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Taxus canadensis: Can We Do Without Synthetic Auxins and a Mist Tent?

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Summary

In this preliminary study, we investigated whether the propagation of *Taxus canadensis* (Canada yew) from cuttings could be made more sustainable by eliminating the use of synthetic auxins and a mist tent. What we found was: (1) softwood cuttings with or without the application of auxins did not root without the use of a mist tent; and (2) hardwood cuttings taken in early January and propagated in a mist tent rooted equally well with or without auxins. Plans to extend this research include examining whether hardwood cuttings taken in early January can be successfully rooted without the use of auxins in a humidity tent.

INTRODUCTION

Taxus canadensis (Canada yew) is a native, evergreen, understory shrub found in bogs and swampy forests in USDA hardiness zones 2-6 westward from Newfoundland to southeastern Manitoba, southward to northern Iowa and New York, and further into Tennessee and Virginia. This species prefers acidic and moist soil conditions and reaches heights of 6 feet with a spread of up to 10 feet. Insignificant yellow blooms appear in the spring, followed by red berries that ripen in the late summer and early fall. *T. canadensis* has a sweeping, plagiotropic, and open habit and is often used as a ground cover in heavily shaded sites (Cullina, 2002). Because seed propagation of this species has been found to be challenging and often requires multiple warm and cold stratification periods (Dirr & Heuser, 2018), seedlings, not surprisingly, rarely appear in nature with propagation typically achieved through layering (Allison, 1990).

The U. S. Forestry Service (n.d.) considers *T. canadensis* to be an important species for conservation and restoration and finding ways to more sustainably propagate this species would support the goals of such ecologically focused projects. Synthetic auxins, including indole-3-butyric acid (IBA), have long been relied upon in propagation, and while generally considered safe in small doses, toxicity if swallowed (U. S. Environmental Protection Agency, 2015), neurological and immunological effects in animals (Yilmaz & Celik, 2009), and environmental hazards (U. S. Environmental Protection Agency, 2015) are among some of the identified risks. High auxin levels also have negative implications for subsequent development in cuttings, including reduced bud break and leaf drop (Sun & Bassuk, 1993). Mist tents, another mainstay of the propagation industry, come with setup and operating costs including equipment, space, and water use, but perhaps more importantly, a continued reliance on a resource that may be scarce in many areas of the country. In totality, eliminating the use of auxins and mist tents would make the propagation process more environmentally and economically sustainable.

In this study, we began our investigation into whether *T. canadensis* cuttings could be propagated without the use of synthetic auxins and/or a mist tent in order to minimize environmental impacts and costs associated with this process. We compared the effects of different hormone treatments against using no hormones at all, time of year cuttings were taken, and the efficacy of using a humidity tent versus a mist tent on rooting success.

MATERIALS AND METHODS

Softwood cuttings were collected in late June. Hardwood cuttings were collected at two time periods: early January and mid-February (**Fig. 1**). While hardwood cuttings have previously been shown to root successfully with high auxin concentrations (Dirr and Heuser, 2018; Hartmann et al., 1996), we were also interested in testing the efficacy of using a humidity tent for softwood cuttings.

Treatments

C: Control (no IBA)
H2: Hormodin H2 (0.3% IBA; 3000ppm)
H3: Hormodin H3 (0.8% IBA; 8000ppm)
H45: Hormex H45 (4.5% IBA; 45,000ppm)
DNG (Dip n Grow): (1% IBA; 10,000ppm)
KIBA: diluted to 0.15% IBA; 1500ppm)

Figure 1. Collecting hardwood cuttings.

Softwood Cuttings

The bottom 1” of each cutting was stripped of foliage and lightly wounded to stimulate root development. Cuttings were then randomly assigned to one of four treatment groups (C, H2, H3, and H45, with 5 replicates per treatment group), stuck in a sharp sand and peat mix (Dirr & Heuser, 2018; Hartmann et al., 1996), and placed in a poly humidity tent.

Hardwood Cuttings

The bottom 1” of each cutting was stripped of foliage and lightly wounded to stimulate root development. Cuttings were then randomly assigned to one of four treatment groups (C, DNG, H45, and KIBA, with 5 replicates per treatment group), stuck in a 1:3 peat:perlite mix, and placed in a mist tent. The mist interval was set to mist for 20 seconds every 20 minutes, and bottom heat (70°F) was used.

RESULTS

Softwood cuttings in all treatments in a humidity tent did not root after approximately 2 months. Hardwood cuttings taken in early January and placed in a mist tent rooted equally well, with or without the application of auxins. Cuttings were scored approximately 2 months after sticking, and rooting success was measured both in terms of mean number of roots per rooted cutting and mean percentage rooted.

The mean number of roots per rooted cutting in the control group (4.0) was comparable to those in the auxin treatment groups (DNG 3.7, H45 5.0, and KIBA 3.2) for cuttings taken in January (**Fig. 2A**). In contrast, when harvesting of cuttings was delayed to mid-February, the number of roots per rooted cutting in the control group (1.0) was far fewer than those found in the DNG and H45 treatment groups (5.0 and 4.8, respectively) (**Fig. 2B**).

