Performance of Red Maple Selections in Southern Georgia

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SUMMARY. In 1991, a cooperative project with the U.S. National Arboretum in Washington, D.C., was initiated in Tifton, Ga. (USDA hardiness zone 8a) to evaluate red maples (*Acer rubrum* L.) potentially suitable for the coastal plain region of the southeastern U.S. Greatest annual height growth across all cultivars over 6 years was for 'Alapaha', a seedling selection from southern Georgia with annual height growth of 35 inches (88.0 cm), and several seedling selections from northern Florida with annual height increases in excess of 33 inches (86.0 cm). Selections showing the least average annual height growth were NA-56024 and NA-57772 ('Red Rocket'). For commercially available cultivars, the most dependable for fall color in Tifton was 'October Glory'®. In addition, two new selections from the National Arboretum have also shown excellent fall color—'Somerset' and 'Brandywine'.

Red maple (*Acer rubrum*) is a commonly used landscape tree throughout the eastern United States. There are many new or underused selections of red maple with landscape potential for urban and residential sites in the southeastern United States. Seedling red maples are often planted with expectations of rapid growth, attractive canopy form, and excellent red fall color. However, studies have shown great variability among seedling red maples collected across their native range, extending throughout the eastern U.S. and Canada (Townsend, 1977). Seedling variability has been the major avenue for selection of new cultivars of red maple. The popularity of red maple cultivars rests in their known uniformity with regard to a particular form, unique foliage, or fall color. Considerable variation exists among cultivars in their regional adaptability (Ruter, 1996; Williams et al., 1993; Witte et al., 1997). Of about 58 recognized red maple cultivars, few have been selected from provenances in the southern portion of the species native range. Determination of suitable red maple cultivars for the southeastern U.S. can increase the choices of reliable shade and ornamental trees for landscape use (Ruter, 1996).

Materials and methods

Cultivars in these trials represent a broad cross section of the classified red maples (Santamour and McArdle, 1982; Witte et al., 1997), including those known from previous studies to perform well in the southeastern United States (Fare et al., 1990; Sibley et al., 1995; Witte et al., 1997). New or pending releases from the U.S. National Arboretum were selected for their insect tolerance and the presence of several unique and desirable horticultural attributes (Dix, 1997). A selection from the freeman maple (*Acer* x *Freemanii* E. Murray) group ['Jeffersred' ('Autumn Blaze'®)] was also included. A clonal seedling selection ('Alapaha') from southern Georgia was included, along with individual seedling selections from southern Georgia and northern Florida.

Three trees of each selection were planted beginning in January, 1992 using container-grown trees of similar size, ranging from 4 to 5 ft (1.2 to 1.5 m) in height on their own roots supplied by the U.S. National Arboretum and several nursery sources. All trees were container-grown for a minimum of nine months under standard cultural conditions in Tifton before transplanting. Trees were field planted in full sun in Tifton loamy sand; fine-loamy, siliceous, thermic Plinthic Paleudult soil in Tifton [31°27'N × 83°31'W, elevation 357 ft (109 m)], in USDA hardiness zone 8a (USDA, 1990); plant heat zone 8 [American Horticultural Society (ASH), 1997]. Minimum and maximum daylengths in Tifton are about 10 and 14 h, respectively. Trees were planted on 10 × 12.5 ft (3.0 × 3.8 m) spacing and were fertilized with 50 lb N / acre (56 kg·ha^{-1}) of N using 16N–1.7P–6.6K plus micronutrients at planting and in subsequent years every March. A 5-ft (1.5 m) wide band of composted pecan shell mulch was applied to a depth of 2 inches (5 cm) at planting and was replenished as needed. Drip irrigation was supplied to each tree during periods of extended drought. Height (from soil line to tip of the uppermost bud) and stem diameter [at 12 inches (30 cm) above soil line] measurements were recorded at planting and annually thereafter through the 1998 growing season. Growth increase was determined by subtracting the previous season's measurement from the current season's measurement. Foliar fall color was evaluated annually from two to three times weekly September through December, as described by Sibley et al. (1995). Results from evaluations of 21 cultivars or unnamed selections are presented in this report (Tables 1–2, Figs. 1–3).

