this beautiful photography are able to catch with their skill that which Mr. Edwards wants to portray.

Mr. Edwards leans toward the classical ikebana styles, infusing his own interpretation with an American awareness of contemporary and abstract art. Since he has used so much of the vegetable world in his studies I think Flower Arrangement and Living Plant material more fully describes this enjoyable book.

Flower arrangers should find the hundreds of pictures will stimulate their own imagination

and creative abilities, and those benighted ones who try to merely copy them must have a good grounding in the basics of classical ikebana since this is a book for the advanced student. The semiformal aspidistra leaves so beautifully illustrated do not indicate to the beginner that front and back of the leaves are very important in placement; the lovely flowering branches set in a low "water-view" container didn't grow that way—you must use most judicious and careful skill in pruning them; his apparent pleasure in the sansai classical rule is beautifully and imaginatively done in what he nearly calls line arrangements.

Mr. Edwards used his own art terms in describing his interpretation of flower arrangements and we may find ourselves calling what Mr. Richardson Wright labeled "buxom bouquets" (mass arrangements) by the Edwards' name "radiation." He is partial to line arrangement, in the oriental manner, eschewing our well-known Hogarth's curve.

Judging and class notes and illustration as suggested in Mr. Edwards' two final chapters make particularly interesting reading for non-accredited judges while accredited judges may find them more disturbing and non-conforming with the book of rules.

Mr. Edwards has had the courage of his artistic convictions and the result is a stimulating, inspiring book. It is sad that the entire book could not be done in full color with such a wealth of wonderfully artistic expression of plant material.

Mr. Edwards' trend-setting book, I hope, may be the forerunner of others as distinctive and illuminating. It belongs on the shelf of really aspiring flower arrangers.

Karen Foss Zimmerer

Japanese Flower Arrangement

Ellen G. Allen. Charles E. Tuttle Company, Rutland, Vermont. 86 pages. Illustrated, indexed. 1963. $2.75. (Library).

The author says, "The purpose of this Primer is fourfold; to increase the skill of all who love to arrange flowers, to provide a more comprehensive understanding of the art in Japanese flower arrangement, to help students where no lecturer is available, and to provide a medium of instructions among the many, often confusing, schools of Japanese flower arrangement."

This book may well serve as a handbook for the beginner as well as many who have knowledge of the art of Japanese flower arrangement. The fundamental rules and various techniques have been presented in a simple and easily understood manner. The lessons are in detail and are accompanied by sketches, photographs and diagrams that clearly show the proper placement of branches and flowers according to the school. The instructions are on the basic as well as the traditional styles of arranging.

The author has included a chapter on the history of this art, and also, gives clear instructions on equipment and proper containers according to the style of the arrangement.

The writer organized Ikebana International which has many chapters in this country as well as in many countries of the world. She has lived in Japan and has returned to that country for further study several times. She is most qualified to write an authentic book on the art of flower arranging as practiced by the Japanese.

Marie Lee

Fruit and Vegetable Arrangement

Emma H. Cyphers. Hearthside Press, 118 East 28th Street, New York, New York. 125 pages. Illustrated, glossary. 1963. $4.50. (Library).

The author of this well-written book is a nationally accredited Flower Show judge and a teacher in Flower Show Judges' Schools.

Her arrangements are done according to the principles of good design in art in any form.

She has covered well such subjects as artistic appreciation of the arranging of fruits and vegetables; compatability of table decoration taking into consideration pleasing forms, hues, textures of materials, whether formal or informal, and the proper containers and techniques of the arrangement; decorations throughout the year, including holiday decorations, special themes and occasions.

There are many pictures of excellent arrangements and finally a glossary of fruits and vegetables, and grains, giving the seasons available, their lasting qualities, and, in some instances, their symbolisms. This, in the reviewer's opinion, is a book much needed and one worthy of a place in the library. It is well written and an inspiration to the reader.

Marie Lee

Pruning Guide for Trees, Shrubs and Vines

Tom Stevenson. Published by Robert B. Luce, Inc., Washington, D.C. 144 pages. 1964. $3.95. (Library).

This is a practical guide for woody plants. It explains why and how pruning should be done. The author describes the pruning of a newly planted tree and the program of training to develop the desired shape. Pruning of older established trees is considered along with the repair to damaged trees. The pruning of deciduous shrubs is first described in general and then specific comments on pruning of the better known kinds is given. The pruning of conifers and of broad-leaf evergreens is described, when and how it should be done as well as the special requirements of these types of plants. Brief descriptions of the pruning of tree and bush fruits and nut trees are discussed. The pruning and training of plants for specialized purposes as hedges or as espaliers, tree forms and bonsai are explained in a helpful manner.

This is a handy book for the home gardener, the explanation is given in an easily read manner and are illustrated with line drawings.

C. B. L.

Other Books Added to the Library

The Gardener's Year

Karel Capek. Translated from the Czech by M. and R. Weatherall, Dover Publications, Inc., 18 Varick St., New York 14, N. Y. Illustrated by Joseph Capek. 110 pages. Library $1.00. (a reprint of 1931 edition).

The Ford Almanac—1964

Edited by John Strohm. Published by Golden Press, Inc. New York, N. Y. 1963. (Library). $1.00.

