THE AZALEAN

Journal of the Azalea Society of America

Volume 6 Number 2 June 1984

AZALEA SOCIETY OF AMERICA

The Azalea Society of America, organized December 9, 1977 and incorporated in the District of Columbia, is an educational and scientific non-profit association devoted to the culture, propagation and appreciation of the series *Azalea* (subgenus *Anthodendron*) of the genus *Rhododendron* in the Heath family *(Ericaceae)*.

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The Journal of the Azalea Society of America, Inc.

Dr. Charles H. Evans, Editor

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IN THIS ISSUE:

THE EDITOR'S NOTEBOOK

Azaleas are propagated by a variety of methods. The rooting of cuttings certainly is the most familiar and widely practiced technique. Grafting and air- and ground-layering offer alternative means which can be useful in specialized situations that include the multiplication of difficult to propagate varieties and the generation of unusual azalea forms such as a plant with multiple flower types or a tree azalea. Each technique is covered in **The Azalea Book.** William L. Brown brings us up to date on grafting in this issue and Neil P. Campbell revisited air-layering in **THE AZALEAN** last year. The newest method for the production of azaleas and other plants involves rooting cuttings in or growing plants from a small leaf segment on artificial or culture medium *in vitro* (in a "test tube"), a method of propagation termed cell or tissue culture or micropropagation.

A year ago, **THE AZALEAN** commenced carrying advertising announcing the availability of tissue culture grown azaleas. In the March 1984 issue, Martin M. Meyer, Jr. presented one method for the micropropagation of the genus *Rhododendron.* In this issue we are pleased to have one of our own members, Steven M. McCulloch, elaborate upon the micropropagation of azaleas.

During the past two decades, the culture and propagation of animal cells *in vitro* has advanced to where it is a common and in many instances a routine procedure in research laboratories, hospitals, universities, and even secondary education classrooms. Innumerable identical cultures (clones) can be grown from single cells, and much effort is being directed toward growing tissues (organized collections of similar cells, such as those lining a blood vessel) and organs (organized collections of tissues, such as those forming the lining and supporting wall structure of a blood vessel or more complex organs including skin, heart, liver, etc.).

The propagation of plants *in vitro* (plant tissue culture or micropropagation) is an emerging method of horticultural vegetative, or asexual, reproduction. It can be particularly beneficial for the propagation of plants, such as deciduous azaleas, that are difficult to propagate in large numbers by traditional rooting or other mass production methods. Using *in vitro* techniques, single cells, collections of cells (a leaf segment), or tissues (an apical or shoot tip) often can be induced to grow into a compete miniature or small plant using a variety of cell culture methods and culture media. Thus, plant cell culture is a powerful method to faithfully preserve biological (genetic, physical, biochemical, etc.) and horticultural characteristics in the production of a large number of plants.

Is micropropagation practical for professional and amateur azalea production? Yes, it is, and micropropagation offers advantages over conventional methods of propagation. Micropropagation is used to produce disease-free (primarily virus-free) plants, and it can be an excellent method to produce a large number of identical cultivars from a new genotype derived from pollination, chromosome transfer, mutation or other form of genetic recombination or manipulation. However, perhaps the greatest advantage of azalea micropropagation or tissue culture is that plants can be cultivated year round in any climate, in numbers commensurate with the propagator's time and bench space, not acres of land and number of laborers, the latter often becoming critical elements in conventional azalea propagation.

But, what about cost? Writing in the April 15, 1984 issue of **The American Nurseryman**, Dr. Raymond Che'e reported that the wholesale price of *Rhododendron* tissue culture production in 1983 approximated $0.35 per plant. That is not bad, but can the small propagator or amateur azalea enthusiast achieve that price, and if so, then how? Many commercial propagators employ clean or "sterile" air facilities as described by McCulloch in this issue. Those of us who have worked with cell and tissue culture during the past two decades know individuals who also have successfully used pressure cookers to prepare small quantities of culture media on a home stove and have prepared specimens for culture on a table in a clean, quiet room such as a home kitchen or basement room.

But, is azalea propagation *in vitro* practical for the amateur or small nursery propagator? Certainly! Plant tissue culture may be ripe for commercial propagators, but it is also ready for propagation at every level—for research as well as routine propagation. You have the plant material, the methods have been described (**THE AZALEAN**, March and June 1984), and the nutrient media and supplies are available (advertising, this issue). Additional information can be obtained from the authors of the micropropagation articles in **THE AZALEAN**, from our advertisers, and from professional associations such as the Tissue Culture Association, Plant Division, 1 Bank Street, Suite 210, Gaithersburg, Maryland 20878.

Microprogation of azaleas offers, as McCulloch presents, a new avenue to rapidly produce conventional, newly hybridized, and rare azaleas. Micropropagation also offers unexcelled opportunities to commercial growers concerned with acreage and labor costs and fickle weather conditions. The same advantages are present for the smaller nurseryman and the amateur grower. Interest and attention to detail, especially sterile technique, are the keys to success. Give micropropagation a try. It well may be the direction of your azalea propagation future.

Charles H. Evans

MICROPROPAGATION OF AZALEAS

Steven M. McCulloch
Olympia, Washington

Perhaps no area of propagation has been as exciting and progressive as micropropagation. In the last 15 years, we have seen the development of a technology used in colleges and universities which is sufficient for propagation of millions of plants—including azaleas.

The terminology associated with these techniques is usually not entirely understood. Tissue culture is a broad term used in describing the culture of tissue(s) in an aseptic environment. *In vitro* is Latin meaning in glass. *In vitro* is commonly used interchangeably with aseptic (meaning free from microorganisms). Micropropagation is the propagation of plants in an artificial or "synthetic" medium under aseptic conditions from very small pieces of plants using plant tissue culture techniques.

In 1902, Gottlieb Haberlandt reported on the first attempts of isolation and cultivation of plant tissue in aseptic culture. Although unsuccessful, this German plant physiologist set the stage for further research. Through the efforts of several individuals and much research, correct media and growth regulators were developed to grow and propagate plants *in vitro*.

Orchids were probably the first economically important plants to be produced by micropropagation. Using plant tissue culture techniques to rid orchids of virus, Morel (in France) discovered that orchids could be rapidly multiplied in number and that the resulting plants were genetically uniform.

In 1968, Dr. Wilbur Anderson began work on micropropagation of *Rhododendron*. Working at the Northwestern Washington Research and Extension Center in Mt. Vernon, Washington, he was able to develop a culture medium with appropriate plant growth regulators to support growth and multiplication of *Rhododendron* 'Rose Elf' shoots (1).

The micropropagation of other ericaceous plants was soon to follow. *Rhododendron*, *Kalmia*, and azalea, for example, were cultured at Brigg's Nursery in the late 1970's.

Micropropagation is but one method that the plant propagator may choose to use. It is not meant to replace other forms of traditional propagation (grafting, cuttage, seed propagation) but rather to complement them. Micropropagation however, offers several advantages to the propagator. It provides a way to:

1. propagate plants considered difficult or impossible to propagate;
2. rapidly introduce new plant material;
3. maintain and produce pathogen-free plant material;
4. propagate plants throughout the year;
5. eliminate costly maintenance of stock plants;
6. circumvent inadequacies in conventional propagation methods; and
7. produce a dependable supply of plants every year.

The techniques of micropropagation involve the aseptic excision of a plant part, which is then placed on a sterilized artificial medium in a contamination free environment. With azaleas, a single shoot is placed on a nutrient gel multiplication medium. This single shoot has several buds. These buds swell and expand into separate shoots due to the cytokinin present in the medium (think of it as chemical shearing or pruning). The newly formed shoots also have young vegetative buds along their stems which also break and expand into new shoots. The process continues until from one shoot, several shoots are formed.

This exponential increase of shoots can be quite dramatic. If, for example, we have an azalea producing ten shoots per test tube every two months and we need 1,000 plants—how long would it take to produce 1,000 plants? In the first two months, we obtain ten shoots from one test tube. The ten shoots are then separated and placed in ten individual test tubes. After the second two month period the ten test tubes each have ten shoots (100 total shoots). The shoots are then transfered in 100 separate test tubes. After the third two month period 100 test tubes each have 10 shoots or a total of 1,000 shoots in six months (Figure 1)! A few tubes may be held over to multiply for next year's crop—and the rest rooted.

