AN EVALUATION OF HOLDEN ARBORETUM'S SHADE TREE COLLECTION

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ABSTRACT. Two hundred eleven trees had been identified from 23 literature sources as suitable for use in urban areas. An examination of the tree collection at Holden Arboretum identified 33 trees previously unrecommended which may be suitable for urban use. A number of these performed well at the Arboretum, but several performed below expectations in the same setting.

Information on trees suitable for the urban environment may be difficult to find because of species and cultivars available and lack of replicated research. Chapin and Kozel (1) evaluated growth of 128 tree species and cultivars in a plot in the Secrest Arboretum in Wooster, Ohio. Specimens were rated on the basis of foliage color and density, branch and crotch development, disease and insect susceptibility, and overall growth rate and condition. Most other recommendations, however, are based on observation, rather than experimentation. Shurtleff (7) compiled a comprehensive list of urban trees for most urban areas in the U.S. Koller's work (5,6) provided a valuable list of under-utilized as well as common trees for use in urban areas.

Arboreta then, play a valuable role in identifying new, neglected, or under-utilized species until their performance is known and attractive to commercial nurseries. The objectives of this study were to compile a list of species, cultivars, and varieties of deciduous tress recommended for urban use, evaluate as many as could be found at Holden Arboretum, and identify new and promising trees, as well as those that performed poorly.

Materials and Methods

This study was located at the Holden Arboretum, Kirtland, Ohio. Founded in 1931 and comprising an area of 800 hectares, the Arboretum contains more than 8,000 different species, varieties, and cultivars of mature and introduced woody plants. The Arboretum is located in USDA hardiness zone 5 (4), with an annual average precipitation of 111 cm. The topography is flat to gently rolling. The predominant soil type is a heavy clay loam.

A universal search of the literature was conducted to disclose tree species recommended for city use (3). "City use" was broadly defined as including streets, parks, cemetries, and other city land. All of these areas are within the city setting but no attempt was made to divide the lists into specific categories. If an author suggested a tree for use in any part of a city, it was noted.

The second phase of this project, a preliminary screening of new urban plant materials, was to evaluate the performance of these and additional trees in the Arboretum. Acquisition source, planting date, survival, records of insects and diseases were recorded and evaluated, etc. The proportion of surviving plants was calculated. Each tree was photographed, and measured in the field for height, diameter and crown spread.

The height of the specimen divided by its age gave the average annual growth rate. Expected mature heights were recorded from the literature. A sixty percent survival rate or a growth rate greater than 10 cm/yr was established as minimally acceptable.

Results

The literature search (3) produced a list of 211 urban use trees from 23 authors comprising 41 genera, the most common of which were:

Acer (21 species, 53 cultivars)
Carpinus (6 species, 12 cultivars)
Celtis (6 species)
Crataegus (11 species, 14 cultivars)
Fraxinus (7 species, 10 cultivars)
Ginkgo (1 species, 6 cultivars)
Malus (6 cultivars)
Quercus (11 species)
Sorbus (5 species, 6 cultivars)
Tilia (8 species, 13 cultivars)

Examination of the trees growing at the Holden Arboretum revealed 33 trees which were not mentioned in the literature search as potentially suitable for urban use. Twenty-six of these trees,

their growth habit, percentage of survival, and growth rates are presented in Table 1. The performance of the following 7 species were encouraging, but were not included in Table 1 because observations were based on a single tree: *Acer macrophyllum, A. saccharum* 'Sweet Shadow', *Fraxinus excelsior, Malus baccata* 'Columnaris', *Malus* 'Donald Wyman', *Malus sylvestris plena,* and *Sorbus Aria gigantia.*

Some of the trees performed poorly at the Holden Arboretum. Fifty percent survival was attained with *Acer ginnala, A. truncatum, Crataegus mollis, Prunus sargentii,* and *Tilia americana gastigiata.* Additionally, growth rates of less than 10 cm per year were attained by *Acer circinatum, Stewartia Koreana,* and *Oxydendrum arboreum.*

Discussion

Thirty three trees not previously identified in the literature as suitable for urban use, have been identified through their performance at the Holden Arboretum. The 60% survival rate was considered somewhat liberal. Use in street environments might well be more harsh, in which case poorer survival would be expected. On the other hand, many off-street urban sites may be less harsh. A

Table 1. The survival, habit, and performance of 26 previously unreported tree species found in the Holden Arboretum.

