1996 WOODY ORNAMENTAL EVALUATIONS

25th Year Edition

Report of Progress 770

Wichita Horticulture Research Center

Agricultural Experiment Station

Kansas State University, Manhattan

Marc A. Johnson, Director

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The Horticulture Research Center was established in 1970 on a 40-acre tract of land at 95th and South Hydraulic, Wichita, KS and expanded to 80 acres in 1991 for the purpose of evaluating horticultural plants for south central Kansas, including turf, ornamentals, fruit, and vegetable crops. The soil is a deep alluvial deposit of Canadian fine sandy loam and Elandco silt loam with a slightly acid reaction (pH 6.0-6.8). Texture varies from very sandy to a somewhat heavier, silt loam. Most of the ornamental evaluations are conducted on the heavier soils, whereas the sandy areas are devoted to orchard and vegetable crops.

Research in ornamentals emphasizes evaluations of plants for hardiness to Zone 6a-USDA. Additional research includes selection of improved cultivars, propagation and exposure studies, plus field and container production evaluations for the Kansas nursery industry. Research results also help meet the growing demand for horticultural information by both the large rural and urban populations of south central Kansas.

COVER: Urbanite Red Ash (*Fraxinus pennsylvanica)*

SPECIES AND CULTIVAR TRIALS

New Plant Introductions

John C. Pair

Primary objectives of the ornamental research program at the Horticulture Research Center are the introduction, evaluation, and, in some cases, propagation of plant materials that have shown superior performance in adaptability and offer potential for landscape use in south central Kansas. Sources of ornamental plants received for evaluation include the USDA Regional Plant Introduction Station at Ames, Iowa; other university experiment stations, arboreta and botanic gardens; and numerous commercial sources. During the past year, the following accessions were received for evaluation:

USDA Plant Introduction Station

Aesculus pavia A22071
Betula platyphylla A22552
Diervilla (*splendens* A19145
Forestiera neomexicana A19065
Nyssa sylvatica A22072
Physocarpus ribesifolius A10078
Spiraea miyabei PI578119

U.S. National Arboretum

Acer rubrum 'Brandywine' NA59907
Acer rubrum NA5772
Ulmus americana NPS3-487
Ulmus americana 'New Harmony'
Ulmus americana 'Valley Forge'
Ulmus japonica NA64463
Ulmus x Jefferson NA62001
Ulmus parvifolia 'Ohio'
Ulmus parvifolia 'Pathfinder'
Ulmus wilsoniana 'Prospector'

Commercial Sources

Acer buergenianum
Acer x freemanii Celebration™
Berberis x Golden Carousel™
Carpinus betulus 'Frans Fontaine'
Cornus florida 'Cherokee Brave'
Cornus florida 'Red Beauty'
Cornus florida 'Wonderberry'
Exochorda x macrantha 'The Bride'
Fraxinus americana ' Chicago Regal'
Fraxinus americana ' Empire'
Fraxinus americana ' Kohler'
Fraxinus oxycarpa 'Aureafolia'
Fraxinus pennsylvanica ' Centerpoint'
Fraxinus pennsylvanica ' Skyward'
Ilex glabra ' Shamrock'
Ilex serrata x verticillata 'Bonfire'
Ilex verticillata ' Shaver'
Itea virginica ' Henry's Garnet'
Malus ' Cranberry Lace'
Malus ' Maypole'
Malus ' Orange Crush'
Phellodendron amurense ' His Majesty'
Potentilla fruticosa ' Pink Beauty'
Pyrus ussuriensis ' Edgewood'
Robinia pseudoacacia ' Bessoniana'
Robinia pseudoacacia ' Pyramidalis'
Spiraea decumbens ' White-Lace'
Ulmus castanaefolia
Ulmus avidiana
Ulmus lamellosa
Ulmus macrocarpa
Ulmus rubra ' Lincoln'
Ulmus japonica ' Accolade'
Ulmus x 'Vanguard'
Xanthocerus sorbifolium

Effect of Landscape Exposure on *Taxus* and *Buxus* Cultivars

Alice LeDuc, John C. Pair, Jerry Longren, and Mike Daratt

Five cultivars of boxwood selections were established in 12 different landscape exposures in the spring of 1995 at both Manhattan and Wichita, zones 5 and 6, respectively (Fig. 1). Included were *Buxus microphylla* 'Winter Gem'; *B. microphylla japonica* 'Green Beauty'; and *B. sempervirens* x*koreana* 'Green Velvet', 'Green Mountain', and 'Glencoe'. *Taxus* x *media* cultivars planted were 'Hicks', 'Runyoni', 'Thayerae' and 'Wardi'. The primary objective was to determine the cold tolerance and the winter color of the boxwood cultivars as affected by exposure. Because of severe winter conditions, boxwood data are presented after one winter. Some replacements were required because of transplant loss. These replacement were made in the spring of 1996. With *Taxus*, the objective was principally to evaluate heat tolerance. Because of transplant loss and the number of replacements needed , the data on yews will be presented later.

The 1995-96 winter was one of great extremes. Midwinter low temperatures of -25˚C (-13F) for Manhattan and -23˚C (-10F) at Wichita were recorded, along with sharp 24-hour temperature drops of 31-32˚C in January and March. Extremely dry, desiccating conditions persisted throughout the winter (see weather data Figs. 1 and 2, p. 21).

Differences in cultivar performance were noted between the two sites, especially with respect to boxwood. Most noticeable differences occurred with 'Green Beauty' boxwood, which was severely damaged in Manhattan by bark splitting but survived much better in Wichita. Best winter color was exhibited by 'Green Velvet' and 'Glencoe', but 'Green Mountain' sustained considerable bronzing of foliage from winter sun.

