

# Plant Breeding at the U.S. National Arboretum: Selection, Evaluation, and Release of New Cultivars

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**ADDITIONAL INDEX WORDS.** materials transfer agreement, stock increase, woody ornamental plants, nursery and landscape industry

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**SUMMARY.** The U.S. National Arboretum has released over 650 new plant cultivars since it was established in 1927. A key to the success of the plant breeding program has been the voluntary participation of universities and private nurseries in evaluating and propagating new plant material. The cooperative evaluation and stock increase programs play a critical role in the successful testing, introduction, and distribution of new cultivars of landscape trees and shrubs. These integrated cooperative programs depend on the involvement of nurserymen, researchers, botanic gardens, or individuals to evaluate potential new cultivars under diverse climatic conditions and hardiness zones, and wholesale propagation nurseries to increase stock of those cultivars destined for release.

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The U.S. National Arboretum, established by an Act of Congress in 1927, is a research facility and living museum in Northeast Washington, D.C. Administered by the U.S. Department of Agriculture, the mission of the National Arboretum is to conduct research, provide education, and conserve and display trees, shrubs, flowers, and other plants to enhance the environment. Part of this mission involves breeding and selecting new plant cultivars for release to the public. Since it was established 74 years ago, the National Arboretum has released over 650 new plant cultivars (Table 1) (U.S. National Arboretum, 2001), including the Glenn Dale hybrid azaleas (*Rhododendron* sp.), cold hardy camellias (*Camellia* sp.), disease resistant crapemyrtles (*Lagerstroemia* hybrids), a wide variety of well-adapted viburnums (*Viburnum* sp.), pest-tolerant red maples (*Acer rubrum*), and american elms (*Ulmus americana*) with tolerance to dutch elm disease (*Ophiostoma ulmi*). Many of the cultivars released over two decades ago continue to be propagated and sold by the hundreds of thousands today.

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**Table 1. Recent woody ornamental plant releases from the U.S. National Arboretum.**

Common name	Species	Cultivar	Year of release	USDA hardiness zone
Red maple	<i>Acer rubrum</i>	Brandywine	1994	4-8
Red maple	<i>Acer rubrum</i>	New World	1997	4-8
Red maple	<i>Acer rubrum</i>	Red Rocket	1997	3-8
Chinese redbud	<i>Cercis chinensis</i>	Don Egolf	2000	6-9
Crapemyrtle	<i>Lagerstroemia indica</i> × <i>fauriei</i>	Chickasaw	1997	to 7b
Crapemyrtle	<i>Lagerstroemia indica</i> × <i>fauriei</i>	Pocomoke	1998	to 7b
Flowering cherry	<i>Prunus</i>	Dream Catcher	1999	6-8
Lilac	<i>Syringa</i>	Betsy Ross	2000	5-8
American elm	<i>Ulmus americana</i>	New Harmony	1995	5-7
American elm	<i>Ulmus americana</i>	Valley Forge	1995	5-7
Burkwood viburnum	<i>Viburnum</i> × <i>burkwoodii</i>	Conoy	1988	5b-8
Leatherleaf viburnum	<i>Viburnum rhytidophyllum</i>	Cree	1994	5-8

A key to the success of the plant breeding program has been the voluntary participation of universities and private nurseries in evaluating and propagating new plant material. The cooperative evaluation and stock increase programs play a critical role in the successful testing, introduction, and distribution of new cultivars of landscape trees and shrubs. These integrated cooperative programs depend on the involvement of nurserymen, researchers, botanic gardens, or individuals to evaluate potential new cultivars under diverse climatic conditions and hardiness zones, and wholesale propagation nurseries to stock increase those cultivars destined for release.

### Plant evaluation

Plant evaluation is the most time- and resource-intensive step in a woody plant breeding program. Although initial selection and evaluation can be done at the U.S. National Arboretum, evaluation in a diverse range of climates and under different production practices is necessary to ensure that a plant will perform well in many locations. After a plant is selected at the National Arboretum for further evaluation, a letter is written to cooperators asking if they are interested in evaluating the selection. Those who express interest are asked to sign a materials transfer agreement (MTA) for the growth and evaluation for test purposes of new plant cultivars. The terms of this MTA, which is signed by the cooperator and USDA, ARS officials, state that the plants will remain the property of ARS; the plants can be propagated only for test purposes; the plants cannot be displayed or exhib-

ited publicly; the plants cannot be used for breeding until released; the cooperator must provide evaluation data to ARS when requested; and the cooperator must destroy those selections that are not chosen for release. Once the MTA is in place, two or three plants of each selection, designated by a five-digit National Arboretum number, are shipped to the cooperators. The cooperator then evaluates the plants for 3 to 10 or more years, depending on the genus.

