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For United Horticulture . . .

The particular objects and business of the American Horticultural Society are to promote and encourage national interest in scientific research and education in horticulture in all of its branches.

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Carmine-Rose Hybrid Polyanthus. Pacific Strain of Polyanthus Primroses developed by Frank Reinelt.

PHOTO VETTERLE AND REINELT

Guest Editorial

Standards in Horticulture

Every one of us who gardens, from the novice to the professional, is involved with and dependent upon the standards which apply in horticulture.

Each of us seeks the best in everything which pertains to the art and science of growing fruits, vegetables, flowers or ornamental plants. When our efforts sometimes produce second-best results we are disappointed, we feel somehow deprived, and we set a new course—determined to produce a first-rate result the next time around.

Horticultural standards have their roots in that individual determination for excellence. Perhaps even more than the professional horticulturist, who has the advantage of formal study and large facilities at his disposal, the home gardener on his own is the major creator of those standards. We admire and applaud the unbelievably beautiful specimens grown under controlled conditions, but what really excites us and stimulates our work are the plants which we can bring to excellent standards of beauty, health and hardiness in our own backyards. In the process of doing this, we find ourselves involved in horticultural standards at every step.

The American Horticultural Society's committees are in large part groups concerned with the work of establishing standards for our field.

Our Committee on Nomenclature and Registration is concerned with the correctness of plant names. It will have some news articles in early issues of the Magazine on recent name changes of popular plants, because correct plant names have to do with standards. Through this Committee the Society will distribute, this Fall, the new edition of *The International Code for Nomenclature of Cultivated Plants.*

As plantsmen we need to know about color standards, too. The Nickerson Color Fan, for which the Society is distributor, is one of our regular garden tools. Its color names have been selected as standard by the Inter-Society Color Council and the National Bureau of Standards. Our Standards and Ethics Committee has worked for more than two years on the new color fan which the Munsell Company will have ready before the end of 1969.

This committee works also with both public and private agencies on standards in horticutural advertising, work aimed at assuring that our gardening materials—plants, soils, fertilizers, containers, insecticides, tools, markers, and other supportive items—are as advertised.

By their very nature our sponsorship of our annual American Horticultural Congress and our co-sponsorship of the annual Williamsburg

Garden Symposium are standard-setting events. They bring together a goodly cross-representation of expertise, individual and group, where we can measure our knowledge and experience against the widely accepted standards to which we all aspire.

Our new Plant Records Center Committee's basic work is a search for the best method of data processing and storing vast amounts of horticultural information for instant retrieval and use. In brief, research for a standard of value for the whole field of horticulture.

Unquestionably, educational standards in horticulture would better serve the public's need if public schools put gardening courses in their curricula for youngsters of all ages. Our Education Committee is developing a plan to help interested educators and their communities do just that, beginning this Fall. Heart of the program is the standard set by the Cleveland public schools in 1904—and strengthened yearly since.

We support another kind of standard in our belief that all men everywhere should have the beauty and the ensuing benefits of a green environment in which to live and work and play. Our Natural Beauty Committee is organizing a national effort to put horticulture into action in urban centers across the land. Its aim is *maximum beauty with minimum care*—criteria for our own gardens as well as for the public sector.

We like to see outstanding horticultural work recognized because the individuals and the organizations which achieve it are creating models for all of us to follow. Our Awards and Citations Committee searches out the best in each field each year for the Liberty Hyde Bailey Medal and for special citations.

Our Film Festival Committee sets standards, too. It awards Certificates of Merit annually to those producers of motion pictures on horticultural subjects which qualify under genuinely instructional and/or educational criteria.

Our *American Horticultural Magazine* sets a high standard of authenticity for our members in the United States and in 53 other countries and territories, where its regular issues and its special issues, our popular handbooks, are respected reference works. Our new bulletin, *News and Views,* is developing a high standard of reporting which we believe will eventually serve as a major communicator among people and programs in horticulture.

Our Committee on International Horticultural Relations is our liaison with the International Horticultural Society. As such it links us with the work, and thus the standards, of gardeners around the globe.

This list is far from complete. Standards and their maintenance are the ultimate goal of all the Society's committees.

Who finances this necessary and continuing search? You and I and all the other members of the Society. This is one big way in which your dues dollars go to work.

As gardeners we learn very early to avoid the sub-standard. In this, we and AHS share a certain kinship with that late, great champion of standards of whom Lady Churchill once said, "Sir Winston is easily satisfied—with the best!"

Sincerely yours,

Fred C. Galle

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Western Horizons in Tuberous Begonias, Polyanthus Primroses, and Delphinium[1]

FRANK REINELT

Plant breeding is a way of life, one that has filled mine happily to the exclusion of other normal pursuits. Fads and fancies come and go with men circling the earth in rockets, Flower Children blooming in the Haight-Ashbury, and deficit financing worrying the oldsters. Do I know about these things? Oh, yes, but a plant breeder just goes peacefully on, cozily insulated from outside disturbances and with his eyes firmly fixed on the horizon where the future generations of plants are arising.

Tuberous Begonias

It is barely 100 years since the first species involved in breeding tuberous begonias were introduced to Europe. *Begonia boliviensis* came from Bolivia in 1864 followed in 1865 by *B. pearcei* which was found near La Paz. Introductions from Peru in 1867 provided our most valuable breeding material for modern tuberous begonias and included *B. veitchii,* discovered near Cuzco at an elevation of 12,500 feet which has been the principal progenitor of the large flowers that we have today. This was followed by *B. clarkei, B. rosaflora,* and *B. davisii* from Chupe at an elevation of 10,000 feet. Six species are represented in the parentage of today's large flowers and variety of forms created by three generations of plant breeders in the past 100 years.

The early work in breeding tuberous begonias was done in England by the firm of Veitch and was followed on the continent in Belgium and France. Lemoine in Nancy, France, perhaps the most productive plant breeder of all time, claimed the prize of raising the first double tuberous begonia flower during the 1870's.

The second generation was represented by Mr. C. F. Langdon, who with Mr. Blackmore, was responsible for most of the progress up to the early 1930's when it was my good fortune to carry the ball in the next generation.

The beginning of commercial production of begonias in California dates back to the embargo enacted on European bulbs in 1917. After several false starts in the north and also in Southern California the industry settled around Monterey Bay where conditions were nearest to the ideal—a long season of growth through cool foggy summers, yet with sufficient chill in December to force the tubers into dormancy.

In the beginning, seed was imported from Europe, and the growers eventually became successful through trial and error despite the lack of any formal

Frank Reinelt, of Vetterle and Reinelt, Capitola, California 95010.

[1]*Address given before the 23rd American Horticultural Congress, San Francisco, Sept. 20, 1968.*

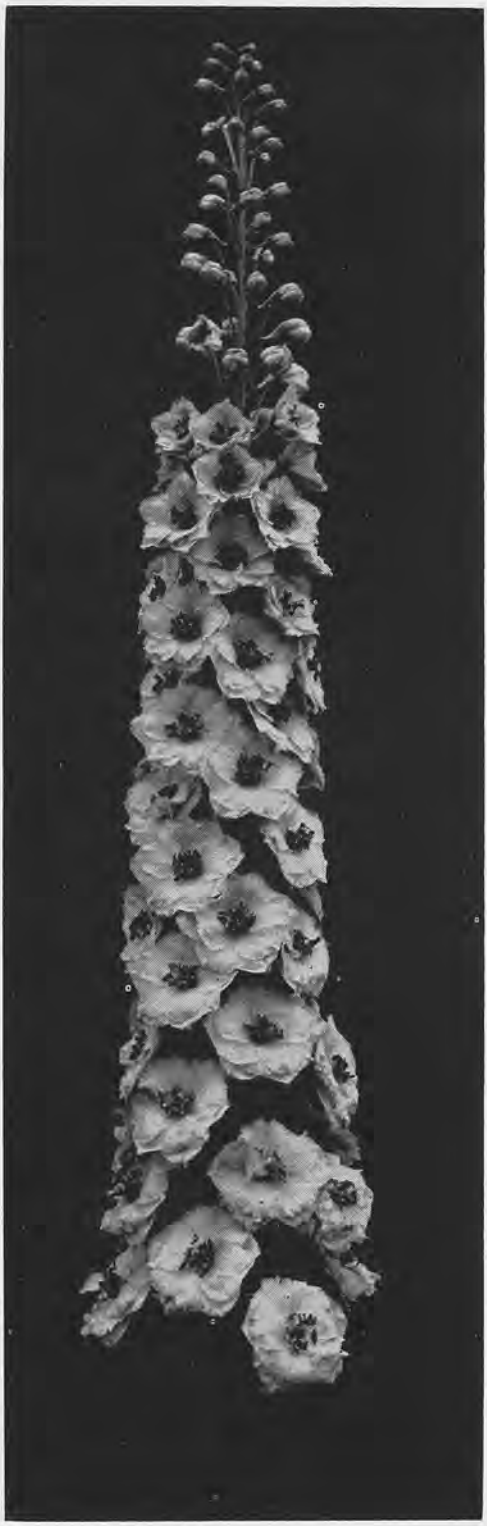
gardening training. The transition of one grower was from strawberries and the other, from cattle.

I came to California in 1926 from Czechoslovakia as a trained horticulturist, full of ambition and with the rosy dream of following in Mr. Burbank's footsteps. Actually, I tried to do just that in the beginning, raising everything wildly in this gardening paradise. The day was never long enough, and my test garden contained everything from Transvaal daisies to tall bearded iris. Delphinium and begonias soon stepped out in front with the polyanthus primroses getting their fair share. These three subjects became not only my passion, but eventually my bread and butter.

The depression kindly pushed me into commercial production as my surpluses were becoming too expensive to grow and my long-suffering friends were beginning to give up on maintaining them just so I could sort them over when in bloom. The Vetterle Brothers were already large-scale tuberous begonia growers, and in 1934 I joined them, establishing Vetterle & Reinelt dedicated to plant improvement.

Since my partners already grew upward of a million begonias yearly, I started experiments in every direction on a large scale. Napoleon said that God was on the side of the big battalions, and while this is not necessarily true in plant breeding, it definitely helps. Flowering time found me in the fields from dawn until dusk. Dr. Sidney B. Mitchell, dean of Librarianship at the University of California, contributed the lion's share to my education. He turned his students into sleuths to come up with material, books, and articles for my work.

After years of experimenting, I have concluded that nothing supersedes selective plant breeding, and that the shortcuts that sounded like magic usually ended short of their promises. Imagination, coupled with a dedication which amounts to obsession, is the only thing that gets results. Then one must be alert to the breaks when they do occur, as well as visualize what might turn up.



Blue Jay, one of the named Pacifics. Pacific Giant Strain of delphinium hybrids developed by Frank Reinelt.
PHOTO VETTERLE AND REINELT

Ruffled camellia type. Mr. Reinelt developed this hybrid tuberous begonia by interbreeding fimbriata plena with camellia.

PHOTO VETTERLE AND REINELT

Hybid Tuberous Begonia, double rose-form type. The classical rose form was developed by Reinelt from the camellia, which it superseded.

PHOTO VETTERLE AND REINELT

Tuberous begonias in the early thirties resembled camellias and were at the outside six inches in diameter. There was a fimbriated type like ragged marigolds, with poor form and size in limited color range. Picotees as we know them now were non-existent. A small freckled form came from Belgium and was called marmorata. This was the progenitor of today's picotees. The hanging types were stiff brittle plants with fuchsia-like flowers, the plants having been derived from *Begonia boliviensis*, again with extremely limited color range.

Most beginning gardeners are impressed with flower size, and I was no exception. Only after years of enlarging the flowers to nine inches did I realize that size of flower is desirable only if the entire plant has been increased in size and stiffened to maintain balance. At the time I started my work stems were pitifully weak, and exhibition flowers in shows had to be supported by wires propping up their chins. My immediate search was for plants with strong stems. After enlarging the size and extending the color range, I concluded that if I were to make a worthwhile contribution, I would be forced to develop completely new types. The quest for new forms began.

In the early 1940s we introduced the rose form, a classically perfect open rose type, as a replacement for the old camellia form; and the ruffled type, a big full deep petalled group that replaced the old fimbriata. Both of these have become the commercial standards of today. Picotees were developed with both the rose and ruffled forms. Hanging baskets were changed completely in hanging habit, which is now pendulous and graceful, resulting in full round baskets with either perfect rose form or ruffled flowers.

The color range is so wide—from the tenderest pastels to the bold and vibrant oranges and reds—that no florist has ever had us stumped in matching begonia blooms to bridesmaid dress swatches for special weddings.

In passing, I will say that size and color are comparatively easy to breed; but form takes generations and big bat-

Hybrid Tuberous Begonia, rose-form Picotee type. Picotees were developed by Mr. Reinelt by interbreeding the small marmorata with the large camellia forms.

PHOTO VETTERLE AND REINELT

talions. With each year new breaks appeared and good form increased, continually setting new standards. Thirty years ago I would not have believed today's begonias, could I have had a sneak preview. I would have been like the oilman from New Orleans who recently walked through our greenhouses and kept repeating to himself, "The man who grows these things is a liar." All it took, of course, was imagination, unlimited hours, and 80 million plants in over 35 generations.

Delphinium

Our Pacific strain of delphinium went through a similar period of development although the progress here does not compare with the more versatile begonias. In the early days, two to three good plants in a row of 100 were considered a fair stand. Outstanding plants were not plentiful. However, by continuous selection and the inter-breeding of the few premium members, both the colors and forms were polished and intensified to a point where they have reached a high percentage of uniformity. This was my object, since propagation of individual cultivars, as practiced in England, is not practical in less favorable climates. My answer was a strain that would produce uniform high quality in color separations so that anyone could grow as fine delphinium as could Mr. Morgan with his millions.

If you grow at least 10,000 seedlings every year, select the 10 best, interbreed these and raise a new generation, you will intensify the quality to the point where it becomes quite uniform. Perhaps after 30 or 40 generations, you will have a beautiful uniform race. New plants will continuously appear, outstanding in both form and color, so that you will demand that everything achieve the quality of your best.

Instead of offering novelties each year, we introduced named series of individual colors. The names have become the standards for colors over the years, with constant upgrading and polishing through each successive generation.

While all of the colors in the Pacific strain now are clear and vibrant, the Elaine series, our final introduction, is my contribution toward pink. In reality, 'Elaine' is a diluted warm lilac, but when freshly opened in dark weather or displayed under artificial light, definitely looks pink, though not the shade found in begonias.

The yellow and red may come eventually, as Dr. Legro in Holland has produced a strain of garden hybrids from the cardinale and nudicaule type. These are still in the experimental stage and will take years of breeding before their size will compare with present day garden hybrids. However, it is a start.

The three basic colors, red, yellow and blue, do not all appear at once in any plant in pure form. In begonias there is pure red and yellow, hence the clear vivid tones of every shade except blue. Since one cannot create a primary color, it has to be in the plant to start with, so the tales of blue roses are wishful thinking.

There are secondary colors, and intermediates like magenta, which in pure form are brilliant and beautiful. Mixed with other colors these tend to have a muddying effect. This brings us to primroses.

Polyanthus Primroses

The basic color here is yellow, with no red nor blue in pure form. In the beginning the reds carried too strong an influence of magenta and so did the blues, which turned purplish. Now after 40 generations and six million plants, the blues are beginning to look blue to some degree, and the reds are an imitation of scarlet. By selecting the bluest and interbreeding them, the magenta is cut to a minimum. I believe that with sufficient time and quantity of plants one might develop clarity to a point where polyanthus primroses would compete with delphiniums.