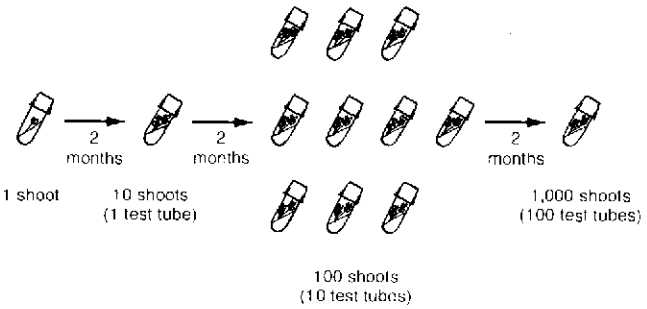

Figure 1. Exponential increase of azalea shoots by micropropagation.

There is a physiological change in the plant when cultured *in vitro*. The shoots become more juvenile or seedling-like. Unlike mature, flowering azaleas or *Rhododendron,* seedlings may be rooted very easily. We use this to our advantage in micropropagating azaleas and other plants.

Greenwood shoots are most commonly used as a course of tissue in starting azaleas. Shoot tips 2-8 centimeters long are collected, trimmed to remove large leaves, washed in soapy water and sterilized. Many different germicides may be used, with dilute laundry bleach (sodium hypochlorite) and calcium hypochlorite being the most common (6). A surfactant (soap) may be added to improve contact of the germicide with the plant shoots. Alcohol (ethyl or isopropyl) may be used to remove surface waxes (bloom) before sterilization. Agitation is also very effective in producing sterile cultures. The reaction is a result of time and concentration. Usually 20 to 25 minutes in 10 percent laundry bleach (0.5 percent sodium hypochlorite) is adequate to kill surface fungi and bacteria. Shoots are then rinsed in sterile water to remove the germicide. If cultures are not properly sterilized, fungal and bacterial contaminants frequently appear within seven to ten days. Latent bacterial contaminants, however, have been reported to show up after two or three transfers with some cultured plants.

Most plants shoots can be grown on a medium containing the necessary 16 macro- and microelements, sucrose, vitamins, agar, growth regulators, and water. Several popular formulations are used. Most woody ornamentals require or grow best on a medium having a low concentration of inorganic salts. With azaleas, the formulations of Dr. Wilbur Anderson (1) and Dr. Brent McCown (5) are popular. Our media are made from scratch. The chemicals are weighed and stored as concentrated stock solutions in the refrigerator. Media can then be made quickly by combing the stock solutions with distilled or deionized water. The pH of the solution is adjusted to 4.5 with 10 percent potassium hydroxide or dilute sulfuric acid. Growth regulators are added. Cytokinins are added for multiplication of shoots. Zeatin, a natural cytokinin present in corn, and N_6-iospentenyladenine (2iP) (1,4) are used with azaleas. The degree of shoot multiplication depends upon the concentration and type of cytokinin used. Sucrose (table sugar) and agar are added, and the solution is heated to dissolve or melt the agar. (media preparation is very similar to making jello). The melted or hot liquid mixture is then dispensed into glass test tubes or jars and capped. The medium is then sterilized by autoclaving at 121°C 250°F) at 1.1 kg/cm^2 (15 lbs/in^2) for 15 to 20 minutes in a manner similar to sterilizing food during the canning process.

All transfers of plant material in micropropagation should be performed in an area free of mold and bacterial contaminants. A laminar flow hood (biological airflow cabinet) assures a contaminant-free environment

Figure 2. A laminar flow hood assures a contamination free environment.

(Figure 2). By filtering air through a high efficiency particulate air (HEPA) filter, 99.99 percent sterile air is produced. The opening and closing os sterile containers and the cutting-up and transfer of aseptic plants are performed on the table top bathed by the sterile air produced in these hoods (Figure 3). All instruments used to cut and transfer the plants need to be germ free and workers must be continually aware of possible sources of contamination.

Figure 3. Plant shoots are cut and transferred aseptically.

After the shoots have been transferred, the sterile containers (test tubes or jars) are incubated on an illuminated shelf. Most growth rooms have continuous fluorescent light with about 100-300 foot candles intensity (Figure 4). This is much less intense than full sunlight which is approximately 10,000 foot candles. Temperatures should be controlled from 25-27°C (76-80°F). Precautions shoud be taken to prevent excess heat build up from the light fixtures. After four to ten weeks, shoots are transfered again or rooted.

Figure 4. A growth or culture room filled with several thousand plants.

Once sufficient numbers of shoots have been produced, they are rotted and eventually weaned or hardened-off. Most shoots from culture have no roots, little surface wax on their leaves, and are very fragile and susceptible to desiccation. The shoots can be rooted at this stage in soil or on a solidified agar rooting medium.

Rooting shoots in soil is very similar to rooting softwood cuttings and takes between two and four weeks for azaleas. The micro-cuttings are very soft; they were grown in a capped tube with 95-99 percent relative humidity, low light levels, and warm temperatures. Shoots are emptied from the tube and placed in water. The agar is washed from the shoots to prevent growth of mold or bacteria. In the greenhouse, shoots are stuck into flats or pots. Rooting powder does not seem to be necessary in the rooting of azalea microcuttings. Care must be taken not to allow the shoots to desicate and falts are, therefore, placed in a sweat box or mist tent (Figure 5). The tent is equipped with bottom heat and

Figure 5. Micro-cuttings are rooted and established in a poly-tent.

intermittent mist. Care must be taken to prevent disease and build up of high temperatures. Once plants have rooted, they are gradually hardened off by dropping the humidity inside the tent.

Rooting plants in culture is accomplished by placing separated shoots on a low inorganic salt medium with the addition of an auxin, indole-3-butyric acid (IBA), or indole-3-acetic acid (IAA). These transfers also need to be done in a laminar flow hood. Rooting in culture is more controlled, but it is much more expensive than rooting in soil. Survival rate is greater since these shoots already have roots before being placed in soil. Once these plants are established in soil, the plants are then gradually hardened off.

Azaleas produced using micropropagation have performed very well. Micropropagated young cuttings over-winter in Olympia better than those from conventional propagation. Also, because of a better, more uniform root ball, the young cuttings tend to be more vigorous. New and exciting plants will be introduced much more quickly to the commercial market. Plant breeders and introducers will not have to wait a lifetime to have their plants grown and appreciated by others.

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ASA NEWS

SATSUKI PROJECT: BROOKSIDE GARDENS SATSUKI COLLECTION

As an outgrowth of an offer by Carl Hahn, Chief Horticulturist for the Maryland National Capital Park and Planning Commission, which operates Brookside Gardens for the county of Montgomery, Maryland, the Azalea Society of America has launched a project to propagate, distribute, and evaluate a special collection of Satsuki azaleas. This group of azaleas to be known as the Brookside Gardens Satsuki Collection consists of approximately 300 cultivars and will be available for purchase in the near future.

These cultivars are the progeny of a larger group imported as cuttings in 1977 and 1978 by Barry Yinger for Brookside Gardens, with support from the Silver Spring Garden Club. They have been grown, further propagated, and to a limited degree evaluated in the meantime by Brookside Gardens.

The majority of the cultivars at the time of importation had not been grown in the United States. Accordingly, we may expect the cultivars in the Brookside Gardens Satsuki Collection to be significant additions to the number of Satsuki hybrids available to U.S. azalea lovers. The degree of hardiness of these plants is not yet known. Nearly all of them have survived at least two winters outside in the Washington area and bloomed the following spring, suggesting that a high percentage will prove to be hardy as far north as the mid-Atlantic region. One facet of the society's evaluation will be collection of data on each clone's performance in various climates.

The Board of Governors has established a panel to direct the operation of the project. The approach to propagation and distribution is for the society to work cooperatively with selected commercial propagating nurseries. Each nursery is to be provided with cuttings, to be propagated for sale first to society members and subsequently to the general public. Although the plan was not adopted until early August 1983, with the help of local Washington, D.C. area Society members, cuttings from at least 80 percent of the cultivars were distributed to the nurseries by the end of August. Panel members are Robert Barry (initial chairman), Jerry Goodman, George Harding, John Rochester, Jr., and Carl Seidler. Nurseries selected for the propagation and marketing, specifically chosen to represent a variety of climates, are the Gordon W. Severe Nursery, Millsboro, Delaware, Hager Nurseries, Inc., Spotsylvania, Virginia, Hass Nursery, Philomath, Oregon, and Dogwood Hills Nursery, Franklinton, Louisiana. Some, but not all, of the plants in the Brookside Gardens Satsuki Collection will be offered for sale in late April, 1985. Evaluation of the clones will be carried out over a span of several years.

Names and numbers of the cultivars comprising the Brookside Gardens Satsuki collection will be listed in a future issue of **THE AZALEAN**, along with details for ordering plants. Descriptions are to be included in the forthcoming revision of **THE AZALEA BOOK,** expected to be in print by 1985 if not earlier.

