Horticulture

UtahStateUniversity COOPERATIVE EXTENSION

extension.usu.edu

May 2011 **Horticulture/Trees/2011-03pr**

Propagating Bigtooth Maple

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Propagating Native Utah Plants

Native plants are playing an increasing role in sustainable landscapes that use fewer resources such as water and fertilizer. Unfortunately, many native plants are not available in the nursery trade, or if they are available they may only be found as seedling plants grown for the reclamation industry. Such plants are high quality and have a valuable role in the reclamation of disturbed sites such as fire-damaged areas. But, these plants by design are genetically diverse and have not been selected for typical horticultural traits such as flowering or fall color. In addition, plants produced for reclamation are usually not grown to the sizes desired in the nursery trade. The first step in producing native plants with greater application in the landscape industry is to propagate or reproduce exceptional selections of these plants.

Bigtooth Maple

Bigtooth or canyon maple (*Acer grandidentatum*) is a small deciduous tree native to much of the western United States (Fig. 1). It is closely related to the eastern sugar maple as confirmed in part by its sweet sap, brilliant fall colors, and deeply lobed leaves reminiscent of the Canadian flag. Locally it is found along mountain ranges at elevations of 4400-9100 feet. Bigtooth maple is highly variable. Its size ranges from a few feet in height to 60 feet or more and it occurs in short, tall, columnar, periodic seed crops of double winged fruits. It has great potential as a small tree for use in water conserving landscapes. Bigtooth maple can be.successfully

Figure 1. Bigtooth maple fall color.

propagated by seed, wilding, cutting, layering, grafting, or micropropagation

Sources

In Utah, bigtooth maple is found virtually state-wide on both public and private lands. Propagules (plant structures used to start new plants) in the form of seed, cuttings, or budwood can be found. It is also possible to collect wildings (self-propagated seedlings in the wild). Any collection of propagules

or plants must be done only with permission and/or permits as required.

Propagation by Seed

Seed is the primary method of propagating bigtooth maple (Bowen-O'Conner et al., 2007). Seedlings are mainly used for reforestation or reclamation (Christensen and Nixon, 1964), though they are used in landscaping as well. Seed propagation is the method of choice for maintaining genetic diversity.

Seed may be purchased or can be collected in the late fall after ripening completely, as indicated by a uniform straw color (late October or November for northern Utah, Fig. 2). Seeds stay on the trees well into December or until they are blown off by winter storms. Seed should be selected from healthy trees and can be collected by simply striping them off the branches. Seed can be stored for 1 to 2 years if well dried and held at 34-38° F and 15% moisture in a sealed container (Young et al., 1992). Bigtooth maple exhibits deep physiological dormancy which means that the seed requires a cold stratification treatment of 8 to 16 weeks before it will germinate. Cold stratification is accomplished by storing seed in a moist, aerated medium such as vermiculite or peat moss at temperatures of 34-38° F. Seed should be presoaked for 24 hours before stratification.

Figure 2. Ripe bigtooth maple seeds.

Maple seed germinates at variable times depending on the seed, temperatures, and duration of chilling. Seeds have a tendency to germinate during stratification, so one way to handle the variation in stratification and germination time is to periodically inspect the seeds and plant only those which have started to germinate. The remaining seeds can be refrigerated and planted later. Stratified seed can be sown in containers or in the field (Fig. 3).

Bigtooth maple seed can also be propagated very effectively by sowing outdoors in the fall and allowing natural stratification to occur over the winter. Such seeds will germinate the following spring and can be grown through the summer before transplanting as dormant plants in the fall.

Seedlings grown in containers should be planted in a soilless medium with sufficient depth to foster a deep root system. They can be transplanted at any time to larger containers, or to the field or landscape as long as they have been sufficiently hardened off (acclimated to conditions outside the greenhouse). Field-grown seedlings can be transplanted by digging the plants bareroot when dormant. As much of the root system as possible should be retained with the transplanted seedling. Bareroot plants should be held in cool (34-36 F), moist conditions until they can be transplanted.

Figure 3. Bigtooth maple seedlings.

