STACKED PROPAGATION

a new way to grow native plants from root cuttings

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ABSTRACT

Stacked propagation is a novel method of growing quaking aspen *(Populus tremuloides* Michx. [Salicaceae]) and other plants that reproduce from underground stems or root cuttings. Because the mother plant is not damaged, it is particularly well suited for rare plants or those that can't be propagated by normal methods. Our initial trials indicate that hundreds of vigorous plants can be produced by this method in each propagation cycle.

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KEY WORDS

Populus tremuloides, vegetative propagation, restoration

NOMENCLATURE

USDA NRCS (2006)

Quaking aspen with splendid fall color. Photo by Thomas D Landis

Quaking aspen *(Populus tremuloides* Michx. [Salicaceael) is an important component of many plant communities across North America and is traditionally propagated by seeds (Wycoff and Zasada 2003), vegetatively using suckers grown from root cuttings (Landis and others 1999), or directly from root cuttings (Dreesen and Harrington 1999). In cases where a specific genotype is cultivated, or aspen seeds are unavailable, the use of root cuttings is often a popular choice. When we attempted to propagate aspen for a restoration project on the Hopi Reservation in northeastern Arizona, where quaking aspen was once common but is now restricted to a few scattered individuals and clones, neither seeds nor root cuttings were effective. This may have been due to the timing of the collections or the lack of vigor in the parent trees, which were in a stressed condition (Pinto and Landis 2003). We were, however, able to collect some catkins from healthier aspen stands on the adjacent Navajo Reservation. This time, the catkins yielded viable seeds and approximately a dozen seedlings were grown in 262 cm^3 (16 in3) DeePot™ containers (Stuewe & Sons Inc, Corvallis, Oregon) and later transplanted into I -gal containers (Figure 1A).

THE STACKED PROPAGATION TECHNIQUE

Because of the difficulty of obtaining viable seeds and cuttings, we needed a way to propagate quaking aspen vegetatively using our few seedlings as stock plants. We learned about a novel vegetative propagation method for quaking aspen that we are calling "stacked propagation" (LaFleur 2004). This technique takes advantage of the rapid and extensive root growth of aspen seedlings and the fact that severed roots will form new shoots.

At the USDA Natural Resources Conservation Service Los Lunas Plant Materials Center in New Mexico, we initiated a series of trials to modify this stacked propagation concept to propagate quaking aspen. In our first attempt, we used Styroblock™ 10 containers (Beaver Plastics, Edmonton, Alberta), which have 77 cells with volumes of 170 cm^3 (10.4 in^3). Our objective was to encourage root proliferation into as many cells as possible. Then, after a dormancy treatment, we would sever the roots with the hope that each root would develop an adventitious shoot. In our first attempt, a hole was cut in a "cover" block, which would hold and insulate the root system of the 1-gal aspen stock plants. Next, we filled another "propagation" Styroblock™ with a commercial growing medium of corn-posted pine bark, pumice, and *Sphagnum* peat moss. A thin layer of medium was also sandwiched between the bottom of the cover block and the propagation block (Figure 1B).

The 2-layer Styroblock™ stacks were hand watered from above and, after a few months, the roots from the aspen stock plants in the cover blocks had grown into the cells of the lower blocks. Next, the roots between the blocks were severed (Figure 2A), and the propagation block was irrigated to stimulate shoot production (Figure 2B). This first trial was modestly successful with about half of the cells containing roots that sprouted into aspen plants (Figure 2C). The main flaw with this system was that the growing medium washed out of the space between the two blocks, preventing roots from proliferating throughout all the cells.

To address this design flaw, our second trial consisted of wrapping the stacked Styroblocks™ with a spunbonded fabric to prevent the growing medium from washing out. Polyurethane cement or staples were used to secure the fabric to the outside of the stacked blocks. This attempt used 3 propagation Styroblock™

