Azaleas—Cultivar Selection, Breeding, and Culture in North Carolina

Azaleas (*Rhododendron*, Ericaceae) are one of the favorite ornamental plants used by homeowners and professional landscapers in the eastern and southeastern United States. They are used as foundation, accent, individual specimen plants, and as mass plantings. Azaleas are good companion plants, working well in designs with many trees, shrubs, and ground covers, offering a variety of landscape options. Azaleas offer consumers choices in flower size, color, or form, as well as plant size and blooming time (late March through mid-June in North Carolina).

The North Carolina Nursery Industry in 1988 harvested nearly 35,200 ha of ornamental crops at an economic value of \$102 million dollars. Azaleas are estimated to be ≈15% of the industry, or about \$15 million dollars. North Carolina has three geographic regions: mountain, piedmont, and coastal plain. Each region has unique soil and climatic characteristics. Therefore, a wide variety of azalea types can be grown and used in North Carolinian landscapes.

Evergreen hybrids are popular in North Carolina, especially Kurume hybrids (0.6 to 1.8 m tall, mid-spring, flowers 1 to 4 cm). Cold hardiness and phytophthora root rot (*Phytophthora cinnamoni* Rands) are major problems of these azaleas. Selections of Southern Indica, Satsuki, Gumpo, and Pericat hybrids are often used in eastern and southern North Carolina landscapes. However, cultivars in these hybrid groups also are susceptible to cold damage. Southern Indica hybrids are popular for larger flower diameter (5 to 7.5 cm) and habit (1.8 to 3.7 m tall). Satsuki hybrids are desirable for variable color patterns (striped, dotted, flecked, bordered, throated) within a flower and later blooms (mid-May and June). White and pink Gumpo are dwarf types of Satsukis with a later blooming period (June-July). Pericat hybrids are selected for petalploidy (double, semidouble, hose-in-hose). Western North Carolina landscapers use various cold-hardy selections, such as Glenn Dale, Gable, and

Kaempferi hybrids. Desirable selections of Glenn Dale hybrids have large flower diameter (5 to 7.5 cm) and variable blooming periods (mid-April to mid-June). Gable and Kaempferi hybrids selected are medium height (1.8 to 2.5 m tall), very cold-hardy plants with flower diameter larger (3 to 6 cm) than Kurumes. Specific cultivars are described by Darden (1985). Several species of deciduous azaleas also are used.

Desirable cultivars are developed by several methods. Many azalea nursery workers are keen observers and select chance seedlings, or "sports", with characteristics that are different from the parent with distinctive, and potentially desirable, characteristics. Plants are propagated vegetatively to maintain the desired traits and evaluated before being released with a name. The attractive 'Greenthumb Peppermint' azalea illustrated on the front cover originated from a sport discovered by D. James Cagle in 1980. Propagules from the original tissue and the sport were grown and evaluated for 8 years by Greenthumb Nursery in Seagrove, N.C. 'Greenthumb Peppermint' flowers at a time when azaleas most often are not blooming, after Kurume selections and before Satsuki hybrids. The new selection consistently produced plants with semidouble, hose-in-hose flowers, pinkish with variable white margins and one or two sports bearing strong purplish-pink or white flowers. The unusual condition of evergreen azaleas typically bearing sports, floriferous flowers of larger size (7.5 cm), mid- to late-blooming during the azalea void, and cold hardiness were the objectives leading to the release of 'Greenthumb Peppermint' (see p. 236-237 of this issue of *HortScience*).

Many cultivars are selected through formal breeding programs as outlined by Galle (1985). Germplasm with diverse genotypes are hybridized to obtain selections that meet specific objectives. The azalea breeding program at North Carolina State Univ., Raleigh, was initiated in 1960 by R.J. Stadtherr and H.M. Singletary. Many desirable cultivars from different breeding lines were accumulated in the gene pool for hybridization. The objectives were to develop new evergreen azaleas with resistance to phytophthora root rot, with cold hardiness, drought tolerance, and ornamental value (objectives emphasized later-blooming selections and floriferousness that included double flowers and blooms opening simultaneously). Stadtherr transferred to Louisiana State Univ., where he continued his research (1968-82) in cooperation with researchers at North Carolina State Univ., including F.D. Cochran, D.M. Benson, and V.P. Bonaminio. Stadtherr coined the name Carla (Carolina-Louisiana) hybrids for this cooperative azalea breeding program in the early 1970s.