The Architecture of the Germplasm

Verne Grant. Published by John Wiley and Sons, Inc. New York, N. Y. 1964. 236 pages. (Library).

How Plants Get Their Names

L. H. Bailey. Published by Dover Publications, Inc., 180 Varick St., New York 14, N. Y. 1963. (Library). Reprint of the original—published in 1933. $1.15.

Guide to Southern Trees

Ellwood S. Harrar and J. George Harrar. Published by Dover Publications, Inc. $2.25. Reprint of the original—published in 1946. Plant nomenclature has been brought up-to-date.

Horticultural Science

Jules Janick. Published by W. H. Freeman and Co., 660 Market St., San Francisco 4, Calif. 1963. 463 pages. $8.50.

Advances in Pest Control Research—Vol 5

R. L. Metcalf, Editor. Interscience Publishers, 440 Park Ave., South, New York 16, N. Y. 1962. 329 pages. $13.50.

Insects in Relation to Plant Disease

Walter Carter. Interscience Publishers, 440 Park Ave., South, New York 16, N. Y. 1963. 705 pages. $25.00.

The Eucalypts

A. R. Penfold and J. L. Willis. Interscience Publishers, 440 Park Ave., South, New York 16, N. Y. 1962. 449 pages, 71 Illustrations. $14.50.

Cucurbits

T. W. Whitaker and G. N. Davis. Interscience Publishers, 440 Park Ave., South, New York 16, N. Y. 1962. 250 pages, 38 Illustrations. $11.50.

The Gardeners' Pocketbook

'Chico'—An Ornamental Dwarf Pomegranate

The history of the pomegranate (*Punica granatum* L.), one of the most ancient of cultivated fruits, is rich in both religious and artistic significance. In the Old Testament, in which it is mentioned 30 times, the pomegranate is presented, along with other fruits, to Moses as evidence of the productiveness of the Promised Land of Canaan (Num. Ch. 13). King Solomon sang of "an orchard of pomegranates with pleasant fruits," and employed its design as an architectural motif for the pillars of his temple.

Interest in the novel plant caused its early migration from Asia Minor to the Western Mediterranean countries and to Asia. This is shown by the fact that prints from India and porcelain from China bore the pomegranate design, as did paintings from Italy, tapestries from France and Flanders, and velvets from Spain. The Spanish city of Granada itself was named for the fine quality of pomegranates produced there. The Spanish first brought the pomegranate to Mexico. From there it was introduced into California by the mission fathers in 1769. It was also introduced on the East coast to the British colonies as early as 1621. From these and later introductions a number of varieties have appeared including fruitless and double-flowered forms.

One of these forms is a double-flowered dwarf introduced by the USDA[1] over forty years ago. It was discovered in 1916 by agricultural explorer Frank N. Meyer in Peking, China, where it was being grown in pots as an ornamental. In Meyer's notes he states that "the Chinese name for the plant is *Pai tze sheh liu*, meaning one hundredfold bearing pomegranate," and that it is "said to bear sometimes as many as 100 fruits on one specimen." At the United States Plant Introduction Station, Chico, California, however, flowering plants have been examined for a number of years and have not set fruit even when hand pollinated. Lack of fruit, however, has not diminished its attractiveness and

Author examining foliage of Pomegranate hedge (Punica 'Chico') at the U. S. Plant Introduction Station, Chico, California.

is a distinct advantage when the plant is used where dropping fruit might be a nuisance. The ornamental dwarf became popular from its first introduction in 1920, although the Chinese name proved difficult to use. With true Yankee simplicity the clone was renamed *Punica* 'Chico' by someone in the nursery industry. A diligent search, however, has failed to show who named the clone or when. It is uncertain if the name 'Chico' refers to the Plant Introduction Station at Chico, California where the plant was first tested and distributed or is the Spanish word meaning small, alluding to the dwarf nature of the plant.

With the current interest in low growing shrubs and container plants for patios, *Punica* 'Chico' is making a colorful contribution to Western gardens. The extent to which this introduction is now established in the nursery trade is indicated by the fact that it is being cataloged by two of the largest wholesale nurseries in California and that it is generally available in garden stores throughout the West.

Punica 'Chico' has much to recommend it in addition to its compact

[1] Plant Introduction No. 43793.

growth habit and ability to thrive in small containers. The dark green lanceolate leaves are about 1-½ inches in length and although smaller, have the same general shape and attractive glossy appearance as those of the standard size pomegranate. The dwarf, like the standard, is deciduous. It has, however, only a short dormant period in mild wintered areas. In Southern California growth is usually resumed shortly after leaf drop.

Perhaps the most noteworthy characteristics of *Punica* 'Chico' is its long blooming season. In the Sacramento valley of California flowers usually appear in late May and continue in abundance until the cool weather of October. The flowers are double, odorless and from one to two inches in diameter. At Chico, individual flowers will usually remain open 15 to 20 days before petal drop. The petal color closely resembles the strong reddish-orange 7.5R 5/13 on the Nickerson color fan. The petals have wavy margins that give the bloom a carnation-like appearance.