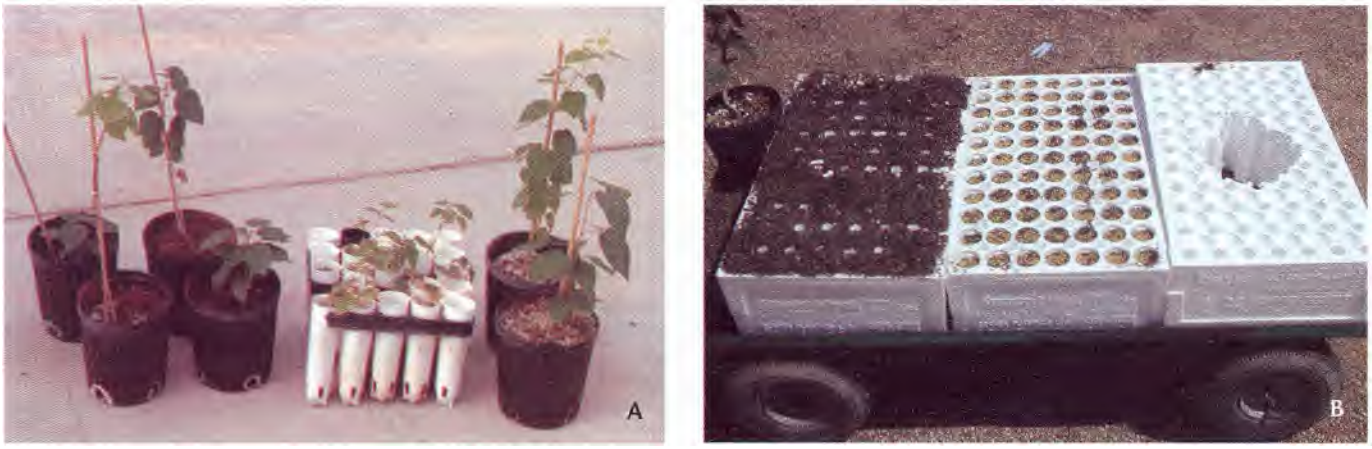

Figure 1. Stacked propagation is ideal for reproducing limited parent material such as these quaking aspen seedlings (A). A 1-gal plant is placed into a "cover" Styroblock™ (far right), which is stacked above "propagation" blocks filled with growing media (B). Photos by David R Dreesen