Propagation by Wildings

An effective way to obtain bigtooth maple plants is through digging and transplanting small trees that have propagated naturally in the wild (wildings) from seed. Such collecting obviously has a much larger impact on the existing environment than does collecting seed, cuttings, or budwood. Therefore, it is critical to have permission before moving plants. Wildings may be found in regions where there has been a disturbance allowing new growth to occur, or adjacent to trees that have produced seed that has successfully germinated.

Trees should be dug in the fall or early spring when the plants are dormant and no leaves are present. The easiest method is to dig small seedlings bareroot. Success can be improved by root pruning (cutting the seedling roots to stimulate a more dense, fibrous root system close to the stem) 1 to 2 years prior to digging, and then digging at a distance beyond where the initial cuts were made. It is possible to try to transplant larger trees. but, it is very labor intensive, usually requires retaining the soil around the roots in a large rootball, and has a much poorer success rate.

Wildings transplanted to a nursery or landscape must be irrigated until the root system is able to reestablish itself. Providing shade to reduce heat and water loss is also an effective practice. Care must be taken to insure the plant receives adequate water to survive, but is not over irrigated to the point of developing problems with root pathogens.

Propagation by Layering

Propagation of trees by seed is easy, efficient, and rewarding. However, it has the drawback that each seedling is genetically unique and will appear different from other maples–even from the same seed lot. If uniformly superior trees are desired, the only option is some type of vegetative propagation such as cuttings, layering, budding, or micro-propagation. Regardless of the vegetative propagation method used, the challenge is to get the propagules to form adventitious roots–that is, roots forming on the stem or shoot where they did not previously exist.

Figure 4. Bigtooth maple shoot girdled with copper wire.

Layering occurs naturally in bigtooth maple when the lower branches come in contact with the soil and form new (adventitious) roots (Eastmond, 1968). After roots have formed the layer may grow independently of the parent plant, or may continue to be attached to it. As might be expected, it is possible to take advantage of this natural method of propagation to produce additional plants (Tankersley and Emino, 1981).

Layering can be done by many different methods, but the most common is mound layering. This is done by establishing mother trees in a nursery row and then pruning them back to within an inch or two of the crown in the late winter. In the spring and summer as new shoots develop, the bases of a portion of the shoots are girdled and covered with a rooting medium (Figs. 4 & 5). New root growth is encouraged through the summer by keeping the rooting medium moist. Rooting hormone is not necessary when juvenile plants are used, but may have benefit with mature plants. Rooted layers are harvested in the fall after the leaves have dropped and before extreme cold weather occurs (Fig. 6). They should be held in a cool, sheltered environment before transplanting in the spring.

Seedling stock plants at Utah State University have been layered by girdling the stems with a copper wire and then covering the base of the stems with moist conifer shavings about the first of July and then sprinkle irrigating for 10 minutes twice a day.

Figure 5. Bigtooth maple mound layer bed.

Figure 6. Rooted bigtooth maple layer.

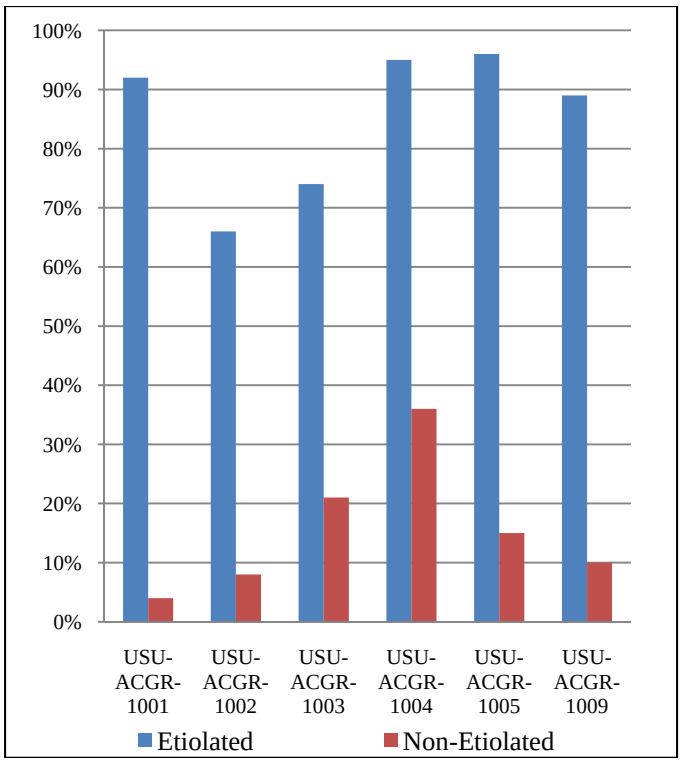

Figure 7. The effect of etiolation on the percentage of rooted bigtooth maple cuttings from six different maple selections.