Delphiniums also have a little magenta in their blues. Compare the bluest delphinium to the bluest blue of the color chart and this will be evident. On the other hand, a visiting seedsman pointed to his blue shirt and said, "Wouldn't it be wonderful if you could raise a delphinium as blue as this?" I picked a blue floret and placed it against his shirt. His shirt, to his amazement, appeared muddy-lavender. Pure blue is the rarest color in nature. I used to dream of a sea-green blue and once discovered one in the field, the color being due, alas, to a virus infection. Another dream gone up in smoke.

I have concentrated on warming the colors in primroses by eliminating as much magenta as possible. Along the way I tried to produce larger stiff round florets in bigger umbels on strong stems, but maintaining balance. During the early quest for size, I produced some monstrosities with four inch flowers, but these were great clumsy, ugly brutes which immediately had their heads lopped off.

Polyanthus have the same color set-up as pansies and iris, so anything possible in one group is possible in the other. All it takes is time and quantity. Here and there you see a hint of the factors a combination of which will in future generations bring the ultimate. Sidney Mitchell, from whose garden some of my original polyanthus came, loved primroses. Every spring I visit with him in memory and wish that he could have seen the impossible color variations of our early dreams now finally appearing in reality.

Plant breeding is a way of life. It has been a magnificent experience for me. The only drawback is that it takes a lifetime to learn something—and then it is time to go. Of course, I have absolutely no intention of going, since I have enough work lined up for the next hundred years. The greatest satisfaction is that my strains are now distributed world wide and that they will continue to grow regardless of the fact that I personally am up to my ears in cacti and off to a new start. Perhaps I am moving to the desert in my older age to prove that cactus can be beautiful even though my friend Alfred Hitchcock calls them the villains of the plant world!

Fertilization of Trees, Shrubs, and Woody Groundcovers

JACK WIKLE

Fertilization is a term that is used and reasonably well understood in our society, yet many of us prefer the term "feeding," which although not quite as acceptable technically, somehow makes fertilization more of a practical, down-to-earth kind of thing.

Label the process what one will, the purpose of this article is to consider supplying supplementary nutrient elements for trees, shrubs, and woody groundcovers—supplementary in the sense that they are in addition to the elements already available from soil and atmosphere, and an addition to the energy foods manufactured in plant leaves. This is not a report of research results. Rather, it is a brief summary of some of the author's understandings developed by reviewing literature, discussing feeding with experienced people, and by personal experience. Hopefully, it will be of value to some who grow woody plants.

Benefits from Feeding

First, it can be said that there is general agreement that fertilizers do make a difference which can be seen. The usual response is more growth, greener color, less dieback and in general a more healthy, vigorous appearance.

Also, evidence indicates that fertilization can increase resistance to drought damage. Scientists define a plant's "water requirement" as the number of pounds of water required to produce a pound of dry matter. And in experimenting, they have found that fertilization commonly reduces the water requirement of plants. Another way of stating this is that fertilized plants will grow more, using the water available, than plants which are not fertilized. Fertilized plants also tend to have more extensive root systems which make more water available during dry periods. The explanation is that, inasmuch as water movement in dry soils is not appreciable, the only water available to roots in dry soil is that which is very close to a root surface. Thus an enlarged root system means an increased water supply.

Fertilization likewise reduces certain insect and disease problems. Many diseases are what the plant pathologists refer to as "weak pathogens" because they are only active in infecting plants which are already weak and growing poorly. Good examples are some of the root rots, canker diseases and verticillium wilt. Furthermore, there are certain insects, particularly borers, which actively select weak and declining plants when laying eggs from which destructive larva are hatched.

If not overdone, fertilization also reduces winter injury. Experimental evidence indicates this. On the other hand, excessive fertilization can increase winter damage, so it must be emphasized that application rates are important. Avoiding fertilization late in the growing season in an effort to promote "hardening" of azaleas and other shrubs prone to winter injury, is still the standard recommendation of most horticultural authorities. Therefore the plantsman is well advised in taking this precaution. However, it is the author's considered opinion that research will eventually establish conclusively that fertilizers at rates yet to be determined, even

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in late summer and early fall, will decrease winter injury rather than increase it.

Not Included as Benefit

At present, increasing survival of transplanted woody plants cannot be included in the list of fertilizer benefits. Although fertilizers are very helpful in starting such things as cabbage and tomato transplants, they have not proven beneficial in transplanting trees and shrubs. In fact, the usual pattern of results in experiments designed to evaluate transplanting is that survival is either not affected or is decreased by fertilizing. The *growth* of surviving plants is usually increased but percentage of survival is not. Some may wonder if the new "controlled release" fertilizers haven't changed all this. Although the answer may change as we learn more about the use of the new fertilizer materials, to date they have not proven as helpful in this respect as was originally hoped. In fact, it appears that the best procedure, if at all practical, is to wait six to eight weeks after transplant before initiating a fertilization program.

Research Needed to Improve Guidelines

Although there is much to learn, it's obvious that plantsmen can be reasonably successful by following the rather broad guidelines as to desirable kinds of fertilizers, application rates, etc., which have been established primarily by trial and error of practicing plantsmen rather than by formal research. One who follows these guidelines, can expect results and little fertilizer-induced plant injury. However, it seems likely that results might be improved if information were available to make possible more precise timing, more specific application rates for given kinds of plants, and more sophisticated selection of fertilizer materials to suit specific plant, soil, and cultural requirements.

Most Common Fertilizer Failures

Most of the glaring failures in fertilization seem to be the result of ignoring established application rates. In short, either too much or not enough fertilizer is used. Personal experience verifies that this is easy to do. Also, it's not uncommon to meet a man who says, "I'll never use that fertilizer again—it didn't do a thing," when he applied less than half the amount normally expected to give results; or a person who condemns a fertilizer which damaged his plants, when the amount used was four to six times the normal dosage. The other common fertilizer failure, if it can be called that, is the result of relying on fertilizer alone in attempting to correct plant problems which are caused by other factors such as over or under watering, poor drainage, compacted soils, poor plant selection, etc. To the plantsman, proper fertilization is but one part of the growing program.

What Analysis?

It is easy to become somewhat confused in selecting a fertilizer analysis since many analyses are available and many claims and counter claims are made by their manufacturers. Even the recommendations of authorities, as published in agricultural extension bulletins and similar guides, include a variety of fertilizer analyses. Three often listed are 5-10-5, 10-6-4 and 12-12-12. There is considerable difference between a product labeled 5-10-5, in which the emphasis is on phosphorus (designated by the middle number in the grade) and a 10-6-4 in which the emphasis is nitrogen (designated by the first number). One reaction to this discrepancy might be to decide on a 12-12-12 or similar formulation because it appears "balanced" in that the proportion of nitrogen, phosphorous, and potassium appears to be equal. However, this apparent balance may not correspond in any way to the balance of supplementary nutrients which would actually be of greatest benefit to a given plant.

Of the three primary elements (nitrogen, phosphorus and potassium), nitrogen is the one to which woody plants respond most often. It is nitrogen that stimulates greater growth and improved

color. Experimental work has shown little effect of phosphorus and potassium on woody plants except in areas where soils are unusually deficient in these elements. Moreover, nitrogen is the one primary element which doesn't accumulate in the soil with repeated applications. The usual pattern is that it is either used up by plants or leached out. Also, nitrogen is the primary element used in the largest quantities by woody plants. All of this is interpreted by the author as indicating that fertilizer emphasis for woody plants should be on nitrogen. Analyses might be 12-4-8, 15-5-5, 15-5-10, 20-10-10 or 30-10-10, but any other analysis which emphasizes nitrogen, meets this standard. Whether an analysis is high, such as 30-10-10 or low such as 4-1-2 is not especially important (unless extra bulk is necessary to reduce application rates by a heavy handed helper) inasmuch as equal amounts of nitrogen can be applied to a given area by using more of the low analysis fertilizer or less of the high analysis material.

Organic Versus Inorganic

Another question which arises is whether the fertilizer must contain a natural organic nitrogen source or whether a manufacured nitrogen source is equally as satisfactory. Natural organics have the support of tradition and history. The Indians used fish. Old gardeners are quoted as saying that growing anything well is a matter of using common sense and lots of manure. Bone meal receives high praise and has been used for many years by professional and amateur plantsmen. Cottonseed meal has been advocated consistently as a fertilizer for shrubs which require an acid soil.

Today, natural organic materials are almost always more expensive sources of nitrogen, phosphorous and potassium than the common formulated fertilizers. Therefore, the main justifications remaining for use of the natural organics are a somewhat slow nutrient release and the increased safety from burning which goes hand-in-hand with it. And even this is becoming a less important factor since some of the newer "synthetic organics" cost less per unit of nutrient element and release nutrients more slowly than do the natural organics.

The value of certain organics, too, e.g., cottonseed meal, in acidifying soil has been overemphasized. Although it is true that cottonseed meal has a soil acidifying effect, most of the commercial fertilizers available are far more effective in lowering soil pH.

Yet there still may be a need for natural organics in that the bulky nature of the materials makes a large overdose much less likely than with more concentrated fertilizers. Therefore, it might be said that where control of application rates is poor, natural organic fertilizers have something to offer. Otherwise, they can be considered rather expensive tributes to tradition.

How Much and How Often?

How much fertilizer should be used? How often should it be applied? These two questions go hand-in-hand. An old nurseryman once advised the author that the way to get extra good results and never burn anything is to use half as much fertilizer as it says on the package, twice as often as it says. There is a lot of wisdom in this approach, and if time is not critical, this is to be recommended, not only because the possibilities for plant injury are reduced but because the plants treated will tend to be of higher quality as a result of the more uniform nutrient element supply.

There are some problems which arise in determining satisfactory dosage and frequencies of application. Some recommendations specify so much fertilizer per shrub or inch of tree trunk diameter, while others give the number of pounds per unit of area such as an acre or 1000 square feet. It is impossible to translate accurately from the first type of recommendation to the second because in the first case, the amount of soil to which the fertilizer is to be applied is not specified. The so-much-fertilizer-per-plant treatment is haphazard at best. An amount which might be quite safe if applied over a four foot diameter circle,

TABLE
TWO LBS. FERTILIZER PER INCH OF TRUNK DIAMETER

	Treated Circle			
Trunk Dia.	*Dia.*	*Area*	*Lbs. of Fertilizer*	*Lbs. of Fertilizer per 100 sq. ft. (approx.)*
6 in.	12 ft.	113 sq. ft.	12	10
3 in.	6 ft.	28 sq. ft.	6	20
1½ in.	3 ft.	7 sq. ft.	3	40

may cause severe damage or death if applied over a circle of half the size (which would increase the dosage four times).

To look at this in another way (see table), following a common recommendation of two pounds of fertilizer per inch of trunk diameter, one might treat a twelve foot circle in feeding a six inch tree. Calculations show this application rate to be slightly more than ten pounds of fertilizer per 100 square feet. Following the same recommendation, in feeding a three inch tree, one might treat a six foot circle, which would be more than twenty pounds of fertilizer per 100 square feet (the dosage per square foot has been doubled). Using the same approach in feeding a one and one half inch tree, the application rate is well over forty pounds of fertilizer per 100 square feet (four times the dosage used on the six inch tree following the same recommendation). This is an overdose by any standard.

As can be seen here, damage from overfertilization is most likely when small plants are being fed or small areas are being treated. And to increase the hazard, humans are much more likely to use four ounces of fertilizer where the directions say two ounces than they are to use four bags when the directions say two!

Also, there are many situations where obstacles squeeze down the area which can be treated with fertilizer. How much fertilizer does one use in feeding the tree planted in the corner where the house and paved driveway meet? How much fertilizer does he use in feeding the evergreens wedged in the awkward little strip left between the walk and the front of the house? How much fertilizer for the azaleas that were crowded a bit to get enough of them into a planter to make a good show? If an amount of fertilizer recommended per plant is used on the limited soil area available for treatment in these cases, or if as often happens, the dosage is increased because the growing conditions are poor, damage is likely.

For consistency and safety, all fertilizer dosages should be based on the size of the soil area to be treated (pounds per square foot, pounds per 100 square feet, pounds per acre, etc.), rather than plant size and/or number of plants. The area treated should be where one can find or would expect to find roots. This may be, as commonly suggested, an area equal to the branch spread for some trees and shrubs, but more often roots will be found extending two to three times as far as the branches extend and a thorough feeding job will take advantage of this extra area for fertilizer application.

Because of the great variety of fertilizers available, it is necessary to select some common denominator in making general statements on dosage rates. In this case, pounds of nitrogen per 1000 square feet will be used because it's felt that nitrogen dosage is, as previously stated, more critical than phosphorus or potassium rates.

Suggested Dosage

The suggested dosage which follows is offered as one which should be sufficient to grow vigorous, healthy looking plants and at the same time allow an ample margin of safety in situations where overdoses, unusual soils, delicate plants, etc., occur. The overall recommendation is to apply four to six pounds of nitrogen per year from a high-nitrogen fertilizer (50 lbs. of 12% nitrogen fertil-

izer would contain 6 lbs. of nitrogen). This four to six pounds of nitrogen should be divided between one or two applications for trees, two or three applications for most shrubs and groundcovers, and three or four applications for plants recognized as being somewhat delicate and/or of borderline hardiness in the area where they are growing.

In situations where a decomposable low-nitrogen mulch (such as woodchips, sawdust, ground corncobs, etc.) is used, it will be necessary to at least double the amount of nitrogen applied per year to supply the additional nitrogen required by the microorganisms which are active in decomposing the mulch.

Application Techniques

Fertilizer application techniques vary. Dry fertilizers are commonly broadcast over the soil surface or put into holes in the soil made with a punch bar or auger. Fertilizers in solution have been used as soil drenches and injected into the soil under pressure (these solutions usually contain 5 to 10 lbs. of fertilizer per 100 gallons, and water must be used to rinse thoroughly any foilage contacted). Also, fertilizer solutions are sprayed on foliage in "foliar feeding" (these solutions commonly contain 2 to 5 lbs. of soluble fertilizer per 100 gallons, and foliage is not rinsed).

Although there are many considerations determining which application technique should be advocated in a given situation, a few points can be made. First, good soluble formulations are generally more expensive than insoluble fertilizers. Therefore, solubles are suggested only when solubility is a requirement. Second, the primary reason for putting fertilizer into the soil is to avoid damage to turf or other delicate groundcovers in the treated area. Deep placement of fertilizer containing phosphorus (which is quite immobile in most soils) may be helpful in some cases, but generally there is no consistent advantage in putting fertilizer into the soil rather than broadcasting it over the surface, for woody plants. Third, foliar feeding, although valuable as a "shot-in-the-arm," cannot supply continuing requirements unless applied regularly at intervals as short as seven to ten days, because only limited amounts of fertilizer can be applied at one feeding without damaging the foliage. Combined benefits of foliar feeding and a soil drench can be obtained by allowing heavy runoff when spraying foliage.

Applying small amounts of fertilizer at regular intervals by injecting them into irrigation water appears to be an excellent fertilization technique when well engineered injection equipment is available. Commercial growers have been very successful in using this technique. Good information on installation and operation of this kind of system is available, and the future will probably see its expanded use in maintaining high value plantings everywhere.

There is much to be learned about developing fertilization programs for woody plants and it must be re-emphasized that proper fertilization is but one facet of growing plants successfully. Watering, soil improvement, pest control and other cultural considerations must also be given attention when problems persist.

Eucalyptus at Disneyland

MORGAN EVANS

The genus *Eucalyptus* covers a range of nearly 45° of latitude, with species numbering in the hundreds (all but two native to Australia and Tasmania) and varying from shrubs to 300-foot giants. With such a source to draw on, it is not surprising that governmental agencies around the world have been able to produce thousands upon thousands of acres of stately forest where no trees grew before.

