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Trends Influencing the Introduction of New Landscape Plants

Mark P. Widrlechner*

INTRODUCTION

Any discussion of new crops in the American nursery industry must begin with a realization that this industry is already one of the most diversified sectors of American agriculture. This diversity is reflected in the range of production methods used, the fact that nursery crops are produced in every one of our states, and the large number of species being grown. These facts notwithstanding, there is strong interest in new plants for the nursery industry. But any single new introduction is likely to have little impact on an industry that already has such a broad mix of products. There is also trouble in defining what exactly is a new introduction. Many of the "new" plants that are identified in the popular literature have been under cultivation for many years and a diligent search of nursery catalogs will show that many of these "new" items have been in the trade, albeit in limited production, for years. With these limitations in mind, this paper will review important trends that may help define the future product mix of the industry, with examination of specific new plants only to show how they may succeed in the trade because they fit with these trends.

At the North Central Regional Plant Introduction Station in Ames, Iowa, I am responsible for a program to search out, propagate and distribute for long-term testing new woody landscape plants that are adapted to midwestern conditions (Widrlechner 1985). In this capacity, I work with trial site cooperators located in a wide range of environments throughout the central part of the United States at state experiment stations, botanical gardens and the USDA Soil Conservation Service. From my experience cooperating with these people, who generally have a good working relationship with their local nurseries, and by reviewing popular and professional journals in arboriculture, gardening, landscape architecture and nursery management from the last five years, I have identified four trends that influence the rise of new plants and the decline of some of the current offerings. These include: the increasing importance of low-input plantings as water and labor become more expensive; the desire to have plantings that are compatible with high-density urban development; the integration of food gardening and landscape plantings; and the refinement of tissue culture to propagate plants that are difficult to handle using conventional propagation methods.

LOW-INPUT LANDSCAPE PLANTINGS

Contrary to the actions, if not the beliefs, of many shopping center developers and local units of government, the establishment and long-term maintenance of landscape plants is usually not cheap nor easy. Many landscape designs, while attractive when newly installed, do not stand the test of time, because the people who are responsible for their maintenance either do not know what needs to be done to keep the plantings healthy and attractive or they cannot afford to do so. The rising costs and/or decreasing availability of two factors, skilled labor and good quality water, must be recognized in new plant introduction. There is no reason to believe that the cost of well-trained workers will stabilize or that water will become more abundant in the future.

Xeriscape

As competition for water has become more intense, some municipalities have been forced to put restrictions on outdoor water use. Many landscape plantings of species with high water requirements have suffered. In response to this problem and out of a desire for landscaping to be part of the solution rather than part of the problem, horticulturists in the western United States have established a new approach to landscaping with minimal water inputs called xeriscape. Xeriscape attacks the problem by combining special cultural practices such as soil preparation and mulching with plants that need less water.

A history of the xeriscape movement was outlined by Wellingham-Jones (1986), who documented its spread, beginning with a challenge issued by the Denver County Water Department in 1981 and going to 1986, when there were already 24 xeriscape programs in 60 western cities. She stated that the movement was drawing increased attention in the east and especially in Florida where fresh water will be in short supply due to the state's special geology and growing population.

Xeriscape requires special plants adapted to dry conditions, but that can thrive in common soils and with

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occasional periods of high moisture. Many woody plants that naturally grow under xeric conditions grow on very well drained or unusual soils and may not be widely adapted to artificial landscape conditions. Baetz (1988) suggested ways that design, installation and maintenance of xeriscape plantings could be modified to better fit the natural adaptations of these plants. Klett (1986) has coordinated a project to test herbaceous and shrubby xeriscape plants under both dryland and irrigated conditions to learn more about the adaptability of these ornamentals.