Undoubtedly, the importation by Brookside Gardens of this Satsuki collection will pay high dividends to azalea lovers in wide areas of the country. Release of the plants to the *Azalea Society of America* by Brookside Gardens and by Carl Hahn represents a cherished opportunity for the the Azalea Society of America to be of service, in keeping with society aims to further the knowledge and appreciation of azaleas.

Ryon Page

Chapter and member activities for inclusion in **ASA NEWS AND VIEWS** should be sent to the Editor three months prior to the month of publication desired in **THE AZALEAN.**

AZALEAS FOR COMMERCIAL FORCING

Dr. Sandra F. McDonald
Hampton, Virginia

Forcing of azaleas into bloom has been practiced by amateur and professional horticulturists for generations and is the dominant means of providing azaleas for the florist market. For the most part, different cultivars are grown in different areas of the country, although there is some overlap. The major azalea production areas in the United States are in the Southeast: Alabama, Florida, South Carolina, parts of North Carolina, and eastern parts of Virginia; in the West and Northwest: California, Oregon, and Washington; and in the Northeast: Long Island, New York, and New Jersey. Ideally each variety of azalea is grown in a section of the country where it is best adapted. Though some azaleas for the florist market are field-grown, many others are greenhouse grown. Varieties selected for greenhouse production do not need to be as winter hardy as field grown varieties.

General characteristics desired in azaleas for commercial forcing are:

1) Fancy Flowers. Hose-in-hose or semi-double to double (these types of flowers do not self-pollinate and therefore the flowers hold well) and to some extent larger frilled, ruffled, or variegated types, especially if the blooms hold well. Blooms with heavy substance, in general, seem to last longer than those of light substance. Pedicels (flower stalks) which are not brittle are desirable so that blooms do not fall off when the plants are transported;
2) Roots. Varieties which root readily and have strong and vigorous root systems are desirable;
3) Vegetative growth and plant habit. Varieties which are vigorous growers, which branch well and have an upright and rounded growth habit when two to three years old make good commercial plants. Good leaf retention and good leaf color are also highly desirable;
4) Blooming season. Early and midseason evergreen azalea varieties are preferable, as they force more uniformly than late varieties and also take less time in a heated greenhouse to bring into bloom. Late varieties are seldom forced commercially;
5) Growability. Varieties selected for commercial forcing should be at least average in disease resistance and should not have any conspicuous weaknesses in their constitution. A florist azalea must be of very high quality. Since azaleas are forced under conditions where many diseases and insects can flourish, good genetic constitution in conjunction with proper sanitation and a disease and insect control program are necessary to insure production of a high quality saleable crop.

General characteristics desired in azaleas for landscape use are:

1) Flowers. Of course these should be attractive, but they can be single, double, hose-in-hose, etc.;
2) Roots. Varieties which root readily and have strong root systems are best;
3) Vegetative growth and plant habit. Good growers are desirable, but bushy growth as a very young plant is not as critical as with forcing varieties. These plants will fill out as they mature in the landscape. Habits can vary from low and creeping to tall and upright. Most commercial growers prefer plants which "make up" quickly, that is attain a saleable size quickly;
4) Blooming season. Early, midseason, and late varieties are all acceptable, though late bloomers are less popular with garden centers because the garden centers are moving on to types of blooming plants other than azaleas after the midseason varieties have finished blooming;
5) Hardiness. Winter hardiness in the area to which the plants are shipped is very important. Therefore, generally hardier azalea varieties are grown for landscaping purposes than for forcing purposes.

SOME POPULAR VARIETIES FOR FORCING

Hose-in-hose Kurume types

'Coral Bells': 1½ inch light silver to coral pink flowers.
'Snow': 1¾ inch white flowers with faint chartreuse blotch.
'Tradition': Pink flowers slightly larger than 'Coral Bells'.
'Salmon Beauty': 1¾ inch salmon pink ruffled flowers.

Hose-in-hose Pericats[1]

'Barbara Gail': Light solferino purple flowers.
'Dawn': 2¾ inch phlox pink flowers with white center and darker blotch.
'Flamingo': 1¾ inch camellia rose flowers with white edge and darker blotch. Form is hose-in-hose semi-double.
'Hampton Beauty': 2 inch carmine rose flowers with darker blotch and partially petaloid sepals.
'Sweetheart Supreme': 1¾ inch camellia rose flowers with darker blotch. Form is hose-in-hose semi-double.

[1]'Flamingo' is to be distinguished from the Brooks, Coolidge and Kurume hybrids of the same name. Le-Mac Nurseries has introduced a number of Pericat hybrids including 'Glory', 'Hampton Beauty', 'Hampton Rose', 'Harmony', 'Melody', 'Rhythm', 'Richesse', and 'Symphony'. 'Flamingo' was acquired in March 1962 and has some similarity in flower size, form, and coloration with 'Sweetheart Supreme'.

Indian and Belgian Indian hybrids[2]

'Albert—Elizabeth': Semi-double, frilled, and variegated camellia-like flowers of delft rose with white center.
'Abrosiana': 3 inch double crimson red flowers.
'Anytime': Semi-double rose pink flowers.
'Chimes': 3 inch semi-double bell-shaped, red flowers.
'Dr. Bergman': 2¾ inch semi-double orange-red, la france pink flowers washed geranium pink with light border.
'Jean Haerens': 3 inch frilled, double, light lilac rose flowers.
'Leopold Astrid': 3 inch semi-double picotee white with salmon red flowers with markings on the edge of petals.
'Loelia Alba': Large, double white flowers.

Bobbink & Atkins and/or Rutherfords

'Alaska': 2 inch hose-in-hose, semi-double, white flowers with chartreuse blotch.
'Amber Glow': 1¾ inch hose-in-hose delft rose flowers.
'Dorothy Gish': 2½ inch hose-in-hose, frilled, orange-red flowers.
'Gloria': Salmon and white variegated sport of 'Dorothy Gish' with red spots in throat.
'L. J. Bobbink': 2 inch frilled, hose-in-hose, petunia purple flowers with almost white throat.
'Salmon Spray': Hose-in-hose light carmine flowers.
'White Gish': Very pale pink opening to white sport of 'Dorothy Gish'.

Gold Cup hybrids

'Baby Jill': 3 inch ruffled, semi-double, lavender-pink, two-toned flowers.
'Easter Parade': 3 inch ruffled, hose-in-hose, pink flowers with white marbling.
'Sun Valley': 2½ inch hose-in-hose pure white flowers.

Whitewater/Motzkau hybrids

'Prize': Hose-in-hose, semi-double, deep pink-red, ruffled flowers.
'Roadrunner': Hose-in-hose deep pink-red flowers.
'Solitaire': Large, hose-in-hose, semi-double, bright pink flowers.
'Whitewater': Hose-in-hose, semi-double white flowers.

Brooks hybrid

'Red Wing': To 4 inch ruffled, red, hose-in-hose flowers.

Shamarello hybrids

'Elsie Lee': 2½ inch frilled, hose-in-hose, semi-double lavender flowers.
'Helen Curtis': 2½ inch frilled, hose-in-hose, semi-double white flowers.

Other hybrids

'Hershey's Bright Red': Hose-in-hose red flowers.
'H. H. Hume': 2 inch hose-in-hose white flowers.
'Mary Lynn': Hose-in-hose pink flowers.

COMMERCIAL PROPAGATION

A small number of forcing azaleas, especially Belgian-Indians, are propagated by grafting, but most forcing azaleas are propagated by cuttings rooted under intermittent mist. A few commercial propagators do not use mist in their propagation. Timing (stage of growth of cutting when taken), cutting preparation, and propagation mix vary from grower to grower. The season for taking cuttings may be spring, summer, fall, or even winter or year round, depending on the grower. Bottom heat is used in some commercial azalea propagation operations. Rooting hormones may or may not be used. In effect, there are as many azalea propagation 'recipes' as there are azalea growers, and most systems work due to vigilance by the propagator and control of the various environmental conditions by artificial methods when necessary.

COMMERCIAL FORCING

Forcing of evergreen azaleas begins in the warm greenhouse after the azalea's cold requirements have been satisfied either naturally, or in a cooler, or even by special chemical treatment.

Recommended forcing temperature is 60° to 65°F (night temperature) with the temperature rising somewhat during the day. A relative humidity of 60 to 65 percent is desirable. Forcing usually takes about five weeks, but it can vary a week or more either way depending upon the variety being forced, the amount of heat and light, and the forcing season.

BRINGING THE PLANT TO MARKET

Forcing azaleas are usually shipped in the dormant condition (either cooled or still in need of cooling) to a greenhouse operation for potting up, if necessary, and forcing and subsequent sale in the regional market. Once the azaleas are forced into bloom, the shipping distances should be minimized, because the plant is in a more perishable condition than the dormant plant, and the shipping environment needs to be quite carefully controlled.

