Evaluating New Cultivars and Getting Them Into Production

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INTRODUCTION

Humankind first used plant material ornamentally when Eve employed a strategically placed fig leaf. I can imagine that Adam thought that the fig leaf was too large; Eve insisted that the fig leaf was appropriate and Adam immediately began seeking out a new and improved smaller leaf cultivar of fig for Eve. Adam and Eve in the evaluation of their new selection began the ongoing process of seeking out plant types that offer greater value than their previously used selection.

New Cultivar Development. The emphasis our industry is placing on new cultivar development and introduction is in response to the buying public's demand for new styles, and our own realization as horticulturists that we need to produce better cultivars. Seed companies spend huge amounts of time and resources on breeding programs to develop new flower colors, plant and flower forms, heat and cold tolerance, higher yields, disease and insect resistance, and many other characteristics that both improve plants for the public and give their company a marketing edge over the competition.

In the Beginning. My topic today is not new. Perhaps because of the importance that new cultivar evaluation, production, and introduction are having on our industry, we feel somewhat pressured and probably feel inadequate to meet the challenge. Our horticultural forefathers brought roses and fruit cultivars from the old countries in the 18th and 19th century to their new country. Our horticultural forefathers imported *Camellia japonica, Ilex cornuta, I. crenata*, and evergreen azaleas from Asia to beautify our residences and plantations early in the 20th century. Our horticultural fathers and grandfathers in the 1940s, 50s, and 60s, grew millions of hollies, azaleas, and junipers. They added plants like *Ligustrum, Pyracantha, Photinia*, and *Pittosporum* to meet the tremendous demand of our rapidly expanding economy following WWII, and the Korean War.

Today, our nursery and probably yours, grow many more cultivars than 20 years ago. *Photinia*, is not a minor crop, nor is it the major crop it used to be. This trend was dramatically reversed 2 to 3 years ago because of the leaf spot blighting throughout the southeast. *Pittosporum*, *Pyracantha*, and *Ligustrum* have gone *from major to minor crops in the last 20 years. Changes in winter weather patterns* have caused the decline in popularity of these crop species and cultivars. When a major cultivar goes out of demand we must determine what will be the new plant or plants of choice.

The Cultivar Evaluation Program at Flowerwood Nursery. Some 15 years ago, our company was aware of the success of Monrovia Nursery Company. One main reason for their success was their historically aggressive new cultivar evaluation and introduction program. At that time, I was directed to expand our

nursery's product list and we are still not finished. The process is ongoing and never ending. We have made some mistakes and we have had many successes.

The*Hydrangea* Program. One success at Flowerwood Nursery was the*Hydrangea macrophylla* program. When I began my work, we produced only one hydrangea cultivar,*H. macrophylla* 'Garden Blue'. We were aware that many named cultivars existed primarily for the florist trade. We purchased 12 cultivars and evaluated them for shrub compactness, foliage quality, flower color, flower size, number of flowers, and ease of propagation. After 2 to 3 years of evaluation, 'Glory Blue', 'Merritt's Supreme Pink', 'Soeur Therese' (syn. 'Sister Thérèse'), and 'Cardinal Light Red' became part of our product mix. After several years, two more red cultivars were purchased and evaluated. 'Charm' was determined the best of the two red cultivars because of spider mite tolerance, bush compactness, and flower color. Consequently, 'Charm' was added to our product mix and 'Cardinal Light Red' was dropped.

More recently Monrovia and Dr. J.C. Raulston have been promoting a compact pink form, 'Pia'. We were working on increasing inventory numbers of 'Pia' because I have faith that it is a tremendous cultivar. For at least 10 years our total production of cultivar hydrangeas has doubled each year. It is my opinion that the hydrangea opportunity is still quite big. Compact blues and whites and variations of existing types will help us realize that opportunity. But we must first collect new cultivars and test and evaluate them before adding any new cultivars to our production list.

The Azalea Program. Fifteen years ago while analyzing our azaleas, I discovered that our two most popular cultivars were 'Satsuki Gumpo White' and 'Gumpo Pink'. We were startled to realize that each Gumpo cultivar was outselling the standard Kurume, Glendale, and Indica cultivars, while commanding a much higher average price year to year. Every year we were forced to sell at the low market price of the standard cultivars, but not with the higher-priced Gumpo cultivars. Knowing this, we bought other late blooming azaleas from eastern U.S.A. and West Coast sources. Most were Satsuki and Robin Hill cultivars. Nearly two dozen cultivars were tested. We exposed them to normal weather conditions. The cultivars differed in cold and heat tolerance, legginess and compactness, flower size and blooming characteristics, disease susceptibility, etc. More than half failed to be solid performers and were not kept in production. To be added to our azalea product list, the cultivar had to: 1) propagate easily, 2) grow vigorously, 3) be relatively disease tolerant, 4) be bushy, 5) flower prolifically with good color, and 6) tolerate our heat and cold.