At Manhattan, only 'Glencoe' in protected locations exhibited good winter color. Shaded locations on the north, northeast, and northwest produced the best plant quality. Poorest performance occurred on the south and southeast exposures (Table 1).

Table 1. Effect of landscape exposures on boxwood cultivars at two locations in Kansas.[1/]

Buxus Variety/ Site	N	ENE	NE	NNE	E	SSE	SE	ESE	S	WSW	SW	SSW	W	NNW	NW	WNW
Winter Gem																
Manhattan	5.7	6.0		6.7	6.0	5.7		5.7	4.0	3.3		5.7	5.7	5.7		6.3
Wichita	8.0	7.3		8.0	7.8	6.7		4.7	7.7	7.7		8.0	7.7	8.3		7.8
Green Mountain																
Manhattan	5.0	5.7		5.3	5.0	4.7		5.7	5.0	5.3		3.7	5.0	5.0		5.0
Wichita	7.3	8.3		8.0	6.7	4.3		7.0	5.7	4.0		7.8	6.0	7.2		8.7
Green Velvet																
Manhattan	5.7	5.7		5.7	5.3	5.0		5.7	5.3	5.0		5.0	5.0	5.0		5.0
Wichita	8.7	8.7		9.0	8.5	8.3		8.7	8.7	8.5		8.5	8.7	8.7		8.3
Green Beauty																
Manhattan		3.0		0.0		0.0		0.0		0.0		3.3		1.7		2.0
Wichita		6.3		5.8		5.3		5.0		3.7		3.0		6.0		7.7
Glencoe																
Manhattan			8.3				6.3				5.7				7.7	
Wichita			8.2				8.0				8.2				7.8	

[1/] Planted spring, 1995. Condition rated on a scale of 0-9 with 0=dead, 9=no appreciable injury. Symbols: N=North, ENE= East Northeast, NE=Northeast, NNE=North Notheast, E=East, SSE=South Southeast, SE=Southeast, ESE=East Southeast, S=South, WSW=West Southwest, SW=Southwest, SSW=South Southwest, W=West, NNW=North Northwest, NW=Northwest, WNW=West Northwest.

Crape Myrtle Evaluations

John C. Pair and Linda Parsons

Many new cultivars of *Lagerstroemia* have been introduced in recent years. In zone 6 (USDA), crapemyrtle can be considered a cutback shrub, because it may be only root hardy in severe winters. Nevertheless, during hot summers from early July through September, no other species of woody shrub blooms more profusely.

Numerous new introductions received from the National Arboretum in 1995 plus several commercial cultivars were planted in the spring for an evaluation of their hardiness and ornamental characteristics. Many are quite dwarf and very worthy of use in island beds and shrub borders or as large ground covers. Preliminary observations are shown in Table 1.

Table 1. Flowering of *Lagerstroemia indica* selections at Wichita, KS [1].

Lagerstroemia accession #/Name	Color	Avg. 1995 Flowering Rating	Avg. 1996 Beginning Date of Flowering
NA 54973/Wichita	Pinkish lavender	6	7/11
NA 62914	Dark pink	7	8/3
NA 62919	Pinkish lavender	6	8/5
NA 63871	Dark pink	5	7/20
NA 63872	Dark pink/lavender	6	7/22
NA 63873	Lilac/lavender	6	7/25
NA 63874	Dark lavender	5	7/29
NA 63878	Dark lavender	4	7/30
Little Chief	Red	5	7/3
Velma's Royal Delight	Purple		

[1] Flowering rated on a scale of 0-9 with 0=no blooms and 9=outstanding.

In addition to the National Arboretum introductions, several selections of local origin were included for comparison. Among them is 'Velma's Royal Delight' and a few other selections of various colors from the same source. Hardwood cuttings were taken on February 9, 1996 and rooted in perlite: peat (70:30 v/v) over bottom heat at 70˚F in a cool greenhouse and potted on May 20. Apparently, rooting success may have been related to the amount of winter injury to the wood prior to taking cuttings (Table 2). Rooted cuttings were lined out for further evaluation of hardiness, flowering, and other ornamental qualities.

Table 2. Rooting of *Lagerstroemia indica* selections by hardwood cuttings [1].

Selection	Color	Percent Rooting
Velma's Royal Delight	Purple	75
" Crimson	Crimson	63
" Coral	Coral	13
" Pink	Pink	13
" White	White	6
Byers Wonderful White	White	50
Peppermint Lace	Pink/white	56

[1]Treated with hormodin No. 2 (3,000 ppm. IBA) and stuck in perlite/peat (70:30) on Feb. 9, 1996.

Hardy Evergreen Azalea Evaluations

John C. Pair

Since 1974, numerous species and cultivars of azaleas have been screened for hardiness and adaptability to south central Kansas (zone 6). Trials have emphasized hardy introductions by notable nursery sources of the past, such as Joseph Gable, Orlando Pride, Tony Shamerello, Dr. Henry Schroeder, and more recently the Girard series. All planting beds typically are amended with sphagnum peat moss and sulfur granules at the rate of 1-2 lbs. (up to 5 lbs. if needed) per 100 sq. ft. in the fall prior to spring planting. Locations of plantings preferably have winter shade to minimize winter burn or desiccation; therefore, beds are located north of pine trees or on the north sides of buildings. Certain experimental introductions are given the added protection of partial shade year-round in a lath house.

The past winter provided a good test of flower bud hardiness, with a minimum temperature of -10˚F and very dry, desiccating conditions with little or no moisture. Nevertheless, very good flowering occurred on several cultivars such as *Rhododendron poukhanense* 'Karens'; *R. kaempferi* 'Herbert'; and a few lesser known azaleas, 'Ling', 'Linwood White', 'Pride's White', and 'Snowball'. The hardiest *Kurume* type was 'Hino Crimson' (Table 1).