A thorough discussion of the technicalities of commercial azalea growing can be found in **Growing Azaleas Commercially**, Anton M. Kofranek and Roy A. Larson, editors, published in 1975 by The University of California.

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[2]'Ambrosiana', 'Anytime', and 'Leopold Astrid' are popular florist azaleas. They are described in **Growing Azaleas Commercially**; the other varieities are described in **The Azalea Book**.

Sandra F. McDonald, Ph.D., is a Horticulturist at Le-Mac Nurseries Inc., Hampton, Virginia and a hybridizer of rhododendrons and azaleas.

"Azalea Classic"
EXCERPT FROM *LES AZALEES* BY LEON DUVAL, PARIS 1895

(translated by B. Y. Morrison, September 1950)

Chapter XV - pp. 63-65

When it is necessary to force azaleas for sale or for the decoration of a private house, it is an operation that demands certain attentions and precautions. Many cultivators do not take sufficient pains with a number of things futile in appearance, and it is that that bores them and makes their work fail. We therefore insist to the reader that all we relate here is the result of long practice, continued observations, and sufficient knowledge—we would not say complete for that can never be—to succeed with the varieties suitable to the type of work described in this chapter.

One of the first qualities of an azalea that is to be used in forcing is that it be an early variety, lending itself readily to the operation. The other required qualities of most importance are that its roots be in perfect condition and that the buds be perfectly formed. Setting aside the question of variety, let us see the principle attentions to be given azaleas intended for forcing.

In the autumn, i.e. in October, when one prepares to return the azaleas to the greenhouse, one should arrange the plants in two categories; those intended to flower at a normal time, i.e. in February, March, April, in order that they be placed in a cold house where the temperatures may fall to 4-5 degrees above zero. The other house for early plants will be a little more temperate, so that one can maintain the heat more easily or give a little less air. This is a necessary preparation, in our opinion.

When the plants are carried into this house one examines them and if there is the least trace of insects, one must dip them (see chapter on Insects) (a nicotine solution BYM); one must take out all the wood without sap or vigor that fills up the interior of the crowns. If these should be too compact, too tight, one may tie the branches apart with raffia in such a way that air reaches all parts of the head and at the same time gives an advantage in size. Then one must get out most carefully all the worms from the interior of the pots.

During the first days of November, the 5th or 6th, one must begin preparation of the forcing house where, if one does not make a specialty of this, or if one is an amateur, one may then place in a warm house in pots turned upside down or on supports the azaleas arranged in such a fashion that they will find their optimum conditions as we will inidicate a little further on. Above all else one must choose very early varieties. Those commonly employed in order of their earliness are:

1. Deutsche Perle
2. Pauline Mardner
3. Punctulata its varieties
4. Sigismond Rucker
5. Versicolor
6. Vervaeneana

It is evident that with these six varieties one will arrive perfectly in having flowers from about the 15-20th of December (if) started in forcing November 5-6. But it is important to point out other less early varieties, which brought into the house then will give flowers from Christmas to New Year's.

They follow in approximate order of earliness:

1. Simond Mardner
2. Eborina plena
3. Madame van der Cruyssen
4. Paul de Schryver
5. Prof. Wolters
6. Sakuntala

It would be well for the reader to get the idea that these lists are variable and that they can always be modified; since every year there are new varieties recommendable for their coloration, their form, and properly, their forcing qualities. But these dozen varieties at least constitute the basis of all (now) forced and at present are considered the best.

For commercial forcing, it will certainly be necessary to have a greenhouse facing south; it is the best exposure, one that receives the sunlight and that permits a perfect arrangement of the plants so that their heads are in full light. This does not mean that no other sort of house can be employed, but is evident that a house of that exposure is infinitely preferable. The temperature can be calculated in advance and readily raised by calculating the number and size of the heating pipes in order to get the heat needed without overheating the water.

In an ordinary forcing house, one should maintain a temperature about 25-30 degrees by day, as one needs more or less heat (but) this temperature will vary a little. It is kept at only 13-15 degrees at night; it is very important to let the temperature drop so that the plants get a needed period of rest. This arrayed, the plants are arranged without being too much in series (in line) and well lit, one begins to give heat. They should be watered daily, morning and night with water at greenhouse temperature, but never on the leaves when the sun shines. In that case one should water the floors, under the benches and along the walls. It is very important to observe the condition of the balls that never must be allowed to dry or to become too wet. If one sees traces of worms they must be taken out with care.

Certain varieties make shoots immediately under the influence of heat and moisture. It is necessary to remove these shoots radically but without harming or damaging the plants; this is accomplished by pulling them lightly, so that they are detached easily at the base. If one neglects this operation, one risks seeing the buds aborted and the loss of all the fruit of ones work. It is sometimes necessary to come to the aid of the buds that are enveloped in a thin tunic, which will rot them.

One must cut this envelope carefully. In about 15-20 days, more or less, under the influence of heat and moisture, the buds swell and show the color of the flowers. At this time one should stop wetting down the (plant) tops or at least moderate it especially if shaded and yet they must not be allowed to dry out. Certain varieties are more or less sensitive to humidity, and one can generally decide to stop wetting the plants down as soon as the buds are well developed. This is the time when the plants need the most sunlight and the plants should be covered as little as possible, even at night. For this we are biased in favor of glass houses with large clear glass, so that we may dispense with any other cover.

As soon as there is a series of plants sufficiently advanced, that is with flowers opening, they are placed in another glass house, also very open and bright, but cooler; this one may call the "cooler". This is an excellent operation. It strengthens the flowers, improves their color and prepares them for their stay in shop or apartment.

Everything that has been said for the forcing establishment can be said about more hot houses where the plants are put on simple supports but it is evident that it will be difficult to give them the good care indicated, as if they were under normal conditions. We should prefer to see the small grower or amateur arrange a small space in a cool house where he can put his plants and attend to their forcing. The first season he will need 40-45 days to force the very early varieties; but the amount of time lessens as the season advances. Thus one could force the very early sorts of our first list 28-30 days after November 20—later, the same varieties would need no more than three weeks.

But in order that our readers realize it well, let it be repeated that aside from early varieties, it is useless to force or try to force later or semi-early varieties and that such a knowledge of varieties is needed by every forcer. The same thing is true of an azalea that shows no sign of development in a reasonable time. It should be removed from forcing. If one persists one courts certain failure. The same is true of plants that for lack of care are infested with insects. They should be removed also for there is the additional risk of infestation of other (healthy) plants. One may make a valuable observation: in general, strong plants that have a good framework and firm wood, force better and more regularly (evenly) than younger plants; the same is true of grafted plants which force more regularly than those of equal age on their own roots. It is absolutely true and evident that to have a perfect result, it is best to force own root plants in the third group, that is toward the end of December. It is necessary to say that in general azaleas for forcing must be well watched in watering and that they like neither an excess of moisture or of dryness. It should also be added that the varieties of our first and second lists can be forced in the second or third season (time period—not year BYM) and that then they lack nothing of their qualities. They are only taken into heat as soon as they show signs of flowering and that one may have Deutsche Perle and Pauline Mardner in bloom in 12 to 15 days. Of the remainder, one perceives easily the great earliness of those varieties that from the first days of January begin to show the color of their flower buds even without forcing.

This "Azalea Classic" is part of a translation of Leon Duval's *Les Azalees* by Ben Morrison from the files at the Plant Introduction Station, Glenn Dale, Maryland.

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Duval's observations are in many respects in vivid contrast to those today and we asked Sandra McDonald to comment.

"The exerpt from *Les Azalees* by Leon Duval is interesting historically. Many people may not realize the temperatures being used are not F., but C. 4 to 5° above zero is about 39 to 41°F and 25 to 30° for day time forcing is 77 to 86°F with 13 to 15° night temperatures being equal to 55 to 59°F. Also the reader should be aware of minimal mention of cold treatment. Since only very early varieties were used, they probably did not require as much cold treatment as the early-midseason and midseason varieties used today. Evergreen azaleas grown in the Middle Atlantic area in general would not receive enough cooling to start forcing by Nov. 5th or 6th unless they were grown in cool areas such as high elevations or high latitudes or received extra cold treatment in a cooler. Plants grown in the Pacific Northwest get somewhat more cooling in autumn than most of the Southeast and Middle Atlantic United States.

The reader will do well if he can put himself in France with its climate and think in proper terms of temperature and variety.

One thing that impacted on me was that most of the varieties forced today last much longer in bloom than the plants evidently did in 1895."

"Azalea Classics" are articles published in the past which **THE AZALEAN** staff deems worthy of being brought to the attention of today's azalea enthusiasts. Whenever possible **"Azalea Classics"** will relate to a feature article in **THE AZALEAN** in order to increase the perspective of the issue. We think this is a valuable way to link the past, present, and future in azalea horticulture.