For Californians, the *Eucalyptus* profile has become so much a part of the coastal scene that we sometimes need to remind ourselves of the friendly debt we owe Australia for its presence here. As a happy aside, it might be noted that our own Monterey pine has found a congenial home in Australia, where it is enthusiastically embraced by government and private industry alike for afforestation purposes.

Thanks to men like John McLaren, who created Golden Gate Park in San Francisco, John Morley, who did the same thing for Balboa Park in San Diego, Dr. Metcalf and Max Watson of San Francisco, nurserymen, and landscape architects too numerous to mention, the eucalypts enhance the scene in parks, groves, avenues, gardens, orchard windbreaks, and freeways, from the Mexican border northward for approximately 600 miles. Selected species are being tested much farther north, and renewed interest in the genus will undoubtedly lead to trials in areas heretofore considered unsuitable for their culture.

Although noble individuals of the common blue gum, *Eucalyptus globulus*, are to be found on the San Francisco Peninsula and elsewhere in southern areas, the preponderant choice of this spe-

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Fig. 1. (left) *Eucalyptus saligna*; direct transplant to new location, Disneyland 1966 (see Fig. 2).
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Fig. 2. (below) *E. saligna*, 1967; same tree as in Fig. 1.
PHOTO WALT DISNEY PRODUCTIONS

cies for windbreak purposes led to its further use in many inappropriate circumstances. Blue gum became synonymous with *Eucalyptus,* and understandably earned the group, albeit unfairly, a bad name. A country lane might support this giant for many years, but as an urban street tree, *E. globulus* very quickly became a menace.

Considering that a choice might be had from the more than 600 species of *Eucalyptus* occurring naturally in Australia, it is surprising that often little care or imagination was given to selection for early California planting—this despite the counsel of the plantsmen mentioned above. In 1937, for example, when "Standardized Plant Names" was being revised, Eric Walther, then Director of Strybing Arboretum in Golden Gate Park, was able to supply the names of 109 species growing in the San Francisco area alone. Fortunately, a number of decorative types, ranging from small garden trees such as *E. caesia* to stalwarts like *E. viminalis,* found sufficient acceptance to maintain interest. In between would fall *E. erythrocorys, ficifolia, lehmannii, cinerea, polyanthemos, citriodora, rudis, cladocalyx, camaldulensis,* and *sideroxylon,* to mention a few.

Early Plantings

In the early days of Disneyland, it was desirable to achieve mature planting effects as quickly as possible, and where the idiom was appropriate, eucalypts proved extremely useful. About two dozen species afford ample range in meeting requirements, with the emphasis on perhaps half that number. Included are two relatively little used species, *E. saligna* and *E. grandis.* These two are closely allied, and though considered by some to be forms of the same tree, are given distinct species status with the vernacular of rose gum and Sydney blue gum, respectively, by some Australian authorities. However this may be, they have proved especially fast-growing subjects at Disneyland, developing a handsome skyline profile about 40-feet high in five or six years. A recent avenue of *E. saligna* set out two years ago from 4-inch pots now stands 15 feet high, broad and robust in proportion.

When it was first opened to the public in 1955, Walt Disney said, "Disneyland will never be completed as long as there is imagination left in the world." True to that declaration, Disneyland has undergone many major changes, adjustments, additions, and in some cases, complete re-design. Keeping pace with the literally changing scene, landscaping components have been repeatedly rearranged. Faced with the need to destroy or salvage, but to remove in either case, the landscape department undertook experimental transplanting of a wide variety of trees and shrubs. Because the soil was of an extremely sandy character, and because much of the established landscape occupied steeply sloping terrain, conventional transplanting techniques were difficult or impossible. At first, only the more tolerant plant species

were subjected to bare root removal, but progressively more and more species were handled in this manner, until today it is standard practice at the Park to pick up, one by one, the entire collection with bucket loaders and swing them by the neck to storage pits or new locations without recourse to root packaging in any form. The aforementioned *Eucalyptus* have figured prominently in this transplanting exercise, and more than a hundred reasonably mature trees, comprising a half dozen species, have been handled bare root with remarkably good results. (See Fig. 1.) In order to avoid injury to the cambium layer, a hole is drilled through the trunk and a steel pin inserted, thus providing a convenient handle for the lifting cable. Once in place in its new home, the tree is guyed against winds, the pin removed, and the hole plugged with a carefully fitted hardwood dowel. Roughly 70 per cent of the leaf surface is removed by pruning small branches immediately prior to the move. Some earth may remain at the center of the root system, but for all practical purposes, the operation amounts to a bare root transplant. In most instances, the original growth is recovered within a period of one year, and two-year-old transplants can scarcely be distinguished from unmolested companions. It should be pointed out that the sandy soil, while unsuitable for boxing or balling, offers a distinct advantage for bare rooting.

Fig. 3. Disneyland's famous Sleeping Beauty Castle, showing the park-like setting of the area.

PHOTO WALT DISNEY PRODUCTIONS

Disneyland, Florida

With the new Walt Disney World project moving rapidly ahead in Central Florida, the Disney landscaping department is confronted with essentially the same need for "instant landscaping," under circumstances in some respects analogous to those of Southern California, but in certain others, quite different. Although native trees are present in vast numbers on the Florida property, the need to elevate the Theme Park site by several feet will present the landscape architect with a gleaming expanse of pure white sand, unsullied by so much as a blade of grass. In order to conjure up the varied scenes conceived by Disney artists, a broad plant palette will obviously be required, and although potential salvage of native trees may contribute an important part, there will still be need for a great number of fast-growing exotic species. It is in this area that cultivars of *Eucalyptus* offer attractive possibilities.

Individually or collectively, the solution for that graceful silhouette, visual screen or wind barrier might be found

among these evergreen hardwoods.

Opportunities for landscape enhancement via the *Eucalyptus* route are not confined to the man-made sites, but include large areas of existing grade somewhat akin to pastureland. Whereas normal maintenance practice, and therefore some control over moisture content in soil, is possible on the elevated grade, an extremely high water table in the native meadows narrows the option in eucalypt choices. In addition to high water table, high rainfall, high temperatures, occasional high winds, low pH, and even lower fertility rate round out the environmental parameters. Lest this sound too easy, it should be added that the possibility of several sharp frosts every winter dispells complacency.

Fortunately for the Disney landscape planners, a *Eucalyptus* testing program was undertaken by a private sponsor in cooperation with the U. S. Department of Agriculture and the Florida Forestry Service approximately four years ago in the vicinity of Fort Myers, Florida. Under the direction of Mr. George Meskimen and Mr. Howard L. Hoffman, some twenty species of eucalypts from various provenances were tested. Approximately fifty different seed accessions were processed through nursery stages and planted into the field in very small sizes, where apart from simple weed control, they were left to their own devices. It is interesting to note that in many instances, seed from sources other than the native stands produced trees superior in nearly every respect. For example, *E. camaldulensis* seed gathered from man-made groves in Spain and Israel out-performed that received from indigenous forests in Australia. Site preparation included two or three approaches, but best results were achieved by gentle mounding for improved drainage and the addition of a small quantity of rock phosphate. Land was typically flat, sandy terrain, which had to be cleared of native grasses and rather sparsely occurring saw palmetto, a condition similar to that existing on much of the Disney site.

Three and one-half years of growth produced a number of trees 30 feet high, with sturdy, tapering trunks, which successfully passed the trials of torrential summer rains, fall winds, and winter frosts. Comparing notes, it was reassuring to find that the most successful species coincided with those set out recently in a test planting on the Disney site. What was of considerably more interest, however, was the unquestionably superior performance of the European seed.

Fig. 4. *E. globulus* en route to new location, Disneyland.

PHOTO WALT DISNEY PRODUCTIONS

Eucalyptus are by no means new to Central Florida, although their use has been quite limited. Here and there handsome old specimens may be found, principally *E. camaldulensis, robusta,* and apparently *viminalis,* although positive identification of the latter is not easy. In recent years, quite a number of eucalypts have been planted as ornamentals in the general vicinity of Fort Myers, largely as a consequence of the exposure provided by the state and federal forestry services and the aforementioned privately sponsored project now happily being continued by the U. S. Department of Agriculture. The Florida State Forestry Service produces an annual crop of *Eucalyptus* in several species, which is made available to qualified growers. In the Lakeland area, an amateur enthusiast, Mr. Robert Snow, has been responsible for the testing and dissemination of a number of worthy species to be seen here and there in parks and residential gardens.

Although the seedling tree planted *in situ* and undisturbed thereafter undoubtedly produces the strongest specimen, the proven feasibility of transplanting has led to a test planting of several thousand young trees at the Disney project site. The principal objective, in this instance that of providing a fast-growing screen, can be realized while at the same time affording an ample supply of transplant candidates selected for individual quality.

The pines and cypress which stretch for miles and presently dominate the site are justly deserving of the respect they enjoy, but they lack the special architectural quality of the Australian gums. The native trees, moreover, are relatively unyielding to the wind, whereas the leaves and pendant branches of the *Eucalyptus* are responsive to the slightest breeze, conveying a sense of life and vitality completely lacking in the coniferous trees.

If good fortune attends this planting program, Walt Disney World may be able to offer among its many attractions a landscape in which the familiar pine tree horizon is agreeably accented by the graceful profile of soaring *Eucalyptus,* if not instantly, at least quickly realized.

Fig. 5. Two-year old *E. saligna* at Disneyland. Fourteen-foot fence for comparison.

PHOTO WALT DISNEY PRODUCTIONS

Nutrition of English Holly (*Ilex aquifolium*) In Oregon

R. L. TICKNOR, A. N. ROBERTS AND O. C. COMPTON

Leaf analysis in most cases has proved superior to soil analysis in determining the nutritional needs of woody plants. However, both of these techniques can be useful in diagnosing nutrient deficiencies in orchards and in properly managing fertilizer programs. A survey, using both soil and leaf analysis techniques in 47 holly orchards in the Willamette Valley and northern coastal counties of Oregon, was made to determine the general level of nutrition in these orchards and to identify areas in the state where specific nutritional problems might exist. Five cultivars, representing three types of English holly, were sampled. The cultivars 'Bleeg' and 'Curley' represented the greenstem type, 'French-English' and 'Rederly' the bluestem type, and 'Silvary' a silver-variegated selection.

The ten trees in each orchard to be sampled were selected at random, except that no tree next to a male tree was sampled since these sometimes have unusually heavy berry crops. Leaves were collected for chemical analysis in July, at cessation of extension growth; in November, at harvest time; and in April, just before new growth started. Standard laboratory methods were used for the leaf and soil analysis.

Variations in Nutrient Content

Area, orchard, seasonal, and clonal differences in leaf nutrient content were found. All elements except calcium and magnesium were higher in the coastal orchards, where the annual rainfall averages 80 inches and light intensity is lower than in the valley orchards, where rainfall averages 40 inches and light intensity is higher. Nitrogen, calcium, and magnesium levels were highest in November, with levels in July and April being approximately equal. Phosphorus decreased markedly between July and November but was at approximately the same level in April as in November. Potassium content of the leaves was highest in July, intermediate in November, and lowest in April. The boron content of the leaves remained relatively constant throughout the three sampling dates. The greenstem hollies 'Bleeg' and 'Curley' had the highest nutrient content, intermediate were the bluestem 'Rederly' and silver-variegated 'Silvary', while the lowest nutrient content was found in the 'French-English' cultivar. Only in the case of potassium did there appear to be a relationship between the soil and leaf analysis, but not with all cultivars.

Orchard Ratings

Holly sprays should have a proper balance of firm, red berries to dark, glossy, green leaves when they are cut in November for storage and later shipment. The annual growth on these shoots is normally 7-10 inches in length. These factors were considered in rating the orchards as being good, average or poor.

The nutrient content of the July leaf samples from several orchards is shown in Table 1. The table presents average values for the cultivar and location and,

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where possible, values for a good and poor orchard in a given location. It was not always possible to make these comparisons, since there were not enough plantings to give differences in product quality for all cultivars. In addition, the average leaf nutrient of *I. cornuta* 'Burford', *I. crenata* 'Convexa' and *I. opaca* 'Silica King' from the greenhouse solution culture work of Dunham (1) is included.

There appeared to be some relationship between quality and the leaf content of certain nutrients. On the average, leaves from the better orchards contained higher amounts of nitrogen, magnesium and boron but lower amounts of phosphorus and calcium. The potassium content of the leaves of greenstem cultivars was about average in the good orchards but this was not true for the bluestem varieties.

Problems Revealed

The survey revealed two possible problems associated with the leaf nutrient content. The yellowing of 2-year-old leaves associated with the fruit clusters was a common cause for holly not being salable. In the good orchards the 2- and often the 3-year-old leaves were still dark green. Since survey samples were confined to 1-year-old leaves, the cause of this yellowing in the 2-year-old leaves was not elucidated. Greenstem hollies were found to be more subject to this yellowing and defoliation of 2-year-old leaves than were bluestem types.

Boron deficiency was found to exist in some of the orchards sampled. Roberts et al. (2) had earlier described the symptomology of boron deficiency in *I. aquifolium* as developed in greenhouse solution culture. The purple, target-spot

TABLE 1.
LEAF NUTRIENT CONTENT OF SEVERAL REPRESENTATIVE *ILEX AQUIFOLIUM*[1] ORCHARDS IN OREGON WITH LEAF ANALYSIS RESULTS FROM GREENHOUSE TRIALS WITH *I. CORNUTA*[2], *I. CRENATA*[2] AND *I. OPACA*[2] (DRY WEIGHT BASIS).

Cultivar	*Orchard Location*	*Quality or Amount*	*N* %	*P* %	*K* %	*Mg* %	*Ca* %	*B* ppm
I. aquifolium		Average	1.89	.108	1.46	0.26	1.22	38.3
'Bleeg'	Valley	Good	2.22	.125	1.87	0.28	0.90	45.7
	Valley	Poor	1.74	.086	1.60	0.22	1.20	34.3
	Coast		1.87	.118	1.40	0.21	0.65	35.5
I. aquifolium		Average	1.84	.109	1.70	0.23	0.87	32.5
'Curley'	Valley	Good	1.97	.104	1.65	0.26	0.90	33.1
	Coast	Good	2.05	.135	1.60	0.18	0.65	34.3
I. aquifolium		Average	1.65	.105	1.31	0.28	0.75	26.2
'French-English'	Valley	Good	1.85	.099	1.00	0.33	0.70	21.8
	Valley	Poor	1.52	.093	1.10	0.35	0.85	37.8
	Coast	Good	2.07	.150	1.55	0.22	0.75	29.6
	Coast	Poor	1.67	.118	1.45	0.24	0.70	27.4
I. aquifolium		Average	1.73	.111	1.46	0.31	0.90	27.7
'Rederly'	Valley	Good	1.78	.099	1.60	0.36	1.05	21.3
	Valley	Poor	1.72	.092	1.97	0.25	0.95	29.6
	Coast	Good	1.77	.163	1.45	0.22	0.70	39.0
I. aquifolium		Average	1.83	.112	1.15	0.28	0.81	28.6
'Silvary'	Valley	Good	2.00	.110	1.00	0.30	0.75	34.3
	Valley	Poor	1.64	.108	1.30	0.27	0.90	28.5
	Coast	Good	1.75	.148	1.35	0.27	0.85	35.5
	Coast	Poor	2.04	.135	1.20	0.27	0.60	29.6
I. cornuta 'Burford'		Average	1.79	0.18	1.79	0.62	1.10	41
I. crenata 'Convexa'		Average	1.67	0.16	1.75	0.45	1.30	34
I. opaca 'Silica King'		Average	1.79	0.15	1.68	0.39	0.70	46

[1] Results of July sampling.
[2] Results from Dunham, et al.[1]

symptoms typical of boron deficiency were always found on the leaves of bluestem cultivars when the boron content of the leaves was below 20 ppm. Symptoms were sometimes found between 20 and 25 ppm, but when the leaf content was about 25 ppm, deficiency symptoms were not observed. Leaf symptoms of boron deficiency were not observed in silver-variegated 'Silvary' or the greenstem cultivars.

