Elm Selections From The Morton Arboretum©

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INTRODUCTION

Elms were a major nursery product in the early 20th century. American elm (*Ulmus americana*), in particular, was the dominant tree in most street tree and park plantings in the northern United States of America. It was not uncommon for an entire city to have a majority of its community plantings comprised of American elms. Because of the many attributes the American elm possessed, it was viewed as the "perfect" tree. It was easily propagated and cultivated, readily transplanted, possessed an incredibly broad range of environmental tolerances, and developed a classic cathedral-like form. Unfortunately, it was extremely vulnerable to Dutch Elm Disease (DED). During the early 1960s in the Midwest, hundreds of thousands of trees were killed by DED, halting the planting and production of this once-valuable tree.

Today, as a result of a number of selecting and breeding programs, a completely new generation of elms is becoming available for use in the Green Industry. Institutions principally responsible for the new selections hardy in the northern half of the U.S.A. are the U.S. National Arboretum, The University of Wisconsin, and The Morton Arboretum.

The genetic pool of elms providing resources for selecting and breeding generally belong to three major groups:

- Asian elm (selections from species and hybrids)
- European and European-Asian hybrids
- American elm (*U. americana*)

THE MORTON ARBORETUM ELM IMPROVEMENT PROGRAM

This paper focuses on The Morton Arboretum's efforts to select and breed new desirable elms. The Elm Improvement Program began in 1972 and was directed by Arboretum Dendrologist, Dr. George Ware. His initial interest in elms came from his understanding of the environmental tolerances floodplain trees possess, in particular, American elm. When Dr. Ware arrived at the Arboretum to begin his research, there was a handsome vase-shaped tree of unknown parentage located near the Thornhill Education Center. This tree possessed the picturesque arching form of the American elm, but it was not of this species. Because of the form and wonderfully glossy, pest-free foliage, this tree attracted attention for many years. This tree was not closely identifiable with any other elm in the Arboretum's extensive collection, though certain features suggested that it might be related to Japanese elm (*U. japonica*).

The tree was grown from one of a group of seeds received from the Arnold Arboretum in Boston in 1924. Its identity was lost through a mix-up in the records. A visit to the Arnold Arboretum solved the mystery. A large Japanese elm was observed to have been growing next to an aging Wilson elm (*U. wilsoniana*). Experimentation and study of the flowers, leaves, buds, bark, and growth habits confirmed that the trees were the parents of the Thornhill elm.

The splendid vase shape, extraordinarily deep-green glossiness, and resistance to DED (confirmed under controlled laboratory testing) justified this tree's selection and promotion. This was the first tree "officially" selected and released to the nursery industry by the Arboretum. It is designated with the trade name Accolade® elm and botanically known as *Ulmus* 'Morton'. This tree inspired Dr. Ware and the Arboretum to formally begin the Elm Improvement Program.

From observations of the Accolade® elm and its parent species, the following criteria were formulated for continuing development and selection of new elms:

- Resistance to Dutch elm disease
- Appearance similar to American elm
- Strong branches and wood
- Tolerance to typical urban soils
- Climatic hardiness
- Resistance to elm leaf beetle
- Resistance to elm leaf miner
- Glossiness and leatheriness of leaves
- Fall color
- Emerging reddish foliage

The Arboretum maintains an extensive collection of elms native to cold temperate regions of the northern hemisphere. Currently, there are 73 kinds of elms represented by 271 individual trees. These trees serve as the principal pollen and maternal stock for the breeding program. Currently, there are 35 species and natural hybrids, and many more cultivated selections contained in the collection. Of the species and natural hybrids, 20 are from Asia, 9 from Europe, and 6 from North America. DED resistance varies among the different species. Asian species possess good levels of resistance (DED is believed to have originated in Asia). European species are generally not resistant or possess low-level resistance, and American species are thought to possess no resistance. After screening many thousands of American elms, a few resistant individuals have been found to exist, and selections have been made from this genetic material.