Out of that original group we currently produce: 'Amaghasa', 'Flame Creeper', 'Frosted Orange', 'Higasa', 'Joseph Hill', 'Pink Cascade', and 'Watchet'. Since then we have evaluated and brought into production other cultivars, i.e., 'Girard's Rose', 'Renee Michelle', and 'Girard's Crimson'. I see a trend for our company to grow fewer standard azalea cultivars because of generally low wholesale prices. Standard cultivars will be replaced with a selection of cultivars from hybrid groups, such as, North Tisbury, Robin Hill, and Girard.

The case studies of*Hydrangea* and azalea cultivar evaluation are examples of our company looking for new cultivars of existing familiar plant groups. Selection of new cultivars gives our customers a better plant and a new style. These cultivars

gave our company a higher return on the investment and the excitement of growing something new. We did not actually develop these cultivars, but we took the hard work of others and through evaluation, we found those few cultivars that work well for our production system and markets.

Problems with Introducing an Obscure Plant Genus. We believe that with an obscure genus it is almost impossible to gain wide market acceptance. It would take many years to accomplish this feat. Introducing a new species of a familiar genus is difficult enough. The easiest and most likely chance of success is to select a new cultivar of an already established species. Examples would be 'Firepower' nandina instead of 'Nana Purpurea' (syn. 'Dwarf Purple') or *Nandina domestica* 'Royal Princess' instead of the common *N. domestica*.

Locating New Cultivars to Evaluate. Where do you obtain a new cultivar for evaluation besides some other wholesale nursery's plant list? We have found new forms of plants as sports within our own nursery.*Abelia* ×*grandiflora* 'Confetti' was a mutated four-leaf terminal of 'Sherwoodii'. *Ilex vomitoria* 'Bordeaux' was found growing as a population of five plants among several thousand dwarf yaupon holly. The selection of *I. vomitoria* 'Hightower' was an individual female with strong upright habit and prolific red berries growing in a mile row of seedling-grown yaupon at our Meadows Branch field production site. Roadsides and native plant acreage all offer opportunities to discover superior forms of native plants.

Botanical gardens, and especially arboretums, offer opportunities for one to see different cultivars. Such places are vast collections and many have been established long enough to thoroughly determine characteristics and value to the landscape. However, a nurseryman still must determine if those cultivars can be economically produced. A new cultivar must be reasonably easy to propagate and grow. They should grow without special care. It was with great excitement that I realized in 1993, while at the Southern Nurseryman's Trade Show in Atlanta, Georgia, that the nursery producers in the Southeast United States were displaying a progressive range of species and cultivars that I knew were an exact fit with our climate and environment. I felt that Drs. J. C. Raulston and Mike Dirr were largely responsible for what I was seeing. At the Monrovia booth I did see some new cultivars; however, what I saw may not be as well adapted to the southeastern U.S.A. as those new cultivars displayed in other nursery booths.

Opportunities for Selecting Superior Cultivars. Any time you grow a seedling population there are opportunities for selection of superior types. Some years ago I was in central Florida to visit our nursery and took the time to go to a new, large nearby wholesale nursery whose activities were of concern and interest. As I was looking around I noticed a rather large crop of 3-gal seedling-grown *Rhaphiolepsis indica* and initially laughed to myself, since no one grows seedling indian hawthorn. The market was for cultivar cutting-grown clones. Then it occurred to me that this was an opportunity to walk through the crop and select superior types, which would save me the time and expense of growing a large crop of seedlings. They allowed me to purchase 35 individuals.

After 6 years of evaluating for leaf-spot and fire-blight susceptibility, form, and flowering characteristics, we have narrowed the 35 down to 3 selections. Our first release was *R. indica* 'Rosalinda'. The selection is very vigorous, dark pink, fragrant, and with bronze new foliage. 'Rosalinda' can be grown as a specimen tree

or large shrub. When picking out the original 35 plants, the original 'Rosalinda' was my last pick. It was tall and unusual, sitting along the road, pulled to the side—definitely an outcast; she was an ugly duckling that grew to be beautiful at maturity. The other *Rhaphiolepsis* selections that we are working with must be specifically adapted to the hot humid areas of the U.S., whereas West Coast selections are disease plagued and loose in growth habit. 'Olivia' and 'Eleanor Tabor' were named as cultivars along with 'Rosalinda'.

In another stroke of good luck, I ventured into a small local wholesale nursery specifically looking at their inventory of cleyera seedlings that were for sale. The time was early December and I noticed a large group of 10,000 3-qt seedling-grown cleyera. Overall the crop was of poor quality. It was explained to me that what I was looking at was a midsummer planting. I could see that the stress of the summer heat had stunted many individuals. Furthermore, on 1 November, the nursery had experienced freezing temperatures and many had frozen, as I could see. Despite all the bad conditions there were a few individuals that had thrived. I purchased 35 plants that had not suffered from the heat or cold. Those individuals were shifted at our nursery into 3-gal containers. I left them untrimmed and observed their growth and development. Ten plants were selected for propagation. Six of the 10 selections failed to propagate easily and they were discarded. Liners of the remaining four were easily propagated, self branching, and had dark green and richly colored foliage. These were planted into 3-gal containers in our normal production cycle. Three of the four selections grew quite well. Now I have to make a decision as to whether to keep 1, 2, or 3 clones and designate them as cultivars. I am confident that any of these clones will be a superior introduction. I have selected for ease of propagation, superior color, self branching, tolerance to heat stress, tolerance to early cold stress, and growth rate. The ultimate consumer will be able to purchase cloned cleyera for desired form and uniformity in the landscape.