Tree species	*Habit*	*Survival*	*Plant size (m)*		*Growth rt. (cm/yr)*		*Mat. ht. (m)*
			Ht.	*Spread*	*Ht.*	*Spread*	
Acer nikoense	vase	5/7	3.0	2.1	24	16	9
Acer platanoides 'Greenlace'	upr.-oval	3/3	3.7	3.0	28	24	15
Acer platanoides 'Royal Red'	rounded	4/4	4.4	2.1	34	16	--
Acer platanoides 'Undulatum'	pyramidal	3/3	7.3	4.7	32	20	9
Acer rubrum 'Schlesingeri'	rnd.-upr.	3/3	8.4	7.6	35	32	15
Aesculus arnoldiana	up. oval	5/5	3.7	1.2	21	12	--
Aesculus octandra	rounded	6/6	5.0	4.6	22	20	12
Alnus glutinosa 'Imperialis'	pyramidal	5/5	5.5	3.0	30	17	15
Carpinus betulus 'Quercifolia'	oval-rnd.	6/8	5.5	4.3	23	12	15
Catalpa ovata	pyramidal	4/6	7.5	5.2	31	22	8
Cornus mas 'Macrocarpa'	rounded	4/4	2.7	2.5	12	11	8
Corylus colurna	pyramidal	6/6	6.8	6.8	30	30	14
Crataegus prunifolia	rounded	3/3	4.3	6.6	12	18	6
Crataegus viridis 'Winter King'	rounded	6/8	3.9	4.4	26	29	9
Fagus sylvatica 'Fastigiata'	columnar	9/9	3.8	1.4	22	10	10
Fraxinus americana 'Rose Hill'	oval	2/3	5.8	5.1	44	39	17
Liquidambar styraciflua aurea compacta	pyramidal	3/3	3.6	2.9	26	21	14
Malus atrosanguinea	mounded	9/9	3.0	5.4	22	39	6
Malus baccata Jackii	upright	2/3	3.7	5.2	21	30	9
Malus 'Radiant'	upr.-oval	3/3	4.9	5.9	35	42	9
Malus 'White Angel'	rounded	6/6	2.7	3.6	18	24	6
Malus 'Winter Gold'	rounded	6/8	4.3	5.4	25	32	6
Phellodendron japonicum	vase	6/10	3.5	3.8	14	15	9
Phellodendron sachalinense	vase	7/8	3.2	2.4	30	22	12
Pyrus calleryana 'Aristocrat'	pyramidal	2/3	3.5	2.1	32	19	11
Quercus petrea columnaris	columnar	6/8	9.3	4.6	39	19	--

terminal growth rate of 10 cm per year was also considered liberal since others consider growth of less than 30 cm per year as slow (2). However, in many urban uses slow growth does not necessarily indicate an inferior plant.

The identification of these trees then, suggests only that the plant materials are worthy of further trials in city spaces. This list is not final, nor should it be. It is hoped, however, that the materials reviewed here may be an initial step in finding new and better materials for use in the trade.

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ABSTRACT

CHAPMAN, DOUGLAS. 1982. **Age, timing, species and site make transplanting a science.** Weeds, Trees and Turf 21(8): 50, 52, 54.

Transplanting a tree is an art and a science. Many factors must be weighed, including timing, age, species, pretreatment, antitranspirants, and site. Timing is the paramount consideration of transplanting. In general, the earlier in the spring the tree is moved after the frost is out of the soil, the greater the degree of success will be. Age also affects transplanting success. The smaller or younger the plant, the easier to transplant. Generally, one should have a high degree of transplanting success (above 90%) with trees up to 1 to 1½ inches in trunk diameter. For tree species that have shown historically to be difficult to transplant, one should carefully move the plants only during early spring or winter dormancy. Site can be the difference between success and failure. Generally speaking, most trees and shrubs should be transplanted into well-drained soils.