Propagation by Cuttings

Historically, vegetative propagation of bigtooth maple has been limited to budding desired clones on to seedling rootstocks. Recent work at Utah State University has shown that restricting light (etiolation) to the base of developing shoots significantly improves rooting of softwood cuttings (Maynard and Bassuk, 1987). Using this method, over 90% of etiolated cuttings formed roots (Fig. 7). Etiolated cuttings also had significantly more roots than standard cuttings.

Etiolation of bigtooth maple shoots requires placing the buds in the dark prior to budbreak so that new growth occurs in the dark. This is done by pruning the shoot to a point immediately below the third node from the shoot base and then placing black, velour, drawstring bags with open ends, over the terminal buds of the pruned shoots (Figs. 8 & 9).

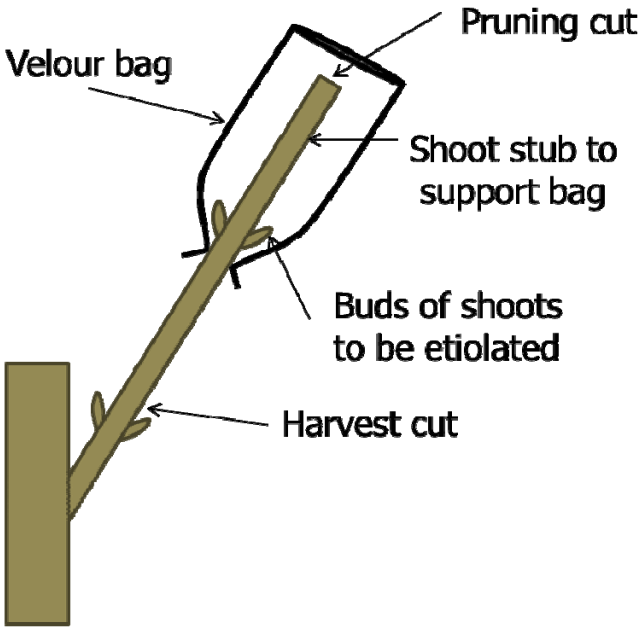

Figure 8. Diagram of technique using velour bag to etiolate shoots for cuttings.

Figure 9. Etiolation of bigtooth maple shoots by black velour bags.

Figure 10. Etiolated base of bigtooth maple shoots grown in bags.

Pruning just below the node will leave a 3 to 5 inch stub that will help support the bag until removed with the cutting. Pruning should be done in January or early February to reduce sap bleeding from the tree. The bags allow the emerging shoots to start in the dark and then grow out of the bag into the light. This results in shoots with etiolated bases and normal tips (Fig. 10). When approximately two sets of fully expanded leaves have emerged from the bag, the shoots can be cut off and used for cuttings.

Cuttings are prepared by harvesting early in the morning and then keeping cool until ready for sticking. Prior to sticking they should be wounded by scraping off a ½ strip of bark on one side and then dipped in a rooting hormone (2000-5000 ppm IBA and 1000-2500 ppm NAA). All knives should be kept clean with a 70% alcohol solution. Cuttings should be stuck in a premoistened medium (3:1 perlite:peat mixture), and then placing under 60% shade with an intermittent mist system to keep the cuttings moist (misting approximately 7 seconds every 12 minutes) (Fig. 11).

Keeping greenhouse temperatures cool (65/60 F day/night temperatures) and using bottom heat at 75-80 F can greatly assist in root formation. In addition, treatment with fungicides to prevent *Botrytis* damage to leaves, and to control rot on the stems and new roots can also be very helpful.

Following rooting (Fig. 12), cuttings are transplanted and grown throughout the summer before placing in cold storage or transplanting to the field. Cuttings do not typically develop any new shoot growth in the summer of the year when rooted. Transplanting is done as previously described with seedlings.

Figure 11. Bigtooth maple cuttings stuck and placed on bottom heat with intermittent mist.

