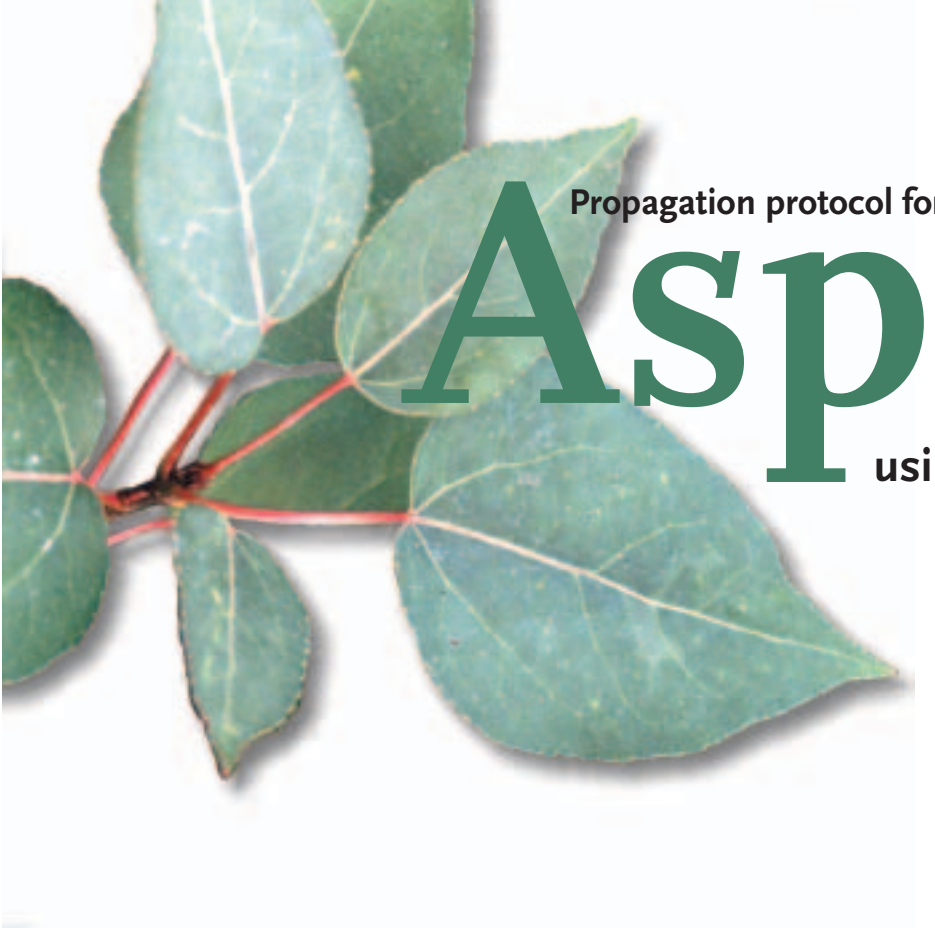

Propagation protocol for Aspen using root cuttings

| Tara Luna

KEY WORDS
vegetative propagation, Salicaceae

NOMENCLATURE
ITIS (2002)

Aspen (*Populus tremuloides* Michx. [Salicaceae]) is the most widely distributed tree species in North America, found from Alaska across Canada to Newfoundland and south to Virginia and throughout the western US south to northern Mexico. Its Old World counterpart, *P. tremula* L., is the most widely distributed species there, extending from the Arctic Circle to North Africa, and from Great Britain across most of Europe east to China and Japan. Together, these closely related species typify the boreal biome.

One of its most distinguishing characteristics is that aspen is largely clonal. Aspen clones are thought to be centuries old and enormous in size; 1 male clone in the Wasatch Range of Utah covers over 43 ha (107 ac) and consists of more than 47 000 boles. Aspen stems are produced from a common root system. New stems are produced on the outside, advancing in front of the clone, with older trees in the center. The root system persists as stems die and are replaced. Clones can be distinguished by morphological differences in phenology, leaf size and shape, branching habit, bole character, gender, and genetically by electrophoresis.

Aspens do produce seed crops, however, viable seed production is dependent on the right combination of environmental conditions. In northern Montana, seed production can be sporadic.

VEGETATIVE PROPAGATION

Aspen has not been successfully propagated from traditional woody stem cuttings. An alternative is to force herbaceous shoots from root sections using procedures described by Schier (1978a). Aspen roots have many suppressed shoot primordia roots that can be seen as small bumps when the cork tissue is peeled away from the root (Figure 1). Under favorable conditions, aspen roots have the potential to generate many shoots.

In Montana in springtime, lateral root sections can be collected from desired clones as soon as the ground thaws and clones begin to flower. My observation is that root sections growing from just below the soil surface to 15 cm (6 in) deep generate more shoots than root sections collected from deeper in the soil profile. On rocky sites, lateral roots may be much deeper, require a lot more effort to extract, and do not appear to generate as many shoots. Another factor important to shoot formation is the physiological condition of the roots (water content, hormone levels and ratios, nutrient content), which depends on the proximity and attachment to trees of various ages and vigor and the time root cuttings are collected (Schier 1978b; Schier and Campbell 1980).