A review of the literature shows a great deal of interest in plants that require little water and many lists of recommended plants (Farmer-Bowers 1984, Hudak 1984, Mielke 1986abc, Mitchell 1985, Pair 1986, Proulx 1984, Sacamano 1983, Simpson 1983). Wellingham-Jones (1986) commented, "a major problem has been finding new plant materials—in California demand exceeded nursery supply for a number of years." The interest is there but so far plants for xeriscape have not been easy to obtain. This may be because xeriscape species are difficult to propagate or to grow in the nursery using conventional production techniques, because many of them were new to the industry or because they were not considered as attractive or marketable as were moisture-loving ornamentals.

This situation should change as more nurseries develop methods needed to produce and market xeriscape plants. Anderson (1987), Baetz (1988) and Taylor (1988) have all described cases where western municipalities have been working with the local nursery industry to build markets for these plants. Proulx (1984) highlighted the progress of one of the growing number of new specialist nurseries, Plants of the Southwest, that can help supply future demand.

Regionalism

The natural landscapes and climates of our nation are extremely varied; our artificial landscapes are more uniform. This is in part a result of the ease of using commonly available plants that have broad adaptability and may also be due to a lack of environmental awareness and originality of people making planting decisions. Strong schools of regionalism have evolved in response to the increasing homogeneity of the American diet and arts repertoire. A similar phenomenon has been taking place in architecture and landscape design (Hough 1984, Olgyay 1963).

Two broad and convincing arguments can be made in support of regionalism. First is the esthetic argument that it is visually interesting for local character to be expressed in the landscape (Briggs 1984a). The other is that regional landscapes should be low-input landscapes. In other words, if plants are chosen that have been shown to be well adapted to local conditions, the costs of keeping plantings healthy and attractive will decrease.

Xeriscape is one strong example of a response to local needs. Another manifestation of regionalism can be found in increasing interest in native trees and shrubs. The number of lists of useful native landscape plants is staggering. In the interest of space, I will cite just a sample of recent books and articles on natives, representing all regions of the United States (Diekelman and Schuster 1982, Farmer-Bowers 1984, Hightshoe 1988, Hubbard 1986, Jones 1987, Norris 1983, Penn 1982, Proulx 1984, Taylor 1988, Wasowski and Ryan 1985, Welch 1984).

It is sometimes suggested that native plants should be less costly to maintain because they evolved under local environmental stresses (Norris 1983, Taylor 1988), but the fact that the soils, microclimates, and arrangements of plants in artificial landscapes bear little resemblance to their nearby natural counterparts complicates the issue.

Breeding and Selection to Reduce Inputs

Publicly supported breeding work on woody landscape plants is not very extensive. Less than eight researcher-years are devoted to this topic (Brooks and Vest 1985), but it is a significant force in developing new plants. Many of the publicly-supported programs have the reduction of maintenance inputs among their primary goals.

Overplanting of American elm (*Ulmus americana* L.) in our cities and the devastating spread of Dutch Elm Disease, caused by *Ceratocystis ulmi* (C. Moreau), ultimately made this attractive tree one of the most labor-intensive street trees (Gibbs 1978). Breeding programs at the University of Wisconsin (Smalley and Lester 1983) and the National arboretum (formerly at the USDA-ARS Nursery Crops Lab in Delaware, Ohio (Townsend 1983)) have been working to develop disease-resistant elms with good form that are adapted to American conditions, such as the new hybrid clones 'Regal', 'Pioneer' and 'Homestead'. These selections are just now getting into the trade and their impact on an industry cautious about elms is unclear.

The prairie region of the north central United States has some of the most challenging environments for trees and shrubs. For over twenty years, the Minnesota Landscape Arboretum has had a breeding and selection program to develop landscape plants adapted to such climatic and edaphic extremes. Releases from this pro-

gram fit well with a desire to promote a regional landscape (Pellett and Luby 1985). Notable products include 'Princess Kay', an especially cold hardy ornamental plum (*Prunus nigra* Ait.) and a number of deciduous azalea selections with midwinter flower bud hardiness to at least -37°C , such as the hybrid cultivars 'Pink Lights', 'Rosy Lights', 'White Lights', and 'Orchid Lights' (Moe and Pellett 1986).