The Selection Time Period. I have described to you the selection and evaluation of a new cultivar from naturally occurring populations of seedlings and the discovery of mutations that might be developed into a cultivar. Thorough selection and evaluation by these methods can take 7 to 10 years. I also mentioned evaluation of named cultivars that were developed by someone else. However, these already named cultivars are still evaluated by me to see if they are superior in form and tolerance and if we can economically produce them. This type of selection and evaluation normally takes 2 to 3 years.

The longest process in developing a new cultivar that I use is through breeding. These projects can take 12 or more years. In a breeding program you must define your goals. For example, we are involved in a breeding program to develop new cultivars of evergreen azaleas that are summer, fall, and spring blooming. The breeder reasoned that his goals would be best obtained by hybridizing the earliest blooming species of rhododendron with existing cultivars. Early blooming is when vegetative buds develop in the spring and mature to be reproductive and bloom by mid summer or fall. Early blooming evergreen azaleas are not the first to bloom in the spring.

The Breeding of New Azalea Cultivars. *Rhododendron oldhamii* is a summer and fall blooming species, reportedly cold susceptible. Two known gene pools of this species exist in the United States. Plants were obtained from a genotype thought

to be more cold hardy than the other. The flowering time of the pollen parent *R. oldhamii* is summer and fall, and spring was the blooming period of those cultivars that were to be hybridized with it; hence, a method of pollen storage had to be developed. In this case mature pollen was collected on dry newspaper. The newspaper was folded and refrigerated until spring. The pollen remained viable. Pollination was made by hand using 40 different evergreen spring-blooming hybrid azaleas, representing several different hybrid groups. Each flower was tagged and monitored for fertilization and seed development. The seed pods were harvested in the fall. The seed were sown and the seedlings were very small and fragile. Many were weak. The seedlings grew slowly and after 4 years and three transplantings there were 10,000 small plants in 3¼-inch-liner pots!

The liners were carefully grown and 1 year later the seedlings were shifted to 3-qt containers and bloomed. At this point the 10,000 seedlings were selected down to 7,000 and shifted into 3-gal containers and observed for 12 months. In July, the seedling azaleas began to bloom in many colors, unlike the pollen parent which had light orange blooms. Single, semi-double, and double flowered plants appeared. Dwarf, semi-dwarf, and tall rangy plants showed up. The full sibling populations were varied. The one-half sibling populations were even more varied. Leaf-spot diseases affected some individuals. There were too many seedlings that looked like the pollen-parent plant, and many seedlings that were potentially desirable. Evaluations of the seedling population were made 4 h weekly for 12 weeks, and promising plants were marked. By October 31, 5,700 3-gal azaleas were of little apparent value and rouged.

Of the original 10,000 seedlings only 300 selections were left, which were shifted into 7-gal containers. The next year they were evaluated for: 1) plant form, 2) bloom period, 3) lace-bug resistance, 4) foliage quality, and 5) flower color. Evaluation for cold and summer heat tolerance continued and from that 300, 50 azaleas were selected for propagation and the next spring 200 1-gal plants of each of the 50 selections were grown. A total of 10,000 more units were evaluated for 2 years.

After all this time and money invested, the final selection of azaleas had still not been made based on all the selection criteria established. Many of the hybrids originally passed over now had desirable characteristics, and 10 acres at a permanent site were planted, since these plants were now too valuable to discard. The project became bigger and more costly than we ever imagined. After asexually reproducing and growing thousands, weaknesses in the plants were observed that became discouraging. Too many selections had apparently desirable characteristics. The question is "how does one reduce the choices to the best 6, 8, or 15 plants?" It takes patience, investment, and close observation.

I have described to you what is now a 9-year project initiated by Buddy Lee and now being carried on by our nursery. We are down to 50 selections and I see at least 2 more years of evaluation. When we make the final selections those plants will have been looked at, treated fairly, exposed to much, and will be very familiar to us. I think we will be in our 12th year after pollination before we sell our first plant. Breeding programs are a long-term investment.

Successful Cultivar Development Depends on the Support of Propagation and Production Managers and Sales Staff. New cultivar evaluation programs must have the full support of propagation and production managers to succeed. Finally, promising selections must also have the full endorsement of your sales

staff. The naming of the cultivar is critical. Suggested cultivar names should be carefully considered and widely agreed upon. I don't think you can have too wide a consensus of opinion in this phase of the cultivar development. This paper has not discussed the marketing phase of new product development and production. However, our ultimate goal with new cultivars is to identify superior cultivars, to be effective in introduction and marketing, and to establish wide consumer acceptance.