With this in mind, I target root collection from younger trees (approximately 7 to 10 cm [2.8 to 4.0 in] diameter breast height [dbh]) growing at the edge of a healthy clone that are in close proximity to a medium to older age (30 cm [12 in]) dbh tree. You can easily locate lateral roots by looking for young trees that are growing in a row away from the older tree at the edge of the clone. The best root sections are typically 2 to 9 cm (1.25

Photo by Tara Luna

Figure 1. Shoot primordia appear on the roots of aspen.

Photo by Tara Luna

Figure 2. Aspen shoots growing on a root section. These shoots can be excised and rooted under high humidity.

to 3.7 in) in diameter and are cut to 15 cm (6 in) lengths using sharp pruning shears. I seal the cut ends with paraffin to prevent fungal or bacterial infection during transport and storage.

Root sections can be placed directly into a mist propagation bed containing a medium of 50% sand and 50% large grade perlite (v:v) with bottom heat maintained at 23 °C (74 °F) or by using open flats with the same medium placed on heating mats in the greenhouse. Bottom heat degrades auxin and promotes cytokinin production in the roots. High cytokinin-to-auxin ratios promote shoot initiation while low ratios inhibit it. Place root sections in the mist bed or flats horizontally and barely cover them with medium. Shoots will emerge in about 2 to 3 wk. Usually, numerous shoots will emerge per root section (Figure 2).

Using a razor blade, cut young shoots from the root section when they are 2 to 3 cm tall (1.25 in) and treat with 2000 ppm (0.2% IBA) rooting hormone. Because the shoots do not have lignified stem tissue at this stage, they should be handled as herbaceous stem cuttings. Immediately place cuttings into a mist propagation bed with bottom heat maintained at 23 °C (74 °F). Maintain high relative humidity to keep the young leaves and stems turgid until adventitious roots form. An alternative is to place flats of treated shoots under a plastic tent with a bottom heat mat. With either system, some shading is needed during the rooting process. If proper environmental conditions are maintained, rooting can be seen in as little as 14 d.

Once an adequate root mass capable of supporting the cutting is formed, cuttings will need to be hardened off from the rooting environment prior to lifting and potting. Bottom heat should be turned off at this stage to encourage development of secondary roots. Medium should not be allowed to dry out during the hardening process. If cuttings are in a mist system, gradually reduce misting frequency, or if you are using enclosed plastic tents around the flats, increase ventilation frequency and duration. These procedures should continue over a 3- to 4-wk period. Hardening off cuttings prior to lifting and potting is a crucial step that greatly reduces post-rooting mortality. This is especially important for rooted aspen shoots, which are herbaceous at this stage and do not recover well from transplant shock.

After proper hardening, rooted cuttings can be potted individually and placed either in the greenhouse or outdoors in a shade house with some wind protection. I transplant cuttings into 172 ml (10 in^3) Ray Leach conetainers (Stuewe and Sons Inc, Corvallis, Oregon), using a growing medium such as Pro Mix BX (Premier Horticulture Co, Quebec, Canada), which contains approximately 60% milled sphagnum peat moss, 20% perlite, and 20% vermiculite (v:v:v). I incorporate Osmocote Plus with minors (15N:9P_2O_5:11K_2O; Scott's Company, Marysville, Ohio) at the rate of 1 g per conetainer. Root tight conetainers

can be produced in 1 y if roots are collected and treated in early April and cultural requirements are met correctly during the growing season. The following spring, trees can be transplanted into larger containers 1 l (3 gal) and are ready for outplanting at the end of the season.

It is important to remember that number of shoots produced from aspen root sections in controlled environments have been shown to vary among clones. Differences varied according to date of collection because of variation in the seasonal trend in shoot production among clones (Schier 1974; Schier 1978b; Schier and Campbell 1980; Schier 1981). Number of shoots produced is probably related to the carbohydrate reserves and hormonal growth promoters present in the root tissue at time of collection. Other factors that can influence shoot number include genetics, clone age and health, and the environmental conditions of the collection site.

Large amounts of roots are needed to produce any number of plants. This can be expensive because of the time, labor, and facilities that are involved. This protocol can, however, give growers the option to produce some nursery stock when seeds are unavailable or if a selected clone is desired for an out-planting project.

REFERENCES

[ITIS] Integrated Taxonomic Information System. 2002. URL: http://www.itis. usda.gov (accessed 22 Jun 2003).

Schier GA. 1974. Vegetative propagation of aspen: clonal variation in suckering from root cuttings and in rooting of sucker cuttings. Canadian Journal of Forest Research 4:565–567.

Schier GA.1978a. Vegetative propagation of Rocky Mountain aspen. Ogden (UT): USDA Forest Service, Intermountain Forest and Range Experiment Station. General Technical Report INT-44. 13 p.

Schier GA. 1978b. Variation in suckering capacity among and within lateral roots of an aspen clone. Ogden (UT): USDA Forest Service, Intermountain Forest and Range Experiment Station. Research Note INT-241. 6 p.

Schier GA. 1981. Physiological research on adventitious shoot development in aspen roots. Ogden (UT): USDA Forest Service, Intermountain Forest and Range Experiment Station. General Technical Report INT-107. 12 p.

Schier GA, Campbell RB. 1980. Variation among healthy and deteriorating aspen clones. Ogden (UT): USDA Forest Service, Intermountain Forest and Range Experiment Station. Research Paper INT-264. 12 p.

AUTHOR INFORMATION

Tara Luna
Botanist
PO Box 447
East Glacier Park, MT 59434
tluna@3rivers.net