Growth and Fall Color of Red Maple Selections in the Southeastern United States[1]

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Abstract

Nine red maple (*Acer rubrum* L.) cultivars ('Autumn Flame', 'Fairview Flame', 'Franksred', 'Karpick', Northwood', 'October Glory', 'Redskin', 'Schlesingeri', and 'Tilford'), three Freeman maple (*Acer* x *freemanii*, interspecific cross between red maple and silver maple) cultivars ('Autumn Blaze', 'Morgan', and 'Scarsen'), and a group of *A. rubrum* seedlings were evaluated in a field study with trickle irrigation for growth rates and fall color. 'Autumn Blaze', 'Morgan', 'Scarsen', and 'Autumn Flame' increased the most in height and diameter annually. Height increase was least for 'Northwood'. 'Northwood' and 'Karpick' increased least in diameter annually. Considerable variation in initiation, peak, and duration of fall color, and time of defoliation were evident among cultivars. 'Fairview Flame' and 'October Glory' exhibited superior fall color while 'Northwood', 'Morgan', and 'Redskin' had poor fall color.

Index words: *Acer rubrum*, *Acer* x *freemanii*, height, caliper, diameter, defoliation.

Species used in this study: Red maple (*Acer rubrum* L.) and Freeman maple (*Acer* x *freemanii* E. Murray).

Significance to the Nursery Industry

Superior red maple cultivars for the Southeastern United States, based on height and diameter growth, and fall color display were 'Autumn Flame', 'Autumn Blaze', 'Fairview Flame' and 'October Glory'. By this same criteria 'Karpick' and 'Northwood' were poor selections for this region. A unique feature of this study was a comparison of red maple cultivars known to perform well in the Southeastern United States based on previous studies (3, 9) with selections from the Freeman maple group generally considered as red maple cultivars (6), but recognized botanically as *Acer* x *freemanii*. The Freeman red maple selections, along with *A. rubrum* 'Autumn Flame', had the best growth performance in this study with no apparent adaptability limitations to the climate of the Southeast.

Introduction

Red maple (*Acer rubrum* L.) is a commonly used landscape tree throughout the Eastern United States. Seedling red maples have been planted with expectations of rapid growth, attractive canopy form, and excellent red fall color. Studies have shown great variability among seedling red maples collected from 49 locations across their native range, extending throughout the Eastern United States and Canada (8). Seedling variability has been the major source of selection among the 48 named cultivars of red maple (7). The popularity of red maple cultivars rests in their uniformity with regard to a particular form, unique foliage, or fall color selected from seedling variants. However, considerable variation remains among cultivars in their regional adaptability. Of the 48 named red maple cultivars, none have been released from selections originating in the southern portion of their native range. As a result, study objectives were to evaluate the growth and characterize the fall color patterns of select red maple cultivars in the Southeastern United States.

Cultivars included in these trials represent a broad cross section of the classified red maples. This study included a comparison of red maple cultivars known from previous studies (3, 9) to perform well in the Southeastern United States, with selections from the Freeman maple group. Maples in this category are generally grouped with red maple cultivars (6), but are recognized botanically as *Acer* x *freemanii* indicating their hybrid origin from interspecific crosses and backcrosses between *Acer rubrum* and *Acer saccharinum* L. (1).

