PROPAGATION METHODS AFFECT TAXUS CUTTINGS AND LINER QUALITY

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INTRODUCTION

Recently, the work of Gouveia (1) and McGuire (2) have shown that *Taxus* species can be rooted with bottom heat in early spring and planted in late spring or fall the same year. In addition, McGuire (2) found that the spring-rooted taxus were equal to or superior to taxus cuttings taken in the fall, rooted on bottom heat, and spring-planted. Cuttings propagated on bottom heat are ready to plant sooner (6) than those without bottom heat (4). In addition, the utilization of bottom heat has eliminated the need to strip needles from the basal end of the cuttings thus saving time and physical injury to propagators (5,3). However, for us—propagating taxus in the spring—does not fit in time-wise with other nursery operations during the busy spring season.

MATERIALS AND METHODS

Five years ago we started a comparison of the rooting and subsequent bed performance of taxus cuttings produced under two different propagation systems.

Our original system involved sticking taxus cuttings in late fall in wooden flats, rooting them on electric heating cables, and then bed planting in May the following year by hand. An 8-row mechanical bed planter was soon purchased. Plants were shaded with sash or snowfence the first year in beds.

In 1977, we initiated the second taxus production system. This is an 18-month production cycle without the use of bottom heat, similar to the procedure outlined by Sabó (4) and seen at Greenleaf Nursery in Oklahoma on an IPPS Eastern Region tour. In November, 6 in. taxus cuttings are stripped and stuck in ground beds filled with 3 in. container medium with 3 in. coarse sand overtop. The air temperature is kept just above freezing with portable 150,000 BTU propane heaters. Cuttings root through the summer in these 13 × 96 ft houses under intermittent mist and 50% saran shade. In January the rooted cuttings are lifted, root-pruned, and heeled back in houses to be bed-planted in April when new root growth is evident. We switched to this system because it provided a less costly method to expand production without the high cost of purchasing and operating bottom heat. We then discontinued shading the newly planted taxus liner beds for the first year. This has worked well with many of the cultivars rooted in this system.

In contrast to these cost savings in the second method we found there were unacceptable bed losses the first winter on some cultivars of the more difficult to produce taxus. These taxus were the slower rooters and were those cultivars found to have less satisfactory root systems produced without bottom heat on the 18-month cycle. Each of the 20 different cultivars of taxus grown at Studebaker's are produced for a certain purpose or market. We therefore designated the problem cultivars for further trials and improvements. In 1984, we reinstated a revised system of bottom heat and conducted rooting trials using both propagation methods to compare rooting percentages and quality of rooted cuttings.

In the revised bottom heat system, cuttings are taken in November, stuck unstripped in groundbeds and rooted at 65 to 70°F on electric heating cables. These are bed-planted in late August the following year for a shortened cycle of 9 months. These cuttings are fall-planted so as to be on the same production cycle for comparisons to the cuttings planted the following spring without bottom heat (which we term an 18-month direct-stick cycle).

The rooted cuttings are planted with an 8 row mechanical transplanter into 5 ft wide beds on a spacing of 7 in. between rows and 5½ in. in the rows. Before planting, the beds are prepared with a sudan grass cover crop for one year, fall plowed and disked, and additional sphagnum peat added at the rate of 215 yd^3/acre. The beds are formed in the fall and fumigated with methyl bromide, then left to settle over the winter before planting in spring. Fall-planted beds are the ones left over from this process. After planting, beds are well watered-in and kept on a weekly watering cycle of 1 in. applied from Rainbird 30 heads on 3 in. aluminum lines. During prolonged periods of extreme heat, such as the summer of 1988, the newly-planted beds were additionally irrigated three to four times daily for short intervals to keep the plants cool. The liners are root-pruned twice in the three growing seasons then undercut and out-planted in the spring of the fourth year.

RESULTS

We made the following observations when comparing the cutting quality, the time of planting, and subsequent liner quality for both production systems over the last five years:

1) The bottom heat system generally produced equal or higher rooting percentages across the board than the non-bottom heat. Ninety to 95% rooting on most cultivars was consistently attainable with bottom heat. An average of 80 to 85% rooting on many cultivars without bottom heat has been attained over the years. The exceptions on the 18-month system are the slower and problem rooters such as: *Taxus* × *media* 'Amherst', 'Brownii', 'Chadwick', 'Everlow', 'Hiti', 'Ohio Globe', 'Slavin', 'Tautoni', and 'Thayerae'. Rooting of

these cultivars was improved 15 to 40 percent overall with the addition of bottom heat.

2) The bottom heat system produced a higher quality, more densely rooted cutting than the non-heated ground bed system. This difference was especially evident with cultivars we listed as problem rooters. With easily-rooted types, such as *T.* × *media'* 'Wardii', 'Runyan', 'Hicksii', 'Densiformis', 'Henry', 'Berryhill', and *T.* × *cuspidata*, the difference was less obvious. This qualitative difference was carried through into the liner stage as a larger top and root mass on 3-year liner types in almost every cultivar tested. Even the easy-to-root cultivars that were virtually similar as rooted cuttings, were comparably better quality 3-years later under the bottom heat system. The distinct advantage of the bottom heat system is greatly augmented by bed planting in the fall vs the spring planting of unheated cuttings. It appears that the fall planting of bottom-heat-rooted cuttings allows root systems to take hold in the fall and begin growing more quickly the following spring. This increased growth the following year was noted by Gouveia (1) in reference to fall planting vs. spring planting.