Asian species have been the principal focus of the Arboretum's selection and breeding effort, due to the high level of DED resistance and other desirable characteristics. Five elm selections have been released to the Green Industry through the Chicagoland Grows® Plant Introduction Program (web site: <www.chicagolandgrows.org>). The program was founded in 1986 and is a cooperative effort involving The Morton Arboretum, Chicago Botanic Garden, and the Ornamental Growers Association of Northern Illinois. The Program's goal is to develop and introduce to the landscape industry a variety of groundcovers, perennials, trees, and shrubs, which are specifically recommended for northern climates. To date, 13 trees, 11 shrubs, and 2 herbaceous perennial selections have been introduced through the Program.

The Morton Arboretum elm selections (listed in order by trade name) include:

***Ulmus* 'Morton', Accolade® elm**

Selected for its graceful vase-shaped habit, vigorous growth rate, dark green glossy foliage, excellent disease and pest resistance, good drought tolerance, and attractive gold-yellow fall color. Young plants are relatively coarse in appearance, resembling American elm. The parent tree, known to be a hybrid of *U. japonica* × *U. wilsoniana*, measures 60 ft in height with a 40-ft spread.

***Ulmus* 'Morton Stalwart', Commendation™ elm**
Selected for its vigor and adaptability, this robust tree possesses excellent drought tolerance and an upright form. It resulted from a controlled cross between Accolade® elm and a hybrid specimen of *U. pumila* × *U. carpinifolia* from Eastern Russia. Commendation™ elm is proving to be the most vigorous selection as a young liner.

***Ulmus* 'Morton Red Tip', Danada Charm™ elm**
Selected for its graceful vase-shaped habit, excellent disease resistance and ornamental red-tinted foliage in spring, and named in honor of the Daniel F. and Ada L. Rice Foundation, which provided financial support for the Elm Improvement Program. The foliage is not as glossy as that of Accolade® elm sibling. It originated from an open-pollinated seedling of Accolade® elm.

***Ulmus* 'Morton Glossy', Triumph™ elm**
Selected for its lustrous dark green foliage, good upright form, strong branching, and excellent disease and pest resistance. Based on experience from shade tree producers, it is perhaps the easiest selection to train as a young plant due to the presence of a central leader. This selection resulted from a controlled cross between Vanguard™ elm (described below) and Accolade® elm.

***Ulmus* 'Morton Plainsman', Vanguard™ elm**
Selected for its vigorous growth rate and rounded habit, and well suited to difficult urban sites where rapid establishment and overall site adaptability are essential. The parent tree originated from seed of *U. japonica* × *U. pumila* distributed by the Agriculture Canada Research Station, Morden, Manitoba.

The following table (Table 1) is a compilation of the growth and other characteristics of the five different elm selections.

The following tables (Table 2 and 3) compare the insect pest and disease resistance of the five different elm selections to the major problems experienced with elms growing in the Midwest. Their resistance is compared to that of American and Siberian elm.

PROPAGATION

The Arboretum has clonally propagated thousands of elms for distribution and trial nursery production. In general, the more Japanese elm the selection possesses, the more difficult it is to root from softwood cuttings. Our method of choice has been to graft dormant scions onto dormant bare-root seedlings of *U. pumila* using the whip-and-tongue method. The grafts are secured with waxed twine or budding rubbers and dipped in melted paraffin wax. Once the wax is cooled, the grafts are placed in flats, surrounded with slightly moist sphagnum moss, and placed in a large poly bag to retain moisture. Elms can be slow to callus, so the flats are placed in a 55 ºF greenhouse out of direct sunlight for approximately 2 weeks, or until callus is observed on the edge of the graft wound. The flats are placed in a 42 ºF cooler for 6 weeks. The plants are then removed from the flats; and the twine or budding rubbers are slit with a razor blade, but not removed (as the new plant begins to grow, the expanding stem sheds the grafting tie). The plants are potted up in 2½ inch wide × 5 inch deep bottomless containers. After a year of growth in a lightly shaded structure, the young plants are ready to line out. No immediate or delay graft incompatibility has been experienced, except with the selection *Ulmus* 'Sapporo Autumn Gold'. This plant was being grown for comparison purposes.