hued flowers, most blooming in 'mid-season. 'Elaine' and 'Pink Camellia' are full doubles, almost rose form. 'Carror' is nearly double, whereas 'Rachel' and 'Jane Spalding' are semidoubles with stamen petaloidy (flagging). 'Autumn Sun' and 'Emily' are hose-in-hose. Seven selections—'Adelaide Pope', 'Cochrans Lavendar', 'Fred Cochran', 'Jan Cochran', 'Pink Cloud', 'Sunglow', and 'Wolfpack Red'—are singles with flower diameter varying from 3 to 10 cm. 'Wolfpack Red' is prized by alumni for its strong NC Slate red blooms. 'Sunglow' has been the finest Carla azalea (Darden, 1985), desired for its single, rose-red blooms and extreme hardiness. Unfortunately, the 11 earlier releases are susceptible to phytophthora root rot (Benson and Cochran, 1980). However, two newer releases—'Rachel' and 'Jan Cochran'—are rated as moderately resistant to this disease (Fantz et al., 1989). In addition, 'Jan Cochran' has a unique, compact growth form that has been compared to an English boxwood by nursery workers. The newest release, 'Fred Cochran' (Benson et al., 1990), named in honor of Fred D. Cochran for his direction and participation in the breeding program, is a selection with superior resistance to phytophthora root rot. A complete set of Carla azaleas are, deposited at the North Carolina State Univ. Arboretum in Raleigh, the North Carolina State Fair Grounds in Raleigh; and the New Hanover County Arboretum in Wilmington.

Researchers at North Carolina State Univ. work cooperatively with the nursery industry. Stock plants of new releases are propagated by the North Carolina Seed Foundation in cooperation with the North Carolina Assn. of Nurserymen. Propagules are distributed to nursery workers under their auspices. Azalea nursery workers have provided advice on new selections before their release. For example, a selection with variegated foliage was discarded as a nondesirable ornamental after discussions with azalea nursery workers. Nursery workers who develop their own selections are assisted in documentation and vouchering, in preparing technical descriptions for publication, and in registration. 'Greenthumb Peppermint' is an example of the cooperation between nursery workers and university researchers.

Potential legal confrontations are increasing as a result of taxonomic problems in identification. Is the azalea being sold under a cultivar name actually that cultivar? A major problem is the lack of good quantitative taxonomic descriptions of azalea cultivars. Authoritative sources such as Galle (1985) and Darden (1985) provide very brief descriptions for cultivars, many of which are similar to other named cultivars. Accurate identification of an unknown plant to cultivar is extremely difficult. There is a need for an inventory of taxa with improved quantitative descriptions and deposition of vouch-

continued on inside back cover

Received for publication 28 Sept. 1989. Paper no. 12370 of the Journal Series of North Carolina Agricultural Research Service, Raleigh, NC 27695-7643. The use of nursery and trade names in this publication does not imply endorsement by the North Carolina Agricultural Research Service of the nursery or the products mentioned, nor criticism of similar ones not mentioned. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked advertisement solely to indicate this fact.

Front cover: 'Greenthumb Peppermint' azalea, a new cultivar exhibiting pink flowers with a variable white margin and one or two sports on the same plant, these bearing strong purplish-pink or white flowers.

continued from inside front cover

ers for morphological comparison. Registration and/or publication of cultivar names is necessary to provide needed data.