Results and discussion

'Alapaha', a seedling selection from Berrien County, Ga., produced the greatest annual height growth across all cultivars over six years with annual height growth of about 34 inches (87.2 cm) (Table 1). Three seedling selections from northern Florida (OH-2, OH-3, and OH-4) had annual height growth increases of about 34, 37, and 36 inches (86.3, 95.0, and 90.8 cm), respectively, over a 4-year period and another northern Florida selection (OH-6) had annual height increases of 36 inches (90.3 cm) over a 3-year period (Table 1). The least height growth was 14 inches (35.7 cm) and 13 inches (33.5 cm), respectively, for NA-56024 and NA-57772 ('Red Rocket') (Table 1).

The greatest stem diameter growth occurred for seedling selections OH-2, OH-3, and OH-4 from northern Florida along with 'Alapaha' averaging 1.0 to 1.1 inch / year (26.3 to 29 mm·year^{-1}). Many selections with poor height growth also had poor

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Table 1. Annual final height (inch) for red maple variety trials in Tifton, Ga., 1992–98.

Selection[z]	1992	1993	1994	1995	1996	1997	1998	Avg ht increase 1992–98
Alapaha	89 ab[y]	145 ab	204 a	213 a	255 a	281 a	295 a	35 ab
Autumn Blaze	55 cd	71 fg	122 cd	146 efg	167 def	201 cde	232 bcd	30 cde
Autumn Flame	63 cd	87 d–g	138 bcd	169 c–f	201 c	220 bc	234 bcd	29 def
Edna Davis	65 cd	91 def	134 bcd	152 d–g	173 def	197 c–f	234 bcd	28 def
NA-55410	47 de	77 efg	112 d	139 g	157 f	169 f	---	25 e–h
NA-56021 (Cumberland)	58 cd	100 cde	131 bcd	141 fg	159 f	181 ef	215 d	28 def
NA-56024	64 cd	64 g	87 e	102 h	123 g	135 g	125 e	14 i
NA-57772 (Red Rocket)	30 e	38 h	68 e	83 h	91 h	96 h	---	13 i
NA-57775	54 cd	74 fg	119 cd	139 g	161 ef	189 def	217 d	27 d–g
NA-59905 (Somerset)	67 cd	79 efg	125 cd	145 efg	166 def	190 def	203 d	23 gh
NA-59906 (Sun Valley)	69 bc	101 cde	141 bc	152 d–g	169 def	179 ef	205 d	21 h
NA-59907 (Brandywine)	75 abc	106 cd	146 bc	157 d–g	181 cde	213 cd	224 cd	25 e–h
NA-60068	66 cd	83 d–g	127 bcd	141 fg	165 def	197 c–f	208 d	24 fgh
NA-61016	62 cd	103 cde	153 b	190 abc	201 c	224 bc	252 bc	31 bcd
OH-1	87 ab	134 ab	195 a	201 ab	220 b	244 b	259 b	29 def
OH-2	89 ab	148 ab	197 a	209 a	224 b	---	---	34 abc
OH-3	75 abc	130 bc	183 a	193 abc	224 b	---	---	37 a
OH-4	93 a	154 a	193 a	207 a	236 b	---	---	36 ab
OH-6	---[x]	31 h	69 e	128 g	138 g	---	---	36 ab
October Glory	71 bc	106 cd	154 b	173 cde	181 cde	217 bcd	234 bcd	27 d–g
Red Sunset	73 bc	102 cde	137 bcd	175 bcd	182 cd	213 cd	230 bcd	25 e–h

[z]Selection accession number, followed by cultivar name if available.
[y]Mean separation by Duncans' multiple range test. Means followed by the same letter are considered not different at $P = 0.05$.
[x]Missing data due to late planting dates or attrition.