Flowers of the dwarf pomegranate are highly variable in morphology. Some have a normal complement of petals, stamens, and pistils. Others are abnormal, exhibiting petaloid stamens and several flower buds which arise more or less concentrically in a cluster from within the main calyx.

At Chico this dwarf pomegranate is readily propagated from softwood cuttings under intermittent mist. The plants are also propagated commercially by this method.

Since flowering usually occurs when the plants are quite small they can be used effectively as container grown patio specimens or equally well for low hedges, or in shrub groups. A number of plants started from cuttings in 1924 were planted the following season as a hedge at the Plant Introduction Station, Chico, California. This hedge was pruned annually until 1951 and then allowed to grow unpruned. As shown in Figure 1 it now stands eight feet in height and is about three feet in width. It has shown drouth resistance and is remarkably free of insect pests and diseases. It is perfectly hardy at Chico with an average minimum of about 20° F. and would probably be tried in areas with even colder climates if the virtues of the plant were better known.

Persons interested in additional information about pomegranate may refer to the following selected references.

References

1. Dillon, C. B. 1934. Westward from Canaan. A Brief History of the Pomegranate Tree. *Louisiana Conservation Rev.* 4: No. 4:30-32, 38.
2. Hodgson, R. W. 1916. Pomegranate: History and Description. *Calif. State Comm. Hort. Bull.* 5:140-7.
3. Sinkler, W. 1948. *Punica granatum. Garden Club Amer. Bull.*, Ser. 11, No. 6: 13-26.

—R. L. Smith, *U. S. Plant Introduction Station, Chico, California.*

Editor's Note: Retail sources of *Punica* 'Chico': Stribling Nurseries, Box 793, Merced, Calif.

Bee Line Nursery, Amelia & Baseline Rd., San Dimas, California.

Select Nurseries, Inc., 12831 East Central Ave., Brea, California.

An Effect of Temperature on Development and Differentiation of Rose Flowers

Temperature is one of the characteristically cyclical features of the environment. Both rate of growth and the morphogenic development of plants are markedly influenced by the pattern of the temperature cycle to which they are subjected. Temperature influences the growth of plants as much as does any other single factor. This research involves temperature effects in the formation of floral primordia and their eventual form and size.

The effects of five different constant temperature regimes on a seedling of the floribunda rose cultivar 'Ma Perkins' are shown in Figures 1 to 3. Flowers were largest at 62° and 72°F but at 52° the flowers were more intensely colored.

The maximum number of petals was formed at 62°, while at 82° and 92°F the number of petals was reduced to 5, the basic number in the wild rose species (Fig. 2). Not only were more petals formed at 62° but at this temperature the petals were more fully expanded.

Temperature also affected differentiation and development of the reproductive structures of the flower. In the seedling shown in Figure 3 the stamens were fewer and the pistils and filaments were relatively longer at lower temperatures. On the other hand, the number of filaments was greater at the higher temperatures. Figure 4 shows another seedling of 'Ma Perkins' in which the temperature response of the reproductive structures was somewhat different. In

U. S. D. A.

Fig. 1. Seedling of the floribunda rose cultivar 'Ma Perkins' grown at five different constant temperature regimes.

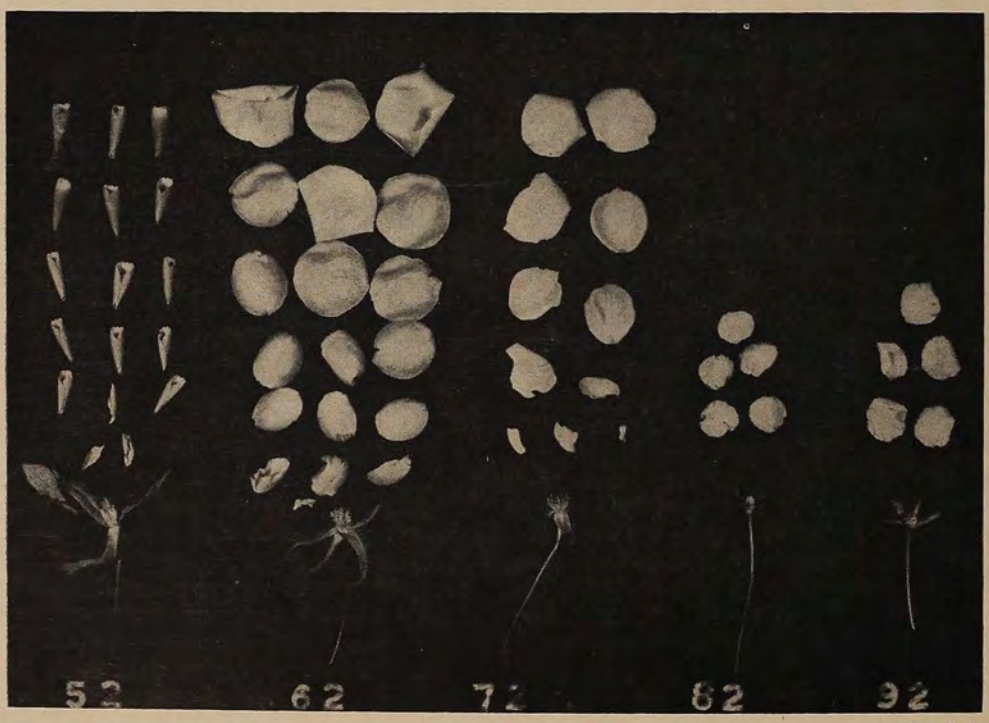

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Fig. 2. Petals and petaloids removed from plants shown in figure 1, showing effects of temperature on their number and size.