In another bed, north of a row of pine trees, numerous azalea cultivars and several rhododendrons were consolidated in 1995 from previous existing trials for demonstration purposes. Out of 38 cultivars of azaleas planted, 13 produced respectable flowering in spite of very difficult winter conditions. Most noteworthy were cultivars 'Bixby', 'Boudoir', 'Balu's Pink', 'Fedora', 'Herbert', 'Polar Bear', 'Purple Splendor', and 'Viking' (Table 2).

Table 1. Flowering of evergreen azaleas in lath house location during 1995-96, Wichita, KS.

Cultivar	Color	Flowering Avg.[1] 1995	1996	Peak Bloom	Comments
Arthur's Pride	Dark pink	2.0	0.5	4-25	
Betty Pride	Dark pink	4.0	1.5	4-25 to 4-28	Double flower, fairly late.
Caroline Gable	Dark pink	2.3	0.7	4-20 to 4-25	
Dusty Rose	Pink	6.0	1.5	4-29 to 4-30	Large, single, late flowering.
Girard Fuchsia	Fuchsia	7.3	2.0	4-20 to 4-23	
Glendale Pink	Pink	7.5	1.3	4-20 to 4-25	Large, single flower.
Glendale White	White	4.5	1.5	4-25	Large, single flower.
Glory	Salmon/pink	8.2	2.0	4-28 to 4-30	Double, late.
Herbert	Lavender	7.3	3.0	4-25 to 5-1	Spreading habit, very hardy, double.
Hino Crimson	Crimson	6.0	4.0	4-23	
Karen's	Dark pinkish/lavender	7.4	3.2	4-20 to 4-23	Very hardy.
Ling	Dark pink	7.0	3.0	4-30	Late flowering.
Linwood White Imp.	White	8.7	3.0	4-28	Double flower.
Maries Choice	White/pale lavender	4.0	1.5	4-23 to 4-30	Late flowering, large flower.
Pink Vigor	Deep pink	7.0	1.0	4-23	Upright habit, double
Prides Pink	Pink	6.0	1.3	4-30	Late flowering.
Prides Pride	Dark pink	8.0	0	4-30	Late flowering.
Prides White	White	8.4	4.0	4-20 to 4-25	
Schroeders Pink Splendor	Dark pink	6.0	1.3	4-30	Late flowering, double.
Schroeders Snowflake	White	5.0	1.0	4-30	
Snowball	White	7.0	4.0	5-2	One of the hardiest white cvs.
Stewartstonian	Orange/red	6.4	0	4-25 to 4-28	

[1]Flowering rated on scale of 0-9 in 1995 and 0-5 in 1996, with 0 = none and 5 to 9 = profuse.

Table 2. 1995 flowering of azaleas planted in pine bed block, Wichita, KS [1].

Rhododendron Species/Cultivar	Avg.	Comments
Billy	0	
Bixby	4.5	Dark red, profuse.
Boudoir	5.0	Hot pink, single, early.
Blau's Pink	3.5	Hose-in-hose, shell pink.
Caroline Gable	1.5	Cherry red, hose-in-hose, upright.
Cascade	2.5	Vigorous, spreading, white.
Corsage	0	
Dorsett	0	Tall, vigorous, light green.
Dr. Henry Schroeder	0	
Elsie Lee	0.5	Lavender, double, vigorous.
Fedora	4.0	Hot pink, large, single.
Girard Fuchsia	3.0	Single, dark purple, early.
Girard Roberta	2.0	Large, salmon pink, ruffled.
Girard Rose	0	
Hardy Gardenia	2.0	Lavender, hose-in-hose, tall.
Hino Crimson	0	
Hino Red	3.0	Dark red, single, ruffled.
H-5 Pink	2.5	Salmon pink, upright.
James Gable	3.0	Red, hose-in-hose.
Joseph Hill	0	Creeping habit.
R. kaempferi 'Herbert'	4.5	Hose-in-hose, ruffled dark lavender.
Louise Gable	3.0	Salmon pink, hose-in-hose (small plant).
Marie's Choice	0	
Marilee	2.0	Large, ruffled, hose-in-hose, lavender.
Mary Schroeder	0	
R. maxwelli	0	
Maybelle (PP#3827)	3	Cherry red (dark pink) ruffled, hose-in-hose.
Mildred Mae	3	Large, single, lavender.
Nakahari	0	
Palestrina	0	Produced some seed in '95.
Polar Bear	4.0	White, late flowering.
R. poukhanense Karens	0.5	Apparently, few or no flower buds set.
R. poukhanense Kelly Marie	3.0	Large, single, dark lavender.
Pride's Pink	2.0	Hot pink, vigorous.
Purple Splendor	5.0	Purple, single, vigorous.
Red Red	1.0	Summer stress '95, shaded under dogwood.
Rosebud	3.0	Double pink (or hose-in-hose) upright.
Rose Greeley	1.0	Red, hose-in-hose.
Sandra Ann	2.0	Purple.
Snowball	3.0	White, single, late blooming, vigorous.
Viking	5.0	Cherry red, single, ruffled.
Joseph Hill	0	Did not flower, but plants alive.

[1] Rated 0-5 w/ 0 = none, 1=poor, 2=fair, 3=good, 4=excellent, 5=superior.

Fruit Thinning of Crabapple by Florel®

John C. Pair, Michael Shelton, and Linda Parsons

Flowering crabapple trees often are associated with producing messy fruits that litter the landscape in late summer. However, many new cultivars have tiny fruit that are retained in winter, thus eliminating the nuisance fruit concern. Nevertheless, for certain old cultivars that drop their fruits as soon as they are ripe, eliminating these unsightly fruits would be desirable. A product called Florel® containing ethephon [(2-chloroethyl) phosphonic acid] is registered for this purpose and was tested on a number of cultivars in 1995 and 1996.