GRAFTING OF AZALEAS

William L. Brown
Hammonton, Louisiana

Grating of azaleas is far from a new practice, but it is certainly a rare practice among commercial growers as well as amateurs. My propagation books tell me that grafting was once a common method of propagation of Belgian Indicas and such hard-to-root plants as the Ghent and Mollis hybrids. I suspect that this was mostly done in Europe.

I can think of only three possible reasons for grafting evergreen azaleas. One is to grow plants of root rot-susceptible cultivars in an area where root rot is a common problem. Another is to produce as much propagating wood as possible of a seedling or other plant in short supply. The third is to produce tree-form and other "topiary" plants of cultivars that would be extremely slow to grow into these forms on their own trunks.

The latter has been my reason for grafting. (And azaleas are only one of many plant groups that I graft for the same reason.) By grafting onto a vigorous stock, a 3 foot tall 'Gumpo' or a 5 foot tall plant of a medium-vigor cultivar can be produced in two years (Figure 1).

These graft combinations have the double advantage of very fast growth the first year or two and the resumption of normal growth thereafter. This results in an extremely low-maintenance plant when a dwarf scion cultivar is used.

Azaleas can be grafted at any time mature scions are available. This can be almost any time with a plant that grows in flushes as azaleas do. I avoid the time from early fall thru midwinter unless I plan to leave the plants in a greenhouse until spring.

The rootstock I have used for most of my grafts is 'Formosa'. It is very vigorous, tolerant of *Phytophthora* root rot and apparently compatible with a wide range of evergreen cultivars. At least 40 different azaleas have been successfully grafted on 'Formosa' stock, including the species *Rhododendron oldhami, R. nakaharai* and *R. lasiostylum.* The only cultivar that we have tried more than twice without success is 'Coral Bells'. Attempts to graft two deciduous species on 'Formosa' were also unsuccessful.

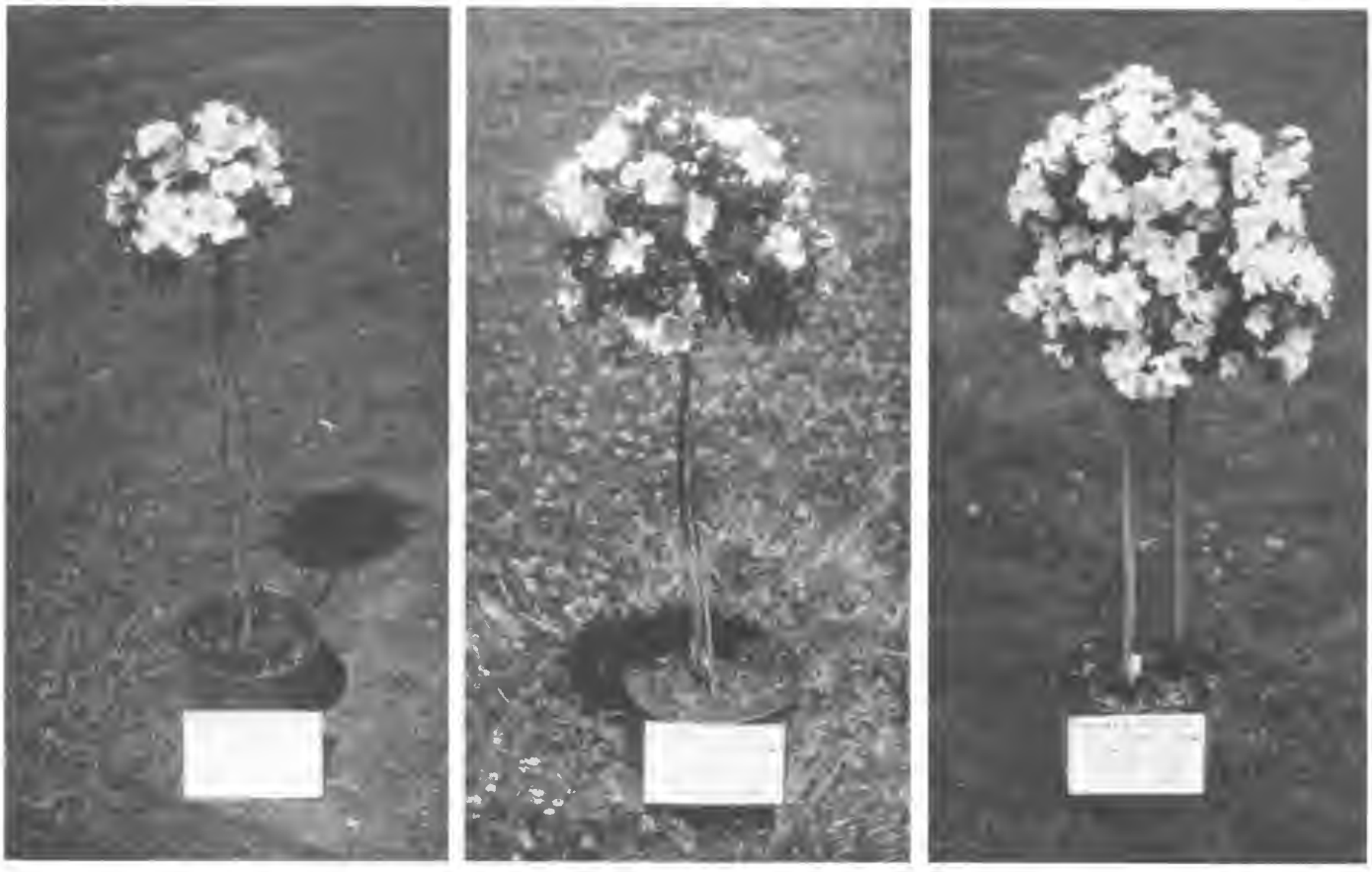

Figure 1. A 2 year old 'Gumpo White' grafted on 'Daphne Salmon' and photographed 1 (left), 2 (center) and 3 (right) years after grafting.

The question of whether tree-form plants with 'Formosa' trunks will be hardy outside of the normal 'Formosa' range has not been answered. My guess is that, after the year or so of vigorous growth following grafting, a hardy scion cultivar will tend to make the stock somewhat more cold-hardy than it would be with its own top.

I prefer a trunk that is about one-half inch in diameter at the point the graft is to be made. If the stock is much larger than this, it is more difficult to make a clean vertical cut. If it is much smaller, it lacks the desired vigor and support.

For a simple "tree-form" or "patio tree", the height of the graft may be anywhere from 2 feet high for a very dwarf cultivar such as 'Gumpo' to 4 feet high for a fairly vigorous cultivar or a cascading cultivar such as 'Pink Cascade'.

The type of graft that I have used in all cases is the cleft. A clean horizontal cut is made at the desired grafting point. A vertical cut is then made through the center of the trunk. Then the 2-3 inch scion is trimmed into a wedge with the side which is to be put on the outer side of the stock thicker than the inner side. The cleft is opened with a knife blade and the scion is placed so that the cambium (the living layer just inside the bark) of the scion is in contact with the cambium of the stock.

Two scions can be placed on a thick stock. This can result in a more densely branched top, but it can also result in a weak crotch or a one-sided top. This can develop after the two scions have grown enough to touch.

When a thin stock is used, a rubber budding strip can be used to keep more pressure on the scion and hold it in place. With a thicker stock, no wrap is needed. The graft is covered with a pint or quart polyethylene bag to retain moisture. The bag is fastened tightly around the stem with a paper covered wire. This is covered with a small paper bag to prevent overheating inside the plastic bag. The plant is then placed in a light shade for additional protection.

After 4 to 6 weeks, the graft should be checked frequently. When union of stock and scion has begun, the wire is lossened to give some ventilation. It is less of a shock to the scion if this ventilation is begun before any new growth is produced. Finally, the bags are removed completely and the plant is left in light shade. If wilting occurs, the uncovering was premature and the graft should be protected again.

During the first growing season, most cultivars will need frequent pinching or light pruning because growth will be vigorous. Removal of growth from the stock will also need to be done frequently, especially if the plant is pushed to maximum growth with fertilization. After the first year, excessive vigor of the top and sprouting of the stock will generally decrease.

Patio trees and pompoms created by grafting can provide variety in the landscape and also provide an outlet for our artistic inclinations.

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THE AZALEA CALENDAR

June	
3	Northern Virginia chapter Satsuki and late variety azalea garden tours.
25	Brookside Gardens chapter azalea plant auction.
July	
15	Northern Virginia chapter cutting exchange.
September	
22	Glenn Dale Preservation Project work day.
October	
20	Glenn Dale Preservation Project work day.
November	
17	Glenn Dale Preservation Project work day.
December	
3	Brookside Gardens chapter annual meeting; presentation of Frederic P. Lee award for 1984.