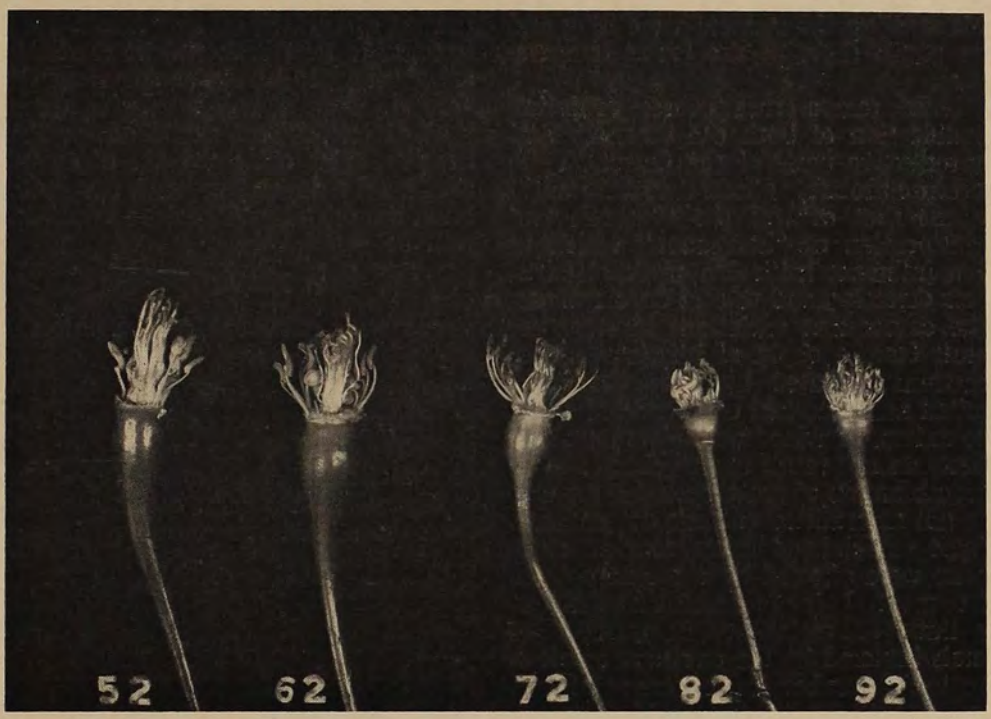

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Fig. 3. Effect of temperature on length of stamens and pistils of rose cultivar 'Ma Perkins'.

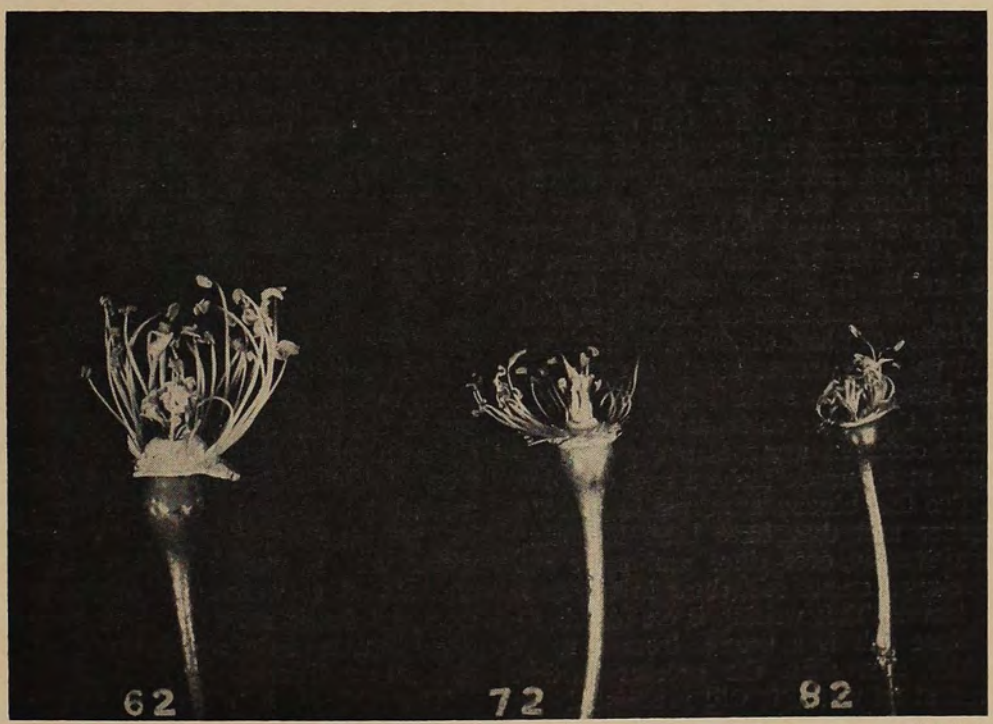

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Fig. 4. Sister-seedlings showing effects of temperature on length of stamens and pistils.

this seedling the stamens were long and the pistils short at the lower temperatures.