Materials and Methods

Cultivars were obtained in March 1988, as microplantlets from a single nursery source (Microplant Inc., Fairview, OR). Selections evaluated (followed by site and date of introduction) were: *Acer* x *freemanii* 'Autumn Blaze' (Fostoria, OH, 1980); *A. rubrum* 'Autumn Flame' (Fairview, OR, 1964); *A. rubrum* 'Fairview Flame' (Fairview, OR, 1992); *A. rubrum* 'Franksred' (Red Sunset™, Troutdale, OR, 1966); *A. rubrum* 'Karpick' (Buffalo, NY, 1985); *A.* x *freemanii* 'Morgan' (also known as 'Indian Summer' or 'Embers', Morgan Arboretum, Macdonald College, Quebec, Canada, 1971); *A. rubrum* 'Northwood' (Minn. Agr. Expt. Sta., 1980); *A. rubrum* 'October Glory' (Princeton, NJ, 1961); *A. rubrum* 'Redskin' (Orchard Park, NY, 1982); *A.* x *freemanii*, 'Scarsen' (Scarlet Sentinel™, Ashtabula, OH, 1972); *A. rubrum* 'Schlesingeri' (NY, 1888); *A. rubrum* 'Tilford' (Wooster, OH, 1951); and a group of seedlings from seed collected at the Oregon nursery in 1987.

Trees were containerized to 2.8 liter (#1) pots in an amended 6:1 (by vol) pinebark:sand medium and grown in a double layer polyhouse for three months, then outdoors under overhead irrigation for the remainder of the growing season. In 1989, trees were transplanted to 9.5 liter (#3) containers for another 12 months. Trees ranged from 1.2 to 1.5 m (4 to 5 ft) in height when transplanted in March 1990, into a Cecil gravelly sandy loam soil at the Piedmont Substation, Camp Hill, AL (lat. 32° 83'N, long. 85° 65'W). Trees were planted in a randomized complete block design with 5 blocks of 2 plants each. Trees were planted on a 9.1 x 10.7 m (30 x 35 ft) spacing and were fertilized with 59 g (1 lb) of nitrogen (N), 25 g (0.4 lb) of phosphorus (P), and 49 g (0.83 lb) of potassium (K) as 13N-5.6P-10.8K (13-13-13) per 2.54

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cm (1 in) of diameter (caliper) at planting and in subsequent years in March prior to bud break. Drip irrigation was supplied to each tree based on 100% replacement of net evaporation from a class A pan. Height and diameter measurements were made at planting and annually following the 1990 through 1993 growing seasons. Initial size differences among cultivars were not significant. Growth increases were determined by the difference in current and the previous season's measurements.

Foliar fall color patterns were evaluated two to three times weekly from September through December of 1992 and 1993 using a modified Munsell Color System (2). Color initiation was considered to have begun when all trees of a selection had at least 1% color or when the average color for a cultivar was greater than 5%. Color cessation was determined as the point when color was 0% in over 50% of the trees or when the average defoliation of the cultivar exceeded 85%. Color peak was the maximum ranking the cultivar attained for that season. Peak color periods were determined to be one observation prior to the peak date and one observation after the established peak. Defoliation was considered to have begun when 30% of cultivar/selection samples exhibited any percent defoliation, and was considered complete when the average defoliation for the cultivar exceeded 95% or when 70% of the trees were completely defoliated.

All data, with the exception of fall color, were subjected to analysis of variance. Mean separations were determined by Duncan's Multiple Range Test, $P = 0.05$.

Results and Discussion

The three Freeman maple selections 'Autumn Blaze', 'Scarsen', and 'Morgan', generally increased the most in height over the four years (Table 1). This precocity for height growth is typical of silver maple (1, 6). 'Northwood' increased the least in height, about one-half that of most other cultivars. Average annual height increases through the end of the 1993 growing season ranged from a low of 37.6 cm (14.8 in) for 'Northwood' to a high of 99.3 cm (39.1 in) per year for 'Autumn Blaze'. Average annual height increases for 'Autumn Flame', 89 cm (35.0 in); 'Franksred', 74 cm (29.1 in); 'Scarsen', 94 cm (37.0 in); 'Schlesingeri', 77 cm (30.3 in); seedlings, 85 cm (33.5 in); and 'Tilford' 84 cm (33.1 in); were 118%, 50%, 55%, 34%, 66% and 48% greater, respectively, than had been reported previously (3). Growth differences for the current study compared to the previous study (3) may be attributed to irrigation versus the lack of irrigation, or own-root trees versus budded trees.