A plant selection program designed to support the xeriscape movement is directed by Benny Simpson at Texas A&M University. His releases of *Leucophyllum frutescens* (Berland.) I. M. Johnst., 'White Cloud' and 'Green Cloud', *L. candidum* I. M. Johnst., 'Silver Cloud' and *Salvia regia* Cav., 'Mount Emory' were specifically chosen for their performance under xeric conditions (Simpson 1983).

URBAN PLANTINGS

As our population continues to grow, our nation continues to urbanize. Urban environments are harsh environments and are clearly different from surrounding natural environments. Landscape plantings have often performed poorly under urban conditions and recently a new subdiscipline of horticulture, urban horticulture, has begun to examine in detail the problems facing urban plantings and potential solutions. Since it is unlikely that urban development will slacken, one should pay special attention to the problems being identified by researchers in urban horticulture and consider the role that properly chosen plants may have in overcoming these problems.

Problems Identified by Urban Horticulture Research

There is a growing body of reports that identify and quantify the problems faced by urban vegetation. One of the major forces behind this work comes from cities faced with the high costs of maintaining and replacing street trees. Thus, many of these reports address problems specific to street trees.

Three recent articles give an excellent overview of the special stresses faced by urban vegetation (Bassuk 1985, Kozlowski 1985, Moffat 1987). These stresses include poor, compacted, irregular soils that are often saline and/or alkaline (Steiner 1980); extreme microclimates with little natural buffering; low or irregular light intensities and photoperiods; and air pollution. Whitlow and Bassuk (1987) published a detailed analysis of extreme temperatures and water stress on New York City street trees and Pfeiffer et al. (1987) reported on stresses faced by plants around King County, Washington parking lots. Experimental data have also been published on the performance of trees and shrubs under controlled soil compaction (Alberty et al. 1984, Gilman et al. 1987).

It becomes obvious that most plants do not perform well under such stresses and furthermore the plants that do survive under these conditions, such as *Ailanthus altissima* (Miller) Swingle (Pan and Bassuk 1986), may not necessarily have other characteristics that make them desirable. Publications from Pennsylvania State University's School of Forest Resources have pointed out the lack of data on the performance of urban trees and have made suggestions on how systems could be designed for cities to do their own testing (Gerhold 1985, Gerhold and Bartoe 1976). Without such data, it is not possible to know how well new landscape plants will thrive under urban stresses and, just as importantly, how well they will fit into urban space constraints caused by utility lines, narrow parkways and the need for traffic visibility.

Potential Solutions to Urban Problems

There are different approaches to dealing with these urban challenges. Many things can be done to improve landscape designs, reduce soil compaction and give better care to plants during establishment. But there are also research methods that can lead to improved genotypes.

One approach is used by breeders who include tests for urban stresses in their selection criteria, such as the salt tolerance system suggested by Townsend (1980), or who are otherwise selecting for plants that have the size requirements to fit into the urban landscape. This approach has led to some interesting selections, such as the low-growing *Weigela* hybrids released by Agriculture Canada, 'Rumba', 'Samba' and 'Minuet' (Svejda 1982, 1985, 1986), and the pollution-tolerant, non-invasive, triploid *Hibiscus syriacus* L. selections from the National Arboretum (Egolf 1988).

The other approach has best been explained in a series of presentations by George Ware of the Morton Arboretum (Davis 1984, Ware 1983, 1984, 1985). In the spirit of Briggs' (1984b) statement that, "the first thing to remember in selecting urban plants is that there is a direct correlation between a plant's adaptability and maintenance costs," Ware posed an interesting hypothesis. He suggested that a detailed analysis of urban soils and climates could be used to direct a search for trees and shrubs growing under analogous conditions in nature. These plants should be better candidates for adaptation to urban stresses than the present array of species.