THE AZALEA CALENDAR lists upcoming Society and chapter activities. Items to be included should be forwarded to the Editor together with name, address, and telephone number of contact person(s) at least three months prior to the month of publication of **THE AZALEAN** in which the notice is to appear.

THE BELGIAN-GLENN DALE HYBRIDS

William C. Miller III
Bethesda, Maryland

On March 12, 1962, the Crops Research Division of the Agricultural Research Service, U. S. Department of Agriculture, released five new azaleas for propagation. These azaleas, which bloom in early May in the Washington D.C. area, were developed to incorporate the flower qualities of the Belgian-type azaleas into the hardy Glenn Dale hybrids, according to press releases and public announcements from the period. They were the end product of a series of crosses made in 1947 under the direction of Ben Morrison at the Plant Introduction Station at Glenn Dale, Maryland, in what became known as Line Project b-11-3-5. But there was more rationale to the project than just the production of a race of hardy Belgian-like hybrids. In a letter dated February 24, 1950 to C. O. Erlanson, Head of the Division of Plant Exploration and Introduction, Morrison explained his proposal for an additional azalea project. He wrote, "I am sorry that there should be proposed now, as we approach the last stages in placing the present Glenn Dale azaleas, a program that will involve a considerable time lag. The material, however, is sufficiently distinct in character and is sufficiently good in quality to make it valuable. In the populations to which I have special reference, there are now about 1200 individuals. The eventual number of clones-to-be-named probably should not exceed twenty-five, a high percentage, but I believe warranted, as none will conflict with the introduced Glenn Dale clones, and it is entirely possible that they may extend the usefulness of the group towards the South." In other words, the seedlings Morrison had were good, and some of the Glenn Dale hybrids were not proving suitable for the South or were "quite useless in the South" to quote his frankness.

Table 1. Belgian-Glenn Dale Bell Number[1] Assignments

B42319	"Florist's Pink" X 'Afterglow'
B42320	"Florist's Pink" X 'Argosy'
B42321	"Florist's Pink" X 'Treasure'
B42322	"Florist's Pink" X 'Aladdin'
B42323	"Florist's Pink" X 'Clarion'
B42324	'Shinnyo-no-tsuki' X 'Bravura'
B42325	'Jindai' X 'Bravura'
B42326	'How Raku' X 'Bravura'

[1]A "Bell Number" was a working number assigned to crosses and a means of individual plant identification utilized prior to naming and the assignment of plant introduction accession number ("P.I. Number"). The Plant Introduction Station at Glenn Dale was often referred to as "Bell Station", a name derived from the nearby station of an interurban trolly line that ran between Baltimore, Maryland, and Washington, D.C.

The five azaleas known today as the Belgian-Glenn Dale hybrids, 'Bayou', 'Green Mist', 'Petite', 'Pink Ice', and 'Whitehouse', were considered the finest of 96 primary selections made from Morrison's 1200 seedlings. The crosses or formulas involved an unidentified Belgian double azalea simply referred to as "Florist's Pink" with a series of Glenn Dale hybrids and three Chugai Satsuki introductions with the Glenn Dale 'Bravura' (Table 1). The crosses involving the Chugai cultivars failed to survive the evaluation and selection process to the point of introduction.

While the Belgian-Glenn Dales were ultimately introduced by John L. Creech, Ben Morrison was very much involved in the effort. In early official documents (official line project descriptions), Morrison was identified as the project leader; and after his retirement to Pass Christian, Mississippi, in 1951, Morrison received seedlings for evaluation. The files at Glenn Dale indicate that Morrison received approximately one-fourth of the plant material. The balance was retained at the Plant Introduction Station at Glenn Dale where complete sets of seedlings were placed in a cool greenhouse, in a deep frame, and in the woods planting. As the evaluation and selection process progressed, the number of cultivars under consideration was reduced.

In March of 1954, selections of the most distinctive seedlings, based on flower type, were made from the four populations, and informal agreements were entered into with cooperators at seven localities for further testing and evaluation. According to Glenn Dale records, the seven cooperators were: Fred Huette, Norfolk Municipal Gardens, Norfolk, Virginia; D. L. Gill, Georgia Coastal Plain Experimental Station, Tifton, Georgia; M. B. Greene, Bellingrath Gardens, Mobile, Alabama; W. D. Kimbrough, Department of Horticulture, Louisiana State University, Baton Rouge, Louisiana; R. D. Dickey, Department of Horticulture, University of Florida, Gainesville, Florida; G. H. Spaulding, Los Angeles State & County City Arboretum, Arcadia, California; and B. O. Mulligan, University of Washington Arboretum, Seattle, Washington.

A "back yard" winter injury evaluation was conducted in College Park, Maryland, by W. E. Whitehouse during the winter of 1955-56. The data and recommendations resulting from this work further pared down the list of candidate cultivars. During 1958, fifteen selections (Table 2) were chosen for naming, and all cooperators were requested in April 1958 to report their observations during the flowering seasons of 1958 and 1959. In the March 2, 1959 progress report (line project CR I2-13 as it was renamed to reflect the change in responsibility) submitted by John L. Creech, four of the selections were

Table 2. The Belgian-Glenn Dale Hybrid Azaleas

Cultivar	Bell No.	P.I. Number	Cross	Description[1]
'Honeymoon'	B44762-4	—	"Florist's Pink" X 'Argosy'	Flowers semi-double with rosebud effect, rose madder 23/1, 2¼".
'Whitehouse'[2]	B44768-331	P.I. 279409	"Florist's Pink" X 'Treasure'	Plant broad, spreading; leaves large, obovate, dull green, slightly hairy; flowers 3¾ inches diameter, single, white; petals roundish, overlapping, margins somewhat wavy.
'Lagoon'	B44772-341	—	"Florist's Pink" X 'Treasure'	Flowers double, amaranth rose 530/3, 3", petals somewhat ruffled, good texture.
'Bayou'	B44773-266	P.I. 279405	"Florist's Pink" X 'Treasure'	Flowers single, occasional petaloid stamens, white, flaked and striped scarlet 19/2, 2½".
'Sultry'	B44774-33	—	"Florist's Pink" X 'Afterglow'	Flowers semi-double, rosette at center, claret rose 021, 4", large ovoid petals, heavy texture and prolific bloomer.
'Starfire'	B44775-57	—	"Florist's Pink" X 'Argosy'	Flowers single, white, with many flakes and stripes of solferino purple and distinct yellow blotch, 3¾", petals broad, giving the flower a square appearance.
'Pink Frills'	B44782-79	—	"Florist's Pink" X 'Treasure'	Flowers single occasioally petaloid stamens, solferino purple 26/1, solid blotch of ruby red 27, 3¼", petals frilled.
'Risque'	B44783-82	—	"Florist's Pink" X 'Argosy'	Flowers semi-double, mostly just petaloid stamens, phlox pink 625 with tyrian purple blotch, 2¾".
'Dancing Waters'	B44802-40	—	"Florist's Pink" X 'Treasure'	Flowers single, white with occasional flakes of amaranth rose, distinct greenish blotch, 3¼", flowers in compact masses, flat-faced and broadly overlapping.
'Pink Ice'	B44813-120	P.I. 279408	"Florist's Pink" X 'Treasure'	Flowers double, mallow purple 630/3, with occasional purple flakes, 3", smooth margins, crisp texture.
'Climax'	B44815-51	—	"Florist's Pink" X 'Clarion'	Flowers single, sometimes 6 petals, rose red 724/2, darker blotch, funnel shaped with overlapping petals.
'Petite'	B44817-132	P.I. 279407	"Florist's Pink" X 'Treasure'	Flowers single, mallow purple 630/3, 3", petals ovoid, wavy margin, overlapping.
'Ballero'	B44819-184	—	"Florist's Pink" X 'Clarion'	Flowers single, madder 23/2, rose blotch, 3½", margins wavy, and petals overlapping.
'Satellite'	B44834-218	—	"Florist's Pink" X 'Treasure'	Flowers single, tendency to petaloid stamens, White, yellow-green blotch, 3½", flowers funnel-shaped, smooth, regular margins.
'Limelight'[3]	B44838-250	—	"Florist's Pink" X 'Treasure'	Flowers semi-double, white, with green blotch, 2½", flat face, large ovoid petals, heavy texture.
'Green Mist'[4]	B44838-250	P.I. 279406	"Florist's Pink" X 'Treasure'	(not listed as one of the original fifteen, the evidence suggests that it is 'Limelight' renamed.)
'Butterfly'	B44842-267	—	"Florist's Pink" X 'Treasure'	Flowers single, amaranth rose 530/2, flaked mallow purple 630, 3", petals with wavy margins.