Conclusions

The nutrient content of English holly leaves varies with cultivar, orchard, area, and with the changing season.

The better orchards usually contained trees whose leaves were higher in nitrogen, magnesium and boron, but somewhat lower in phosphorus and calcium, than average.

Two possible nutritional problems were observed during the survey. These were yellowing of 2-year-old leaves associated with heavy fruit clusters and purple spotting of the leaves associated with deficiency levels of boron.

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Excerpt From Peter J. Van Melle

On "Die-back" Shrubs (1948)

In a rather lengthy discussion under this title, Van Melle discusses shrubs which are mostly summer or fall-blooming species, in which the flowers are produced on the new growth. Some of these plants, such as Vitex, *are only "root-hardy" and must be spring-pruned. He goes on to say:*

In very mild winters some of them may be frozen back only slightly. But since the place allotted to them in the garden picture is usually that of a single summer's growth. I prefer to cut these shrubs uniformly, every spring, down to mere stubs, regardless of how far they may have been killed back. This extreme form of spring pruning represents an annual rejuvenation process. We raise practically a new shrub every summer, from its base. In this way we achieve a controlled, artificial but efficient use of many kinds of shrubs that would otherwise be difficult to manage in the garden picture.

(Shrubs which should be treated in this manner):

Hydrangea arborescens 'Hills of Snow'	*Spiraea* × *'Anthony Waterer'*
Hydrangea radiata	*S.* × *bumalda, froebilii, fritchiana*
Abelia × *grandiflora*	*Amorpha fruticosa*
Buddleia davidii (all cvs.)	*Lespedeza thunbergii*
Caryopteris incana	*Vitex agnus-castus & negundo*
Clerodendrum trichotomum	*Tamarix odessana*

Box Huckleberry—A Much Neglected Native

HAZEL AND DON SMITH

Gaylussacia brachycera, an exclusively North American species, is indigenous to restricted areas of the northeast. It is found in concentrated, sometimes isolated, colonies along the Cumberland Plateau, parts of the Alleghenies, and in three separate lowland spots in Maryland and Delaware.

For one hundred years after André Michaux discovered this plant, in the 1790's, its history was shrouded in mystery. It was alternately "lost" and "found" by scientists, and by 1919 the plant was believed to be almost extinct. Its major concentration was in one area near New Bloomfield, Pennsylvania. This fascinating story through the 1920's has been well covered by F. V. Coville (1) and Edgar T. Wherry (2). There is every reason to believe that individual isolated colonies, often covering several acres of ground, have developed over a great span of years from a single seed. Colonies of this plant spread laterally in the wild by underground stolons, approximately six inches a year. Isolated colonies are nearly self-sterile. No seedlings could be found after careful checking at the Amity Hall, Pennsylvania, locality, and no germination was obtained from seeds collected from this colony. Healthy seedlings were obtained by Dr. Wherry from plants cross-pollinated with plants from Delaware (3).

Writing of the Amity Hall clone, Dr. Moldenke (5) reports, "The colony is not a series of small plants, but one plant connected by underground stolons. . . . There was not the slightest variation of morphological characteristics of the members from one end to the other." This particular plant has been estimated to be 13,000 years old. According to Dr. Wherry, several writers have questioned the age of box huckleberry patches, on the absurd ground that the estimates are based on misunderstanding of such terms as "clone" and "stolon." Actually, the age is ascertained just as that of a tree: by measuring the annual growth-increment.

Description

Whether or not one accepts the box huckleberry as the oldest living plant in the world, one would agree, after seeing it in cultivation, that it is a charming plant. When grown in full sun, its dark evergreen leaves set off the bell-like blossoms which appear in May and are white, flushed with pink. By August the flowers have ripened into light-blue berries, both beautiful and good to eat. In winter the extra dividend appears as the leaves turn to rich mahogany-red, with fat buds nestled at their base. It is attractive all year.

We fell in love with *Gaylussacia brachycera* ten years ago when Mr. Fordham at the Arnold Arboretum gave us a small plant for propagation. When our customers saw it, they too wanted one. Propagation was slow, so we started what proved to be a futile search for wholesale or retail sources. A few plantsmen had once carried it, but it had gradually been forgotten, like so many plants—perhaps because it was errone-

The Don Smiths operate the Watnong nursery, at Morris Plains, New Jersey 07950. They specialize in dwarf and slow growing evergreens.

ously thought difficult to propagate from cuttings. Our interest in its history was aroused and for the past few years we have enjoyed collecting information about the box huckleberry, seeing as many colonies as we could, propagating it by cuttings, growing and distributing small plants in an attempt to make it better known. Thus we help to preserve the species, the colonies of which, being self-sterile, are lost when roads and other clearing operations for "progress" occur.

Distribution

We have seen the box huckleberry growing in its farthest eastern area at sea level in Bethel, Delaware, and at 2100 feet in West Virginia. Plants at Millsboro, another locality in Delaware, have been exterminated by civilization. We have also seen it at East Jamestown and Rugby, Tennessee, and at Amity Hall, northwest of Harrisburg, Pennsylvania. In 1901, Gattinger reported finding it at Parksville, Tennessee, but did not document this. That area is now a huge dam. Observe from the map (Fig. 1.) how this plant occurs along the Cumberland Plateau and in the Alleghenies; note also the great gap in distribution from Cass, West Virginia to Amity Hall. Perhaps it is there, just waiting to be found. There is also the small area along the coast. The greatest concentration of known colonies is along the southeastern border of West Virginia, where Michaux first found this lovely groundcover.

Having checked old records, we spent a week in the fall of 1967 searching areas mostly in Tennessee and Kentucky, just touching West Virginia. With our appetite whetted we then spent two weeks in the Cumberland and Appalachian areas hunting more colonies, old and new. The mountain people knew this useful berry under several local names: juniperberry, bear-, cliff-, winter-, or Jerusalem huckleberry. They were quite willing to show us where it grew, often far off the beaten path.

The way in which the common names came into use is fascinating. In the early 1800's it was known as whortleberry, this being the early name for *Vaccinium*, the genus in which Michaux first placed this plant. When Asa Gray classified it as *Gaylussacia brachycera* in 1846, he de-

Fig. 1. Distribution of *Gaylussacia brachycera*.

MAP MADE BY JOHN J. LARKIN

Fig. 2. (a) Growing at Longwood Gardens from plants collected at Bethel, Delaware. Height, 6-8 in.
LONGWOOD GARDENS PHOTO

scribed the leaf as box-like, and it became the box huckleberry. In West Virginia, it is known as juniperberry, a corruption of June berry, the name used by the early settlers for blueberries that ripened in June, and eventually the name used for this July huckleberry. In Kentucky and Tennessee the use of bear-, cliff-, or winter-huckleberry is understandable. Bears are berry eaters; the plant follows the edge of sandstone ridges; and it is the only huckleberry that is evergreen. But we have not found the reason for the name Jerusalem huckleberry.

On our most recent trip we had the satisfaction of trying to track a number of the colonies found by Rev. Fred Gray and referred to in his article (4). Having advertised for "known patches of juniper berry in West Virginia," he received 75 replies. He tracked down 41 of these stations and showed many of them to Dr. Wherry in 1921. Notes of these findings had kindly been given to us by Dr. Wherry, and we set out 48 years later to find "patch #13, 4 miles up from White Sulphur Springs, West Virginia, towards Anthony's Creek to John Alderson's and up Two Lick Hollow to a low place between this hollow and Old House Hollow, 2¼ miles back from road." That one we have not yet found, but of the fifteen colonies we did check, all but one were still there, and many others were nearby. The farms were still known by the local people, although original owners might long since have passed on, and everyone was friendly and interested in helping as much as possible.

The box huckleberry was evidently sent to Europe by Michaux, for it is recorded as having been brought into cultivation in 1796. It was described under the name *Vaccinium brachycerum* by Richard A. Salisbury about 1805, in a work on plants around London which bore the romantic title, "Paradisus Londinensis." It has been cultivated for a number of years in Oregon and Washington. Three years ago we sent it to the Trompenburg Arboretum in Rotterdam, Holland, where it is growing suc-

Fig. 2. (b) Growing at Longwood Gardens from plants collected in Perry County, Pennsylvania. Height 6-8 in.

cessfully. We have sent plants to St. Helena, California, and our grandson is trying it near Dallas, Texas. Last year the Arnold Arboretum sent plants as far north as Canada. It will be interesting to learn how it adapts to north and south climatic extremes.

Growth Habit in the Wild

We have seen 27 different colonies of *Gaylussacia brachycera* which have varied in height from 3 to 20 inches, with leaf size varying from ¼- to ¾-inch long. In dry woods where it is the predominant ground cover, it is taller and thinner in both stem and leaf structure. In moist woods, when growing with other ericaceous plants, the leaves and stems tend to be heavier and foliage generally more lush. On the edge of woods, where it is heavier textured and gets more light, it sets more buds. The more sunlight, the more colorful the foliage, stems and buds in winter. There is often considerable variation of leaf size on an individual plant—a young vigorous shoot with large leaves appearing from a small-leaved plant.

There is a strange abruptness to the limits of the growth of a colony. It has never been known to cross or jump streams. It will often grow for great distances in one direction along a steep north and west bank, perhaps in a thirty- or fifty-foot wide swath for a quarter-mile. When found on decaying white pine stumps, growth is especially lush. Twice in Pickett State Park, Tennessee, it was seen protruding from under the bark of a live white pine tree three feet above ground level. We found our only seedling in the wild here, in a decaying pine log.

Elsewhere, colonies were found in these types of soil and growing conditions:

Moist, moss-covered, well-drained; damp sandstone, well-drained; wet leafmold over clay, poorly drained; dry woods, sand with light leafmold, often over a clay base; almost pure sand, very dry, with light leafmold.

Plant communities associated with box huckleberry included the following:

Trees:

- Oaks (*Quercus* spp.)
- Hard maple (*Acer saccharum*)
- Dogwood (*Cornus florida*)
- Cucumber magnolia (*Magnolia acuminata*)
- Holly (*Ilex opaca*)
- Canadian hemlock (*Tsuga canadensis*)

Shrubs:

- Mountain-laurel (*Kalmia latifolia*)
- Witchhazel (*Hamamelis virginiana*)
- Maple-leaf viburnum (*Viburnum acerifolium*)
- Inkberry (*Ilex glabra*)
- Bayberry (*Myrica* sp.)
- Blueberry (*Vaccinium* spp.)
- Rhododendrons (*Rhododendron* spp.)

Groundcover plants:

- Teaberry (*Gaultheria procumbens*)
- Partridgeberry (*Mitchella repens*)
- Trailing-arbutus (*Epigaea repens*)
- Wandflower (*Galax aphylla*
- Wild-ginger (*Asarum canadense*)
- Catbriar (*Smilax* spp.)
- Climbing fern (*Lygodium palmatum*)

Growth In Cultivation

Where it does not have competition it makes a much more compact ground cover than in the wild, and for us, has flowered and berried quite heavily. Grown in semi-shade, without competition, box huckleberry remains a low, slowly spreading carpet.

Worth noting are three plants that have been growing in the same area for 10 years. One is a handsome patch in the slat house at the Case Estates of the Arnold Arboretum in Weston, Massachusetts. The other two are found side by side in the rock garden at Longwood Gardens, Kennett Square, Pennsylvania though these are from different areas. One comes from Pennsylvania, the other from Delaware. The two plants make an almost impenetrable cover six to eight inches high; they are approximately three feet in diameter. Note (Fig. 2) the difference of leaf size and growth habit each has retained.

Propagation

Contrary to much of the literature on the subject, we have found *Gaylussacia brachycera* roots well from cuttings, and when taken *carefully* from the wild in small amounts, it can be successfully moved. Our experience has been that box huckleberry cuttings, like those of the blueberry, give the highest percentage of rooting when taken between March 15 and April 15, although they do root when taken in October and November. When the wood was too soft we were less successful. Our rooting mixture has been half peatmoss and half perlite, in the greenhouse, in both the open bench and the vapor box. Controlled scientific studies of rooting cuttings, relative to timing, wood age, variation in individual colonies, and other factors, are being carried out by Professor Marvin Runner, Department of Horticulture, Pennsylvania State University. These will undoubtedly prove informative.

Seedlings are scarce in nature, but there is conclusive evidence that cross-pollination produces viable seeds. Studies in relation to seed fertility are being made by P. E. Marucci, Research Specialist, Entomology, Cranberry and Blueberry Research Laboratory of Rutgers University, New Brunswick, New Jersey; and C. E. Heit, Seed Technologist, Department of Seed Investigations, New York State College of Agriculture. After checking seed sent from our nursery, where plants from different areas are growing close together, both men found high percentages of non-viable seed. However, two factors would warrant further study of seed fertility, one, the fact that the berries were not received fresh; and two, Mr. Marucci found frass similar to that found in bluberries, indicating the possibility of *Lepidoptera* larvae.

Alfred Fordham, chief Propagator at the Arnold Arboretum, collected ripened seed of plants from at least three different areas near their greenhouses. Seventy-five percent of the first

batch was sound, but only 20 percent of a later one. Seed picked and planted August 15 started to germinate in 11 weeks; those picked and planted September 18 germinated in six weeks, and there are now flats of healthy young seedlings growing in the greenhouse. Part of each batch was given a three month cold treatment at 40 degrees and was sown November 15 and December 23; none had germinated by February 22. The outcome of these studies will prove interesting.

Natural Settings

Box huckleberry can be seen in its natural setting in several areas where it is protected. (Fig. 3.) A four acre tract near New Bloomfield, Pennsylvania, given to the State Department of Forests and Waters in 1929, was set aside as the state's thirteenth "National Natural Landmark" on July 11, 1968. There are acres of *Gaylussacia brachycera* in the parks at Cumberland Falls and Yahoo Ridge in Kentucky. The largest area we have encountered is in Pickett State Park near Jamestown, Tennessee. Here you may wander through eight square miles of unspoiled wild areas where box huckleberry is the predominant ground cover along the footpaths. The owner of the Delaware area has become aware of the historical and botanical significance of this colony, so it too may become a protected preserve.

The box huckleberry should continue to be protected so it may become better known and more used in our gardens. It is being propagated by three wholesale and a few retail nurseries (6) so will be available soon. We hope you will see this "neglected native" in the wild and will enjoy growing it in your garden.