Thus, temperature causes profound modification of both the accessory and reproductive parts of the flower. Temperature probably affects the plant mechanisms that control the synthesis and translocation of "hormones," which in turn influence initiation of floral parts, their direction and rate of development. The consequent variations in structure result from a chain of physicochemical reactions initiated by genes but controlled and modified by other genes and the external environment. Temperature effects do not result in any change in or recombination of the genetic factors, and are not transmitted to their descendents. These well-defined morphological characters were affected by the external environment. It is of interest that the lower limit of variability in number of petals imposed by the environment is 5, the basic number in the ancestral species.—PETER SEMENIUK, *Crops Research Division, U.S.D.A., Beltsville, Maryland.*

Allium perdulce

As hardy alliums have always been an interest to the writer, many have been tried in this garden with relatively small success.

The species discussed in this note came from Prairie Gem Ranch, Smithwick, S. D. and while it is a minor species if showiness is the major concern, it has its own merit, namely that of very early bloom. Here it would appear in all lists of flowers in bloom in December. No change of temperature seems to bother it. The low mass of foliage, about the same mass one might get from a newly set plant of *Armeria maritima,* and its short scapes barely overtopping the leaves, carry a small head of flowers about the same color as those of the more common armeria, a slightly purplish rose, and do make a nest of color.

The first blooms appeared in mid-December and they have been following continuously ever since and more undeveloped scapes still show in the mass of leaves. This writing is on March 14.

Since this is a species from a much colder area than the present garden, even at its worst, it will presumably be cold hardy much farther north in other regions than its native range.

Since all plants on trial here are in limited quantities, no suggestions are offered as to how it should be used. The other plants in bloom at this same time here are all species narcissus, in various hues of yellow, and would not combine happily. The old hyacinths of colonial gardens in lavenders and the Swan's Neck narcissus in milk white would look well behind it, perhaps.—B. Y. MORRISON, *Pass Christian, Miss.*

Prunus campanulata—Taiwan Flowering Cherry

In Southern California, the various sorts of Japanese flowering cherries are occasionally seen, but are not well adapted to the climate. Frequently they do not receive sufficient winter chilling and perform in a mediocre manner. Unquestionably *P. campanulata* is the best adapted, since it is native to a warm climate.

The tree is slender and tall which displays the deep pink flowers to their best effect. They are particularly lovely against the background of a clear blue sky. Blooming is typically early, often in February, just before or during leaf emergence. The flowers are single with a bell-shaped form and are pendulous on long stems. The fruit is ovoid and red.

The tree will stand heat and dry air and is thus adaptable to a large inland area, where winters are not too cold. There are reports of successful growth from the East Coast. The tree requires little space in the garden and is worthy of trial in many of the mild climate areas of the country. — V. T. STOUTEMYER, *Dept. Floriculture, U. of California, Los Angeles, California.*

Acmena smithii—The Lilly-pilly tree

This is a tall timber tree in the rich river valleys of Queensland, Australia, but in the mild coastal area of Southern California it is seen as a small shapely tree. It is suitable only for the warmer areas, but is not common there, although its fine ornamental qualities suggest a wider use. It prefers a deep rich soil and abundant water and unlike many trees and shrubs from the mediterranean type climates of the world, is well suited to lawn conditions.

The foliage is glossy with a rich bronzy green color. The white flowers with numerous stamens are typical of the myrtle family (*Myrtaceae*). Former-

V. T. STOUTEMYER

Acmena smithii

V. T. STOUTEMYER

Callistemon 'Red Chico'

ly this species was included with the eugenias. The fruit of this species is large and notably attractive over a long period in the winter, having a lavender cast with a suggestion of iridescence. Frequently the branches are so heavily laden with fruit that they become weeping. The tree is best in sun and in areas where minimum winter temperatures are above 24° F. The modest size of tree and its easy response to pruning make it ideally adaptable to small gardens.—V. T. STOUTEMYER, *Dept. Floriculture, U. of California, Los Angeles, California.*

Callistemon citrinus—*Bottlebrush*

This showy shrub with brilliant red flowers consisting of clusters of stamens surrounding the stem is coming into increasingly extensive use. It is usually grown in bush form, but when trained as a standard is coming into use as a small erect, non-weeping street tree.

The bottlebrushes tend to vary from seeds and superior ornamental types are often grown from cuttings. The form illustrated here, 'Chico Red' is currently one of the most popular cultivars.

Bottlebrushes grow well from the desert to the seacoast in Southern California and are not particularly sensitive to frost. They benefit from adequate watering.

Other related species offer an assorted range of flower colors and plant habits. —V. T. STOUTEMYER, *Dept. Floriculture, U. of California, Los Angeles California.*

Tsuga canadensis 'Pendula'

The weeping form of Canadian hemlock (*T. canadensis* 'Pendula') commonly referred to as Sargent hemlock is one of the most graceful and beautifully proportioned pendulous forms of all conifers. There are a number of clonal selections of the weeping hemlock, many of which may be seen only in the Hemlock Arboretum, Germantown, Philadelphia. Still others could probably be found with sufficient time and patience. Although specimens have graced arboretums and other plant collections for nearly a century, it has never been widely used in landscaping homes and public places.