Florel® was applied at full bloom at the rate of 1 quart per 10 gallons of water for a total of 15 gallons of solution on 20 trees at a pressure of 400 psi. [Note: the chemical is very acidic (pH of 2.4) and the spray deposit can damage acrylic plastics, certain paints, and metals such as on automobiles]. Flowering was rated before spraying, and fruit set was estimated in mid-summer.

Fruit was thinned, but not eliminated on 'Burgundy', 'Weeping Candied Apple' and 'Ruth Ann' in 1995, although the latter is not a heavy fruiting cultivar. Partial thinning occurred in 'Centurian', 'David' and 'Prairifire'. Treatment apparently had little or no effect on 'Indian Summer', 'Indian Magic', 'Mary Potter', or 'Radiant'. In 1996 Florel® appeared to have thinned fruit on 'Pink Priness' , 'Prairifire'. and Ruth Ann'. Little or no reduction of fruit set occurred on 'David', 'Mary Potter', 'Ormiston Roy', 'Indian Magic', 'Prairie Maid', 'Centurian', 'Indian Summer', or 'Radiant' (Table 1).

In spite of thorough application and timing sprays to coincide with peak bloom periods of each cultivar, the product was not effective in eliminating fruit set, although it substantially reduced the fruit on certain cultivars. Because most new crabapples do not produce unsightly fruit but have attractive fruit that is retained in winter, the need for eliminating nuisance fruit is minimized with the choices available today.

Table 1. Effect of Florel® on fruit set of crabapple cultivars, Wichita, KS [1].

		Average Flowering Rating				Average Fruit Rating			
		Florel®		Control		Florel®		Control	
Cultivar	Color	1995	1996	1995	1996	1995	1996	1995	1996
David	White	---	7.0	6.0	5.0	---	4.0	5.0	3.0
Doubloons	White	---	9.0	---	9.0	---	7.0	---	8.0
Mary Potter	White	8.0	3.0	3.0	8.0	4.0	3.0	2.0	6.0
Ormiston Roy	White	6.5	4.5	6.0	6.0	6.0	4.0	6.0	2.0
Redbird	White	---	8.0	---	7.0	---	3.0	---	7.0
Candied Apple	Pink	4.0	---	6.0	---	2.0	---	6.0	---
Candymint	Pink	---	6.0	---	4.0	---	2.0	---	0.0
Indian Magic	Pink	6.5	5.5	5.0	4.0	6.5	5.5	5.0	1.0
Pink Princess	Pink	---	6.0	---	5.0	---	1.0	---	2.0
Prairie Maid	Pink	---	6.0	---	7.0	---	4.0	---	2.0
Ruth Ann	Pink	9.0	7.0	9.0	7.0	0.0	1.0	2.0	2.0
Burgandy	Red	7.0	6.0	7.0	5.0	2.0	1.0	6.0	1.0
Centurian	Red	8.0	7.0	8.0	7.0	5.5	4.5	8.0	5.0
Indian Summer	Red	4.5	4.0	3.0	6.0	4.0	3.3	2.0	3.5
Prairifire	Red	5.5	6.5	6.0	7.0	3.0	1.0	5.0	4.0
Radiant	Red	4.5	5.5	6.0	5.0	3.0	5.0	4.0	4.0

[1] Applied at full bloom at rate of 1 quart product per 10 gallons of water.

Evaluation of Maple Species and Cultivars

John C. Pair and Steve Yuza

In 1983, 10 hard maples repesenting cultivars and ecotypes of *Acersaccharum* and *A. nigrum* were established in a randomized complete block to evaluate growth, performance, and fall color in south central Kansas. Numerous measurements of drought stress, as indicated by xylem water potential and amount of scorch and leaf tatter, have been determined (see Reports of Progress 1993 and 94). During the summer and fall of 1995, additional notes were recorded during a year of very peculiar weather conditions. A rainy season through June was followed by a drought until August when suddenly 8 inches of rain fell, only to be followed by another drought through winter.

Best performing sugar maples continued to be cultivars 'Commemoration' and 'Legacy' plus Caddo maple seedlings. The latter exhibited excellent fall color, although it typically occurred late in October and early November. Earliest to color, with also the most intense red fall color was 'Bonfire', but it exhibited considerable leaf tatter. Neither *A. nigrum* seedlings nor 'Greencolumn' performed as well as reported closer to their native range in western Iowa (Table 1).

Table 1. Foliage condition and fall color of sugar maples at Wichita, KS, 1995

Acer Species and Cultivar	Foliage Cond.[1]	Fall Color[1]	Fall Color		Miscellaneous Comments
			Begin Date	Peak Color	
A. saccharum					
Bonfire	6.0	7.8	Sept. 25-30	Oct. 13-17	Fairly large leaf, severe tatter along veins. Some anthracnose & leaf scald.
Commemoration	7.6	5.8	Oct. 5-17	Nov. 2-8	Some damage to leaves along veins. No appreciable tatter, some leaf anthracnose, severe in Rep. 5. A few tips damaged.
Legacy	7.8	6.1	Oct. 5-10	Oct. 25-30	Little or no leaf tatter, a few tips injured and sinuses torn. Dark green, a few torn leaves. Small amount of anthracnose.
Green Mountain	6.0	7.0	Oct. 1-5	Oct. 30	Severe damage to tips of lobes. Tearing along veins within sinuses. Lobe tips brown or missing, large leaf. Some ragged leaf tips, marginal scorch.
Fairview	4.6	3.8	Oct. 2-5	Oct. 30	Severe tatter, some chlorosis, considerable tearing of sinuses. Anthracnose noted in Rep. 4 & 6. Some lobes ragged with holes
Wright Brothers	5.8	6.4	Sept. 30 - Oct. 2	Oct. 25 - Nov. 5	Considerable tatter, some anthracnose. A few leaves torn along veing. Large leaf, some lobes missing. Anthracnose in Rep. 4 and leaves ragged.
Endowment	6.6	6.3	Sept. 30	Oct. 25-30	Light green color, veins torn. Some interveinal tearing, long petiole. Large leaf, a few tips scorched.
Caddo	7.0	7.2	Oct. 5-15	Nov. 1-10	Dark green, no tatter, some anthracnose in Rep. 3,4,5 & 6. Good summer appearance.Excellent dark green leaves.
A. nigrum (sdlgs.)	6.2	2.7	Sept. 25	Oct. 15-30	Spots & curling plus some leaves sunburned. Large leaf, some tatter along veins and leaf scorch on margins. Anthracnose in Rep. 6.
Greencolumn	6.9	4.7	Sept. 15-30	Sept. 25 - Oct. 15	Large, leathery leaf with some torn veins. Few lobes scorched. Light green anthracnose and curling of lobes.

