Significance to the Nursery Industry

This paper, and those cited in *Acer* and *Quercus*, form the basis of our studies of inter- and intraspecific variation in cambial peroxidase isoenzymes and their possible relationship to graft compatibility in these 3 genera. We have established that graft incompatibility problems in the nursery industry are most prevalent within those species (e.g. *Acer rubrum* L., *Castanea mollissima* Blume, *Quercus rubra* L.) that exhibit wide intraspecific variation in cambial peroxidase isoenzyme patterns. Similar problems would be encountered when using these variable species in interspecific grafting. When there is little or no isoperoxidase variation within a species (e.g. *Acer platanoides* L., *Gleditsia triacanthos* L.), intraspecific grafts seldom exhibit incompatibilities. Now that we have some understanding of isoenzyme variation patterns we can begin to analyze the various grafts we have made between plants of similar and different isoenzyme constitution.

Following such analyses, we may be able to provide guidance to nurserymen regarding the choice of compatible rootstocks for selected cultivars in these genera.

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Temperate Zone Woody Plants for Interior Environments[1]

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Abstract

Japanese yew (*Podocarpus macrophyllus* 'Maki') and Wheeler's Dwarf pittosporum (*Pittosporum tobira* 'Wheeler's Dwarf') grown outdoors under 3 production light levels and shade-grown fatsia (*Fatsia japonica*), dwarf gardenia (*Gardenia jasminoides* 'Radicans'), variegated pittosporum (*Pittosporum tobira* 'Variegata'), leatherleaf mahonia (*Mahonia bealei*), and Chinese mahonia (*Mahonia fortunei*) adapted well to interior conditions following production. Quality of asiatic jasmine (*Trachelospermum asiaticum*), Okinawan holly (*Ilex dimorphophylla*), and dwarf Japanese euonymus (*Euonymus japonica* 'Microphylla') grown under the 3 production light levels and all species grown in full sun, except the Japanese yew and Wheeler's Dwarf pittosporum, were judged unacceptable.

Index words: acclimatization, indoor landscaping, fatsia, dwarf gardenia, pittosporum, Japanese yew, euonymus, Asiatic jasmine, Okinawan holly, leatherleaf mahonia, Chinese mahonia

Introduction

Most plants used in interior environments are tropical or semi-tropical in nature, and adapt well to conditions of relatively low light, warm temperatures, and low humidities. Proper light acclimatization during production increases quality and survival of these plants when maintained under low interior light levels (2, 3, 4, 5, 6). Many temperate zone woody plants prefer or will tolerate low light conditions in the exterior landscape and, if adaptable, could increase the selection of plant material for the interior environment. The purpose of this study was to evaluate for interior use selected woody landscape plants typically used in the exterior landscape in the temperate zone. Plants were grown under 3 production light levels to determine the effects of light acclimatization on interior performance.

Materials and Methods

In experiment 1, 30 uniform 7.5 cm (3 in) liners each of *Fatsia japonica* (fatsia), *Gardenia jasminoides* 'Radicans'

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(dwarf gardenia), *Pittosporum tobira* 'Variegata' (variegated pittosporum), *Podocarpus macrophyllus* 'Maki' (Japanese yew), and *Trachelospermum asiaticum* (Asiatic jasmine) were potted July 22, 1983, in 15 cm (6 in) containers. In experiment 2, uniform liners of *Euonymus japonica* 'Microphylla' (dwarf Japanese euonymus), *Pittosporum tobira* 'Wheeler's Dwarf' ('Wheeler's Dwarf' pittosporum), *Ilex dimorphophylla* (Okinawan holly), *Mahonia bealei* (leatherleaf mahonia), and *Mahonia fortunei* (Chinese mahonia) were potted April 6, 1984, in 15 cm (6 in) containers. Milled pine bark-sandy loam soil (10:1, by vol) growth medium was amended with 3.6 kg/m^3 (6 lb/yd^3) dolomitic limestone, 1.2 kg/m^3 (2 lb/yd^3) single superphosphate, 1.2 kg/m^3 (6 lb/yd^3) gypsum, 0.9 kg/m^3 (1.5 lb/yd^3) Micromax micronutrient fertilizer (Sierra Chemical Co., Milpatas, CA 95035), and 3.6 kg/m^3 (6 lb/yd^3) Osmocote 14N-6.2P-11.6K (14-14-14). Plants of each species were divided into 3 groups of 10 single-plant replicates and grown outdoors under the following light conditions: 1) full sun; 2) 47% shade; and 3) 64% shade. On October 23, 1983, and August 8, 1984, plants were transferred to an interior environment (11.2 μEsec^{-1}m^{-2} irradiance provided by 40 watt cool white fluorescent lamps, 12-hr photoperiod (6 A.M.—6 P.M.), 21.1° C (70° F) temperature, and 80% RH). Plants were completely randomized within a species and evaluated periodically during the following 15 weeks for sustained qual-

Table 1. Response of 10 woody landscape plants, grown under 3 light levels, to an interior environment.

