Bigtooth Maple

A. grandidentatum (Nutt.) is a woody deciduous tree that is indigenous only to North America (St. Hilaire, 2002). The plant has a contiguous geographic range that covers 18° of latitude and includes regions in Utah, Idaho, Wyoming, Arizona, New Mexico, and Texas (Bsoul et al., 2006). This extensive range gives the bigtooth maple taxa one of the largest ecological ranges among the North American Acer genus. The plant’s small stature (Morgan, 2002), adaptability to a variety of edaphic conditions (Barker, 1974), tolerance to drought (Bsoul et al., 2007), salinity (Bsoul, 2005), and radiation (Bowen-O’Connor et al., 2013) and autumn foliage colors that range from yellow to crimson (Morgan, 2002) make it well suited for urban and managed urban landscapes, New Mexico and includes regions in Utah, Idaho, Wyoming, and Texas (Bsoul, 2005).

Bigtooth Maple, ‘JFS-NuMex 3’: Mesa Glow®

Rolston St. Hilaire*

Department of Plant and Environmental Sciences, New Mexico State University, P.O. Box 30003, Las Cruces, NM 88003

Received for publication 16 Jan. 2018. Accepted for publication 26 Feb. 2018.

I thank Emad Bsoul and Clare Bowen-O’Connor for determining the tolerance of plants to environmental stresses. I also thank Tim Buchanan, Sheri Chavez, Gil Eckrich, Lee Hughes, Roger Kjelgren, Grant Madden, and David Riskin who collected seeds that helped establish the bigtooth maple germplasm at New Mexico State University. I acknowledge the technical and field testing assistance of Guy Meacham and Keith Warren at J. Frank Schmidt & Son Wholesale Nursery. I thank Terry Lombard of the Arrowhead Center at New Mexico State University for assistance with intellectual property protection for the cultivar.

**Corresponding author. E-mail: rsthilai@nmsu.edu.

Bigtooth Maple, ‘JFS-NuMex 3’: Mesa Glow®

Between 18 Aug. and 3 Nov. 2001, mature samaras (seeds) of bigtooth maples were collected from trees occurring in natural stands and used to establish the germplasm of bigtooth maples at NMSU (St. Hilaire, 2002). Samaras originated from the following locations: Chiricahua Mountains, Douglas, AZ (elev. 1633 m, lat. 31°35.517’ N, long. 109°21.367’ W), Logan Canyon, Cache County, UT (elev. 2500 m, lat. 41°46.000’ N; long. 111°49.000’ W), Dripping Springs State Park, Las Cruces, NM (elev. 1280 m, lat. 32°23.333’ N; long. 106°48.783’ W), Guadalupe Mountains, Salt Flat, TX (elev. 1680 m, lat. 31°54.000’ N; long. 104°52.017’ W), and the Lost Maples State Natural Area, Vanderpool, TX (elev. 580 m, lat. 29°40.000’ N; long. 99°21.000’ W). Where required, permits were secured before samara collection. An alphanumeric code was assigned to identify provenance (letter) and single-tree origin (number) of the samaras.

From 24 May to 14 Sept. 2002, half siblings from all provenances within the collection were screened initially for tolerance to episodic drought (Bsoul et al., 2006). Drought tolerance screening involved assessment of the efficiency of photosystem II, plant water relations, leaf relative water content (RWC), specific leaf weight, total leaf area, specific stem length, leaf thickness, plant height, xylem diameter, leaf, stem, and root dry weight (DW), relative growth rate (RGR), and net assimilation rate (NAR) in plants exposed to multiple cycles of drought compared with well-irrigated controls (Bsoul et al., 2006). A cycle of drought consisted of irrigating plants only after pot gravimetric moisture loss because of evapotranspiration reached 56% to 57%.

Initial screening results revealed that selected provenances in Texas, New Mexico, and Utah might contain drought-tolerant ecotypes (Bsoul et al., 2006). This prompted a second round of drought tolerance testing of plants from those selected provenances in Texas, New Mexico, and Utah in an outdoor field setting from 23 Aug. to 11 Nov. 2003 (Bsoul et al., 2007). On 30 Mar. 2003, plants were potted into 30-L pots using the same 1 peat : 1 Perlite (v/v) growing substrate and placed in an in-ground nursery production system (pot-in-pot) to facilitate drought testing and emulate a nursery production environment. For drought testing of plants from selected provenances in Texas, New Mexico, and Utah, five plants each were assigned to episodic drought treatment and well-watered controls (Bsoul et al., 2007). In this second experiment, a drought episode consisted of irrigating plants only after pot gravimetric moisture loss due to evapotranspiration reached 35% (Bsoul et al., 2007). All plants not selected for drought testing were maintained in the field in-ground nursery production system, drip irrigated, and fertilized with 150 mg L⁻¹ N every 7 d with the same fertilizer solution used in the first experiment. During drought testing, plant water relations; leaf RWC; specific leaf weight; foliar stable carbon isotope composition and carbon and nitrogen content; plant height; xylem diameter; total leaf surface area; RGR; NAR; and leaf, stem, and root DW were assessed. The second drought experiment revealed that plants from the Lost Maples State Natural Area, designated as LMP1 (single tree) and LMP5 (single tree), and the Guadalupe Mountains, designated as GM2 (single tree), effectively endured drought (Bsoul et al., 2007).