Table 1. Compilation of the growth and other characteristics of the five different elm selections.

Growth Characteristics	Accolade®	Commendation™	Danada Charm™	Triumph™	Vanguard™
H × W (in ft) (mature)	70 × 60	60 × 50	70 × 60	60 × 50	45 × 45
Shape	Vase w/arching limbs	Upright oval	Vase w/arching limbs	Upright oval to vase	Rounded, vase
Foliage – summer/fall	Glossy dark green/yellow	Green/yellow	Dark green/yellow	Glossy green/yellow	Green/yellow
Special notes	Excellent, pest-resistant; coarse texture in youth	Fastest growth rate when young	Red-tinted new foliage	Good form when young, easier to train An "improved" Accolade®?	Excellent heat and drought tolerance; smallest leaves
Cold hardiness	4	4	4	4	4
Propagation *	GR, MC	GR, MC, RC	GR, MC, RC(?)	GR, MC, RC	GR, MC, RT

* Propagation Key: GR = Graft on *Ulmus pumila* rootstock. MC = Tissue culture-generated cuttings. RC = Rooted softwood cuttings.

Table 2. Comparison of the insect pest and disease resistance of the five different elm selections to the major problems experienced with elms growing in the Midwest.

	Accolade®	Commendation™	Danada Charm™	Triumph™	Vanguard™
Insect pests					
elm leaf beetle	R	S	S	IS	IS
cankerworm	R	IS	IS	IS	IS
gypsy moth	R	S	S	IS	IS
Japanese beetle	IS	S	S	IS	IS
elm leaf miner	R	R	R	R	R
Diseases					
Dutch elm disease	R	R	R	R	R
elm yellows	R	R	R	R	R

Key: S= susceptible; IS = intermediate susceptibility; R = resistant.

Table 3. Comparison of the insect pest and disease resistance of the American and Siberian elms to the major problems experienced with elms growing in the Midwest.

	American elm	Siberian elm
Insect Pests		
elm leaf beetle	R	S
cankerworm	S	IS
gypsy moth	IS	S
Japanese beetle	S	IS
elm leaf miner	R	R
Diseases		
Dutch elm disease	S	R
elm yellows	S	R

Key: S = susceptible; IS = intermediate susceptibility; R = resistant.

Several West Coast liner producers are successfully producing the elms via budding on seedling *U. pumila*. All of the selections have been successfully propagated via microcutting produced via tissue culture. The resulting plants often exhibit slightly different morphological characteristics than the original parent trees. These traits are generally attributed to an expression of juvenility. This has been particularly noticeable with Accolade® elm. Young plants possess leaves that appear more rugose and feel like fine-grade sandpaper. The branches are often slightly winged (to a lesser degree than *Euonymus alatus*), and the lower branches also tend to curve down at the ends. It is believed that the plant will eventually outgrow these characteristics as it matures.

IN CONCLUSION

It is clear that there is a revival in the use of elms. It is not unusual to observe several new elm selections in the inventory list of quality liner and finished plant producers. This once-dominant group of plants is back in the nursery industry — hopefully to stay. Although the new selections from The Morton Arboretum's Elm Improvement Program and other programs are resistant to DED, other less serious problems can be experienced with these trees. Common sense must be used to make sure our landscapes are planted thoughtfully to ensure that a good level of diversity is created so no single pest or disease can cause the large-scale loss experienced in the past. With good planning (and planting), the new generation of elms will be a useful tool in regreening our cities in the future.

ADDITIONAL READING

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