[1]Foliage condition in July and fall color rated on scale of 0-9 with 0= worst and 9=best.

Shantung Maple Performance

John C. Pair, Harold Pellett, and Mark Widrlechner

Shantung maple (*Acer truncatum)*, also called Purpleblow maple, has shown considerable promise as a heat- and drought-tolerant tree since its introduction into Kansas. The first accessions were obtained through cooperation of the USDA Plant Introduction Station, Ames, IA. The three original trees obtained in 1972 have since flowered and produced seed and many other seedlings have been propagated for trial. Seed have a very short stratification period and often germinate after 32 days of chilling (see Report of Progress, 1986, p. 14). Sometimes soaking overnight and chilling for only 2 weeks can break dormancy.

Other methods of propagation include T-budding in August and softwood cuttings taken from June through August and placed under intermittent mist. The latter method, although not highly successful, is being used to propagate seedlings with superior fall color for further evaluation. T-budding has been much more successful when wood is removed from behind the bud in what is referred to as "shield" budding.

Superior selection of *Acer truncatum* and *A. mono*, a closely related species obtained from various sources, including the parent tree on the HRC grounds, were chosen for further evaluation by Harold Pellett of the University of Minnesota and propagated by Bailey Nurseries of St. Paul, MN at their Oregon site. Eight budded selections were established in the spring of 1992 to evaluate growth, stress tolerance, and fall color. Trees were of only moderate growth rate, but many are 8 to 10 feet tall and have 1 to 2 inch caliper, grown under rather neglected maintenance. However, some selections have died back for various reasons, including winter injury and borers. Fall color has ranged from poor to excellent.

The growth and foliage quality has been particularly good on the HRC parent tree, trees from Michigan State University campus, and the Morton Arboretum selection (Table 1).

Table 1. Growth, fall color, and performance of budded *Acer mono* and *truncatum* selections , 1992-95 [1].

Acer Species or Other I.D.	Origin or Source	Growth Ht.(ft.)	Growth Cal.(in.)	Leaf Emergence & Flowering Notes	Foliage Quality [2]	Fall Color Begin	Fall Color Peak	Fall Color Rating [3]
A. mono	Korea			Borer damage killed Early leaf emergence, cutleaf				4.0
Died to ground 81-607A				pubescent, moderately early.				
A. truncatum KSU-1	China via NC-7 Intro. Ames, IA	9.4	1.7	Moderately late to emerge. Leaves stay green late; excellent vigor, fall color.	8.0	10-20	11-2	5.3
A. truncatum KSU-2	Clinton, OK	8.0	2.0	Moderately late, reddish new foliage, fall color red.	7.3	10-18	11-1	6.3
A. truncatum 'Arnold'	Arnold Arboretum	5.7	0.9	Flowering begins April 1. Early leaf emergence, reddish new foliage, fall color red.	3.5	Died to ground but vigorous regrowth.		
A. truncatum NW Wells Hall	Michigan State U.	7.0	1.3	Moderately early (March 27). New foliage reddish, green late.	8.0	10-27	11-2	4.0
A. truncatum SW Wells Hall	Michigan State U.	4.4	0.8	Early, some flowering (April 1). Some leaf scorch, slow growth.	5.5	10-18	10-30	5.0
A. truncatum 64045	Minnesota Landscape Arb.	7.5	1.6	Early leaf emergence (Mar. 27). Some flowering. Slight scorch, leaves stay green late.	8.0	10-20	11-1	2.0
A. truncatum 761-50	Morton Arboretum	10.2	2.1	Vigorous, large leaf, striking appearance.	8.0	10-18	11-1	6.3

[1] Planted in spring, 1992 as budded whips.
[2] Foliage quality rated on scale of 0-9 w/0=dead and 9=least scorch, best quality.
[3] Color rated on scale of 0-9 w/0 =none and 9=deep maroon.

Hardiness of Lacebark Elm Selections

Channa Rajashekar, John Pair, and Michael Shelton

Numerous cultivars of lacebark elm (*Ulmus parvifolia*) have been introduced recently without adequate testing of their hardiness. A block of commercial cultivars plus numerous experimental numbers has been established to observe differences in growth form, ornamental characteristics, and hardiness. In addition, laboratory freezing tests are conducted on several selections monthly to determine acclimation and deacclimation to low temperatures.

Twig samples were collected and sent to the Department of Horticulture Forestry and Recreation Resources each month from November to March. Stem sections approximately 1.5 inches long were sealed in test tubes and placed in a low temperature glycol bath maintained at 32˚F. Samples were cooled by approximately 5.4˚ per hour from 32˚ to - 20˚F and held for 1 hour at each temperature. Samples then were removed and allowed to thaw at room temperature for 1 to 2 days and sectioned longitudinally to observe browning in xylem and bark tissues.