Ware has spent many years studying the problems of trees in the Chicago region and stated (1984) that many of the problems faced there were a result of poorly drained, alkaline clay soils. By exploring regions with poorly drained, calcareous soils that have even more extreme fluctuations in climate than the area around

Chicago, such as certain parts of the Great Plains and Rocky Mountain states, one could find candidate plants for propagation and evaluation.

Diverse populations of many of our common native landscape trees have been evaluated for performance and adaptation by foresters and horticulturists. The results of such evaluations, known as provenance tests, for the following common landscape trees have been published: *Acer rubrum* L. (Townsend et al. 1979); *Cercis canadensis* L. (Donselman and Flint 1982); *Fraxinus americana* L. (Alexander et al. 1984, Clausen 1984, Wright 1944); *Picea pungens* Englm. (Van Haverbeke 1984); *Pinus ponderosa* Dougl. ex P. Laws. & C. Laws., (Kopp et al. 1987); *Pinus virginiana* Mill. (Warlick et al. 1985); and *Quercus rubra* L. (Flint 1972).

A true test of Ware's hypothesis, provenance testing of selected populations under urban conditions, remains to be accomplished. It might be best done by first evaluating many provenances, chosen in part by Ware's criteria, at a field site near an urban area or with certain artificially controlled stresses. One could then test the best populations directly under urban conditions using designs of the sort outlined by Gerhold (1985).

THE EDIBLE LANDSCAPE

During the 1970s and early 1980s surveys indicted that an increasing number of American households were involved in fruit and vegetable gardening. Recent surveys (Anderson 1988) show a shift in interest to amenity gardening. My review of popular garden magazines showed a movement away from designs that clearly define areas to be used only for fruit and vegetable production toward an integration of food and decorative plantings.

This integration of food gardening with an attractive landscape, called edible landscaping, has been championed by a California landscape designer, Rosalind Creasy. Her book, "*The Complete Book of Edible Landscaping*," (1982a) has generated a great deal of interest in the topic and re-examination of many fruit and nut plants for their ornamental characteristics.

Since the publication of this book, Creasy has given "how-to" examples to gardeners and the landscape industry (1982b, 1988) and many other reviews oriented toward edible landscape plants have appeared in popular publications (Goodell 1983, Hill 1986, McKinnon 1984). Certain uncommon trees and shrubs have been singled out for praise, because of their fruit and nut production. These include thorough reviews on *Asimina triloba* (L.) Dunal. (Mansell 1986, Nichols 1986), nut-producing species of *Pinus* (Reich 1988), and the use of *Corylus* in garden hedges (Benowitz 1986).

Many of the tree and shrub genera that are useful for edible landscaping for humans are also good for wild-life plantings (cf. species lists in reports by Burley (1987) and Thomas et al. (1973)). There has been increasing interest in plants that feed and shelter backyard wildlife as is evidenced by the growing number of gardens enrolled in the National Wildlife Federation's Backyard Wildlife Habitat Program (Harrison 1983, Johnson 1987).

An increase in the number of edible landscapes, for both humans and wildlife, should increase demand for certain new introductions, such as three new selections of *Amelanchier* (Dirr 1977) made by Tom Watson, a Wisconsin nurseryman. These three all have tasty fruits, the largest borne on *A. canadensis* (L.) Medic., 'Prince William', a suckering shrub with orange-red fall color. *A. × grandiflora* Rehd., 'Princess Diana', is extremely floriferous and can show excellent fall color; the third, *A. laevis* Wieg., 'Prince Charles', was selected for its upright habit.

Vaccinium crassifolium Andrews, 'Wells Delight' and *V. sempervirens* Rayner and Henderson, 'Bloodstone' are two new groundcovers with edible fruit (Kirkman and Ballington 1985). These selections of little-used, native species were made for high-quality, evergreen foliage and adaptation to southeastern conditions. The black fruits of these two cultivars can be used by people and wildlife alike.