From 12 Nov. 2003 and while still in the in-ground nursery production system, all remaining half-sibling plants of LMP1, LMP5, and GM2 were evaluated for aesthetic qualities such as leaf morphology, leaf color, fall foliage color development, absence of foliar tip burn, and resistance to leaf tatter. In addition, pest and disease occurrence, branching habits, and plant height were assessed. Based on the abiotic and biotic stress data, aesthetic quality assessment, and plant growth and morphological traits, three half-sibling plants—two from LMP1 and one from LMP5—were deemed worthy of further evaluation. On 28 July 2004, three tip cuttings (≈3–5 mm diameter) containing two to three nodes were selected from each of those plants, designated as NMSU 1 (LMP1,
half-sibling no. 1), NMSU 2 (LMP2, half-sibling no. 2), and NMSU 3 (LMP5, half-sibling no. 1), respectively. Leaves (lamina and petiole) were excised, and cuttings were placed between moist paper towels and shipped overnight to J. Frank Schmidt & Son Co., in the j. frank schmidt & son. J. Frank Schmidt is a landscape tree wholesale nursery and has introduced several ornamental maples to the U.S. landscape and nursery industry (J. Frank Schmidt & Son Co., 2013).

Subsequent testing for resilience to radiation stress revealed for the first time that bigtooth maples, especially those from the lost maples state natural area (the source of the LMP plants), have the ability to acclimate to contrasting light environments via the violaxanthin and lutein photoprotective mechanisms (Bowen-O’Connor et al., 2013).

Clonal Propagation and Evaluation

Cuttings were veneer-grafted onto sugar maple scions and then planted into replicated experimental blocks in three different farms of the J. Frank Schmidt & Son wholesale tree nursery located in the Willamette Valley in Boring, OR. Aesthetic and production qualities of the NMSU 1, NMSU 2, and NMSU 3 clones; numerous typical seedlings of A. grandidentatum; numerous clones of Utah origin; and the established cultivar of the species Rocky Mountain Glow® to the U.S. landscape tree wholesale nursery and has introduced several ornamental maples to the U.S. landscape and nursery industry (J. Frank Schmidt & Son Co., 2013). Production and aesthetic qualities were rated on a scale of 1 to 4 with 1 being the highest.

Performance

In the 9 years (July 2004 to July 2013) of field evaluations at J. Frank Schmidt & Son, NMSU 3 was the best performing of the three clones. On 17 sept. 2013, the new mexico agricultural experiment station released clone NMSU 3 as A. grandidentatum ‘JFS-NuMex 3’, which was almost comparable to that of sugar maples. The plant is upright and well branched, resulting in a desirable canopy (Fig. 1A and B). A desirable tree canopy is judged to be one where the collective architecture of the foliage, branch, and tree trunk produces uniform cover when viewed from multiple angles. ‘JFS-NuMex 3’ production and aesthetic quality rating from 29 July 2004 to 27 July 2013 averaged 1.3 and 1.4, respectively. The performance of ‘JFS-NuMex 3’ (12 individual clones) was compared with the established cultivar, Rocky Mountain Glow®. An example of the data that were collected on two dates for an individual clone of ‘JFS-NuMex 3’ planted on farm South Farm, block 9E, row 045S26, and how the data compared with Rocky Mountain Glow® is given in Table 1. ‘JFS-NuMex 3’ has shown improved resistance to tar spot fungus and powdery mildew, both common diseases of A. grandidentatum in its natural range. ‘JFS-NuMex 3’ was shown to be marginally cold hardy in USDA Cold Hardiness Zone 5. The range of average annual minimum temperatures for Zone 5 is −28.9 to −23.3 °C.

When grown on its own root, the tree reached 4.0 m in 10 growing seasons and attained 8.1 cm caliper size. From grafting, 1-year-old trees produce 2.1-m tall whips, 2-year-old trees reach 2.5–3.2 cm caliper size, and 3-year-old trees are 3.8–4.4 cm caliper-branched trees. The mature height and canopy spread ‘JFS-NuMex 3’ is 8.5 m and 2.4 m, respectively.

About 5% graft union incompatibility was noted in test plots. However, this occurs early in the life of the tree, so incompatible trees can be culled in the nursery. While of concern, this level of graft incompatibility is manageable during nursery production and will not represent a landscape problem.