Data on the performance of the selections under evaluation is solicited annually or as needed, either via a written evaluation form or by personal communication with the evaluator. Data on disease and pest incidence, growth rate, bloom date and duration, fruit production, and other genus-specific horticultural aspects are requested. However, one of the most useful pieces of information that the cooperator provides is an opinion of the commercial potential of the selection.

### Stock increase

Once a decision has been made by the National Arboretum to release a selection as a named cultivar, the plant must be propagated by the thousands or tens of thousands before it can be released. Although the National Arboretum has personnel skilled in plant propagation, the facilities are not designed for mass production; hence, the most efficient method to rapidly increase advanced selections is to enlist the voluntary cooperation of commercial wholesale nurseries. Those nurseries who express an interest in propagating the selection before release are asked to sign a MTA for increasing the

planting stock of vegetatively propagated plants. Similar to the evaluation MTA, the terms of the stock increase MTA state that the cooperator will keep ARS informed of the number of plants propagated, and, as previously, will not sell, display, or use for hybridizations the selection until it is officially released.

### Cultivar release

The period of cooperative stock increase typically lasts for 2 to 4 years, depending on the genus. Based on communications between the cooperator and the National Arboretum regarding the number of plants available and the perceived demand that will be created, the National Arboretum names and prepares a release notice for the selection. Copies of the release notice are sent to all cooperators who evaluated and/or propagated the selection. Although historically the National Arboretum has not promoted or advertised its cultivars, we have recently developed full color fact sheets for selected cultivars that contain information on the plant's origin, landscape uses, cultural requirements, propagation, and availability. These fact sheets, which can be viewed on the National Arboretum's web site at <[www.nationalarboretum.gov](http://www.nationalarboretum.gov)> (U.S. National Arboretum, 2001), are helpful in providing clear information to a wide range of users, including wholesale and retail nurseries, landscape architects, and the gardening public.

The National Arboretum's cooperative evaluation and stock increase program has been in place since the 1960s and is one reason for the success of the woody plant breeding programs.

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**Outstanding features**

Long-lasting red-purple fall color, tolerance to potato leafhopper, no seed  
Elm-like crown structure, tolerance to potato leafhopper, no seed  
Cold hardy, strongly columnar crown structure, tolerance to potato leafhopper  
Slow-growing compact habit, easy to propagate, seedless  
Miniature, densely branched compact habit, fine-textured mildew resistant foliage  
Miniature plant, deep rose flowers, glossy dark green mildew resistant foliage  
Large medium-pink single flowers, disease tolerance, well-suited to nursery production  
Pure white fragrant flowers, field tolerance to powdery mildew, relative adaptation to warmer climates  
High tolerance to Dutch elm disease, broadly V-shaped crown with slender terminal branches  
High tolerance to Dutch elm disease, upright, arching, vase-shaped habit  
Compact habit with fine-textured dark green foliage, fragrant white flowers, persistent fruit  
Dark green evergreen foliage, cold hardiness, densely branching habit

**Reference**

U.S. National Arboretum, 2001  
U.S. National Arboretum, 2001  
U.S. National Arboretum, 2001  
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Pooler and Dix, 1999  
Pooler and Dix, 1999  
Morgan, 2000  
Benson, 2000  
Townsend, 2000; Becker, 1996  
Townsend, 2000; Becker, 1996  
Egolf, 1988; Davis, 1997  
U.S. National Arboretum, 2001

No patents, royalties or licensing fees are associated with any of the woody plants that come from the National Arboretum, and no money is exchanged with the MTA. The program has been successful because of the benefit to both parties involved. Although the commercial cooperators have to commit the time and resources necessary to evaluate the plants, some of which are never released, they also have large stock plants from which to propagate if the selection is released, plus they are familiar with the plant's performance in their production operation. The National Arboretum receives critical evaluation data from the very people who will be growing and marketing the selection, and with the help of cooperators, is able to ensure that an adequate number of plants will be available when the cultivar is released. Such a mutually beneficial system guarantees that only superior, well-tested plants are released from the breeding program, and that these plants will be distributed as effectively as possible.

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