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6. Nurseries with *Gaylussacia Brachycera.*
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   Mayfair Nurseries, Nichols, New York 13812 —a few now, more spring 1970
   Leslie's Wildflower Nursery, 30 Summer Street, Methune, Massachusetts 01844—spring 1970
   Only at nursery—
   Watnong Nursery, Morris Plains, New Jersey 07950

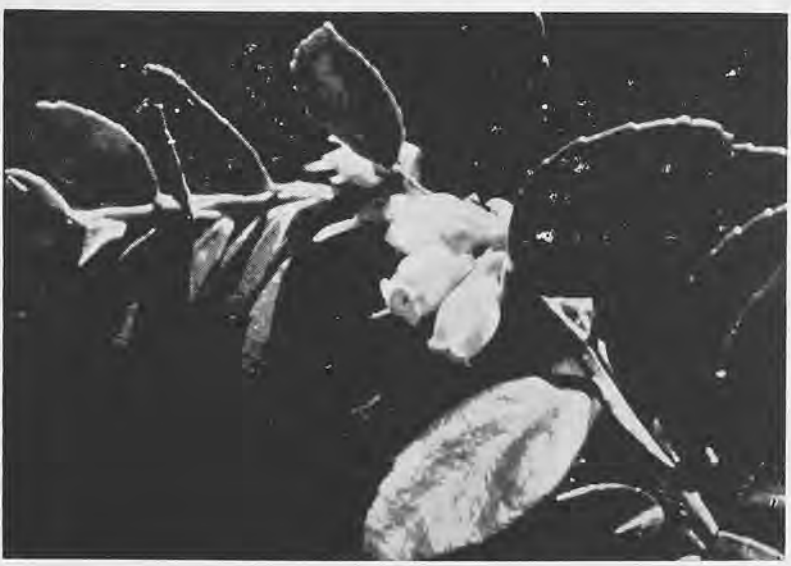

Fig. 3. Closeup of branch with flowers.
Photo by R. J. Pringle

Vernonia— A Useful Native for Gardens

SAM B. JONES

The genus *Vernonia* (ironweed), a member of the Composite or Sunflower family, is a rather large genus with an estimated 1,000 species in southern Asia, Africa, and the new world. It was named for William Vernon, 16??-1711, an English botanist who traveled in North America. This paper, however, will only discuss the 19 species native to the United States. Our species are perennial herbs with erect, unbranched leafy stems and alternate leaves. The flowers are in heads which are collected together in a large rounded terminal cluster. The corollas are usually purple, or very rarely, white or pink. The typical purple flowers match the deep reddish purple (10P 3/9) on the Nickerson Color Fan. Color photographs of most of our native species of *Vernonia* may be seen in Rickett (1967). It is of interest to note that most of the horticulturally desirable species are included in his photographs and may be identified from these excellent photographs.

My interest and enthusiasm in the group has developed in connection with research since 1961 into the systematics and evolution of the species indigenous to eastern North America. That these plants have not been grown and used in our gardens is probably due to their common name of ironweed. It is true that several of them do become weedy in over grazed or neglected pastures or rangeland. This is, however, partly the result of man's activities and not that of the plant alone. On the other hand, all of them have been grown in the transplant garden and in the greenhouse and have not been found to be aggressive. In the garden, the clumps do not spread nor are their seedlings a problem. It is not known why they are called ironweeds, as their stems are not especially tough or hard. It should be noted that they have been known to horticulture for some time, as two of our native species are included in Miller's (1768), *The Gardeners Dictionary*. A few clumps of *Vernonia* in the garden will reward the gardener with nice clusters of purple flowers in July and August, with a minimum amount of effort.

Assistant Professor of Botany, The University of Georgia, Athens, Georgia 30601.

Culture

Our species are for the most part extremely hardy and adapted to a variety of soil conditions. They will generally do best in a sunny location in almost any well-drained soil. Some, however, will grow even in poorly-drained or wet soil. Table 1 provides information on their natural habitats as well as their geographical locations. One or more species can be found in almost every state in the eastern United States. At Athens, Georgia, all of the species are winter hardy with the exception of *Vernonia blodgettii* from extreme south Florida. Dr. J. A. Steyermark (1963) reports that he has grown *Vernonia* plants from the Missouri Ozarks in his wildflower garden in Illinois. One of my students, Mr. Urbatsch, has overwintered *Vernonia altissima* collected from Alabama and Georgia on his farm in Iowa. This probably indicates that they would be extremely hardy away from their native location.

The best way to start these plants in the garden is to dig and collect the rootstocks while the plants are in flower. They can be easily recognized at this time. My students and I can spot the plants, which normally grow in colonies, as we drive along the roads at highway speeds. The stems should be cut near the ground level and the freshly dug root-

stocks placed in moist plastic bags, which should be sealed until the contents are transplanted. Our collections frequently sprout in the bags if we are on a long field trip. The plants can also be started from field-collected seeds which should be planted in January in the greenhouse and later transplanted to the garden, where they will flower the first year. The plants are not rare and may be collected without depleting the natural populations.

Insects do not appear to be particularly troublesome on *Vernonia*. A rust is often prevalent on natural populations in the field. It has not, however, been troublesome in the garden where sanitation has been the only control measure. On the other hand, pollinators, mostly bees and butterflies, are attracted to the flowers in large numbers.

The flowering season extends from July to early September, depending on the species (see Table 1). Hybrids among the species are common in nature where two or more species grow in the same locality. Hybrids have been produced in every species combination that we have attempted so far in our experimental crosses. The F_1 hybrids are usually fully fertile and intermediate in their appearance between their parents. Some of the species more promising as ornamentals are indicated in Table I under "Additional Comments". It is hoped that this paper will encourage gardeners to try *Vernonia* in their gardens. I have certainly enjoyed growing them in connection with my research interests.

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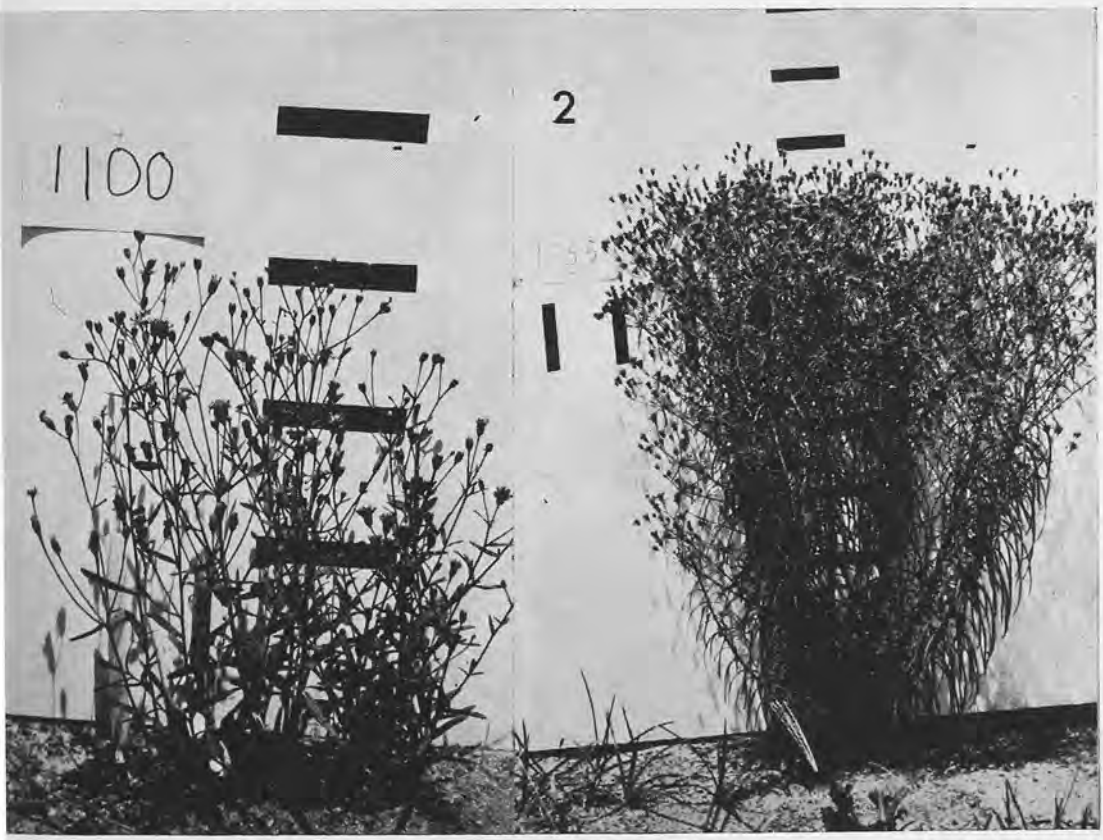


Figs. 1 and 2: **Fig. 1, *Vernonia blodgettii*; Fig. 2, *V. angustifolia* (the black lines are 10 cm. long, or almost 4 in.).**

TABLE 1. THE NATIVE SPECIES OF *VERNONIA* IN THE UNITED STATES

Species	*Geographical Location*	*Natural Habitat*	*Height (ft.)*	*Texture*	*Flowering Season*	*Additional Comments*
V. acaulis	N. C., S. C., Ga.	sandy woods	2	fine	July	has basal cluster of leaves, excellent ornamental
V. altissima	Iowa to Pa., south to Ga. and Texas	pastures, roadsides	6	coarse	August	most widespread species, dry to wet soil, not ornamental
V. angustifolia	coastal Miss. to N. C.	sandy scrub oak woods	3	fine	July	excellent ornamental, grows well in dry soil
V. baldwinii	uplands of Ark., Mo.	well drained pastures and roadsides	4	coarse	July	bract tips are recurved, not ornamental
V. blodgettii	outhern Fla.	low pineland	2	fine	July	not winter hardy, good in south Florida
V. crinita	Ozarks of Ark., Mo.	moist ditches	3	medium	August	large, showy heads, excellent ornamental
V. fasciculata	Iowa to Ohio	wet pastures	4	medium	August	good in wet soil
V. flaccidifolia	Appalachian region of Ga., Ala., Tenn.	edge of oak-hickory woods, well drained	3	coarse	July	good in well drained soil
V. gigantea	coastal Ga., Ala., Fla.	low roadsides	6	coarse	August	not ornamental
V. glauca	uplands from Ala. to Pa.	edge of oak-hickory woods, well drained soil	4	coarse	July	excellent ornamental in well drained soil, large heads
V. interior	Great Plains	pastures and roadsides, well drained soil	4	coarse	July	not ornamental
V. lettermannii	Ouachita River drainage in Ark.	sand bars and rocks along Ouachita River	2	fine	July	dainty grass-like leaves, excellent ornamental
V. lindheimeri	limestone prairie south of Dallas, Tex.	alkaline prairie soil	2	fine	July	has white pubescence, excellent and interesting ornamental
V. marginata	Great Plains	pastures and roadsides	2	medium	August	good in dry areas
V. missurica	lowlands, Ark., Mo.	low pastures and roadsides	4	coarse	August	good ornamental
V. noveboracensis	Ala. to W. Va., Pa., N. Y., Mass.	low meadows and wet roadsides	6	coarse	Aug.-Sept.	excellent ornamental, large heads, will grow in wet to moist soils
V. ovalifolia	Central Fla.	low roadsides	3	coarse	July	not ornamental
V. pulchella	southeastern Ga.	sandy scrub oak woods	2	fine	July	interesting foliage
V. texana	Tex., Ark., La., S. W. Miss.	pine woods	2	fine	July	leaves are widely spaced, not ornamental

The Tree As Air-Conditioner

JOHN M. HALLER

The tree is nature's original air conditioner. A tree in a field is an oasis to which men and beasts are irresistibly drawn. Trees planted around a house so that their branches overhang the roof keep the inside temperature down to an agreeable level.

Trees do more than provide shade. They humidify and freshen the atmosphere, encourage the gentle movement of air, and at the same time break the violence of strong winds.

Functioning as a fountain, the tree draws many gallons of water from the soil—as much as 200 or 300 gallons a day—and evaporates them through its leaves into the air. Each tree, during the daylight hours, is enveloped in a blanket of water vapor within which one is cooled and freshened. Some species, such as the willow, pump out liquid water through the leaves in the form of finely divided droplets. This fine mist may be felt on the hands and face, and in certain lights, clearly seen. When a slight breeze is blowing, the temperature under such a tree may be 10 to 15 degrees less than the temperature outside its canopy. Manufactured evaporative coolers work on exactly the same principle: a current of wind sent through a curtain of moisture.

Man-made structures have always provided shade, but until the invention of mechanical air-conditioning, never equalled the cool comfort of a forest. A concrete roof placed over 10,000 miles of desert would be a welcome improvement, but it could not duplicate the miracle effected by the sudden transplantation of a forest.

The tree's canopy is superior in several respects to the mere inert extension of a roof. Consider its pattern of overlapping leaves, arranged in discrete tiers which filter out much of the solar heat and a good part of its light and yet at the same time permit the free passage of air. Buildings, in contrast, tend to trap air masses within them and unless artificially air-conditioned are often hotter than the outside air. Consider how the tree's canopy is hung from a central mast, obviating the necessity for any kind of enclosure, while the thick, heavy roof of a building must be supported by walls. Consider how walls impede the passage of air, regardless of the number of windows that may be cut into them, and how at night, aided by the roof, they re-radiate trapped solar heat into the interior. The tree, in contrast, needs no windows because it has no walls; even its "roof" is an open lattice-work permitting the free circulation of air currents upward, downward, and sidewise.

Primitive builders have come nearer imitating the tree than civilized ones, constructing their houses without walls, equipping them instead with spreading, sloping roofs, sometimes round, sometimes two-gabled. The rounded roof, especially, reproduces the design of a tree in several interesting particulars: first, its shape (all tree crowns are round in cross-section, if not in profile); second, the fact that it is taller in the center than at the edges; third, the fact that it is made of thatch, which is a loosely woven vegetable material effective in keeping out rain, in deflecting solar heat, and in quickly giving up at night all heat absorbed during the day. Many tropical roofs, in fact, are not woven at all, consisting simply of palm leaves superimposed and imbricated. Such a roof is usually 10-12 inches thick. Many palm

1236 College Ave. Modesto, California

trees give of their leaves to make it, and it may be fitly called a "concentrated tree."

The chief differences between a tree and a building made of thatched roof and no walls are two: the roof is compressed into one plane rather than soaring upward into a three-dimensional glory of tier upon tier, and the roof is supported by a sprawling framework rather than by a central mast. Recent efforts of modern architects indicate a reversion to the central-mast pattern: in California and Florida and other semi-tropical places, wall-less roofs supported by a central column are seen in increasing numbers as shade-providers for lunch stands, picnic spots, and sidewalk cafes. When builders learn the technique of constructing such roofs of separate strips that may be opened and closed at will, like the slats of a Venetian blind, they will have approached one step nearer the perfection of the tree.

Excerpts From Peter J. Van Melle

On Rock Gardens (1933)

Many of those who may originally have been impelled by the [rock-garden] fashion must have come to hear a voice of Nature in their contact with that wide range of wild plants that drape even the most primitive sort of rockery. Nature never wearies of appealing to the heart of man, and her opportunities of late have probably been not altogether lost. She must have awakened in thousands of these unskilled amateurs some vague new appreciation of the kindred loveliness of all those velvet spreads and mounds. Of them she must have whispered, "Lo, with such as these my mountain sides are clothed." Of the little narcissi and the gentian, "These are the sunlight of this snow-fed pasture." And of the tiny sedum's tinted beads, "They are but pieces of the coral reefs on high."

In some such way, surely, Nature has lately spoken to thousands, newly come within reach of her voice, whom the woods and the fields had not persuaded. Will there not be an answer, a response, "How beautiful upon their mountains," that may give new life to our gardens?

On the Beauty of *Sempervivums* (undated)

The silver tracery of *S. arachnoideum* is perhaps the greatest achievement of *Sempervivums* in the garden. If there be anything which is prettier than it for weathered stone surfaces, it is *S. fauconnettii,* which shows, under the patches of very tiny rosettes in which there is emerald green, a little of the silver webbing of *arachnoideum* and a shimmer of red leaf-tips. These patches are particularly lovely during the period of new growth in spring.