IN VITRO PROPAGATION

The first three trends have dealt with potential changes in the demand for landscape plants; this final section looks at supply. In 1984, *American Nurseryman* helped introduce the topic of *in vitro* propagation to the nursery industry with forward-looking reports by Chée (1984) and Davies (1984). These reports suggested that tissue culture would be an important tool in producing useful species that are otherwise difficult to propagate. At that time, there were also two reports of successful nursery enterprises specializing in genera of the Ericaceae that were making great strides with tissue culture (Norris 1984, Smucker 1984) and a feature article in another popular journal on the role tissue culture played in the commercial production of new *Kalmia* cultivars (Cross 1984).

Tissue culture propagation has continued to expand both in terms of the number of species that have workable production protocols and in the total number of propagules produced (MacCarthaigh 1986). This expansion has not come about without some problems, however. In a provocative opinion article, Mezitt

(1988), one of the major tissue culture producers featured four years earlier by Smucker (1984), expressed concern that lack of quality control, problems with epigenetic variation, a poor understanding of the market potential for tissue cultured products, and an insufficient commitment by the nursery industry to fund long-term research and development on *in vitro* propagation methods would hamper the future success of tissue culture to produce, high-quality, true-to-type plants economically. Many of the technical limitations to the *in vitro* propagation of woody plants are discussed in more detail by McCown (1986).

Even with such cautions to temper one's judgment about the future, there are already examples of useful new plants that would not be in the marketplace without tissue culture. It is my belief that the number of these examples will continue to grow.

Current success stories include the cold-hardy, deciduous azaleas released by the University of Minnesota (Moe and Pellett 1986) and *Kalmia latifolia* L. cultivars such as 'Ostbo Red' and 'Shooting Star' (Cross 1984). These plants would be limited to an extremely small market without tissue culture, as efficient cutting propagation systems have never been developed. Likely candidates for commercial success in the near future include the three *Amelanchier* cultivars mentioned in the previous section (Dirr 1987) and *Betula platyphylla* Sukachev var. *japonica* (Regel) Nakai, 'Whitespire'. This birch was selected from a Japanese plant introduction, PI235128. It is a narrow-pyramidal, white-barked tree well adapted to midwestern conditions that is highly resistant to bronze birch borer (*Agrilus anxius*) (Hasselkus 1987, Reed 1985). Commercial production is currently mostly from open-pollinated seed from the University of Wisconsin's Longenecker Gardens, but clonal propagation would be much more desirable. The seed comes from a somewhat isolated population of only three trees. The bulk of the seed is true but may be inbred and the possibility for outcross contamination does exist. Tissue culture is now being used to bring the original, superior genotype into the trade directly (Hasselkus 1987).

CONCLUSION

Although the American nursery industry already produces a diverse array of products, there is clearly interest in new plants. Many potentially useful new plants have been used as examples in the text. Table 1 lists my suggestions of species, either already extant or potential selections, that deserve a closer look. One can judge the potential success of new offerings by considering how they fit the needs of consumers and whether they can be produced economically. Both the needs of the consumer and production methods continually change. The trends I have outlined describe some of these important changes and the increasing influence they are having on plant introduction. Of course, actual success for any new introduction will be the result of the interaction of these trends and an appropriate production and marketing effort.

Table 1. Plants with potential to meet current landscaping trends.

