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Propagation of *Tsuga canadensis*

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Summary

Canadian hemlock is native to northern North America. It is under threat from the hemlock woolly adelgid, and breeding and selection programs are searching for potential resistance to this invasive pest. An efficient clonal propagation system would be required to study and eventually multiply resistant or tolerant selections. Preliminary results are reported for cutting and air layering propagation.

INTRODUCTION

There has been a renewed interest in propagation of *Tsuga canadensis* as part of breeding efforts aimed at developing resistance to hemlock woolly adelgid (HWA), an invasive insect that has affected hemlock stands throughout the eastern US. Efforts in conservation breeding have brought a focus on cloning cultivars or individuals that may exhibit evidence of potential resistance under field conditions. Two separate techniques were attempted for both mature and juvenile *T. canadensis*.

Cutting propagation success was tested with dormant, fall (November) cuttings using mature *T. canadensis* from natural areas of The Holden Arboretum (THA), and five-year-old potted trees grown from seed collected in natural areas of THA. Since much of the published literature is on success of cuttings with *T. heterophylla*, we incorporated one-year-old seedlings of this species obtained from the Franklin H. Pitkin Forest Nursery, Moscow, Idaho, into the experiment as a third tree type. Cuttings were a uniform 2.5 inches cut from the growing tip at 45° angles. The lower 1 inch of needles was stripped from each cutting prior to treatments. Applied treatments were a full-factorial combination of IBA (Advocate, Fine Americas Inc.) at 0%, 0.5%, and 1%, and fungicide (3336F, Cleary Chemicals LLC.) at 0 or 20 ounces per 100 gallons. Cuttings were treated with IBA during a 30 second basal dip, and fungicide with a 15-minute submersion. After allowing to dry, they were stuck in tray pots filled with Sunshine #1 potting mix (Sun Gro Horticulture). Ten cuttings were stuck in each tray, with a tray constituting a replicate. There were six pots for each of six treatments in the two blocks (bottom heated vs unheated) totaling 216 pots or 2,160 cuttings. Trays were located inside a greenhouse in a polyethylene chamber covering a bench top and receiving mist at the rates of 1 minute every 2 hours or 2 minutes every 1 hour, depending on outside conditions. The bottom-heated portion was set to 70° F.

Cuttings were harvested in March (4 months) and May (6 months). In March, there was no rooting in the non-bottom heated portion of the chamber. In the bottom-heated portion, success was highest in the juvenile *T. canadensis*, slightly higher than *T. heterophylla*, with success of up to 63% in the 0.5% IBA + Fungicide treatment. This was significantly greater than the highest success of the mature *T. canadensis* at 16%, achieved in the 1% IBA without fungicide treatment. In May, the unheated portion also began to show similar rooting success for all tree types except the mature *T. canadensis*, which showed none. Juvenile cuttings of both *T. canadensis* and *T. heterophylla* reached 80% success while mature *T. canadensis* peaked at only about 20%. At 6 months, rates were very similar across treatments for a given species.

Air layering propagation was initiated in August 2023, with three treatments: control treatments receiving no rooting compounds; a 1:5 dilution of liquid Dip ‘N Grow; and powder Hormodin #3. There was replication of 6 for each treatment on each of two tree types: mature *T. canadensis* from natural areas of THA, and five-year-old potted trees grown from seed collected in natural areas of THA. All were harvested in November 2023. Mature *T. canadensis* had no rooting success. On juvenile trees, there was rooting on one air

layer and callous formation on two air layers, all treated with Hormodin #3. All three were potted. The rooted air layer survived the one-year mark to August 2024.

Parent age is shown to present an obstacle to rooting success in both cuttings and air layering, necessitating more investigation into overcoming this issue. For cuttings, the necessity of bottom heat, especially for mature *T. canadensis*, is of significance to the industry. While not necessary, IBA appeared beneficial in many cases, but there was variability between tree type, time since sticking, and bottom heat in relation to the best concentration to use. Air layering of *T. canadensis* is possible, and to the best of our knowledge, this is the first documented instance of such.