Diameter increases did not follow height increase trends (Table 2) from 1991 through 1993, but diameter increases were more consistent from year to year. Similar findings have been reported by others (4, 5). While the Freeman group selections had a precocity for height growth typical of silver maple, the diameter growth on an annual basis was different for each. Among the thirteen selections of red maple evaluated, 'Autumn Blaze', an *A.* x *freemanii*, had the greatest annual increase in diameter with 25.3 mm (1.0 in) per year. Annual diameter increase of 'Morgan', another *A.* x *freemanii*, was 19.7 mm (0.8 in) about in the middle of the selections. 'Scarsen', also an *A.* x *freemanii*, was among the lowest ranked selections with an average annual diameter increase of 17.5 mm (0.68 in). 'Northwood' and 'Karpick' had the least annual increase in diameter with 11.8 and 11.5 mm (0.46 and 0.45 in), respectively (Table 2). All selections developed greater increases in diameter each successive year following establishment with the exceptions of 'Tilford' in 1992, and 'Karpick' in 1993, which had slight declines.

Fall color duration varied yearly. The longest duration of fall color in 1992 occurred with 'October Glory' and 'Fairview Flame' (33 days) (Figure 1), while in 1993 'Fairview Flame' (37 days), 'Schlesingeri' (37 days), 'Franksred' (35 days) and 'October Glory' (30 days) had the longest duration of fall color (Figure 2). Cultivars showed greater variability in the timing of peak fall color in 1992 than in 1993. In both years 'Northwood' and 'Morgan' were the first cultivars to exhibit fall color and to have fall color peaks. However, in 1992, 'Northwood' had completely defoliated by October 24, a time when 'Autumn Blaze' was at its peak and 'October Glory' had not yet begun to display notable fall color. Peak fall color was displayed 7–10 days later in 1993 for most cultivars. For the two seasons that fall color evaluations were made, the cultivars 'Fairview Flame' and 'October Glory' had the best display of red coloration,

Table 1. Height of red maple selections.[z]

Cultivar/seedling	Height increase (cm) 1991	1992	1993	Annual average	Final height 1993 (cm)
Autumn Blaze	94ab[y]	106abc	98a	99a	478a
Autumn Flame	71abc	105abcd	92ab	89abcd	482a
Fairview Flame	66bc	77ef	73cde	72gh	394c
Franksred	80abc	73f	70de	74fgh	404c
Karpick	62c	65fg	85abcd	71gh	361d
Morgan	85abc	116ab	84abcd	95ab	450b
Northwood	24d	49g	40f	38i	340d
October Glory	65bc	88cdef	87abc	80defg	436b
Redskin	63c	82ef	58e	68h	361d
Scarsen	88abc	122a	72cde	94abc	437b
Schlesingeri	76abc	84def	71cde	77efgh	366d
Seedling	79abc	98bcde	79bcd	85bcde	447b
Tilford	98a	70f	82abcd	84cdef	404c

[z]Growth increases were determined by the difference in current and the previous season's measurements.

[y]Mean separation within columns by Duncan's Multiple Range Test, $P = 0.05$.

Table 2. Trunk diameter of red maple selections.[z]

Cultivar/seedling	Diameter increase (mm) 1991	1992	1993	Annual average	Final diameter 1993 (mm)
Autumn Blaze	18a[y]	27a	31a	25a	104a
Autumn Flame	15abc	25ab	29a	23b	104a
Fairview Flame	14abc	23abc	28a	22bc	95b
Franksred	13abc	17de	23b	18de	78cd
Karpick	5e	16ef	15d	12g	58f
Morgan	13abc	22abc	24b	20cd	81cd
Northwood	8de	12f	15d	12g	58f
October Glory	14abc	20bcde	29a	21bc	95b
Redskin	13abc	22abcd	21bc	19de	84c
Scarsen	11cd	19cde	22b	18e	76d
Schlesingeri	13bc	19cde	24b	19de	78cd
Seedling	17ab	25ab	28a	23b	96b
Tilford	14abc	13f	19c	15f	65e

[z]Growth increases were determined by the difference in current and the previous season's measurements.