Table 2. Annual final stem diameter (inch) for red maple variety trials in Tifton, Ga., 1992–98.

Selection[z]	1992	1993	1994	1995	1996	1997	1998	Avg diam increase 1992–98
Alapaha	1.3 abc[y]	2.5 bc	4.1 ab	5.3 a	5.9 a	7.1 a	7.4 a	1.01 a
Autumn Blaze	0.5 gh	1.2 h	2.3 fgh	3.3 def	3.7 def	4.6 cde	5.4 bcd	0.81 bc
Autumn Flame	1.2 bcd	1.9 def	3.0 de	3.5 cde	3.9 cd	4.4 cde	5.1 b–e	0.65 b–f
Edna Davis	0.9 e	1.7 fg	2.8 def	3.5 cd	4.2 cd	5.0 bc	5.7 bc	0.80 bcd
NA-55410	0.7 efg	1.1 hi	1.7 hi	2.2 gh	2.4 h	2.8 fg	---	0.42 gh
NA-56021 (Cumberland)	0.8 e	1.5 gh	2.3 fgh	2.8 d–g	3.2 fg	3.7 def	4.0 def	0.54 fgh
NA-56024	0.6 fg	0.8 ij	1.4 ij	1.8 hi	2.1 h	2.5 g	2.9 f	0.37 h
NA-57772 (Red Rocket)	0.4 h	0.5 j	0.9 j	1.2 i	1.4 i	1.4 h	---	0.21 i
NA-57775	0.8 ef	1.3 gh	2.2 fgh	2.7 efg	3.1 g	3.8 def	4.1 def	0.55 fgh
NA-59905 (Somerset)	0.7 efg	1.2 h	2.3 fgh	2.8 d–g	3.4 efg	4.1 cde	4.4 cde	0.63 def
NA-59906 (Sun Valley)	1.1 cd	1.9 def	3.0 de	3.5 cde	3.7 def	4.5 cde	4.5 cde	0.57 fg
NA-59907 (Brandywine)	1.2 bcd	2.2 cd	3.3 d	3.6 cd	4.0 cd	4.2 cde	4.7 b–e	0.61 ef
NA-60068	0.7 ef	1.2 h	2.2 gh	2.7 efg	3.1 g	3.5 efg	3.9 ef	0.54 fgh
NA-61016	1.1 cd	2.2 cd	3.4 cd	4.2 bc	4.3 c	4.8 bcd	5.3 bcd	0.70 b–f
OH-1	1.3 a–d	2.4 bc	3.9 bc	4.3 b	4.8 b	5.7 b	5.9 b	0.78 b–e
OH-2	1.4 a	2.7 ab	4.1 ab	4.8 ab	5.9	---	---	1.14 a
OH-3	1.1 cd	2.3 cd	4.1 ab	4.6 ab	5.6 a	---	---	1.10 a
OH-4	1.4 a	3.0 a	4.6 a	5.2 a	5.8 a	---	---	1.09 a
OH-6	---[x]	0.5 j	1.3 ij	2.6 fg	3.0 g	---	---	0.83 b
October Glory	1.1 cd	2.1 cde	3.2 d	3.5 cde	3.8 cde	4.5 cde	5.0 b–e	0.64 c–f
Red Sunset	1.1 cd	1.7 efg	2.4 efg	3.1 def	3.2 fg	4.3 cde	4.4 cde	0.55 fgh

[z]Selection accession number, followed by cultivar name if available.
[y]Mean separation by Duncans' multiple range test. Means followed by the same letter are considered not different at $P = 0.05$.
[x]Missing data due to late planting dates or attrition.

stem diameter increase. The least stem diameter growth occurred for NA-57772 ('Red Rocket') with just over 0.2 inches (5.3 mm) per year diameter increase.