Advances in Horticulture

The opulent tropics, somnolent for ages astride the Equator, warmed by brilliant sunshine, bathed in torrents of rain, await man's purposeful exploitation to produce the food his children will need. Tamed by powerful machines, planted with the new gene-manipulated cultivars, fed with life-giving nitrogen and supporting nutrients, protected from pests of soil and air, the tropical regions loom as a giant cornucopia for continuous production of the products for man's sustenance in the years to come.

A step along the way toward the fulfillment of this dream is this contribution from Hawaii. Donald Watson, Chairman of the Department of Horticulture of the University of Hawaii (Honolulu 96822) assembled these modest reports from some of his colleagues who describe their progress in improving horticultural crops for Hawaii.

HAWAIIAN INTRODUCTIONS

Development of horticultural crops for tropical and subtropical regions at one time resulted from colonial programs of European origin. More recently, however, breeding programs of interest to and initiated by the Hawaii Agricultural Experiment Station have been supplementing this earlier activity. Today many of the University of Hawaii introductions are being tested and widely used on the mainland, throughout the Pacific basin, in Africa, and other tropical and subtropical regions throughout the world. Some recent representative introductions from among the many tropical crops include macadamia, sweet corn, anthurium, papaya, and tomato.

DONALD P. WATSON
(Journal Series No. 1059 of the Hawaiian Agricultural Experiment Station)

MACADAMIA

'Keaau', a new commercial macadamia (*Macadamia integrifolia*) originally selected in 1948 has been under close observation since 1958. Annual yield of kernels has been shown to be significantly higher than that of three standard macadamias—'Kakea', 'Ikaika', and Keauhou'.

Producing a well-formed vigorous tree with medium sized, smooth-shelled nuts of 42-46 percent kernel, it is resistant to anthracnose (*Gloesporium* sp.)

'Keaau' was named after Keaau Orchard of the Royal Hawaiian Macadamia Company in Hawaii County, where the first comprehensive yield test was conducted.—*R. A. Hamilton and H. Ooka.*

TROPICAL SWEET CORN

Failure of winter sweet corn production in the tropics is because of the short daylength stunting and the disease susceptibility of temperate hybrids. Plant heights are often reduced by 50% in winter months, and ear lengths are shortened measurably. Damage by mosaic-stripe, transmitted by the leaf-hopper, *Peregrinus maidis,* as well as earworm and blight (*Helminthosporium turcicum*) damage are often serious.

Two sweet corn hybrids have been released by the Hawaii Agricultural Experiment Station. H38 is highly productive, tender, sweet, and matures in about 70 days. Ears are small (5-½ to 7 inches) with slender cobs, tight husks, and short husk tips. Plants usually bear two marketable ears. H38 is resistant to earworms and sweet corn mosaic, but susceptible to *Helminthosporium* leaf blight (*H. turcicum*).

H68 is a productive hybrid selected especially for its comparatively large (6-½ to 8 inches) ears and high quality. It is a tall hybrid, especially in summer months, and matures 1 to 4 days later than H38. Yields of marketable ears on H68 approach or equal H38, but the ears are heavier, longer, and have shorter husk tips. Resistance to pests and diseases is comparable to that of H38. Both of these hybrids have performed creditably throughout the tropics.—*J. L. Brewbaker.*

PASTEL-COLORED ANTHURIUMS

Although the first introductions of anthurium over 75 years ago were pastel-colored spathes, recently the bulk of commercial production has been those with red and orange spathes.

In the spring of 1950, the Hawaii Agricultural Experiment Station inaugurated a breeding program placing emphasis on improvement of flower color, size, shape, texture, productivity of flowers and young plants. After 13 years in which selected plants were placed under surveillance and a hybridization program was conducted, the following two seedling selections were introduced (see photo).

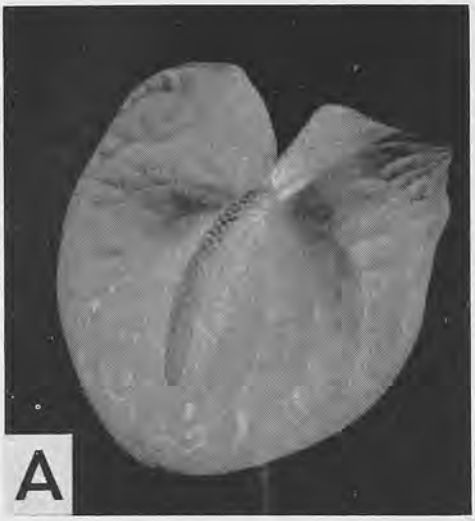
Cv. 'Uniwai'

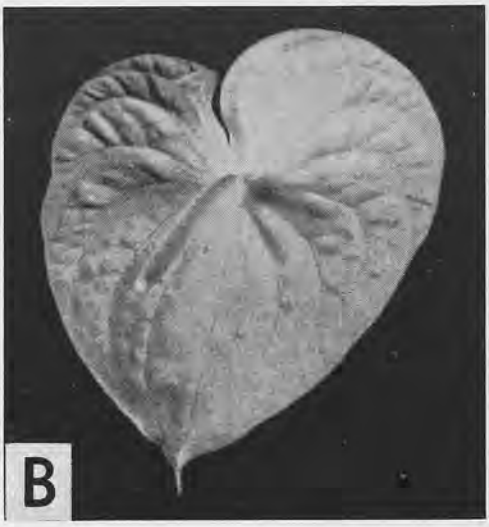
A smooth, pliable, white, heart-shaped spathe with overlapping lobes maintained an exceptionally high yield of 7.7 flowers per plant per year. The spadix is short, yellow and drooping when young but turning upright with age. Sucker production is relatively low. The spathe tends to develop a slight pink tinge during spring months, but the demand for white flowers and high yield make it a valuable introduction.

Cv. 'Marian Seefurth'

The rich pastel pink spathe measuring 6-½ inches long and 5-½ inches wide with heart-shaped overlapping lobes makes this a desirable anthurium. The spadix is white and upright when mature. Flower yield over a consecutive period of 151 weeks averages 6.9 flowers per plant per year.—*H. Kamemoto and H. Y. Nakasone.*

New anthurium selections: A. 'Uniwai'—broad heart-shaped white spathe; B. 'Marian Seefurth'—broad heart-shaped pink spathe. (*Technical Bulletin 58*, H.A.E.S.)





'SUNRISE SOLO'—A DIFFERENT COLORED SOLO PAPAYA

'Sunrise Solo' combines the orange-red flesh color and precocious low-fruiting habit characteristic of Line 9 'Solo', with excellent quality, high sugar content and the desirable 'Solo' flavor of 'Kariya' solo.

'Sunrise Solo', is a precocious low-bearing cultivar maturing its first fruit about nine months after transplanting,

at a height of approximately three feet. Carpellody is almost completely absent and there is little or no sterility, depending on season and growing conditions.

Fruit from hermaphroditic plants is pyriform in shape with a slight neck and generally smoother with less ribbing than other 'Solo' strains, and the seed cavity is not as deeply indented or star-distinct 'Solo' flavor and aroma. Total shaped. Flesh is sweet with mild but dissolved solid content ranges from 12 to 17 percent, with an average of about 15.5 under good growing conditions.—*R. A. Hamilton and P. Ito.*

DISEASE RESISTANT TOMATO HYBRIDS

Multiple disease resistant F_1 hybrid tomatoes with inherited resistance to as many as eight different diseases are the result of crossing multiple resistant but quite unrelated lines from Florida and Hawaii.

With most of these diseases, the genes for resistance were dominant and therefore expressed in the hybrid if present in one or the other of the parents. In the case of some of the diseases, both of the parent lines were resistant. This was true of *Fusarium* wilt, gray leaf spot, and tobacco mosaic virus resistance in hybrid N-52, N-56, N-63, N-65, and N-69. In addition, these hybrids received root knot and spotted wilt resistance from the Hawaiian parent, and leaf mold and early blight tolerance from the Florida parent. Some tolerance to Phomopsis and vascular browning in Hawaii, along with resistance to radial cracking, was also present.

The multiple resistant F_1 hybrids produced to date by crossing Hawaii lines with recent southeastern tomato lines have, with the exception of N-69, all been indeterminate in vine habit. They also have immature fruit color of the "green shoulder" type. The greater longevity of these hybrids in the tropics is now well proven and appears to result from a combination of hybrid vigor and disease resistance.

Hybrid N-11, made with the island variety 'Anahu' and STEP 174 from the U. S. Vegetable Breeding Laboratory at Charleston, South Carolina, was the heaviest yielding tomato in the 1960 STEP replicated trials conducted in 15 southern states. In more recent years, hybrids N-55, N-64, and N-65 have also won that distinction.

In El Salvador under conditions of severe disease infestation which made tomato production extremely difficult, hybrid N-56 yielded some nine tons of fruit per acre, approximately four times the yield of the standard varieties used as a basis of comparison.—*J. C. Gilbert.*

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Weeds

"He who has a garden has a future." These words greet visitors to the headquarters of the venerable Garden Club of San Francisco. Gardeners everywhere will appreciate their philosophical and inspirational message.

So do the editors of The American Horticultural Magazine. *As practicing gardeners, however, they confess a corollary thought: He who has a garden also has weeds.*

Thus is born this new feature of the American Horticultural Society's journal. Its editor is Dr. Loran L. Danielson, Leader, Weed Investigations, Horticultural Crops, Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Maryland 20705.

The purpose of this new service is to help Society members become knowledgeable about weeds and their control.

CONTROLLING POISON IVY AROUND THE HOME

Few people have escaped the skin-blistering effects of contact with poison ivy *Rhus radicans*. Though we generally use considerable care in our ramblings in the woods and gardens, we are often unknowingly exposed to it.

Poison ivy grows as a woody twining vine on trees, as a tall shrub 3 to 4 feet high, and as a low-growing shrub 1 to 2 feet tall. In general, twining and low-growing forms are found in densely shaded areas. The large shrub forms usually occur in slightly shaded or open areas. Poison ivy has alternate trifoliate leaves. Leaflets may be smooth-margined or variously toothed or notched among the several subspecies. Clusters of small, white, waxy, berrylike fruits are formed in the leaf axils. Birds carry the seeds to uninfested areas, and established plants spread by creeping rootstocks. It grows well in many locations including perennial ornamental plantings, parks, and camping areas. The various forms of poison ivy are widely distributed over the United States, with the exception of the extreme Southwest.

Poisoning occurs when crushed leaves or broken stems contact the bare skin. An intense itching and formation of blisters follows within a few hours. Contact is most frequent in woody ornamental plantings, wooded areas around the home, and on hikes or camping trips in the woods, mountains, or at the beach. The defoliated stems, handled mistakenly as other brush in fall or early spring, often cause poisoning. Poison ivy seedlings grow unnoticed among woody ornamentals until they emerge through the covering foliage where we make contact with them. Severe cases have been reported of poisoning from contact with the smoke from poison ivy plants burned with other brush. Animals do not appear to be affected, but some cases of poisoning of humans have been tentatively traced to contact with pets that were previously exposed to poison ivy foliage.

Prevention of poisoning or even the most sensitive person is possible. First, avoid it by knowing the plant. Study descriptions and photographs. Remember our childhood warning, 'Leaflets three, let it be." Second, if you must handle poison ivy, wear heavy rubber or leather gloves that can be thrown away. Avoid contact with contaminated clothing or tools. Finally, eradicate the poison ivy plants.

Poison ivy cannot be satisfactorily controlled by handpulling, grubbing, or mowing. Many roots are overlooked in grubbing, and repeated mowing is a temporary remedy. Repeated exposure to the plants in these manual operations

Rhus radicans **growing through canopy of azalea foliage.**

is a real hazard. Fortunately there are herbicides that will safely and effectively control poison ivy in practically any area. Carefully directed sprays or solution treatments of 3-amino-*s*-triazine [amitrole] and ammonium sulfamate [AMS] can be used in wooded areas around the home and in woody ornamental plantings. Spray only during calm weather. Use low pressure and a metal or cardboard shield to protect valuable plants. Where poison ivy is growing among ornamentals, it may be necessary to apply the herbicides with a small sponge nailed to a wooden handle to prevent injury to the ornamentals. These herbicides move from the foliage to all parts of the ivy plant and thus kill the roots as well as the tops.

In large wooded areas or parks and lawns, (2,4,5,-trichlorophenoxy) acetic acid [2,4,5-T] will kill poison ivy without injury to desirable plants if sprays are carefully directed.

All chemicals described in this report should be applied in accordance with the directions on the manufacturer's label as registered under the Federal Insecticide, Fungicide, and Rodenticide Act.

STINGING NETTLE—A GARDEN PROBLEM

How many times have you reached into a clump of flowers to cut a bouquet and snatched your hand back with a sensation of having been stung by a bee or wasp, but saw no sign of the insect? The culprit is often a stinging nettle plant growing unobtrusively among the foliage of the ornamentals.

Stinging nettle (*Urtica dioica*), a broadleaf weed, is a member of the Urticaceae or nettle family. There are several perennial and annual species of nettles widely distributed throughout North America. They have numerous bristly, stinging hairs on the stem and leaf surfaces. Contact with the stinging hairs produces a moderate itching and burning sensation that usually lasts for less than an hour. The stinging nettle spreads by seed and shallow creeping rootstocks. Though widespread across the continent, stinging nettle is infrequent because it is a nitrophilous or nitrogen-loving plant. Thus it grows best in moist fertile soils around barnyards, in gardens, and in the heavy mulches on forest floors. Nettles grow well in either low or high light conditions, and therefore may flourish unnoticed under the foliage canopy of other plants during early vegetative growth. Later, the stems elongate preparatory to flowering,

and may grow to a height of 3 to 6 feet, depending on fertility and light levels. The small, greenish flowers form in clusters at the stem nodes. Flowering and seed formation occur in August and September in the Middle Atlantic States.

Because nettles spread by rhizomes as well as seed, they tend to grow in localized clumps. They sometimes grow in fertile, uncultivated areas where they can be safely killed by treatment with 3-amino-*s*-triazole [amitrole] or (2,4-dichlorophenoxy) acetic acid 2,4-D, applied as a spray on the foliage during the early vegetative stages of growth. Repeated mowing will prevent seed formation and limit spreading. Cutting off the stems or killing the tops alone does not kill nettles because of the surviving live rhizomes. Hand grubbing of roots and rhizomes, and exposure to drying, help minimize spread; but these are not completely effective, because many roots and rhizomes are missed.

Stinging nettles among ornamentals are successfully controlled by donning a pair of leather gloves, separating out the nettle plants, bending them down to the ground without breaking them, and carefully wetting the foliage with a sponge soaked with a solution of amitrole. Amitrole is a systemic herbicide that kills the nettle plants by entering and moving to all parts, including stems, roots, and rhizomes. To accomplish this, the treated tops must remain attached to the roots and rhizomes for a minimum of 2 weeks after treatment. Be sure to avoid applying amitrole solution to foliage or stems of ornamental plants.

***Urtica dioica*, showing bristly, stinging hairs on stem, petioles, and leaves.**

Introduction of stinging nettles into gardens can be minimized by planting weed-free crop seed, avoiding transfer of roots or rhizomes in soil which accompanies transplants, and by fumigating topsoils and rotted peat moss with methyl bromide before use. Follow special precautions described on manufacturer's label when using methyl bromide.

All chemicals described in this report should be applied in accordance with the directions on the manufacturer's label as registered under the Federal Insecticide, Fungicide, and Rodenticide Act.