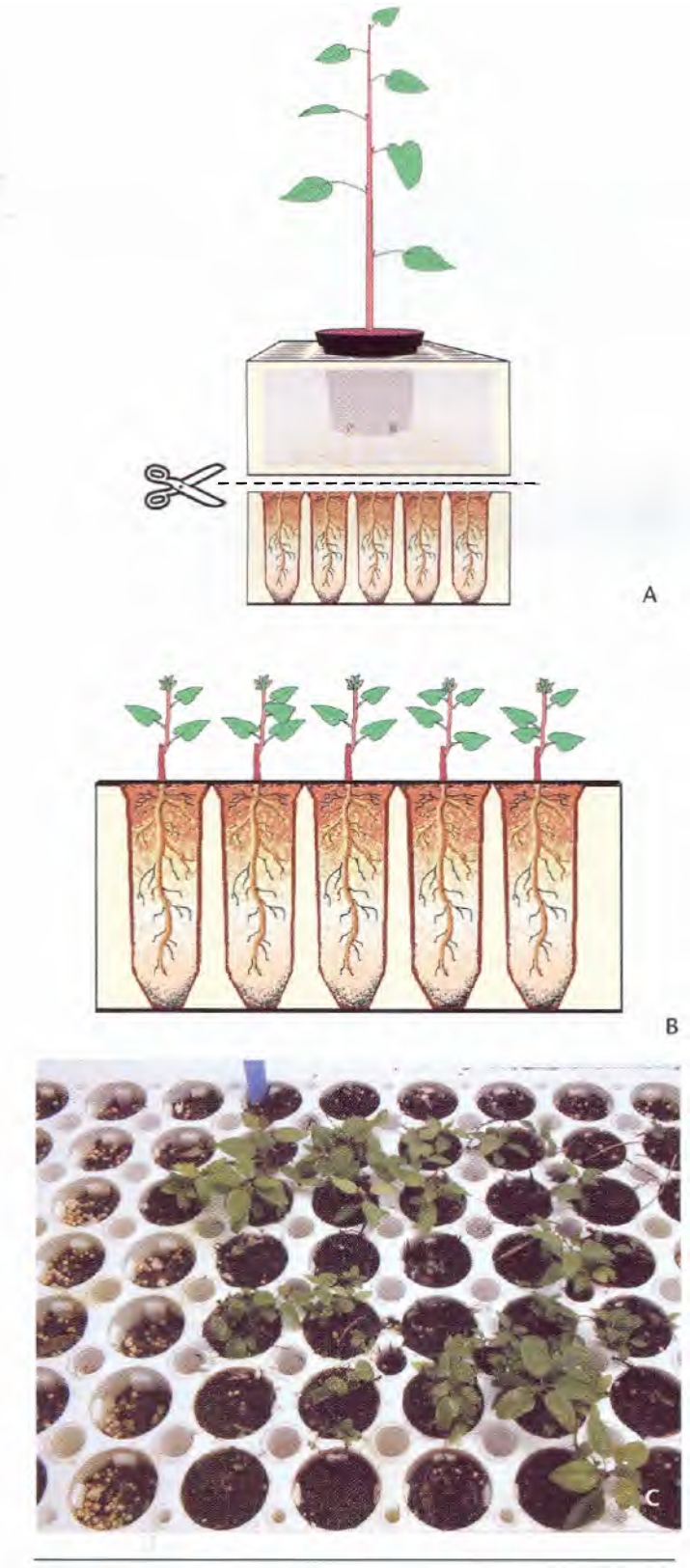

Figure 2. The concept behind stacked propagation is that roots from the mother plant will grow down through the cells of the lower propagation blocks, which will then be severed (A). Sprouts will develop from the cut roots and grow into shippable plants (B). In spite of losing a considerable amount of growing media, our first attempt was moderately successful (C).

Illustrations by Steve Morrison Graphics; Photo C by Thomas D Landis

Figure 3. Spunbonded fabric is used to prevent growing medium from washing out of this 3 layer stack of propagation Styroblock TM containers. Photo by David R Dreesen

Figure 4. The latest modification is to use Styrofoam TM strips to seal the gaps between the Styroblock TM containers. Photo by Jeremy R Pinto

containers per stack to determine if roots from the aspen stock plant would grow into more than one propagation block (Figure 3). About 1 y after assembly of 2 stacked block units, approximately 85% of the cavities had aspen roots emerging from the bottom rooting block. This system, however, was labor intensive and not efficient.

In our third iteration, we used strips of expanded polystyrene approximately 2 cm x 2.5 cm (0.75 in x 1 in) to form a perimeter barrier to retain the potting mix. The strips were pinned to the propagation blocks with rigid wire pins to allow removal when the mother plant was cut away. The small gaps above and below the perimeter strips allow some drainage and aeration while still retaining the potting mix (Figure 4). The cover block was secured to the propagation blocks with plastic twine, and filament tape was used to cover the vent holes in the propagation block to prevent the loss of growing medium.

After 3.5 mo, 7 aspen stacks were assessed for root emergence. The percentage of cavities with emerging roots ranged from 55% to 85% with a mean of 75%. With a full growing season, higher root emergence percentages might be achieved. Root emergence in itself does not guarantee shoot development, but these percentages give an indication of increase potential. The stock aspen plants appear to be vigorous.

APPLICATION TO OTHER SPECIES

The Hopi are also interested in propagating shrub oaks, which do not regularly produce acorns. To that end, we have initiated trials with 2 thicket-forming oak species, Gambel oak (*Quercus gambelii* Nutt. [Fagaceae]) and wavyleaf oak (*Quercus* × *pauciloba* Rydb. (pro sp.) *[gambehi* × *turbinella]* [Fagaceae]). Gambel oak has the capability of sprouting from adventitious buds on lignotubers and rhizomes; adventitious buds are concentrated in the top 30 cm (12 in) of soil (Simonin 2000). The only stock plants available for the test were growing in Tall One Treepots™ (2830 cm^3 [173 in^3]; Stuewe & Sons Inc, Corvallis, Oregon), so the cover block unit required 2 stacked Styroblock" gallons (8 cavities, each 3000 cm^3) (Beaver Plastics, Edmonton, Alberta) for each single propagation block. Therefore, 8 seedlings of each species were supported and insulated by the stacked cover blocks (Figure 5A).

Stacked propagation may have application to other native plants that have been propagated with root cuttings, especially several genera in the Rosaceae, including *Amelanchier* Medik., *Prunus* L., *Rosa* L., and *Rubus* L. (Figure 5B), as well as *Aesculus* L. (Hippocastanaceae), *Populus* L. (Salicaceae), *Rhus* L. (Anacardiaceae), *Robinia* L. (Fabaceae), *Sambucus* L. (Caprifoliaceae), and *Symphoricarpos* Duham. (Caprifoliaceae) (Del Tredici 1996).

CONCLUSIONS

Stacked propagation is particularly attractive when plant material is limited,

Figure 5. Stacked propagation is also being tried on native shrub oaks (A) as well as wild raspberry (B). Photo A by David R Dreesen and Photo B by Jeremy R Pinto

when other propagation techniques are not effective, or when vegetative propagation is preferred. Another benefit is that the original mother plant is not damaged and can be used for several more iterations. In spite of its novelty, however, this is still vegetative propagation—be sure to use as many mother plants as possible to ensure maximum genetic variation. In the case of dioecious plants such as quaking aspen, you must also use both male and female mother plants (Landis and others 2003).

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