This evaluation demonstrates the importance of using germplasm from a provenance appropriate for a given geographical area and the need to select red maple cultivars specifically adapted for use in USDA zone 8 of the southeastern U.S. With the exception of NA-56021 ('Cumberland'), the National Arboretum selections in this study were from northern Minnesota in USDA hardiness zone 3a or 3b (Townsend and Douglass, 1998), Rhinelander, WI (NA-55410) or are crosses between 'Franksred' ('Red Sunset'™), 'October Glory'® and 'Autumn Flame'.

Studies in Alabama and Tennessee found freeman maple selections 'Autumn Blaze'®, 'Scarsen', and 'Morgan' ('Indian Summer', 'Embers') generally increased the most in height in trials. This precocity for height growth is typical of the silver maple parent (Bachtel, 1989; Santamour, 1993). 'Autumn Blaze'® in our trial evaluation, while not showing the same growth rates as reported in Alabama (Sibley et al., 1995) and Tennessee (Witte et al., 1997), appears to be well adapted to growing conditions in the coastal plain of Georgia. Growth differences for this evaluation compared to other studies may be attributed to environmental conditions such as photoperiod (Downs and Borthwick, 1956), chilling (Perry and Wang, 1960), rainfall, variable temperatures, or cultural practices (Perry, 1971). Furthermore, some caution must be used in comparing our own-root trees versus budded trees from other stud-

Fig. 1. Hue and duration of foliar fall color for red maple selections in 1995.

Selection[z]	Typical color[y]	Color present	Peak color
NA-55410	OR	23 Oct. to 4 Nov. 13 to 21 Nov.	5 to 13 Nov.
NA-56021	RP	23 Oct. to 13 Nov.	14 to 20 Nov.
NA-56024	RO	27 Oct. to 13 Nov. 16 to 20 Nov.	14 to 16 Nov.
NA-57772	OY	23 Oct. to 6 Nov. 12 to 16 Nov.	6 to 12 Nov.
NA-57775	OB	23 to 27 Oct.	27 Oct. to 9 Nov.
NA-59905	PR	27 Oct. to 10 Nov. 25 to 30 Nov.	11 to 24 Nov.
NA-59906	R	23 Oct. to 6 Nov. 13 to 20 Nov.	6 to 13 Nov.
NA-59907	RP	23 to 29 Oct. 13 to 30 Nov.	29 Oct. to 12 Nov.
NA-60068	PR	27 Oct. to 17 Nov. 26 to 30 Nov.	17 to 25 Nov.
NA-61016	PR	27 Oct. to 11 Nov. 25 to 30 Nov.	11 to 25 Nov.
Alapaha	YB	17 Nov. to 3 Dec. 7 to 16 Dec.	3 to 6 Dec.
Autumn Blaze	RO	27 Oct. to 15 Nov. 24 to 30 Nov.	16 to 24 Nov.
Autumn Flame	ORY	27 Oct. to 20 Nov. 26 to 30 Nov.	20 to 26 Nov.
Edna Davis	RO	23 Oct. to 3 Nov. 17 to 24 Nov.	3 to 16 Nov.
October Glory	PR	27 Oct. to 17 Nov. 1 to 2 Dec.	17 to 30 Nov.
Red Sunset	PRO	27 Oct. to 20 Nov. 22 to 30 Nov.	20 to 22 Nov.
OH-1	RP	27 Oct. to 24 Nov. 1 to 7 Dec.	24 to 30 Nov.
OH-2	YO	27 Oct. to 7 Dec. 11 to 18 Dec.	7 to 10 Dec.
OH-3	PR	6 to 18 Nov. 26 Nov. to 7 Dec.	17 to 25 Nov.
OH-4	R	6 Nov. to 8 Dec. 10 to 18 Dec.	7 to 10 Dec.
OH-6	ORB	11 to 20 Nov. 1 to 7 Dec.	20 to 30 Nov.