GEORGE WASHINGTON MEMORIAL CEDAR

In December, 1899, a Masonic group planned a memorial ceremony at George Washington's tomb in commemoration of the centennial of the General's death. Mr. W. R. Smith, Superintendent of the United States Botanical Garden in Washington, D. C., supplied for the ceremony a sapling of a tree identified by him as cedar of Lebanon (*Cedrus libani*). Since the weather on the date of the ceremony, December 14th, was most unfavorable, the tree therefore was actually planted three days later by a committee of The Mount Vernon Ladies' Association a few yards southeast of General Washington's tomb.

In later years the memorial trees at Mount Vernon were numbered and recorded by the superintendent of The Mount Vernon Ladies' Association and his staff in order to make reference to them more readily as time went on. In 1938, the cedar tree planted in 1899 was identified on the list as a deodar cedar, but who provided this identification is not known.

Flowering of the tree was observed for the first time about 1957. This tree commences to flower and to distribute pollen during February. For the first time, to our knowledge, viable seeds were emmitted from the cones during November and December, 1968, sixty-nine years after the tree was planted. A quantity of these seeds was planted under greenhouse conditions on December 10, 1968 in a wardian case at a temperature of 72°F. Germination commenced on January 14, 1969. Another quantity was sown in an open 50°F greenhouse bench of Turface on February 6, 1969, with germination commencing on February 20th.

We are now assured by botantists at the United States National Arboretum that the tree is a cedar of Lebanon, as originally identified.

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***Cedrus libani* near George Washington's tomb, Mount Vernon, Virginia. Planted in 1899 to commemorate the 100th year of the General's death.**

PHOTO ROBERT B. FISHER

BERGENIA STRACHEYI 'ALBA'

Distinctive characteristics make the cultivar more desirable than the better known *Bergenia stracheyi.* The genus *Bergenia* is closely related to *Saxifraga,* is sometimes included with it, and has been called *Megasea; B. stracheyi* has been known as saxifrage or winter primrose.

This and other species are still around in old gardens and in parks, having been planted for winter flowers and a thick coverage of shady ground. *B. stracheyi* went out of favor, when its "shocking" pink became unpopular and its interlacing rhizomatous stems made too fine a housing development for snails and slugs.

The cultivar has an even more vigor-

Bergenia stracheyi 'Alba'.

PHOTO BY JUDITH BROWN

ous overlay of thickened root stocks but since the foliage is decidedly more handsome it is worth the trouble to keep the leaves reasonably free of holes. They are larger, rounder, thicker, glossier, of richer texture, with more indented margins; the color is a deeper green and is shaded bronze in leaves very young or quite old, while in autumn all leaves are reddish copper. They burn very little around the edges in full sun on the San Francisco peninsula. Plants will also withstand a cold winter here, and in fact, this *Bergenia* is reported only a little less hardy than the hardiest bergenias. There would be winter damage in northern areas.

The color of the flowers of 'Alba' is creamy white. The clusters are about 4 inches long by 4 inches wide on stems sometimes as long as 10 inches, and are numerous. The green seed pods are not unattractive.

Propagation is easy from pieces of thickened root stock.

Plants in my garden have been established at the top of a 4-foot adobe wall for five years. The adobe is the old-fashioned mix of earth and bitumen. This year near the base of the wall, in the wall itself, many seeds germinated together with moss, and a space a foot tall and 2 feet wide is thick with charming seedlings of various ages all with round glossy smooth green leaves of various sizes from 1 inch to 3 inches across. How the seeds were carried and became affixed to the face of the adobe bricks is a mystery. Upon examination I found the roots were well attached to the wall but were shallow so that they could be gently removed. I transferred a few to a bed of regular soil and they are thriving.

This spontaneous growth in quantity under such conditions has encouraged me to try to grow from seed several uncommon bergenias which otherwise would take some time to be ready to distribute from root stock. One is *Bergenia* 'Bellawlay' a handsome cultivar which was sent to Strybing Arboretum from England in 1967.

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AN UNUSUALLY CORKY SWEET GUM

In 1962 I found an extremely corky specimen of *Liquidambar styraciflua* in Charles City County, Virginia, five miles from Route 5 and on Route 623 that leads toward Holdcroft. The tree, estimated to be sixty feet tall and measured to have a circumference of three and a half feet at breast height, grew fifty feet west of the road. The cork occurred in localized wings and pegs and, in places, doubled the diameter of the stem. The fruits were small for this species.

I detected the tree from the road as I drove past. Located in the margin of a low-lying wood and at the edge of a field, the tree is conspicuous at a distance. In the latter part of October and early November its leaves vary from yellows through reds to purples, maroon, and violet. Perhaps the amount of rainfall and other climatic conditions affect coloration, as well as nutritional supplies for particular branches. This tree is especially handsome in winter when all its sculpturesque branches are

***Liquidambar styraciflua.* Branch with blasted leaves from seedling of Xilitla, San Luis Potosi, origin; other branch from Williamsburg, Virginia tree. Photographed December 20, 1968, in studios of Colonial Williamsburg, by Charles G. Kagey.**

apparent. Pieces of the branches constitute "found" art.

I sent wood for propagation to Henry J. Hohman, Kingsville Nurseries, Kingsville, Maryland and he made grafts on seedlings. Four grafted specimens that he sent us are now eight feet tall and exhibit marked corkiness in places along the stems. Mr. Hohman included this corky sweet gum in a plant list which he recently distributed. My hope is that the cultivar will keep the character of the mother tree—that the extreme corkiness is genetic. This sweet gum should then enjoy a wide usage and be a significant addition to our horticultural trees.

Joab L. Thomas (1961) published a paper on *Liquidambar* (*Arnoldia,* Vol. 21, No. 10: 59–63) in which he states the *L. styraciflua* forma *suberosa* was "described in 1933 as having branches with unusually thick, corky wings. It differs very little from the normal . . . and is thus hardly worth distinguishing." I have greater expectations for our plant.

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TREES FROM POT PLANTS

It's fun to train a pot plant into a small flowering tree, with flowers at nose level. My trees have been made from heliotrope, *Pelargonium, Fuchsia, Bougainvillea, Plumbago capensis, Clerodendrum thomsonae* (a special joy), azalea, *Acacia, Cassia, Gelsemium, Osmanthus fragrans, Forsythia,* and others.

When you have trained a strong-stemmed young plant up to about two feet, brace it firmly and tie the leader firmly but gently between every branch. For a brace I bend heavy wire orchid hangers into a clamp over the rim of the pot.

After a first year of good feeding and side branch growth, start nipping off side branches at the base, but stake the trunk and keep it going up. Maximum height for corky-stemmed heliotrope or *Pelargonium* is two or three feet; for woody *Clerodendrum* or *Bougainvillea,* six or seven feet; and somewhat less for *Fuchsia*; *Forsythia* tops off at eight feet or more. Staking can be done with any size pipe or rod, from 3/8-inch (curtain rod size) to 1 inch.

Start forming the tree the second year, pinching back main branches in successive years and keeping unwanted side and basal growths cut off. By the third season it will be lovely at full height and will have been moved to a tub. A ten-inch tub is right for *fuchsias,* a fourteen-inch tub for *bougainvilleas* and big azaleas, and at least a sixteen-inch tub for *Forsythia.*

Varied Color

Your tree will give you about one month of spectacular color. Clerodendrums show white and crimson against rich green in November, *Gelsemium* showers fragrant yellow bells in midwinter, and *Plumbago* follows with sky-blue flowers. In early March the bougainvillea's four-foot blooms are a mad sight, while the heliotrope is opening its first purple perfume bottles.

Care

When the little trees are growing, feed as required, water lavishly, and allow appropriate periods of rest. Allow also for their idiosyncracies. The showy cassias are messy, the *Osmanthus* (sweet-olive) needs coolness. Acacias are subject to red spider, and heliotrope to whitefly; in addition, the latter turns brown if allowed to dry out, but pruning its branches severely will not hurt it. *Clerodendrum, Bougainvillea,* and *Fuchsia* are susceptible to mealybugs, and *Plumbago,* to many pests plus a rusty spot affliction which is controlled by "Phaltan." We use the systemic spray "Cygon" for mealybugs, or a big dose of "Scope" in the pot. These treatments are also effective for scale, which afflicts *Gelsemium.**

Other possibilities for this hobby include *Bignonia, Allamanda,* mock-topiary forms of ivy, and Christmas cactus types grafted onto columnar cactus bases.

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CLEYERA JAPONICA FOR SCREEN PLANTING

Shortly after the installation in 1957 of air-conditioning in Ewell Hall at the College of William and Mary, we planted six specimens of *Cleyera japonica* Thunb. to screen off the outside equipment. The photograph shows the planting in January, 1966; the plants are now twelve feet tall. The screen is effective.

Fig. 1. *Cleyera japonica* used as a screen.

PHOTO BY ARTHUR H. SAWYERS
COLONIAL WILLIAMSBURG

Cleyera has found the site a good one: the foliage remains a rich green year-round; the plants flower and fruit prolifically (see close-up, January, 1966.); volunteer seedlings spring up in abundance in the pine-bark mulch. The location is a shaded court. But perhaps the moist breezes from the air-conditioner

Fig. 2. *Cleyera japonica,* closeup of branch.

PHOTO BY ARTHUR H. SAWYERS
COLONIAL WILLIAMSBURG

* Use systemics with caution.—Eds.

account in great measure for the healthy and vigorous growth of these plants. Other represenatives of the same lot of *Cleyera* (sent to us by the Missouri Botanical Garden) get more sun and none of the breezes. The plants are in a sorry plight.

A scale insect, which Miss Louise Russell, Systematic Entomology Laboratory, USDA, identifies as *Ceroplastes ceriferus* (Anderson), also enjoys this ecological situation: it occurs in great number on the moistened side of *Cleyera* but hardly at all on the drier side.

There is often confusion about *Cleyera, Ternstroemia,* and *Eurya* in the horticultural trade. Dr. Carroll Wood of The Arnold Arboretum kindly clarified the taxonomic problems for me.

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THE RARE OCONEE BELLS

The natural habitat of the Oconee bells, *Shortia galacifolia,* has been certain deep gorges and ravines at lower elevations in the Blue Ridge mountains. The range was confined to two counties in South Carolina, three counties in neighboring North Carolina, and one elusive station in Rabun County, Georgia. In these areas *Shortia* grows under beech *(Fagus grandifolia)* and the great rosebay *(Rhododendron maximum).*

In more recent years *Shortia* has been discovered in Virginia and Pennsylvania, but it is thought these stations were planted. *Shortia* in the wild has always been elusive. To briefly review its known history, it was discovered by André Michaux in 1788. This was in December and Michaux collected only the leaves. These leaves were seen by Dr. Asa Gray when he visited Paris and Michaux's herbarium in 1839. Dr. Gray recognized that *Shortia* was a new plant, and named it for Dr. Short of Kentucky. Dr. Gray began a search for the *Shortia,* but was led astray by Michaux's notation, "found in the high mountains." The *Shortia* was rediscovered by Prof. Charles S. Sargent in North Carolina, in 1878, and Dr. Gray finally saw it growing on the banks of the Keowee in 1879. Meanwhile C. M. Hyams found *Shortia* near the Catawba River in 1877.

Botanists and ecologists fail to agree on the reason for the very limited distribution of *Shortia.*

Dr. Wilburn Duncan who helped discover the only known Georgia station, wrote (*Rhodora,* Oct. 1950), that the *Shortia* once had a much wider distribution. His theory is that the plant has remained only on those oldest mountain ranges that were present before the Great Smoky Mountain overthrust. Another scientist has suggested that changes in climatic conditions caused the plant to survive where the "combination of shade, humidity, and temperature was such as was necessary for the maturing and germination of seed." There are two other species of *Shortia* in the world, both in Asia. One is sometimes offered for cultivation under the name of "Nippon-bells."

There are many ravines with similar ecological conditions and associated plant species. Yet the *Shortia* is found in only a very limited area of apparently

***Shortia galacifolia,* Oconee bells**

identical habitat. Unfortunately, much of its natural range in South Carolina is being destroyed by backwaters from new dams on the Keowee and Toxaway Rivers, and by development of a new highway and recreational area near White Water Falls.

We became personally acquainted with *Shortia* in the wild in the area of the White Water River, near Camp Jocasee, South Carolina, while on a search for the Arizona Fern with the Rev. Rufus Morgan of Franklin, North Carolina. At Camp Jocasee we met the caretaker, an extremely interesting old gentlemen, named J. G. Hagerty, who considered himself the guardian of the Oconee bells. While glad to show "the plants" to interested botanists, he deplored the new power complex soon to flood the area. Mr. Hagerty wrote letters to various heads of state in protest against this flooding, but of course, to no avail. It is always refreshing, in this day of destructive development, to meet someone who is trying to save something in its natural state. In his philosophy and appearance, Mr. Hagerty reminded us of the great naturalist, John Burroughs.

When Mr. Hagerty took us to the *Shortia* beds, only a few feet from the main road, we were amazed at the carpet of richly green scalloped leaves. The area was deep in moss, watered by a trickling, spring fed stream. The *Shortia* was growing under a few beech trees, and dense thickets of rhododendrons, in association with *Galax,* white violets (*Viola pallens*), bluets (*Houstonia pusilla*), and variegated-leaf Ginger (*Asarum* sp.). Rocks, old stumps, and fallen logs were covered with the *Shortia,* which spreads by runners, or stolens. The whole area was laced with the evergreen-leaved creepers of the wood-vamp (*Decumaria barbara*). It was a place that exactly exemplified a "mossy dell."

A visit to *Shortia* in its natural habitat can be an inspiration to any flower lover, especially when it is in blossom. Each five-petalled, waxy white flower rises on a slender stem from its mat of leaves. Bending down, one gets a whiff of the almost elusive fragrance of the flower. When not in flower or seed, *Shortia* might be mistaken for the distantly related *Galax* which has a round leaf, with prominent veins branching fanwise from the edge of the rounded petiole. *Shortia* has a more oval leaf, with veins digressing from the midrib, and a grooved petiole. A *Galax* leaf is slightly aromatic when crushed. Both have leaves shiny green in spring and summer, and deeply crimson or bronze in late autumn. From a car window, certain round-leaved violets, or patches of wild-ginger leaves might be mistaken for *Shortia.*

Shortia has been planted successfully in private gardens, and in nature reserves at Fernbanks in Atlanta, and Pearson's Falls at Tryon, N. C. It is also offered for sale in some wild flower nurseries. Botanists and nature lovers should be on the lookout for new stations for *Shortia.*

Shortia will probably continue to exist in gardens and under cultivation. But somehow this is not the same as to see *Shortia* growing wild in its beautiful natural setting. At the rate the native habitat is being destroyed, *Shortia* is in danger of disappearing. It is now time to create a preserve for part of its natural habitat before it is too late.

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RARE KOREAN BITTER TREE THRIVES IN NEW HAMPSHIRE

In a 1920 report, the bitter tree, *Picrasma quassioides,* was described as "... a small tree with pinnately divided leaves and lenticellate shoots, the bark of which is intensely bitter to the taste and is used by Coreans both for medical purposes and also in the manufacture of shoes. It is chiefly found in central Corea, though not very common there." [*Arboretum Coreense, Part II,* M. N. Trollope. 1920. Transactions of the Korea Branch of the Royal Asiatic Society, Vol. XI, pages 40-75. Reprinted by YMCA Press, Seoul, Korea in 1936.]

I was fortunate to have been able to collect a few seeds in autumn 1947 from a tree growing on the upper slopes of

Foliage of Korean bitter tree with prominent leaf veins made conspicuous by yellow autumn coloration.

PHOTO BY ARTHUR HAWKINS

Ing Wang mountain, located just beyond the western edge of Seoul, Korea. I remember only this tree standing beside a large granite boulder, though it would seem there must have been another sufficiently near by to furnish pollen, as the Bitter Tree is dioecious. Seeds forwarded to the late A. F. Yeager, Horticultural Department, University of New Hampshire, Durham, were stratified promptly and germinated the following spring.