3) As a result of trials run on bottom heat of many cultivars of unstripped taxus cuttings, we found non-stripping was preferable to stripping. This was not found to be the case in non-heated ground beds and we continue to strip all cuttings done in that method. The obvious benefit was the labor savings realized in non-stripping. In addition, some cultivars were visually more densely rooted non-stripped than stripped (*T.* × *media* 'Tautonii' and 'Amherst') when compared. However, thin stemmed (*T.* × *media* 'Slavin') or a heavily branched cultivar (*T.* × *media* 'Densiformia') require extra care to get them securely into the medium when non-stripped. Cuttings of upright growers, such as *T.* × *cuspidata* 'Columnaris' and *T.* × *media* 'Hicksii', when non-stripped develop branches lower and may produce fatter liners at the base that tend to be a problem in their production.

4) The bottom heat method concentrated the roots more densely around the base of the rooted cutting, while non-bottom heated cuttings exhibited rooting up the stem on many cultivars. These higher roots are troublesome and labor must be spent removing them when liners are dug prior to field planting. If they are not removed, these surface roots are cut off quite severely in field harvest and cause a lower quality balled and burlapped product.

DISCUSSION

Bed survivability from fall planting of bottom heat cuttings has been variable from year to year. Losses have been generally greater than our spring-planted losses of 5 to 15% for unheated cuttings. Previously, we seeded oats in the fall beds as a cover-crop to protect the cuttings the first winter, but the debris and required clearing off of beds in the spring have caused problems. Currently, we are using a Bowie Straw Blower, Model W4-1770, to blow spoiled straw over these beds to a 2-in. depth as a protective mulch and weed inhibitor. We also preferably plant easier-to-root cultivars in the fall which seem to establish better, with lower losses. The first winter in the fall planting system is definitely the greatest challenge to the success of this method. More research needs to be done at this stage of the production system to improve the success of this method.

A promising variation of the bottom heat method is a return to the shortened 6-month production cycle of November sticking, rooting, then out-planting to beds in May. In spring-planted tests of *T.* × *media* 'Hiti', 'Tautonii', 'Chadwick', and 'Everlow', from the first year onward in liner beds, the 6-month bottom heat exhibited equal or larger top and root systems than the 18-month unheated ground bed cuttings. These 6-month trials survived the first winter with normal losses without shading or mulching the first year. The 18-month unheated cuttings planted the same time had higher losses from heaving due to less than sufficient root systems produced without bottom heat. All of these harder-to-root cultivars are now rooted on bottom heat. These 6-month bottom heat cuttings were not as large at any stage in the beds as the fall-planted 9-month bottom-heated cuttings stuck the previous year. However, their comparative quality, high survivability, and simplicity of maintenance may outweigh the benefits of the fall planting method. Larger trials are being conducted on this method for next spring focused on the harder to produce cultivars.

In summary, the overall advantage in quality of the final liner is better with the bottom-heated cuttings, whether planted in spring (6-month) or in fall (9-month), as compared to the non-heated cuttings 18 month liner. However, the quality differential on many cultivars may not warrant or necessitate production on costly bottom heat. Based upon in-house trials in the facilities available at your own nursery, both methods may be used successfully for production of high quality liners.

It is interesting we have come back full circle to re-exploring the original method of taxus propagation we used in the early 60s (7), but with a greater knowledge and improvements to those techniques. Many of these methods and improvements in our propagation system have been due largely to the wonderful sharing of the IPPS whose many members over 27 years helped make our newly-born nursery successful. This Society is indeed a special organization.

LITERATURE CITED

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BRUCE BRIGGS: What hormone and what concentrations do you use?

DAN STUDEBAKER: Wood's Rooting Compound at a 1:3 or 1:5 v/v, dilution or 1:2, v/v, for the most difficult types.

BRUCE BRIGGS: Just a comment. Your results show how a hormone does not work without bottom heat.

MICROPROPAGATION OF *OXYDENDRUM ARBOREUM*

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Abstract. Micropropagation and acclimatization of *Oxydendrum arboreum* (L.) DC. (sourwood) is described. Explants were axillary shoots forced from dormant stems of a mature tree, or nodal stem sections obtained from spring growth of the same tree. Optimum shoot growth was obtained with WPM supplemented with 0.4 to 0.8 mg/l zeatin. Shoots could be divided and subcultured after 6 weeks. Microcuttings were rooted on WPM supplemented with 0.5 to 2 mg/l IBA, or in peat/vermiculite after treatment with 0.8% IBA in talc. Mist, plastic bags, and a wet fabric tent were compared for acclimatization and promotion of normal stomatal functioning. The wet tent appeared to promote the most rapid acclimatization.

REVIEW OF LITERATURE

Oxydendrum arboreum (sourwood, sorrel, or lily-of-the-valley tree) is an attractive, slow-growing tree native to the eastern and southeastern United States, that has considerable value for use in the landscape. While *Oxydendrum* can be propagated easily from seed, there are significant variations in growth habit, flowering characteristics, and fall color. Cuttings are difficult to root (3). *Oxydendrum* is a member of the Ericaceae. It was considered to be a