Cultivar and production light level	Growth index[z] Post-production	Growth index[z] Post-interior	Color rating[y]	Leaf drop[x]	Quality rating[w]
Fatsia[v]					
full sun	12.7 b[t]	15.9 c	3.8 a	0.7 a	1.7 b
47% shade	28.6 a	32.1 b	3.2 a	0.0 a	4.2 a
64% shade	31.4 a	36.6 a	3.2 a	0.3 a	4.1 a
Dwarf gardenia[v]					
full sun	22.3 b	22.6 b	1.5 b	77.3 a	1.5 c
47% shade	28.0 a	28.5 a	3.7 a	38.8 b	4.1 a
64% shade	28.6 a	28.6 a	3.9 a	43.8 b	3.6 b
Variegated pittosporum[v]					
full sun	17.4 b	17.0 b	1.5 b	9.5 a	1.5 b
47% shade	22.2 a	22.6 a	3.6 a	3.3 b	3.5 a
64% shade	23.7 a	24.6 a	3.8 a	2.7 b	3.3 a
Japanese yew[y]					
full sun	25.9 a	26.1 a	5.0 a	11.3 a	3.5 a
47% shade	27.5 a	27.2 a	5.0 a	7.5 a	3.6 a
64% shade	30.0 a	28.3 a	5.0 a	11.8 a	3.3 a
Asiatic jasmine[v]					
full sun	18.9 a[s]	18.7 a	1.7 b	54.8 a	1.4 b
47% shade	18.9 a	19.5 a	4.8 a	48.0 a	2.9 a
64% shade	21.3 a	17.4 a	4.7 a	33.0 b	2.8 a
'Wheeler's Dwarf' pittosporum[u]					
full sun	28.2 b	29.6 b	3.0 c	41.5 b	3.2 b
47% shade	32.4 a	33.1 a	4.1 b	101.4 a	4.4 a
64% shade	32.0 a	32.5 a	4.4 a	107.8 a	4.6 a
Okinawan holly[u]					
full sun	29.5 a	28.7 a	3.1 b	160.8 a	1.3 a
47% shade	29.9 a	29.0 a	3.4 a	146.6 a	1.7 a
64% shade	30.4 a	29.3 a	3.5 a	141.9 a	1.4 a
Dwarf Japanese euonymus[u]					
full sun	31.9 b	32.2 b	3.3 b	763.9 a	2.1 b
47% shade	34.8 a	36.6 a	4.4 a	768.1 a	2.2 b
64% shade	34.9 a	36.3 a	4.5 a	852.0 a	2.9 a
Leatherleaf mahonia[u]					
full sun	35.5 b	35.5 b	2.6 c	3.2 a	1.9 c
47% shade	39.2 a	39.9 a	3.8 b	3.5 a	3.2 b
64% shade	41.4 a	41.1 a	4.4 a	3.7 a	3.6 a
Chinese mahonia[u]					
full sun	25.1 c	37.3 a	4.5 a	22.8 a	2.9 c
47% shade	30.0 b	37.4 a	4.5 a	7.2 b	3.4 b
64% shade	32.9 a	40.7 a	4.5 a	7.9 b	3.8 a

[z]Growth Index: (height + width + width)/3; in cm.

[y]Color Rating: 1 = light green; 3 = medium green; 5 = dark green. Recently matured leaves rated.

[x]Leaf Drop: total number of leaves dropped during interior period; leaflet drop for *Mahonia* spp.

[w]Quality Rating: 1 = poor, not salable; 3 = good, salable; 5 = excellent.

[v]Plants evaluated in 1983.

[u]Plants evaluated in 1984.

[t]Mean separation within columns and species by Duncan's multiple range test, 5% level.