Nomenclature presents additional taxonomic problems. Fantz et al. (1989) noted that Carla hybrids are often listed as *Rhododendron kiusianum* Mak. or under its synonym as *Rhododendron obtusum* (Lindl.) Planch. f. *japonicum* (Maxim.) E.H. Wils. (Bonaminio et al., 1982)—names commonly associated with Kurume azaleas. Galle (1985) provides historical and nomenclatural data noting that no azaleas similar to these species exist in the wild. Carla cultivars have a multispecies heritage and are hybrids. Application of the international rules of nomenclature (Brickell, 1980) for hybrids require a multiplication sign between the generic name and an epithet validly and effectively published that reflects the parent germplasm. Many of the parents used in the Carla breeding program were hybrids whose lineage is undocumented; thus, a specific epithet is unavailable. Galle (1985) circumvents the nomenclatural issue by assigning Carla azaleas to the "Inter-group evergreen azaleas", a group lacking a scientific binomial. Jefferson and Wain (1984) described a similar problem with Japanese flowering cherries (*Prunus* L.) and explored nomenclatural alternatives in accordance with international rules. Thus, adoption of this nomenclatural style recommended in accordance with international rules makes the correct name change, for example, to *Rhododendron* × 'Rachel' [*Carla* Hybrid], not *R. kiusianum* 'Rachel' or *R. obtusum* f. *japonicum* 'Rachel'.

Most azaleas produced and sold in the Southeast are commonly grown in 2.7-liter containers. Professional landscapers usually

install larger plants. However, many plants die due to poor cultural practices, based on myths, false information, or ignorance of the biology of the plant. Cultural production problems of azaleas are related to fluctuation or excess fertilizer application. Azaleas are considered to be sensitive to high conductivity levels often caused by over-application of fertilizer or poor management of irrigation, nutrition, and container media interactions. Fluctuations of conductivity within the container can cause root death, followed by root rot diseases caused by *Phytophthora cinnamomi*. Nursery workers have had fewer cultural problems over the past decade as a result of growing azaleas in very porous media that allow for better fertility control.

Azaleas may exhibit winter injury due to interaction between cultural practices and environmental influences. Fluctuations of high fertility levels late in the growing season may increase susceptibility to winter damage. Stem bark splitting occurring at the medial surface frequently is observed. Exposure to winter elements causes foliage dessication. Azaleas often are placed in structures for winter protection to reduce these problems.

Azaleas planted in the landscape require good drainage. In most cases, a raised bed is recommended and not a planting hole. The planting bed is elevated to ensure good internal and 'surface drainage. Topsoil is amended with organic matter, such as pine bark, to provide a well-drained and aerified plant bed.

Future efforts will continue in assisting nurse-t-y workers and in providing information on production and landscape use of azaleas. A concerted educational effort has been employed by extension specialists and teaching faculty at North Carolina State Univ. and

several other institutions in North Carolina with ornamental and landscape programs. Students and the public are informed on proper planting and cultural procedures. Azaleas can continue to be enjoyed and grown in almost every landscape in the southeastern United States.

Literature Cited

- Benson, D.M. and F.D. Cochran. 1980. Resistance of evergreen hybrid azaleas to root rot caused by *Phytophthora cinnamomi*. Plant Dis. 64:214-215.
- Benson, D. M., P.R. Fantz, and W.A. Skroch. 1990. 'Fred Cochran' Carla azalea. HortScience. (In press.)
- Bonaminio, V. P., D.M. Benson, and F.D. Cochran. 1982. 'Autumn Sun', 'Cochran's Lavedar', 'Pink Camellia', and 'Wolfpack Red' azaleas. HortScience 17(5):837-838.
- Bricknell, C. D., ed. 1980. International code of nomenclature for cultivated plants—1980. Bohn, Scheltema & Holkema, Utrecht, Netherlands.
- Darden, J. 1985. Great American azaleas. The Greenhouse Press, Clinton, N.C.
- Fantz, P. R., D.M. Benson, and W.A. Skroch. 1989. 'Rachel' and 'Jan Cochran' Carla azaleas. HortScience 24(4):717-718.
- Galle, F.C. 1985. Azaleas. Timber Press, Portland, Ore.
- Jefferson, R.M. and K.K. Wain. 1984. The nomenclature of cultivated Japanese flowering cherries (*Prunus*): the Sato-zakura group. U.S. Dept. Agr. Natl. Arboretum Contrib. 5.
- Upchurch, W. 1978. Seven new azaleas released. Res. & Farming (N. Carolina State Univ.) 37 (1/2):5.
- TED E. BILDERBACK and PAUL R. FANTZ
Dept. of Horticultural Science
Box 7609
North Carolina State University
Raleigh, NC 27695-7609