Table 1. Morphological and aesthetic qualities of a selected clone of Acer grandidentatum ‘JFS-NuMex 3’ as evaluated on 27 July 2005 and 10 May 2007. A comparison with Rocky Mountain Glow®, the established cultivar of bigtooth maple, is given.

| Date       | Trait     | Value observed | Compared with Rocky Mountain Glow®       |
|------------|-----------|----------------|------------------------------------------|
| 27 July 2005 | Foliage   | Green          | Glossier dark green                      |
|            | Form      | Well branched  |                                          |
|            | Height    | 1.52 m         | Slightly taller                           |
| 10 May 2007 | Foliage   | Green with one or two interior red leaves | Fall color is later                       |
|            | Form      | Oval, upright  | More upright and equally well branched   |
|            | Caliper   | 4.5 cm         | Larger                                   |
|            | Growth    | Excellent      | Larger tree                              |

*Indicates the trait was not recorded in field notes.
Botanical Description

Mature leaves have five well-developed palmate lobes and two smaller proximal lobes (closest to the petiole) each with acuminate tips that are characteristic of the taxa (Fig. 1C and D). The leaf base is acute. The average length from the apex to the petiole of the simple leaf is 10.8 cm. Average leaf width is 7.3 cm. In summer, the adaxial surface of mature leaves is glossy and has a dark green color that corresponds to 137B on the Royal Horticultural Society (RHS) Color Chart (Royal Horticultural Society, 2001). The adaxial leaf surface is glabrous and the abaxial leaf surface is pubescent with unicellular trichomes that are prominent along the veins. Veins on the mature leaves are yellow green (153B on the RHS Color Chart). Petioles on mature leaves are red (RHS 46A) (Figs. 1C, D, and 2A). Fall color develops later than most seedlings and selections of the species. Fall color varies from yellow orange (RHS 16A) to deep red (RHS N34C), and ‘JFS-NuMex 3’ was the reddest bigtooth maple selection that has been observed in the test plots in Boring, OR.

Spring foliage color on the abaxial leaf surface is light green (RHS 138B). The newly emerged foliage are grayed-orange (RHS 177A) and glossy (Figs. 1C and 2A). Young twigs on the stems of the plant’s current season growth are grayed-orange (RHS 176A) (Fig. 2A). The bark on mature stems is brown (RHS N200B). The fruit is a double samara and has a samara angle of 44°. Individual samaras average 0.5 cm wide at the broadest part of the membranous wing and average 2.0 cm in length. Samara color varies from green (RHS 141C) when immature to brown (RHS 200C) when mature.

Availability

‘JFS-NuMex 3’ was patented (US PP27,930 P2) on 25 Apr. 2017 and is marketed under the trade name of Mesa Glow®. Under a licensing agreement with New Mexico State University’s Arrowhead Center Inc., this cultivar is available from J. Frank Schmidt & Son Co., P.O. Box 189, Boring, OR 97009, phone (503) 663–4128.

Literature Cited

Barker, P.A. 1974. The spectacular canyon maple. Utah Sci. 35:7–10.

Bowen-O’Connor, C.A., D.M. VanLeeuwen, T.M. Sterling, G. Bettmann, and R. St. Hilaire. 2013. Variation in violaxanthin and lutein cycle components in two provenances of Acer grandidentatum L. exposed to short-term contrasting light. Acta Physiol. Plant. 35:541–548.

Bsoul, E.Y. 2005. Ecotypic variation in drought and salinity responses of bigtooth maples. Plant and environmental sciences, New Mexico State Univ., Las Cruces, NM, PhD Diss.

Bsoul, E.Y., R. St. Hilaire, and D. VanLeeuwen. 2006. Bigtooth maples exposed to asynchronous cyclic irrigation show provenance differences in drought adaptation mechanisms. J. Amer. Soc. Hort. Sci. 131:459–468.

Bsoul, E.Y., R. St. Hilaire, and D. VanLeeuwen. 2007. Bigtooth maples from selected provenances effectively endure deficit irrigation. HortScience 42:1167–1173.

J. Frank Schmidt & Son Co. 2013. Welcome. 18 July 2013. <http://www.jfschmidt.com/>.

Morgan, D.L. 2002. Acer grandidentatum. Amer. Nurseryman 195:106.

Richards Reed, M. and L.A. Rupp. 2012. Etiolation improves rooting of bigtooth maple cuttings. HortTechnology 22:305–310.

Richards Reed, M., L.A. Rupp, R. Kjelgren, and V.P. Rasmussen. 2012. Selection and budding propagation on native bigtooth maple for water conserving landscapes. HortTechnology 22:669–679.

Royal Horticultural Society. 2001. RHS Colour Chart. Royal Hort. Soc., London, UK.

St. Hilaire, R. 2002. Bigtooth maple: A plant that merits more use in southwestern landscapes. Landscape Plant News 13:10–11.