The Sargent hemlock is a quality, low-maintenance plant that comes relatively

U. S. D. A.

Fig. 1. Mature specimens of Sargent hemlock over 25 years old.

true from seed. It is a durable evergreen that withstands light shade or full sun. Like other hemlocks, it prefers a loose, rich soil but it must have plenty of water to perform its best. In a foundation planting or hedge, its slow growth will keep it in scale for many years.

In an article titled "Weeping or Pendulous Hemlocks (*Journal of the New York Botanical Garden,* 40: No. 475, July 1939), A. B. Stout described what he believed to be the original specimen from which all of Sargent (weeping) type hemlocks were derived. The tree was named the Horton hemlock for the owner of the wild mountainside location of the tree overlooking the village of Hortontown near the northern border of Putnam County, New York. In 1939 the girth of the trunk measured 58 inches at 4½ feet above ground level, while the plant's height was about 16 feet.

Five miles in a direct line from the Horton hemlock is the village of Fishkill. That was the site of the four wild plants described by Professor Charles S. Sargent as being the first "pendula" form of the Canadian hemlock. Purportedly, it was from these four Fishkill seedlings that all Sargent hemlocks evolved.

Dr. Stout, in the article previously mentioned, stated that only one of approximately 2,000 open pollinated seedlings of Sargent hemlock that he grew did not have the pendulous character. He also found that all vegetative propagations retained this character.

In the middle 1930's during the early development of the U. S. Horticultural Field Station[1] at Beltsville, Maryland, several plants of *Tsuga canadensis* 'Pendula' were purchased for experimental work. The exact source of these plants is not known. Figure 1 shows one of these plants as it appeared in 1960. Mature specimens will attain 12 to 14 feet after several decades.

In October 1953, seeds were collected by H. Fisher from the weeping hemlocks at the Plant Industry Station[4] and brought to the U. S. Plant Introduction Station, Glenn Dale, Maryland, where they were sown in flats of sphagnum.

[1]USDA Plant Industry Station.

[2]Seeds were collected from these same plants by the American Horticultural Society and distributed to its members in 1960. No reports on performance are as yet available.

Confirming the findings of Dr. Stout, all of the resulting seedlings were pendulous. The plants were transferred to pots, grown under greenhouse conditions for once year, transplanted to a cold frame for two years and then spaced out in 1957 in a nursery area in four foot rows with plants 2½ feet apart.

During the autumn of 1959 the first growth records were taken of 134 plants, then six years old from seed. At that time, the plants were exceptionally uniform ranging in size from 16 to 20 inches in height and 36 to 45 inches in width, except for one very dwarf plant 5 inches high and 9 inches wide, and four semidwarf plants ranging from 9 to 12 inches high and 18 to 26 inches wide.

During the past several years, two distributions of plants (24 and 46 plants) were made to the Plant Industry Station and 36 plants were sent to the Longwood Gardens, Kennett Square, Pennsylvania for landscaping purposes. Observations of growth on the plants remaining at Glenn Dale and those at the Plant Industry Station have continued to date. Although all of the seedlings have the weeping habit and none develop a central leader, differences in vigor and plant form within the group as a whole became evident during the 1960 growing season and have become increasingly more obvious since.

Measurements taken during the autumn of 1963, when the plants were ten years old, showed a maximum height of 40 inches and width of 86 inches, Figure 2. The minimum size, as represented by the one extreme dwarf plant, was 9 inches high and 15 inches wide, Figure 2. With the exception of a break for the smaller sizes, the general distribution approximated a normal curve.

The ratio of total plant height to plant width was found to vary from prostrate forms with a ratio of 1 to 3.6 to the most upright, narrow forms with a ration of 1 to 1.6. Again the distribution approximated a normal curve. The extremes of the curve were represented by 25 percent prostrate forms with a height of 1/3 or less compared with width and 21 percent comparatively upright forms with a height of ½ or more that of the width.

During the spring of 1962, fourteen weeping hemlocks were transplanted to make a hedge in a four-foot strip of soil between the front of the Glenn Dale Plant Introduction Station office and a sidewalk. The nine year old plants had not received any pruning prior to transplanting. Although some fairly large cuts were necessary for the development of a uniform hedge, the plans responded surprisingly well in most casts. Two less severe trimmings during the 1963 season have kept the plants within the size limits desired. The natural dome-shape of

Fig. 2. Ten year old Sargent hemlock seedlings showing relative size; maximum (left) and minimum (right).

J. J. HIGGINS

the seedlings was partially destroyed in the original hedging operation because of the age of the plants. Had they been pruned earlier, the graceful arching effect of the many over-lapping branches could have been maintained.