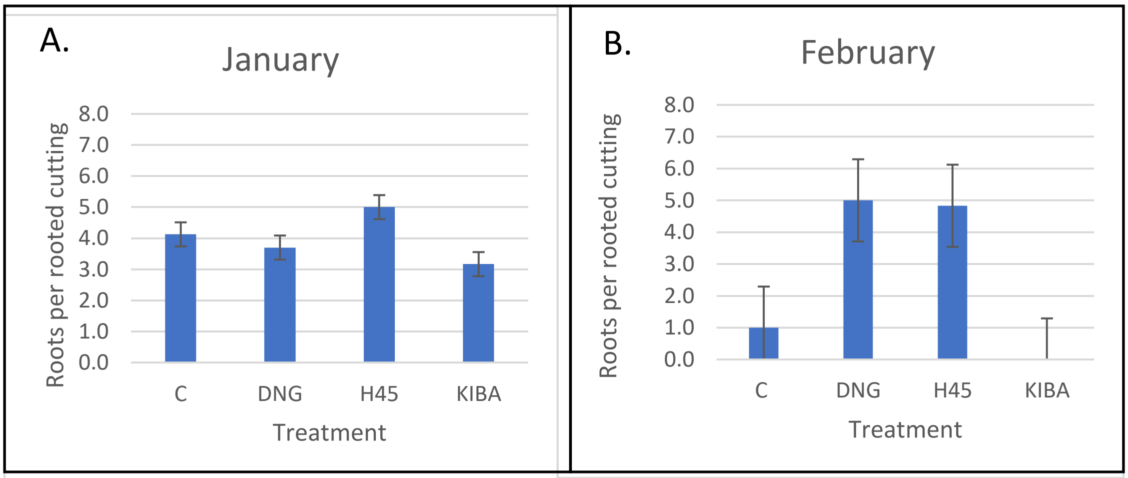

Figure 2. Roots per rooted cutting in untreated or IBA-treated softwood cuttings taken in January or February.

The mean percentage of cuttings that rooted successfully in the control group (53.3%) was also comparable to those found in the auxin treatment groups (DNG 46.7%, H45 20.0%, and KIBA 60.0%) for cuttings taken in January (**Fig. 3A**).

In contrast, when harvesting of cuttings was delayed to mid-February, the mean percentage of cuttings that rooted successfully in the control group (20.0%) was lower than those found in the DNG and H45 treatment groups (30.0% and 46.7%, respectively) (**Fig. 3B**). In February, cuttings treated with KIBA failed to root.

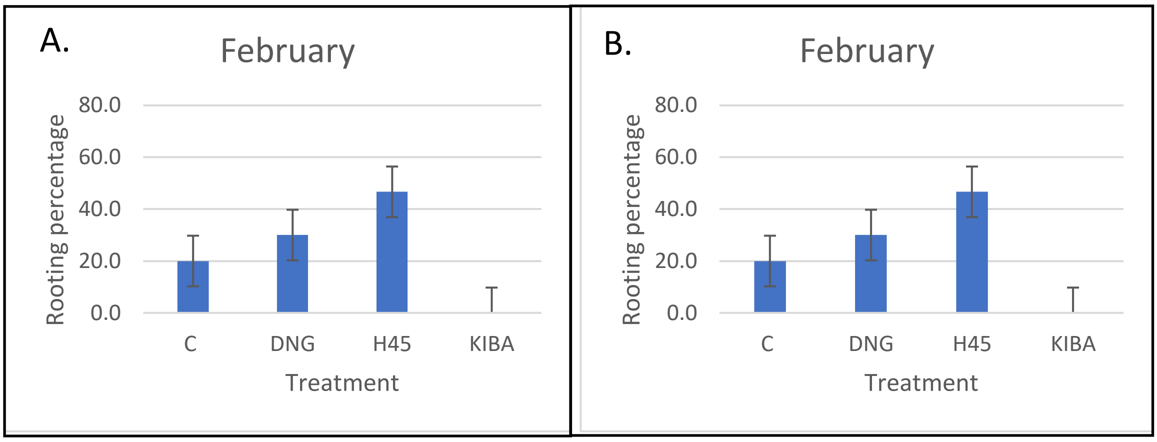

Figure 3. Rooting percentages in untreated or IBA-treated softwood cuttings taken in January or February.

A representative example of a cutting that rooted successfully without the use of auxins is shown below (**Fig. 4**).

Figure 4. Rooted hardwood cutting without the use of auxins.

DISCUSSION

In the current study, *T. canadensis* softwood cuttings did not root in a humidity tent regardless of treatment, providing further support that *Taxus* species are best propagated from hardwood cuttings (Dirr & Heuser, 2018; Hartmann et al., 1996).

Hardwood cuttings taken in early January in a mist tent, however, rooted successfully without the use of auxins. These results support the idea that not every species requires auxins to root and that auxin use should be considered on a species-by-species basis rather than simply as a default (Barakat and Draie, 2024; Maynard, 2012). In the current study, targeting the correct time of year to harvest cuttings (i.e., early January) had a significant impact on rooting success.

Given the small sample size in this study, these results should be considered preliminary; it would be valuable to repeat this study using a larger sample size to determine whether results could be replicated. The current results would, however, suggest that cuttings should be taken in early January as this time period appears to be optimal for rooting without the use of auxins.

A follow-up study could examine whether hardwood cuttings taken in early January could be propagated without auxins and without a mist tent. Reducing auxin and mist tent use has both environmental and economic benefits including eliminating contact with a potentially toxic substance, reducing reliance on a sometimes scarce natural resource, and decreasing overall propagation costs. The overall goal of continued research in this area would be to find ways to make the propagation process more sustainable.

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