Two of the seedlings have been under observation for the past two decades in my home grounds at Rochester, New Hampshire where, most winters, minima of minus 5° to 10°F can be expected. In winter 1958-59, minus 25°F was recorded here. No appreciable injury to the bitter tree resulted. As the noticeable cinnamon-brown dormant buds are naked, they are most fascinating, since bud scales commonly are considered protection against adverse conditions. Both trees have strong wood and have not been broken by heavy wet snow or ice storms.

Now a score of years old, one tree with excurrent main stem and growing in the open approximates 20 feet in height; the other, planted on the northwest shady side of a building, has bifurcate trunk and is 15 feet tall.The rather stiff branches form mostly a 45-degree angle with the main stem. Very few are joined more acutely to the trunk. Large lenticels of one-year-old twigs are particularly conspicuous.

I have tasted the bark of the twigs. It is decidedly bitter. The glossy dark green odd-pinnate leaves often have thirteen leaflets, but there is nothing unlucky about them. Neither insects nor diseases have troubled the foliage. Prominent veins of the leaves become even more striking in fall when yellow color of the blades develops to make the compound leaves look like engravings (see photo). Sex of the two trees is unknown as neither has blossomed.

It was a surprise to learn in summer 1967 that the bitter tree was not among the many fine hardy trees at the Arnold Arboretum, Jamaica Plain, Massachusetts, so roots were dug from my largest tree in December and sent to Alfred J. Fordham, Propagator. He has written to me that root pieces placed horizontally in flats of sandy soil gave abundant shoots, and as they were juvenile, rooted quickly. Through the summer repeated batches of shoots were harvested, for as soon as one was collected a new crop would appear. I observed also that several shoots volunteered from the severed roots left in the soil under the tree in my home grounds.

As it is possible to propagate this pleasing small ornamental tree readily by means of root cuttings, the bitter tree can become available for planting in northern states without the necessity for growing seedlings.

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Book Reviews

From Sea to Shining Sea

A Report on the American Environment—Our Natural Heritage. The President's Council on Recreation and Natural Beauty. Superintendent of Documents, Washington, D.C. 20402. 1968. $2.50.

The objectives of this report are outlined as follows, "One is to outline progress in environmental improvement programs since the 1965 White House Conference on Natural Beauty. Another is to present proposals and recommendations which will stimulate Federal, State, local and private action to further enhance the quality of our environment and the beauty of our Nation. A third objective is to present a guide for action by local officials, professional men and women, citizen groups of many kinds, and individuals."

The report begins with the problems, first the environment, where we live, our neighborhoods, downtown, the suburbs, the city, rural areas, the small town and the metropolitan region. For each of these there are certain problems and issues to be met. Blighted neighborhoods, deteriorating housing, little or no park or recreational space. These deficiencies provide opportunities for citizens and government to work together for improvement. Downtown business areas call for modernizing with improved transportation facilities to provide easier access to the remainder of the city and the suburbs. Regional planning is necessary as suburbs, towns and community developments grow together to form metropolitan regions. The rural areas of the United States require attention also, to maintain the values of rural and small town living, to preserve the beauty and productivity of the land, and to heal the damage of poor and improper land and resource usage. The rural areas play a vital role in supplying the needs of our population not only for food and fiber but for scenic beauty, and recreation.

Transportation is essential for modern living and it directly influences our environment. Thousands of acres of land are required for highways, railroads and airports. Transportation equipment produces objectionable odors, waste products and noise. These problems require local, state and federal coordination to solve and to direct toward orderly growth and expansion.

Many problems exist in maintaining or restoring our water resources, our lakes and streams. Water has many uses, some with high standards such as that required for drinking, with varying requirements as a minimum for its other uses for irrigation, wild life, recreation, and transportation. Water problems require regional solution, since few major streams are found within only one state, or even international action, as in the case of the Great Lakes.

Pollution is recognized as a major problem in our present environment. Water and air quality of a high degree are necessary and must be maintained. Sources of pollution must be recognized and steps taken to eliminate them. Solid waste disposal becomes a form of pollution of land and scenic beauty. The disposal of waste of industry, garbage, old automobiles, discarded building materials again represents problems that know no geographical or governmental boundries.

This is a well illustrated report. A bibliography is included to provide reference to printed material, films and sources of help and guidance with environmental problems. Many examples of private and public actions are cited showing how these problems are being attacked. This report is an excellent guide for discussion of specific problems by local groups since very likely they will find material on local issues. "It is also a challenge for the future, a comprehensive statement of environmental needs and goals, a charter to guide environment quality programs for Administrations yet to come."

CONRAD B. LINK

How To Prune Almost Everything

J. P. Baumgardt, M. Barrows & Co., Inc. New York 10016. 1968. 192 pages. Illustrated. $5.95. (Library)

I must admit that when I first saw the title of this book, I thought it overly-ambitious, even pretentious. However, upon closer inspection, I find that the title is, in fact, appropriate for this very useful volume.

Introductory chapters are titled: "Why we prune," "How to prune," "When and where to prune," "Special techniques for special purposes." Each of these chapters is a thorough and informative treatment of the subject. Numerous photographs and diagrams illustrate pruning techniques for different plants; these are well-chosen and clearly reproduced. There are several very interesting photographs of large trees which have been pruned to emphasize their twisted and picturesque growth habit. Throughout the author stresses the goal of maintaining the natural form of the plants being pruned.

The main part of the book consists of an alphabetical listing of plants from A to Z with brief comments on their growth habits and pruning requirements. This book will be useful to gardeners throughout the U.S. since it includes plants grown in both warm and cold regions. In addition to ornamental trees and

shrubs, fruit trees, vines and some herbaceous plants such as dahlias and tomatoes are also covered. I found this book especially valuable for its information on many other lesser-known but desirable landscape plants.

In addition to pruning hints, the author occasionally offers useful observations on other topics such as winter protection, propagation, and effective landscape use. He is clearly a well-informed plantsman of wide experience.

ROBERT L. BAKER

Trees of North America

Brockman, C. Frank (H. S. Zim, Ed.). Golden Press, New York. 1968. 280 pages. Illustrated. $2.95, paper. (Library)

This neat, truly pocket sized manual includes 594 of the 865 species native to America, north of Mexico. Naturalized and introduced species are included, to give a total of more than 730 species in 76 families (numbers from the introduction).

Instead of the technical keys common to most manuals, each family is described briefly and a typical illustration given. Necessary descriptive terms regarding leaves, flowers, fruits, twigs, and bark are given by means of illustrations with labels.

The book is arranged in the usual systematic fashion beginning with the Gymnosperms. Distinctive features of each group, for example pine family or oak genus, are given by word and illustration. The generic descriptions are followed by illustrations and concise descriptions of each species. The accurate illustrations are in color; leaves, flowers, fruits, tree shape, and bark are shown. The size range of leaves, tree height, and trunk diameters are given by word, also the habitat and usefulness of each species. The natural range of each native species is given by a small map.

The color illustrations make the book attractive; the bold type face is easily read. The paper cover promises to outwear cloth.

This book will probably be in my station wagon more days than on the shelf; in fact, I never expect to travel outside my own state without it. It is recommended to all travelers who, by foot or by car, really want to learn as they travel.

RUSSELL G. BROWN

Anyone Can Have a Green Thumb

Alice DeWolf Pardee. Hearthside Press, Inc., New York. 1968. 126 pages. Illustrated. $4.95. (Library)

This is not as unconventional as its non-capitalized title might suggest. It is a practical book for the novice gardener. Unlike many gardening books now on the market, this one is filled with information rather than pictures. To be sure, it has line drawings that will bring chuckles from female gardeners with non-gardening husbands. Mrs. Pardee's husband designed her garden, and with great success, as proved by the color-photo endpapers. It is on the elaborate side, however, and not for the beginner.

Mrs. Pardee has gardened in several states, under varied conditions. Her ten-point program differs widely from the usual compost practices and attention to the chemical composition of the soil. For her present patio garden, top soil and manure were added and worked in before any planting was done—a procedure almost certain to bring success, or at least be the first step toward it. Her lists of favorite plants and those to be avoided should be very helpful.

On the whole, careful study of this book should save time, energy, and expense for the beginning gardener who usually has to rely on the trial and error method.

MRS. A. THOMAS BENZINGER

You Can Grow Cattleya Orchids

Mary Noble. Published by the author, 3003 Riverside Ave., Jacksonville, Fla. 32205. 1968. 148 pages. Illustrated. $3.50.

This is a simple, easily read, factual book on the growing of *Cattleya* orchids. The author is using the term to mean not only this species but those closely related to it and with which many bigeneric or compound genera have been developed. Familiar compound genera are × *Laeliocattleya* and × *Brassolaeliocattleya* although 24 compound genera have been registered.

The author goes through each step in orchid culture, after first describing the plant and its habits of growth. The culture is described with comments that apply to either greenhouse or indoor home culture. Propagation is covered for both division and by seed. The sections on problems and pests in growing orchids is well done. The description and the illustrations should be very helpful in diagnosing any difficulty and the suggested remedy is listed. This book is well done.

CONRAD B. LINK

A Field Guide to Wild Flowers

Roger Tory Peterson and Margaret McKenny. Houghton-Mifflin Co., Boston. 1968. 420 pages. $4.95. (Library).

The Field Guide includes species in the northeastern states, Virginia; Kentucky, Missouri northward to southern Canada. Since all ferns, grasses, sedges, trees and most shrubs are excluded, this manual includes probably half of the herbaceous species, about 1300 to be found in the area covered. Little wonder Peterson needed twenty years to locate the plants and make the illustrations!

Fortunately most of the illustrations are excellent line drawings, mostly made from fresh specimens; the few color plates are generally inaccurate as to color. Arrows direct the user's attention to the most dependable or noticeable characters in the illustrations; the text usually mentions only the field characters of greatest

usefulness. The size of each species, its habitat, and range are given.

Nowhere is the user advised to use a good 10-power hand lens (a hand lens is a must for the field botanist just as binoculars are for the bird student). Just one or two additional characters, visible under such magnification would have made many identifications more certain. An enlarged sketch of the flower, fruit, or other small part should have been made for each species, not the occasional one.

The glossary of terms is limited and the illustrated glossary, on the inside covers, would be more convenient if right with the definitions.

Perhaps in fairness the reviewer should mention that he has taught plant identification from standard manuals, (five different ones over nearly forty years, only one with illustrations) and has found no shortcut or substitute for careful, methodical examination of a plant and the use of keys and complete descriptions to determine species. Some of my students used the Guide last spring and expressed my opinion of its usefulness—"an excellent set of illustrations to use with a manual."

RUSSELL G. BROWN

Gardening on Main Street

Buckner Hollingsworth. Rutgers University Press, 30 College Ave., New Brunswick, N.J. 08903. 1968. 170 pages. Illustrated. $7.50. (Library)

This thoroughly enjoyable volume is a record of the author's Vermont dooryard planting, with its many problems, its failures and its triumphant success. By the time the black and white prints of the outdoor and indoor blooms have been admired and the book is laid down, one feels acquainted not only with the gardener and her home, but also with her country neighbors and her casual visitors.

One has incidentally learned about garden gimmicks and gadgets and the trick of placing chicken wire over emerging shoots of perennials and raising this as the plants grow, to make a frame that defies wind and rain. We also know Mrs. Hollingsworth's dislike of "glad" and "mum" and artificial flowers as substitutes for the real. Her intensive research, done for an earlier book, *Garden Chronicle*, comes to the fore as she discusses the oldtime favorites artemesia, garden pinks, and the peonies of early England.

Informal as it appears to be, this volume is a real contribution to garden literature. It is equally suited for the gardener's own bookshelf and as a gift to a gardening friend.

MRS. A. THOMAS BENZINGER

The American Camellia Yearbook

Edited by Joseph H. Pyron. The American Camellia Society, Fort Valley Georgia. 1969. 302 pages. Illustrated. $4.00. (Library).

Society annual yearbooks offer the opportunity to publish new information about their particular plant interest. The 1969 issue of the American Camellia Yearbook does this well for the camellia. The recording of new introductions and evaluating of old ones is important for any garden plant. New varieties from several sources are described and lists of the most popular varieties for California, Florida and Georgia are included as well as the 100 most popular camellias. Such lists help the beginner to start a collection and the collector to develop one, of kinds that would be expected to succeed.

A report on the use of gibberellins for the production of early large show blooms is outlined by John I. Wear of Auburn, Alabama. Tests at the U.S. National Arboretum on an out-door collection are described by Arthur A. Maryott. A list of approximately 90 cultivars is divided into 3 groups according to their response, I—foolproof, II worth a try, III don't waste time on them. Most of those in group I are seasonally classified as early or early to mid-season.

This annual publication includes articles on the historical development of the camellia as well as "personages" associated with its development.

Other articles consider some historical topics such as Japanese camellias of 1710, camellia practices in England, shipping camellias, blooms, and an arrangement contest.

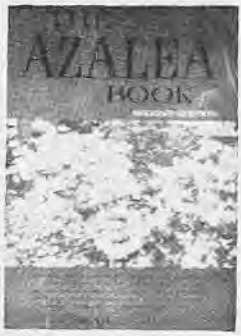
A cumulative index, 1958-1968 based on both topics and authors is a valuable part of this issue but would have been more convenient at the end of the volume where the society membership list is placed.

CONRAD B. LINK

THE AZALEA BOOK

Second Edition

by FREDERIC P. LEE



This handsome book tells everything there is to know about azaleas, incorporating the most recent developments in cultural practices, the latest methods of treating diseases and pests, and the best of the new imported and domestic azalea varieties.

Here is botanical and historical information of immense interest to the scientific expert as well as complete know-how for enthusiastic amateurs on selecting, planting, fertilizing, and pruning azaleas—whether they be evergreen or deciduous, 6-inch dwarf or 10-foot giant.

The vast knowledge of plant explorers, government specialists, and foreign collectors is embodied in this authoritative book. Sponsored by the American Horticultural Society and successor to its Azalea Handbook, this volume reflects world experience with azaleas, and also contains the considerable practical knowledge of Frederic Lee, who himself continually tested some 500 azalea plants in his Maryland garden.

Part I is a complete garden guide, with information on planting and care, hardiness, companion plants, propagation, indoor culture, and directions for bonsai plants. In addition, plant hardiness has been keyed to the new Plant Hardiness Zone Map of the United States Department of Agriculture.

Part II thoroughly covers basic horticultural—plant structure, growth factors, soils and nutrition, with step-by-step procedures for hybridizing.

Part III considers the place of azaleas in the plant world: relationship to rhododendrons; distribution and classification, with detailed descriptions of Ghent, Mollis, Kurume, Belgian and Southern Indicas, Gable, Glenn Dale, and many other azalea groups, together with their origins and history. There is also a revised classification and description of some of the American and Japanese species and a thorough revision of the Satsuki group.

Part IV offers a complete index of deciduous and evergreen azaleas, with notes on habit, blooming period, flower type, size, and color. The list of azalea breeders and nurserymen in America, and their contributions to azalea culture has been fully updated. International registration proceedings are discussed, and the list of trade sources extended. A table cataloging registered azaleas is also included, as well as several lists of recommended varieties.

408 pages, 6¾ x 9¾. 65 illustrations, 5 in color.

The American Horticultural Society, Inc.
2401 Calvert Street, Northwest
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Please send me _____ copies of *The Azalea Book*, 2nd Edition $_____ is enclosed.
Price to non-members $12.50, plus 40¢ for postage and handling.
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