[y]Mean separation within columns by Duncan's Multiple Range Test, $P = 0.05$.

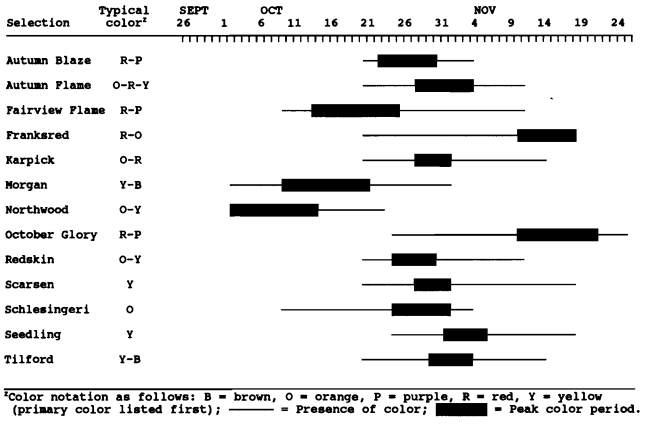

Fig. 1. Hue and duration of fall color for red maple selections in 1992.

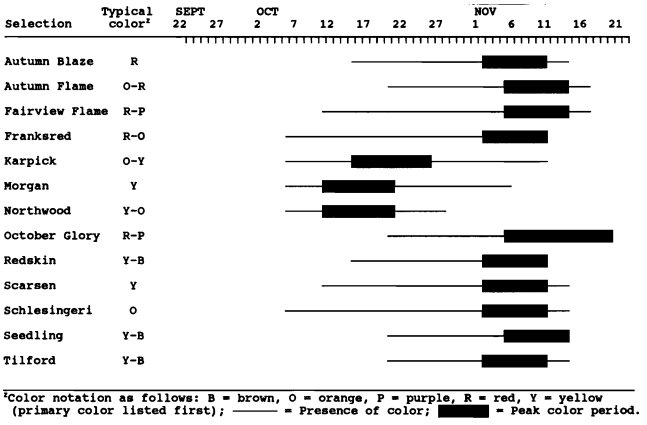

Fig. 2. Hue and duration of fall color for red maple selections in 1993.

based on typical color hue and duration while 'Northwood', 'Morgan', and 'Redskin' had poor fall color. Defoliation coincided with the end of fall color for most cultivars each year.

In a study by Townsend (8), red maple seedlings were found to be highly variable in fall color characteristics. He reported seedlings from four northern locations exhibited the most consistently red fall color, with progenies from 45 other locations showing less consistent red and more yellow fall color. In our evaluations only 20% of the seedlings exhibited any markings of red in their fall foliage. The other seedlings had yellow to brown fall color.

In a previous evaluation (3), six of the same cultivars used in the current study were evaluated for bud union incompatibility. Mortality rates for cultivars in this study from tissue culture were not as prevalent. Previous (3) versus current study mortalities were: 'Autumn Flame', 11% versus 0%; 'Franksred', 0% versus 0%; 'Scarsen', 55% versus 0%; 'Schlesingeri', 78% versus 40%; and 'Tilford', 22% versus 50%. Of the remaining cultivars in the current study one tree each of 'Northwood' and 'Karpick' died.

Superior red maple cultivars for the Southeastern United States, based on height and diameter growth rates, and fall color display were 'Autumn Flame', 'Autumn Blaze' and 'October Glory'. By this same criteria 'Karpick' and 'Northwood' were poor cultivars for this region. Selections with superior fall color and adequate growth rates during this study were 'Fairview Flame', 'October Glory', 'Autumn Flame', and 'Autumn Blaze'.

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