During the winter of 1995-96, no visible injury could be noted on trees in the field, in spite of very dry, desiccating weather with temperatures reaching -10˚F. Laboratory freezing tests indicated acclimation to -30˚C (-22˚F) by December 18 on selections Alleé™, A- 1, C-48, and the Garden City champion tree. During warm periods in February, deacclimation occurred on many selections to -18˚ (0˚F), but the Garden City tree maintained a killing point of -30˚C (-22˚F). Hardiest selections on March 12 were B-34 and R88-108 (Fig. 1). These tests will continue next year.

PRODUCTION AND PROPAGATION TRIALS

Selection of Improved Osage Orange Cultivars

John C. Pair

The search for thornless, male selections of Osage orange (*Maclura pomifera inermis)* continues via the propagation and evaluation of numerous clones. Superior specimens identified by various individuals over the past 20 years have been included in this trial. In addition to this propagation experiment, a replicated field plot of 10 selections will provide long-term evaluation of tree form, vigor and growth characteristics.

Osage orange seedlings, growing in quart milk cartons, were either budded in August, 1995 or bench grafted in February, 1996 to several clones having unique and desirable characteristics. Following emergence of top growth of the scions, grafts were potted in 1 gallon, square, rootmaker pots containing a medium of bark:peat:sand(3:1:1 v/v) plus Osmocote 17-6-10 plus minors at 10 pounds cubic yard plus dolomite lime at 5 pounds/cubic yard on March 20, 1996.

In addition to 11 male clones, two female selections that have deserving attributes were included: 1) Delta, a large tree with unusually large melon-size fruit from Illinois and 2) Quaker, a thornless female selection from Texas as a comparison and usable as a seed source in the future for seedling production. Several new male selections were propagated to compare with previously tested clones such as 'Wichita' and 'Whiteshield'. Several show comparable growth and thornlessness, so will be outplanted in field trials in 1997.

Table 1. Growth and thornlessness of *Maclura* selections, Wichita, KS.

Accession	Origin	Bud/Graft	Avg. # Thorns[1]	Avg. Height[2]
Beta	Petersburg, IL	G	4	28.3
Campbell	Wamego, KS	G	4	26.9
Delta	Petersburg, IL	G	0	23.0
Denmark	Denmark, IA	B	0	19.4
Dickerson	Wichita, KS	B	0	28.0
Double O	Oquawka, IL	G	14	30.5
Graham	Halstead, KS	B	0	19.3
K-2	Ames, IA	G	1	27.7
Quaker	Lubbock, TX	G	0	30.3
Smolan	Smolan, KS	B	0	15.2
Triple O	Ottawa, KS	G	0	27.1
Whiteshield	Hammond, OK	B	0	23.5
Wichita	Wichita, KS	B	1	19.1

[1] Average of 3 to 5 replications (some individual plants had no thorns).
[2] Height in inches taken on August 1, 1996.

Evaluation of Cottonwood and Hybrid Poplars

Richard Hall, Wayne Geyer, John Pair, and Mike Shelton

In 1972, a windbreak was established at the Horticulture Research Center consisting of a replicated planting of three hybrid poplars (*Populus* x *deltoides)*, 'Northeaster', NE-355, and 'Robusta', and three male cottonwoods including 'Siouxland', a Nebraska clone named 'Lydick', and a local cottonless (male) cottonwood in the trade. To date, the only survivor is the 'Lydick' cottonwood, the others having succumbed to Cytospora canker.

'Lydick' cottonwood is named after the late J.J. Lydick who resided near Tekamah, NE and obtained cuttings from a native specimen along the Missouri river northeast of Tekamah (American Nurserymen, January 15, 1948, p-8). In previous comparisons ,the Lydick cottonwood was obtained from two sources: 1) Ashland farm windbreak in Manhattan and 2) the former Kansas Landscape Nursery in Salina. Both sources survived, but only one clone was a male; the other produced cotton. This male clone has prompted the need for the present evaluation comparing all current *Populus* selections available.

Principal sources of cutting wood are the *Populus* germplasm repository in Ames, IA; the University of Nebraska Forestry Division and numerous local trees of superior growth and endurance. Initial propagation was achieved by rooting hardwood cuttings received from Ames, IA and Lincoln, NE plus other miscellaneous sources. The Morton Arboretum provided trees of *Populus tomentosa* from China, which were increased by softwood cuttings under mist in 1995. The *P. alba* cuttings from Ames were given a 24 hour soak of 150 ppm indolebutyric acid (IBA) before sticking. All other cuttings were treated with hormodin No. 2 (3,000 ppm IBA) talc formulation before sticking in perlite:peat (70/30 v/v) and placed over bottom heat at 70˚F.

Eight trees (or fewer if necessary) of each of 60 clones were planted in four replicates of two trees each spaced 12 feet apart, with 15 feet between rows. A duplicate planting was established at Manhattan. The Wichita site was equipped with a drip irrigation system supplied by Robert's Irrigation of San Marcos, CA and Agricultural Products, Inc. of Ontario, CA. Results of propagation and initial establishment data are shown in Table 1.

Table 1. Propagation and establishment of *Populus* clones at two locations in Kansas.