[1]The color descriptions are from the Horticultural Colour Charts prepared by Robert F. Wilson and published in two volumes by the Royal Horticultural Society in 1941. This system of color descriptions was later replaced by the R.H.S. Colour Chart in use today. Flower form and size descriptions unless other wise indicated are from the files at Glenn Dale (see text).

[2]'Whitehouse' was a later selection, so a description comparable to the others in the Glenn Dale files was not available. This description was obtained from USDA Plant Inventory No. 170, Washington, D.C., March, 1968, page 56.

[3,4]'Limelight' and 'Green Mist' appear to be one in the same (see text). 'Green Mist' is described by F. P. Lee as a single in **The Azalea Book**. The following description is as described in the USDA Plant Inventory No. 170, Washington, D.C, March, 1968, page 56: " 'Green Mist'. Plant upright, spreading; leaves glossy, narrow-elliptic, glabrous; flowers 2.5 inches diameter, semidouble, white, with greenish blotch, texture heavy." The latter agrees with the description in the Glenn Dale files as listed here.

rated "very good", three of the selections were rated "good", six selections were rated "fair", and two were not rated due to plant size. The report further stated that performance of the fifteen selections at the National Arboretum had been good and that they had received considerable comment. Hardiness behavior was reported as satisfactory, while forcing tests at the University of Maryland had concluded that none of the selections was superior to varieties already in commerce. For reasons not apparent in the Glenn Dale records, at least one additional selection was made over and above the fifteen chosen in 1958; in another case one name was changed. 'Whitehouse', the additional selection, is important because it became one of the five introductions. And, it appears that the name 'Limelight' was changed to 'Green Mist' given that they share the same Bell Number. The descriptions in Table 2 have been compiled from dated and undated documents and notes from late 1959 in the files at the Plant Introduction Station at Glenn Dale, Maryland. These descriptions are important because they are the only remaining clues to the unintroduced Belgian-Glenn Dale hybrids, many of which still exist today.

It seems to be a general "fact of life" that while some cultivars are not introduced in an official process, they "escape" and become available in the trade. This has occurred with the Glenn Dale hybrids, and I believe that I have a specimen of the Belgian-Glenn Dale 'Sultry' which was never introduced. Ron Bare, Curator of Rhododendron and Azalea Collections at the U.S. National Arboretum, moreover, reports that the Arboretum has a number of unnamed and named but unintroduced Belgian-Glenn Dale cultivars, as well as those that were introduced, despite the fact that some losses were sustained in the severe winter of 1981. As a group, the Belgian-Glenn Dale hybrids should not be considered as hardy as the Glenn Dale hybrids of which they are direct issue. But, a more southerly latitude than that of Washington, D.C. or a modicum of protection would be expected to significantly enhance the performance of Belgian-Glenn Dale azaleas.

William C. Miller III is president of the Brookside Gardens Chapter and a previous contributor to **THE AZALEAN.**

PROPAGATION FOR BEGINNERS

James S. Wells

PRODUCING EVERGREEN AZALEAS

We have spent nearly a year getting ready to take some cuttings and it's about time we began to do some propagating. No better crop than the widely grown evergreen azaleas could be found to illustrate the value of some of the methods we have been discussing.

Evergreen azaleas can be divided into two main groups: the relatively dwarf and compact types, called Kurume hybrids, and the taller and somewhat more loose types, known collectively as Kaempferi hybrids. Among the Kurumes, there are many subgroups, such as the Wilson 50, which were the original introductions from the town of Kurume, Japan, selected by E. H. Wilson; the Gables, bred by Joseph Gable for compact habit and extreme hardiness; the U.S. Department of Agriculture hybrids produced at Beltsville, Maryland; the Pericat hybrids; and many more.

All these so-called Kurume groups have similar growth habits. They are relatively compact, dense, low-growing shrubs, with a profusion of flowers in April and early May. A wide range of colors is available. The main difference between the groups is their relative hardiness; some are much hardier than others.

The Gable hybrids have proven to be almost universally successful because of their extreme hardiness. Almost all of them are hardy to —20°. Therefore, they can be grown in many areas where the average Kurume, such as *Rhododendron* x 'Hinodegiri,' will not survive. Most of the Kaempferis are quite hardy, but many of the Glenn Dale hybrids raised at the U.S. National ARboretum, Washington, DC, by B. Y. Morrison have a similar tall habit but are only hardy in Washington or points south. Propagation of all groups is essentially the same.

Once flowering is finished, new growth should commence if the plants are in good health and free from diseases or pests, which, of course, they have to be. Strong, vigorous shoots will originate all over the stock plants, and these shoots will develop quite rapidly during June.

When these shoots are about four to five inches long and reasonably firm—springy and slightly resistant to bending by the fingers—they are ready to take. In New Jersey, this stage is usually reached about the first week in July, but the date varies according to the age of the stock plants, the season and one's locality.

Small, young plants generally grow quicker and stronger than older plants, and the new shoots do not harden up until the second or third week in July. However, shoots on older plants grow with slightly less vigor and may begin to harden up somewhat earlier.

Only knowledge gained by experience enables the propagator to judge the right time. If you decide to take a batch but see clear indications within a few days that things are not right, you know that you have tried a little too soon. For example, the bottom leaves may turn black and drop off. My suggestion is to scrap the first batch, clean and resterilize the bench, and start again two weeks later.

MISTING

Using mist has greatly simplified the propagation of all azaleas. Of all the plants we propagate from cuttings, these are without doubt the most responsive to mist. Cuttings can be rooted with ease out in the open under the protection of a good mist system, which must provide complete coverage of the rooting area.

Our first tests of this method were made many years ago under constant mist, which was turned on manually at 8 am and turned off again at sunset. The mist was clearly excessive, yet the cuttings began to root rapidly. Within three weeks, they were rooting well.

Intermittent mist is now much more generally used. If the cycle is short, say a burst of about 12 seconds every three minutes,the results are excellent. I have also seen fine batches of cuttings being rooted in Mobile, Alabama, in plastic houses in which the application of water was done through a small, simple revolving head sprinkler. The water was controlled through a solenoid and time clock, so that the sprinklers ran for about 30 seconds every five minutes. The number of jets and water required were minimal because of the wide range and the total amount of water used by each jet. The results were excellent.

Most growers are now rooting their azaleas directly into some type of small plastic container to eliminate potting the rooted cuttings. Molded plastic trays with 24 or 48 small slots in each are used by some. Other growers use plastic carrying trays filled with individual plastic pots, perhaps 50 to a tray.

The usual rooting medium is half coarse peat and half medium-grade perlite. The containers need to be sufficiently deep so the cuttings can be stuck to a depth of 1½ to 2 inches with about 2 inches of the cutting above the surface. Some growers using the smaller molded containers insert just one cutting in each. The cuttings root quickly, but because the containers are small and close together, they cannot be held in the trays too long.

Once well rooted and hardened off, they have to be moved into larger growing containers. The advantage of the small cube is its greater production from a given area. But this can be self-defeating if you are not organized to deal with the young material quickly.

Generally, it pays to use a container about 2½ inches square and at least 3 inches deep, which allows the rooted cuttings to remain for a time without going back. Some growers use even larger pots, such as three by three inches, and insert three cuttings into each pot. These groups of cuttings all root readily. If the groups are then moved to gallon cans, well-branched, solid plants eight inches across are produced in one season.

GATHERING CUTTINGS

Individual cuttings are gathered at the same length, about four inches, and are best removed from the stock plants early in the day. If this is not possible, the cuttings should be held after they are gathered in a storage area enclosed with plastic and covered with a mist jet. Under these conditions, cuttings that may have to be gathered later in the day can plump up and become fully turgid before they are handled.

The cuttings are made by rapidly removing all leaves from the bottom half with one stroke of the fingers. No trimming with a knife is necessary unless the persons gathering them have been sloppy and broken off some shoots that are too long.

As the leaves are stripped, the center bud is removed from the top of the shoot. If the tip is still in active growth, with a portion at the top extremely soft and limp, perhaps the top two sets of leaves should be removed also, not just the central growing bud.

Removing the terminal bud does two things. First, it greatly reduces the development of flower buds at the apex of all cuttings after rooting. Second, it ensures that subsequent growth of the rooted cuttings is branched instead of just one shoot. These details improve the quality of the liners at planting time. Even if pinched, a few flower buds will form and open later in winter. They must be removed by hand at once to prevent rotting.