The results of the pruning and hedging of these weeping hemlocks indicate that there is little real advantage in nurserymen vegetatively propagating selections of the weeping hemlock that may exemplify particular growth patterns. In general, the seedling population at the Glenn Dale Plant Introduction Station contained about 4 percent dwarf or semi-dwarf types, 12 percent very vigorous types and the remainder intermediates; all of which were represented in varying height to width ratios. Dwarf forms can be separated out at an early age and used to advantage where this characteristic may be highly desirable. Very vigorous plants can be restrained and the comparatively upright made prostrate through a little selective pruning. These training manipulations would appear sufficient for the nurseryman to present a quality product at reasonable cost to the average customer. It will only be in satisfying the plant specimen collector and connisseur that the tedium and expense of vegetative progagation of special types will be worth while.—W. L. Ackerman and G. A. Seaton, *U. S. Plant Introduction Station, Glenn Dale, Maryland,* and H. H. Fisher, *USDA-ARS, Crops Research, Beltsville, Maryland.*

Preliminary Notes on Christmas Cactus and Allies

The Christmas Cactus has long been a favorite house plant in many parts of our country but seems in most cases to have been a plant that one got from a neighbor rather than by purchase from a nursery. As one saw it, it was either a vigorous old plant that had been in the family "for years" or else was a newly started cutting just received. It was a matter of cuttings that started the writer's interest in it and has lead to further search. The typical plant, or perhaps better put, the form most commonly found, bears flowers of a brilliant pink, rather on the magenta side of pink, than of coral or rose. The color is brilliant and a well-grown and well-flowered plant is spectacular.

I. N. ANDERSON

Schlumbergera gaertneri 'hybrid'

No one suggested to the writer that there were any particular difficulties in its culture, but a study of the comments of successful homegrowers indicated that it needed a fairly rich but quick draining soil mixture, an ample supply of water through its flowering and the season of new growth that immediately follows, and a rest period in which it may show signs of some shrivelling of its sections, that appear like leafy shoots, but are not, with a dropping of some segments, for no particular reason. Some shade rather than the full sun for the hottest parts of the year, and a cool temperature during the winter were the other comments most often encountered.

The first gift of cuttings, responded to the treatment outlined and no particular new difficulty arose.

A memory of having read that there were "other colors" lead to a rereading of the few pages in Scott Haselton's "The Epiphyllum Handbook" and there, to quote is the statement that there "are many variations in color, ranging from almost pure white through purple, carmine, wine-red, brick-red to salmon." The same text indicates that "there was

a time in Europe when many varieties were listed none of which are probably not now in cultivation, certainly not in this country." This was quite enough to start the writer on a search.

Then turning to an old friend-by-correspondence who specializes in the large-flowered epiphyllums, Mr. Sherman E. Beahm, we found a longish list, not all of which proved to be available at the time of inquiry. And, after an interval, there arrived from California, a beautifully packed box with twelve *Zygocactus,* two *Schlumbergera,* one *Epiphyllanthus,* and one *Rhipsolodopsis,* all in fine condition and a plant of *Schlumbergera gaertneri* 'Hyb.' well set with buds. All this in April, which gave the clue to the 'Easter Cactus' the *Schlumbergera.*

Checking further the instruction for handling, the warning was repeated to have a soil mix that would drain quickly and well, and yet have in it enough humus material to keep an even degree of moisture, together with the suggestion that if the plants received were without soil, they should have the roots soaked carefully until they appeared turgid. As all the plants in the shipment had come with soil, this was not tried, but it can be said, that in changing pots, of the old local plants, it was noted that soil that fell away from the root system, fell off completely and the plants were guarded so that the roots did not dry out.

The mixture made up here was the usual acid loam mix with peat moss to which was added an almost equal part, by bulk, of chopped osmunda fiber.

A second shipment of plants from another source, brought potted plants, again beautifully packed, but in a soil mix that appeared much more firm and less filled with humus of any sort. This lot has not been repotted and all are growing on well.

The original lot of cuttings rooted in sand, before potting, had an ordinary mixture, with no special coarse drainage matter added, and it must be confessed that growth seems to be about equal in all three.

All plants here are grown in the cool greenhouse, that is kept shaded in summer, with all ventilators open, and in summer when temperatures are highest an exhaust fan is kept on day and night.

Growth commenced on all the plants almost at once but in varying degrees, some quickly and well, some slowly. Two plants died at once, the clone known as 'Pink Elephant' and the small plant of *Epiphyllanthus.* No explanation can be offered and no excuses.

By autumn all the living plants had made some growth and appeared to be in normal condition, save a few of the named clones, 'Vivid', 'Mia', and the *Schlumbergera* hybrid 'Andre'. These had not "plumped up" as the gardeners would say, and looked shrivelled. Of these three 'Mia' appears to have made an almost complete recovery at this writing (March 1964) but the other two may be hopeless of recovery. Not all had grown during the summer to produce blooms but enough did to prove to the writer's satisfaction that colors, othe than the cerise pink-tending to magenta of the common form, did in fact exist and were well worth the search.

Whatever the ultimate decisions may be taxonomically, the plants in cultivation under 'fancy' names, make fine plants for the home gardener, with a range of blooming times that may in fact justify the common terms of Thanksgiving and Christmas cacti.

The term zygomorphic should be explained as indicating that the flower can "be split only at one point so that both halves are alike." (l.c.) From the common point of view, this means that the blooms on zygocacti, appear to one as in profile, those of *Schlumbergera* appear full face.

Among the clones grown in the present collection, there are more without the long claws than with, but there does not appear to be any connection between this and the times of blooming.