<i>Acer campestre</i> L. (European selections with good street-tree form)
<i>Acer rubrum</i> L. × <i>A. saccharinum</i> L.
<i>Actinidia</i> Lindl. (Hardier selections with desirable fruit)
<i>Amelanchier</i> Medic. (Small, non-invasive selections with desirable fruit)
<i>Betula</i> L. (Selections from wild populations subject to severe summer stresses)
<i>Ceanothus</i> L. (Selections from wild populations growing on less well-drained soils)
<i>Cercocarpus</i> HBK. (Selections from wild populations growing on less well-drained soils)
Conifers (Salt-tolerant selections for urban roadsides and screening)
<i>Corylus colurna</i> L.
<i>Crataegus</i> L. (Rust-resistant cultivars)
<i>Fothergilla gardenii</i> J. Murr.
<i>Fraxinus ornus</i> L. (Hardier selections)
<i>Hibiscus syriacus</i> L. (Sterile, cold-hardy cultivars)
<i>Juniperus virginiana</i> L. (Rust-resistant cultivars with good winter color)
<i>Pistacia chinensis</i> Bunge
<i>Rhododendron</i> L. (Cultivars selected for tolerance to higher pH soils)
<i>Rhus copallina</i> L. (Low-growing selections)
<i>Sapindus drummondii</i> Hook. & Arn.
<i>Sorbus alnifolia</i> (Siebold & Zucc.) C. Koch
<i>Ulmus parvifolia</i> Jacq. (Hardier selections)
<i>Vaccinium</i> L. (Hybrids involving <i>V. corymbosum</i> L. and a stress-tolerant, low-bush parent, such as <i>V. angustifolium</i> Ait. or <i>V. vacillans</i> Torr.)
<i>Weigela</i> Thunb. (Cold-hardy, dwarf cultivars)

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Cuphea glutinosa Selections for Flowering Ornamental Ground Cover in Southeast United States

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INTRODUCTION

The genus *Cuphea* (Lythraceae) containing about 260 species, is native in the area from Mexico through Brazil, with two species found in the eastern United States (Graham and Kleinman 1985). Much research interest has centered on cuphea because its seeds have a high content of medium chain triglycerides (MCT) (Earle et al. 1960 Graham et al. 1981, Wilson et al. 1960). The MCT include caprylic acid (C8), capric acid (C10), lauric acid (C12) and myristic acid (C14). These MCT are used in soaps and detergents, high energy foods, plasticizers, lubricants, and health foods (Thompson 1984).

An alternative use of some *Cuphea* spp. may be as a landscape or ornamental plant. Plants for special use in the landscape must cover bare ground, prevent erosion, add variety, tie-in different plants or add color (Georgia Cooperative Extension Service 1978, Plant Genetics and Germplasm Institute 1975). The cigar plant [*C. ignea* (DC)] is presently grown as an ornamental. Several selections of *C. glutinosa*, (Cham. & Schldl.), native to Brazil (Graham et al. 1981) have been identified with unique and desirable ornamental characteristics such as excellent ground cover and flowerings, and may have potential as ornamental ground cover for the southeastern United States. *Cuphea procumbens* × *C. llavea* hybrids have also been suggested as potential ornamental plants (Thompson et al. 1987).

EVALUATION STUDIES

Two hundred and twenty *C. glutinosa* plants representing 4 different introductions were transplanted to the field in May 1986. Only 25 of these plants were still living after the 1986-87 winter and they were assigned Georgia (GA) selection numbers 1 through 25. Plants which can overwinter would have greater adaptability for a permanent landscape. The lowest temperature in the 1986-87 winter was -6°C.

Two tests were conducted on *C. glutinosa* during 1987-1988; for environmental adaptation, and evaluation for desirable ornamental characteristics. The environmental adaptation test consisted of full sun and level soil, full sun and 30% slope, full shade (90% summer shade) under hardwood trees, and full shade (90% summer shade) under pine trees. All treatments had 10 replications of 5cm plugs of rooted stems and seedlings of plant selection GA 16. Transplanting was on June 18, 1987. Plants were irrigated and fertilized as needed. Plants were evaluated for ground cover diameter and height, number of flowers, flower rating for attractiveness, and overall rating for growth and flowering 103 days after transplanting.

The 25 overwintering *C. glutinosa* selections were evaluated under full sun and level soil. Ten 5cm plugs of rooted stems and seedlings of each Georgia selection were transplanted on June 24, 1987. Plants were evaluated