FERTILIZER

Most varieties of azaleas do not need any hormone treatment to root successfully. They root quickly and vigorously under the conditions described. However, a few varieties are rather slow and uneven in rooting. A treatment with Hormodin No. 2 plus Benlate usually ensures that rooting on these varieties is even and rapid. Gables' 'Stewartstonian' is an excellent example of such a variety.

As rooting begins, it is essential that the frequency and duration of the misting cycle be carefully adjusted downward to reduce the total amount of misting as rapidly as possible. This requires care and judgment day by day. If too much mist is applied after rooting has commenced, the cuttings can decline suddenly.

It is helpful at the onset of rooting to apply a light drench with a liquid fertilizer, such as 20-20-20 at 200 parts nitrogen per million, but apply it only once. This offsets any nutrient loss in the leaves due to leaching and restores the cuttings to a deep, rich green.

Once well rooted and hardened off, cuttings produced in this way can be held for some time until it is convenient to plant or to move them into larger containers. If the delay between rooting and transplanting is likely to be some months, smaller plastic containers should not be used, for the cuttings become too dense and material is lost. Additional light feeding may be necessary to keep the cuttings in good condition, but this should only be given when soil tests indicate the need.

James S. Wells is a retired nurseryman with extensive experience in propagating azaleas. He is the author of **Plant Propagating Practices,** The Macmillan Co., N.Y. (1955) and wrote this article for **The Amer. Nurseryman,** 158:84-87 (1983).

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FORCING GLENN DALE AND GABLE HYBRID AZALEAS

Dr. Conrad B. Link
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Some years ago, we had the opportunity of forcing 60 varieties of azaleas obtained through the courtesy of M. G. Coplin of Rock Creek Nurseries. They were varieties developed by B. Y. Morrison and by Joseph Gable. The plants were received October 15, potted in 6 inch azalea pots, and kept in a cold greenhouse. They were divided into three groups. One group was placed in a 40°F cold storage room from October 24 to November 27. They then were brought into a 60-65°F greenhouse for forcing. The remaining two groups were left in the cold greenhouse until January 15 and March 18 and then they too were brought into the warm house for flowering.

The following varieties were those that forced the most rapidly.

Variety	Hybrid group	Group 1 40° Oct 24 to Nov 27 then to 60-65°F	Group 2 40° Oct 24 to Jan 15 then to 60-65°F	Group 3 40° Oct 24 to Mar 18 then to 60-65°F
		Weeks to bring into bloom		
Abbot	Glenn Dale	9	6	none
Ballet Girl	Glenn Dale	7	3	½
Cantabile	Glenn Dale	7	3	1½
Cavalier	Glenn Dale	5	3	1
Fanfare	Glenn Dale	7	6	none
Festive	Glenn Dale	9	3	
Lucette	Glenn Dale	12	6	2
Lustre	Glenn Dale	7	6	
Paradise	Glenn Dale	9	6	2
Pastel	Glenn Dale	7	3	½
Scout	Glenn Dale	9	5½	2
Souvenir	Glenn Dale	7	3½	1
Carol	Gable	16	6	2
Rose Greeley	Gable	7	4	½
C-3-G	Gable	8	none	2

These are large growing types developed for landscape use and are not really suitable for pot plant forcing purposes. For this, one needs short, compact types with small to modest foliage size and large flowers. Commercial pot forcing also requires azaleas that can be propagated easily by cuttings and can be grown rapidly to a saleable size ready for forcing within 24 months or less. The "Belgium" (Belgian-Indian hybrids, etc. originally developed in Belgium) and other kinds have been found to be of greater value, and in recent years, still others have been selected and grown for forcing purposes. The Glenn Dale and Gable hybrids, however, are varieties that can be forced rather easily in larger sizes, such as would be used in a spring flower show.

For forcing potted azaleas in the home, the plants should be brought inside approximately ten weeks before they are desired to bloom. Timing varies considerably with the variety, temperature, and amount of light. If kept at very cool temperatures, a minimum of 10-15 foot candles light at the leaf surface is required to prevent leaf drop. Our homes often have inadequate light for optimal forcing, and one must select a well-lighted location to obtain satisfactory forced bloom. Plants are returned outside after the danger of frost. They can be topped or pruned one or more times before they are brought inside again for forcing the following year.

Dr. Link is Professor Emeritus in the Department of Horticulture, College of Agriculture, University of Maryland. Retiring in 1982 after 34 years service to the University, he edited **The Maryland Florist** and recently was inducted as one of eight charter members into the Maryland Floriculture Hall of Fame. The preceding is adapted [Ed.] from his note of the same title in **The Maryland Florist,** December 1953, and from his presentation on the "Forcing of Azaleas" at the April 23, 1984 meeting of the Brookside Gardens Chapter.

THE IMPORTANCE OF POROSITY AND HOW TO MEASURE IT IN YOUR CONTAINER MIX

Don Hager
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Porous: defined by Webster as "full of pores, through which fluids, air or light may pass" and, porosity: defined as "the quality or state of being porous".

As a supplement to the excellent articles on soil mixes and container growing media in the past issue of **THE AZALEAN**, I would like to add an important element that was but briefly discussed. Porosity! Whether in a soil that does not percolate, or remains waterlogged, or in a container where roots penetrate slowly or not all into the bottom of the pot, lack of porosity is generally the culprit. With a severe lack, particularly so with azaleas or rhododendrons, the plants have only one way to go - Down or Dead!

Because growing in a container has an azalea in an unnatural environment, it is especially important to know how much air space is available in the container. Even the best growing medium, for example, will turn out poorly if excessive compaction causes loss of air space needed by the roots. Azaleas have been grown successfully in such apparently unlikely media as crushed slag, cinders, fresh sawdust, styrofoam and ground hard plastics. As long as the medium is an inert or non-toxic material, amendments, conditioners and a tight control will allow the plant to grow normally, but only if the root system is obtaining the necessary amounts of oxygen.

In determining the porosity of our garden soils, the only test required is digging a hole in the desired area, filling the hole with water, and observing the length of time it takes for the water to drain away. Five minutes or less drainage time should denote a satisfactory porosity of the soil. Too fast a drainage, as in very sandy locations, may require copious amounts of organic matter, such as peat moss to correct the problem. Very poor drainage can be handled by constructing raised beds and using a good garden soil, or in many instances, by adding a considerable amount of sharp or coarse sand. Don't ever take for granted that a bank or slope always means that good drainage is present.

Whatever the growing medium in a container, it is especially important not to use a material that will compact too quickly for the length of time the plant will be in the container. I find, for example, the use of fine peat and vermiculite to be very unsatisfactory after a period of five or six weeks.

Determining the amount of available air space in a container medium is an easy procedure; but, separate tests should be done for various sizes of containers. It is likely one will obtain a very different result when comparing a one quart container with a three gallon or when comparing a shallow container with a deep one. Regardless of container size, all testing is done in the same manner.

After selecting the container to be used, the drainage holes are plugged from the outside with a material such as a putty or childrens' play dough. The pot is then filled with water to the level where the top of the potting mix should be. Then using a measuring cup pour out the water to determine the total ounces of water in the container. After recording the amount, fill the container with potting mix to the previous level occupied by the water. Do not tamp or pack down the mix. Add sufficient water to completely fill the pot and let stand for 24 hours to absorb all possible water. At the end of this period, gently turn the container on its side and let it remain until water has stopped draining. Then placing the container in an upright position, refill it with water until the level is exactly to the top of the mix, being careful not to let the mix float. After one hour, place the container in a pan, such as a dish pan, setting it on another container to allow full drainage. Remove the plugs from the drain holes. When the filled container has stopped draining, carefully measure the amount of water collected. Dividing the original amount of water in the container into the ounces of water left by the final drainage will give the percentage of air space in the mix. For example, if the container contained 100 ounces of water on the first filling and the final drainage was 15 ounces, dividing 15 by 100 gives a percentage of 15%.

A good mix should contain between 15 and 20% air space for optimal azalea growing conditions. Keep in mind that the more air space available in the container, the quicker the container mix will dry. If the plants can only be watered infrequently, it may be necessary to reduce the porosity of the material by adding some additional water holding material such as sphagnum peat or perlite. A coarser material, while giving maximum aeration for root development, requires careful monitoring of both watering and feeding.

One of the biggest problems resulting from a soilless media with too little porosity is the absence of bacteria that fight *phytophthora*, or root rot. This disease can be deadly and fast spreading among container plants. The use of composted pine bark for reasons I've never been able to find, apparently has an inhibiting effect on *phytophthora;* and, I cannot ever remember seeing an azalea that died from this disease when grown in a pine bark mix. Hopefully, in the future, a determination of this factor and the reason for it will be forthcoming from research being carried out today.

Don Hager is an azalea nurseryman, a member of the Northern Virginia chapter and a previous contributor to **THE AZALEAN**.