I.D. No. Clone	Source	% Rooted [1]	No. Planted	No. Surv
12XAA9005	Ames, IA	80	8	8
8XAA9004	Ames, IA	65	8	8
11XAAG9102	Ames, IA	69	8	8
CRANDON	Ames, IA	93	8	8
252-3	Ames, IA	38	8	8
252-4	Ames, IA	81	8	8
68J1700	Ames, IA	97	8	8
80X00603	Ames, IA	97	8	8
80X00605	Ames, IA	78	8	8
80X01112	Ames, IA	78	8	8
80X01134	Ames, IA	81	8	8
91.05-06	Ames, IA	97	8	7
91.06-13	Ames, IA	88	8	8
91.07-06	Ames, IA	97	8	7
91.08-09	Ames, IA	61	8	7
DO5	Ames, IA	100	8	8
D07	Ames, IA	90	8	8
D105	Ames, IA	97	8	6
Mighty Mo	Ames, IA	94	8	7
Ohio Red	Ames, IA	78	8	8
PLATTE	Ames, IA	94	8	8
7300501	Ames, IA	100	10	10
MWH 12	Ames, IA	100	8	8
MWH 14	Ames, IA	100	8	8
MWH 7	Ames, IA	90	8	8
107.14	Ames, IA	94	8	8
Jud's RCC	Ames, IA	70	8	8
NM 2	Ames, IA	97	8	8
NM 6	Ames, IA	94	8	8
119.16	Ames, IA	RC	7	6
7300502	Ames, IA	RC	8	8
80DD106	Ames, IA	RC	8	8
220.5	Ames, IA	RC	8	8
42.7	Ames, IA	RC	NP	--
45.6	Ames, IA	RC	NP	--
51.2	Ames, IA	RC	NP	--
80X00601	Ames, IA	RC	8	8
80X01132	Ames, IA	RC	8	7
91.05-02	Ames, IA	RC	NP	0
91.05-08	Ames, IA	RC	4	4
91.05-10	Ames, IA	RC	4	3
91.09-03	Ames, IA	RC	4	4
91.65-00	Ames, IA	RC	8	8
91.79-00	Ames, IA	RC	NP	--
D03	Ames, IA	RC	NP	--
D11	Ames, IA	RC	4	4
D114	Ames, IA	RC	4	3
412.52	Ames, IA	RC	7	5
EUGENEI	Ames, IA	RC	NP	--
Imperial	HRC	92	8	8
Noreaster	Nebraska	95	8	8
Ashford	Nebraska	95	6	

[1]RC=rooted cutting received; some not viable. Those not planted (NP) will be replaced in 1997.

Effect of SPIN OUT ™ on Container Plants

Houchang Khatamian and John C. Pair

In recent years, a number of container designs and root pruning techniques have been employed to prevent spiralling root growth. One such technique involves SPIN OUT™, a copper hydroxide latex compound that is painted on the inside of the containers. Pots are being produced that have been pretreated with SPIN OUT™.

In May 1993, several ornamental species were transplanted into 1-gallon and 3-gallon size, pretreated pots filled with a medium of bark:peat:sand(3:1:1 v/v) containing Osmocote 17-6-10 plus minors at 8 pounds/cubic yard and dolomite lime at 5 pounds/cubic yard. An equal number of plants was potted in untreated containers containing the same mix. Cultivars chosen were *Acersaccharum* ' Commemoration' and *Maclura pomifera* 'Wichita' along with seedling grown *Acer saccharum* (Caddo) and *Pistacia chinensis.*

Preliminary reports indicated significant pruning by SPIN OUT™ on Osage orange indicated by visual inspection of root tips visible on the side of the exterior of the root ball when removed from the container. SPIN OUT™ treated Caddo and 'Commemoration' maple selections also exhibited fewer visible root tips at the sides and bottoms of the root ball. Treated Chinese pistache trees had no roots showing on the sides, although the number of roots on the bottom surface of SPIN OUT™ treatments showed a nonsignificant reduction (see Progress Report, 1994).

The number of roots visible at the surface of the root ball also was determined by a grid intersect method. With this technique, a clear plastic sheet with a 1- centimeter grid is placed over the root ball the number of roots intersecting the grid is counted, and the total number for each plant (root ball) is recorded. The greater the root intersect number, the more roots are visible on the surface of a root ball. Based on the root intersect results, the control plants had a much greater number of roots visible on the root ball surface than the SPIN OUT™ treated ones (Table 1)..

Another measurement made was non-destructive volumetric determination of root volume by displacement of water. Roots were washed thoroughly to remove soil and organic matter and then submerged in water to measure displacement. The root volume of plants from SPIN OUT™ treated containers was greater, yet roots were not visible at the root ball surface. Therefore, more roots were contained within the medium and less root spiralling occurred. Greater root volume is advantageous in water and nutrient absorption and may lead to greater transplanting success.

To determine transplantability four replications of each treatment and species combination were transplanted on May 9, 1995 to a field plot to observe treatment effects on future growth and survival. Xylem water potential was determined in 1995 and 1996 under rather stressful conditions. Initial differences in transplant survival were not apparent, but later three out of four 'Commeration' maple control plants died to the ground, whereas only one SPIN OUT™ treated maple had injury to its top growth.

Table 1. The effect of SPIN OUT™ on root growth and root volume (cc) of ornamental species[1].

	Root Intersect Number	Root Volume (cc)			
Plant Species	Treatment	1 gal.[2]	3 gal.	1 gal.	3 gal.
Acer saccharum	SPIN OUT™	200	740.00	173	
Caddo	untreated	728	822.66	155	
Acer saccharum	SPIN OUT™	500.00	1025		
Commemoration	untreated	1857.6	562		
Maclura pomifera	SPIN OUT™	76.33	30.66	80	
Wichita	untreated	613.00	519.00	70	
Pistacia chinensis	SPIN OUT™	50.33	0	66.66	
	untreated	481.00	58	160.00	