In general, the color most commonly encountered is a shining magenta tending toward cerise. It seems particularly brilliant as the surfaces of all parts of the flower, both the petal-like bracts along the flower tubes and the petals proper, are smooth and shining. In nearly all cases, the color is least intense along the tube of the flower and most intense at the margins and tips of the petals and bracts. In some the tube is almost white, never pure white, but sufficiently white to allow the use of the name 'Bicolor' for one clone; in another

1. South Orange 2. Vivid 3. Violacea 4. Bahai 5. Delicatissima
Clones of Christmus Cactus

this pattern is reversed with all the color concentrated in the tube and at the bases of the floral parts, permitting the name 'Delicatissima' and the optimistic suggestion, that the clone is white.

An additional factor in making the colors seem intense is that in the same flower one may find a pink or rose hue that is basically related to purple and another pink, that is basically related to scarlet.

Of those that flowered here, their first year, under conditions somewhat of trial and error, the following color notes were taken.

'South Orange', November 23. Tube white-flushed with RHS Scarlet, which has a pinkish hue; the margins flushed with Fire Red 15/4 deepening on the margins to 15.

Using the Ridgway chart, the results are: tube white flushed with La France Pink, deepening to Peach Red on the scale-like bracts and petals. The stigma is Tyrian Red, the style paler.

'Bicolor'. November 25. The pale central portion, tube and bases of bracts and petals, not quite white, flushed with Phlox Pink (a lavender hue). The body color is Rose Red, stigma and style Rose Red, the filaments of the stamens white.

The basic contrast in this clone results from the "purplish" tone of the Phlox Pink and the pure Rose Red.

'Violacea'. Nov. 27. The tube and bases of all parts, bracts and petals, white, washed with Mallow Purple, deepening to Rhodamine Purple toward all edges.

'Vivid'. Nov. 29. Almost a self; the whole flower except tube and pistil, Spectrum Red, flushed with Rhodamine Purple. All green parts of the plant are flushed with dull purple. The flowers of this clone are smaller than most others, as seen here, but are very brilliant, but the plant has not been entirely successful in our growing.

'New Red'. December 30. Tube and bases Rose Pink to Deep Rose Pink, bracts and petals Rose Red. Stigma Aster Purple. This makes a very brilliant red.

'Bahai'. December 30. This clone bloomed more profusely than any other. The flowers seem a little smaller than many but one does not know if this is typical or came from lack of adequate feeding. The tube and bases of bracts and petals, Tyrian Rose, tending toward Amaranth Pink. The petals, brighter than Tyrian Rose, tending toward Rose Red. The filaments are Amaranth Pink, fading toward white as the flower ages, but never white. This is the only clone flowered here, that does not have white filaments. The stigma is Rhodamine Purple and opens to show the divided styles. This again, may not be typical, but shows in this clone only as seen here. In illustrations seen, of the type, the divided styles do not show in more cases than one.

'Delicatissima'. January 3. Basically these flowers are white in effect, but actually they are washed from the bases of all floral parts with Mallow Pink, the darkest areas, Light Mallow Purple (they are pale lavender pinks). The clone is white in all areas where other clones are colored; and colored, where others are white or light in hue.

'Peacheroo'. This clone tried to bloom but the flower was accidentally broken off before it could show any color.

The clones that have not yet bloomed are: 'Amelia Manda', 'Electra', 'Manda's Orange', 'Pink Elephant', and 'Salmonea'.

No notes were taken of the color of the *Schlumbergera,* but a photograph is attached chiefly to clarify the definitions of zygomarphic flowers. The other plant, *S. gaertneri,* is in bud at this writing, March 17, but the buds are so small they may not develop in time for this year's early Easter, March 29.—B. Y. Morrison, *Pass Christian, Miss.*

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American Association of Botanical Gardens and Arboretums

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American Camellia Society

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The Hemerocallis Growers of Dallas, Texas
The Herb Society of America
Hilltop Garden Club, Washington, D. C.
The Hillside Garden Club, Lynchburg, Virginia
Hines Wholesale Nurseries, Santa Ana, California
Holly Society of America
Horticultural Society of New York
Hunting Creek Garden Club, Alexandria, Virginia
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International Shade Tree Conference, Columbus, Ohio

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International Garden Club, Inc., Pelham, New York

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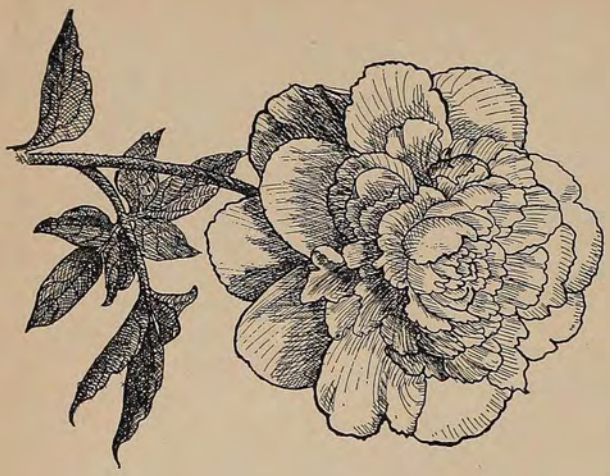

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