[z]Cultivar names corresponding to NA accession numbers if available are NA-56021 ('Cumberland'); NA-59905 ('Somerset'); NA-59906 ('Sun Valley'); NA-59907 ('Brandywine'); and NA-57772 ('Red Rocket').
[y]Color notation as follows: B = brown, O = orange, P = purple, R = red, Y = yellow (primary color listed first).

Fig. 2. Hue and duration of foliar fall color for red maple selections in 1996.

Selection[z]	Typical color[y]	Color present	Peak color
NA-55410	RPO	4 Oct. to 12 Nov.	12 to 23 Nov.
NA-56021	RPO	9 Oct. to 17 Nov.	17 to 23 Nov.
NA-56024	RO	4 Oct. to 12 Nov.	12 to 23 Nov.
NA-57772	ROY	4 to 30 Oct.	30 Oct. to 18 Nov.
NA-57775	RPO	9 Oct. to 16 Nov.	16 to 23 Nov.
NA-59905	RPO	4 Oct. to 16 Nov.	16 to 23 Nov.
NA-59906	RPO	9 Oct. to 12 Nov.	12 to 23 Nov.
NA-59907	RP	17 Oct. to 24 Nov.	24 Nov. to 2 Dec.
NA-60068	RPOY	4 Oct. to 19 Nov. 25 Nov. to 6 Dec.	19 to 25 Nov.
NA-61016	RPO	9 Oct. to 19 Nov.	19 to 25 Nov.
Alapaha	YB	12 Nov. to 7 Dec.	7 to 13 Dec.
Autumn Blaze	RPO	15 Oct. to 16 Nov.	16 to 23 Nov.
Autumn Flame	ORY	9 Oct. to 20 Nov.	20 to 23 Nov.
Edna Davis	RPO	4 Oct. to 16 Nov.	16 to 23 Nov.
October Glory	RP	12 Oct. to 20 Nov.	20 Nov. to 2 Dec.
Red Sunset	OYR	9 Oct. to 20 Nov.	20 to 23 Nov.
OH-1	RP	12 Oct. to 18 Nov. 25 Nov. to 4 Dec.	18 to 25 Nov.
OH-2	ORY	18 oct. to 9 Dec.	9 to 16 Dec.
OH-3	ROY	4 Oct. to 2 Dec.	2 to 6 Dec.
OH-4	RP	18 Oct. to 2 Dec.	2 to 16 Dec.
OH-6	RPYO	12 Oct. to 21 Nov. 28 Nov. to 3 Dec.	21 to 28 Nov.

[z]Cultivar names corresponding to NA accession numbers if available are NA-56021 ('Cumberland'); NA-59905 ('Somerset'); NA-59906 ('Sun Valley'); NA-59907 ('Brandywine'); and NA-57772 ('Red Rocket').
[y]Color notation as follows: B = brown, O = orange, P = purple, R = red, Y = yellow (primary color listed first).

Fig. 3. Hue and duration of foliar fall color for red maple selections in 1997.

Selection[z]	Typical color[y]	Color present	Peak color
NA-55410	ROP	27 Oct. to 11 Nov.	11 to 17 Nov.
NA-56021	RP	30 Oct. to 11 Nov.	11 to 20 Nov.
NA-56024	ROY	27 Oct. to 6 Nov.	6 to 12 Nov.
NA-57772	ROY	27 Oct. to 6 Nov.	6 to 9 Nov.
NA-57775	RPOY	27 Oct. to 11 Nov.	11 to 13 Nov.
NA-59905	PR	27 Oct. to 13 Nov.	13 to 26 Nov.
NA-59906	RPO	27 Oct. to 5 Nov.	5 to 12 Nov.
NA-59907	PRO	30 Oct. to 20 Nov.	20 Nov. to 3 Dec.
NA-60068	PRO	27 Oct. to 13 Nov.	13 to 26 Nov.
NA-61016	RP	30 Oct. to 13 Nov.	13 to 23 Nov.
Alapaha	YO	9 Nov. to 6 Dec.	6 to 20 Dec.
Autumn Blaze	RPO	27 Oct. to 9 Nov.	9 to 18 Nov.
Autumn Flame	OYR	30 Oct. to 17 Nov.	17 to 26 Nov.
Edna Davis	RPO	20 Oct. to 11 Nov.	11 to 22 Nov.
October Glory	RPO	27 Oct. to 23 Nov.	23 Nov. to 3 Dec.
Red Sunset	RPO	27 Oct. to 19 Nov.	19 to 25 Nov.
OH-1	RO	9 Nov. to 5 Dec.	5 to 7 Dec.