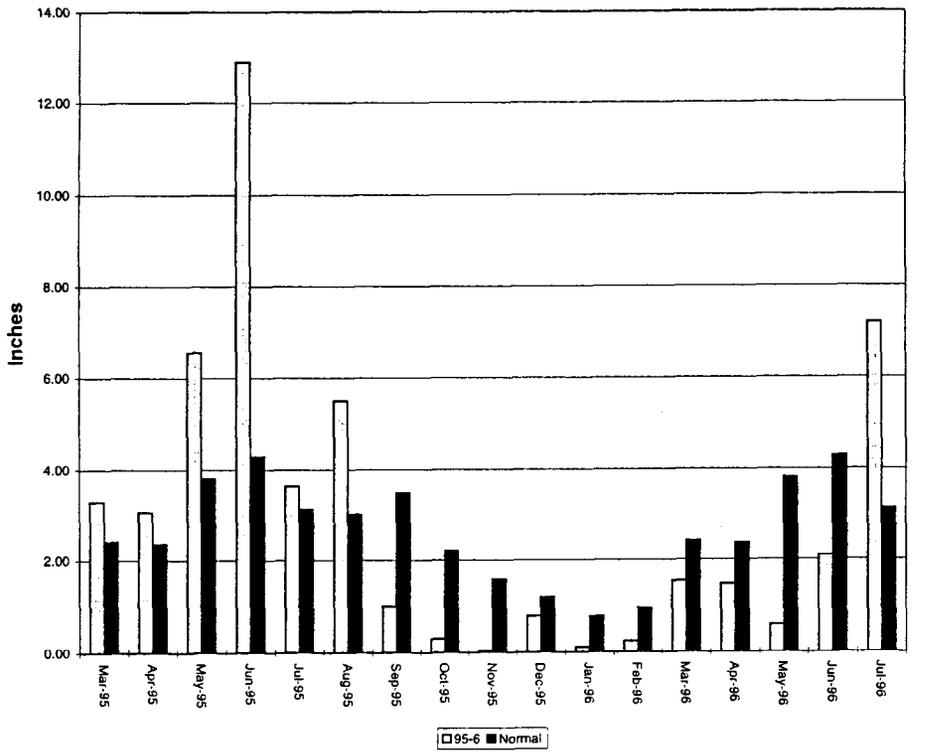
[1] The root extension on surface of root ball was measured using the grid intersect method, where the number of root intersects on a 1-cm grid was counted. The root volume was determined using the water displaced by the root system.

[2] Size of container, either 1 or 3-gallon.

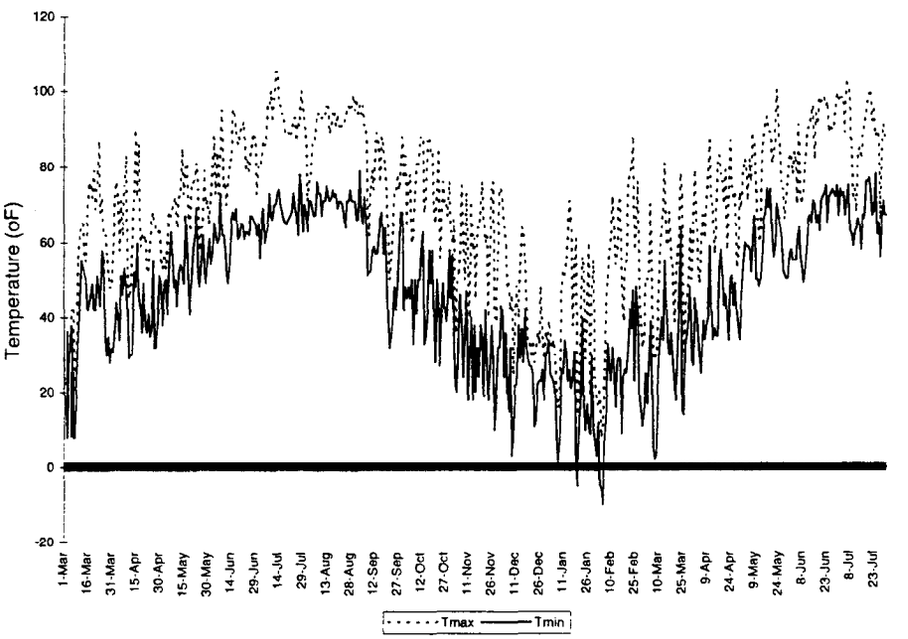
WEATHER SUMMARY

Mary C. Knapp

Wichita 1995-6 Precipitation



Wichita 1995-6 Temperatures



ACKNOWLEDGEMENTS

Appreciation is expressed to the following for their contributions to ornamental research:

Agricultural Products, Inc., Ontario, CA
Bailey Nurseries, Inc., St. Paul, MN
Borst Nursery, Wichita, KS
Brady Nursery, Wichita, KS
Carlton Plants, Dayton, OR
Carman's Nursery, Los Gatos, CA
Greenleaf Nursery, Inc., Park Hill, OK
Girard Nurseries, Geneva, OH
Heritage Seedlings, Inc., Salem, OR
Jenco Wholesale Nursery, Inc., Wichita, KS
Kansas Arborists Association, Manhattan, KS
Lett's Ornamentals, Fredonia, KS
Lite Weight Products, Kansas City, KS
Marshall Evergreens, Inc., Higginsville, MO
Midwest Groundcovers, St. Charles, IL
Morton Arboretum, Lisle, IL
Lawn and Garden Products, Inc., Fresno, CA
Rennerwood Nursery, Tennessee Colony, TX
Roberts' Irrigation, San Marcos, CA
Root Control, Inc. Oklahoma City, OK
J. Frank Schmidt & Son Nursery, Inc., Boring, OR
F.W. Schumacher Co., Sandwich, MA
Studebaker Nurseries, Inc., New Carlisle, OH
Sunshine Nursery & Arboretum, Clinton, OK
The Scotts Company, Marysville, OH
Tree Introductions, Inc., Athens, GA
Willis Nursery Co., Inc., Ottawa, KS

NOTE: Trade names are used to identify products. No endorsement is intended, nor is any criticism implied of similar products not mentioned.
Contribution No.97-53-S from the Kansas Agricultural Experiment Station.

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SRP 770 September 1996