[s]Shoots clustered together and length measured.

ity and growth. Following data collection, plants were maintained in the interior environment for 5 additional months and fertilized every 6 weeks with 100 ppm N from Peter's 20N-8.6P-16.6K (20-20-20) soluble fertilizer to determine if plants would resume vegetative growth without exposure to low temperatures or short days.

Results and Discussion

Post-production. Plants of *Fatsia japonica, Gardenia jasminoides* 'Radicans', *Euonymus japonica, Pittosporum* cvs. and *Mahonia* cvs. grown in full sun were smaller than shade-grown plants (Table 1). Unshaded *Ilex dimorphophylla, Pittosporum tobira* 'Wheeler's Dwarf' and *Gardenia jasminoides* 'Radicans' were dense and compact, while their shade-grown counterparts were looser and more open. Foliage of all species except *Podocarpus macrophyllus* 'Maki' was lighter green and thicker when plants were grown in full sun rather than shaded. Foliar tipburn occurred on *Fatsia japonica*, both *Mahonia* spp. and *Pittosporum tobira* 'Wheeler's Dwarf' grown in full sun. Generally, plants shaded during production were of higher quality than plants grown in full sun, which concurs with previous research (4, 5).

Post-interior. After 15 weeks in the interior environment, *Fatsia* produced in 64% shade were larger than those produced in 47% shade or full sun (Table 1). Production size of *Mahonia fortunei* increased as shade level increased, but after 15 weeks in the interior environment all plants were of similar size, regardless of production light level. Other species retained their same relative sizes after being placed indoors. Foliar color (rating) was highest for *Gardenia, Pittosporum tobira* 'Variegata', *Trachelospermum, Ilex*, and *Euonymus* grown in shade, but was similar for *Fatsia, Podocarpus*, and *Mahonia fortunei*, regardless of production light level. Foliar color of *Pittosporum tobira* 'Wheeler's Dwarf' and *Mahonia bealei* was darker when plants were grown under 64% shade compared to 47% shade. With all species except *Fatsia*, mature foliage color of plants grown in full sun did not improve during the interior period.

Gardenia, Pittosporum tobira 'Variegata', and *Mahonia fortunei* grown under both shade levels and *Trachelospermum* produced under 64% shade dropped fewer leaves than plants grown under higher light conditions but leaf drop from *Pittosporum tobira* 'Wheeler's Dwarf' was less when plants were grown in full sun; explanation of this observation is not known. With other species, leaf drop did not vary with production light levels.

Quality rating, based on a visual observation of plants at the end of the interior period, considered numerous plant characteristics, including habit of growth (density), leaf spacing, leaf drop, foliage color, and overall appearance and was deemed the primary factor determining a plant's potential for interior use. At the end of the 15-week interior period, the quality of *Podocarpus* was good for plants grown under all production light levels, while quality of *Pittosporum tobira* 'Wheeler's Dwarf' was higher when plants were grown under shade. Plant quality of *Fatsia, Gardenia, Pittosporum tobira* 'Variegata' and *Mahonia* spp. grown in shade was good to excellent. Quality of all plants grown in full sun, except *Podocarpus* and *Pittosporum tobira* 'Wheeler's Dwarf', was judged unacceptable. Better performance in the interior environment from plants grown in shade is supported by other studies (2, 3, 4, 5, 6). Quality of *Trachelospermum, Ilex*, and *Euonymus* was poor, primarily due to heavy leaf drop. With *Ilex*, 60% of plants grown in full sun, 30% grown in 47% shade, and 50% grown in 64% shade died in the interior environment.

Dormancy, a requirement for many temperate zone plants, would prevent their extended use in the interior environment; however, a period of dormancy is not essential for all temperate zone plants. Conklin reported survival and sustained quality of southern magnolia and camellia after 10 years in the Ford Foundation interior plantings (1). In our study, plants of fatsia, euonymus, and Chinese mahonia continued to grow during the interior period, as indicated by the growth indices. During the subsequent 5 months indoors, all plants initiated new growth, suggesting that a period of dormancy is not required by these species to survive and sustain vegetative growth.

Significance to the Nursery Industry

Traditionally, plants used in interior environments have been tropical or semitropical in nature and limited in number. However, our results indicate that temperate woody landscape plants such as *Podocarpus, Gardenia, Pittosporum* spp. *Mahonia* spp. and *Fatsia* can be successfully used in interior landscapes, thus providing potential market for nurserymen, increasing the plant selection available to interior landscapers, and providing a more diverse interior environment for all of us to enjoy.

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