[z]Cultivar names corresponding to NA accession numbers if available are NA-56021 ('Cumberland'); NA-59905 ('Somerset'); NA-59906 ('Sun Valley'); NA-59907 ('Brandywine'); and NA-57772 ('Red Rocket').
[y]Color notation as follows: B = brown, O = orange, P = purple, R = red, Y = yellow (primary color listed first).

ies. Different data collection procedures in different studies occasionally create difficulty in making direct cross-study comparisons. In addition to recent reports from the U.S. National Arboretum (Dix, 1997; Townsend and Douglass, 1998), results of these evaluations indicate that several of the National Arboretum selections demonstrate suitable growth and autumn color performance in the coastal plain of Georgia. Noteworthy exceptions would be the poor performance of NA-57772 ('Red Rocket') and NA-56024 (Tables 1–2).

Fall color patterns were evaluated annually, however, only 1995, 1996, and 1997 results are presented in this report (Figs. 1-3). The data collected during these years was on well established trees and offers a true picture of the fall color performance that might be expected for those cultivars in southern Georgia. For commercially available cultivars, the most dependable fall color (Figs. 1–3) has been evident in 'October Glory'®, although the development of color is not nearly as good as it is in the Atlanta, Georgia area (J.M. Ruter, personal observation). Two new selections from the National Arboretum, 'Somerset' and 'Brandywine', showed excellent purple/red fall color in Tifton. Fall color was generally poor for 'Autumn Flame' and 'Red Sunset'™ in Tifton.

Leaf hoppers (*Empoasca fabae* Harris) and the maple tip borer (*Episimus tyrius* Heinrich) (Solomon, 1995) are maple insect pests statewide. Damage from the maple tip borer is usually evident by the second week of May in Tifton with the second generation of adults causing the most damage in June. All trees in the Tifton trial are attacked annually by the maple tip borer (J.M. Ruter, unpublished data).

Tar spot [*Rhytisma acerinum* (Pers.:Fr.)Fr.] seemed to infect seedling selections from Florida and Georgia, but was not a problem on any of the National Arboretum or commercially available cultivars at Tifton. Bot canker (*Botryosphaeria* Ces. & De Not.) was isolated from NA-61016 and several seedlings at Tifton after very dry summers.

Evaluation trials of this type will prove horticulturally valuable as new introductions of selected seedlings from nurseries and the National Arboretum are released to industry. Our trial results gave an indication of expectations of growth and performance following establishment under field or landscape conditions throughout southern Georgia and similar regions of the southeast. As our trees mature, future reports on fall color, branching habits, and scaffold strength will continue to give growers valuable information. The data presented from trials such as these could help growers select faster growing cultivars for production. While faster growing trees can be an important consideration for nursery growers, not all fast growing trees are adapted throughout the southeastern U.S. Furthermore, while selections such as 'Alapaha' demonstrate excellent growth at Tifton (normally defoliating around the first of December and often flowering by the first week of February), selections with consistent red fall color are still needed in USDA zone 8 since the predominate fall color of 'Alapaha' is yellow (Figs. 1–3). The release of 'Brandywine' and 'Somerset' from the National Arboretum give producers and consumers the possibility of a reliable red-orange-purple fall color palette in USDA zone 8. Please use sound horticultural judgement when interpreting the data presented in this and other related studies.

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