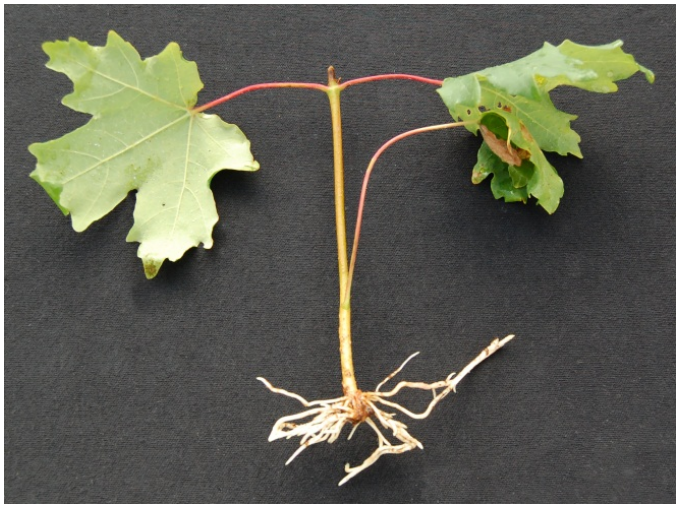

Figure 12. Rooted bigtooth maple cutting.

Propagation by Budding

The most common method of producing maples in the nursery industry is through budding selected clones onto seedling rootstocks. Success with this method requires that both the rootstock and scion (budwood) be at the correct physiological stage. Typically, seedling rootstocks are grown for 2 to 3 years to develop a vigorous rootstock for budding. Budwood is taken from stock blocks of the selected variety and grafted to the rootstocks at the optimum time of year (Howard, 1973; Richards, 2010). Budding can be done by either chip bud (Rupp, 2010), or by using a "wood-out" T-bud (Warren, 2010).

Research at Utah State University suggests the optimum window for budding maples in Northern Utah is from the first of July until about the middle of August. Budwood should contain well developed buds in leaf axils. Budwood is prepared by cutting budsticks of current season's growth off of the mother tree, removing the leaf blades, and then keeping the wood cool and moist until used. Chip budding is done by making a 45 degree cut into the stem about ½ inch below the bud and to a depth of between 25-33% of the way through the stem. A second cut is made starting about ½ inch above the upper tip of the bud and proceeding in a straight line to the base of the first cut. A similar cut should be made in the rootstock at the location where the bud is to be placed. Buds are placed on rootstocks of the same or slightly larger diameter. A remnant of the petiole is retained to help protect the bud, and the entire bud is covered by tape (in this case with Parafilm® grafting tape) (Figs 13 & 14). Usually 3 to 4 weeks is long enough to give a good indication of whether or not the bud will be successful. But, a final determination of success cannot be made until bud break the following spring.

Figures 13 & 14. Chip budding of bigtooth maple showing cut on rootstock and tying in of bud.

Budding plants is a several year process. Rootstocks must be grown, then one season is required for budding and then success is still not determined until the following season (Fig. 15). While this may seem challenging, when plants are being produced annually it is a common and effective means of propagation. Once buds have taken, the plant is handled similarly to the other propagation methods.

Figure 15. Successful chip bud on bigtooth maple.

Micropropagation

Yet another method of vegetative propagation of bigtooth maple is through tissue culture or micropropagation. This method has some great advantages in that large numbers of plants can be produced very quickly once a protocol for propagation has been developed. But, it does

require more extensive facilities than the other methods described.

Recent work at New Mexico State University has shown that propagules selected from greenhouse-grown 2-year old seedlings can be established in a tissue culture medium and then induced to form roots. Its full potential will be gained only when methods are developed to establish propagules from mature trees. This will then allow selected, high quality specimens to be propagated in large numbers.

Conclusions

There are a number of methods of propagating bigtooth maple. Seed propagation is very effective and commonly used to grow plants for reclamation and utility purposes. Seed propagation is also an acceptable means of propagating rootstocks for budding of selected clones. Production of selected clones with highly desirable traits is currently possible through the use of cuttings, layering, and budding. These methods make it very feasible to improve the quality and number of exceptional selections of bigtooth maple available for use in landscape applications.

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This publication is issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Noelle E. Cockett, Vice President for Extension and Agriculture, Utah State University.