NURSERY TREATMENTS ALTER ROOT MORPHOLOGY OF 1+0 NORTHERN RED OAK SEEDLINGS

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Abstract—Poor root growth is frequently associated with poor planted northern red oak seedling establishment and performance. Therefore, we determined if several nursery treatments resulted in differences in northern red oak seedling characteristics, particularly in root systems, which might increase rapidity of growth after outplanting and thus improve regeneration success. The treatments we chose were undercutting after two flushes of growth and dipping germinated seed in either low concentration (2,000 ppm) or high concentration (8,000 ppm) K-IBA prior to planting. Each of these has been reported to alter number of first-order lateral roots and/or their distribution along the taproot. However, reports of these treatments compared were not found. Half-sib seed from each of two mother trees were planted either in the fall 1992 (control and undercut treatments) or in the spring 1993 (auxin dipped seed treatments) at Wilson State Forest Tree Seedling Nursery in Boscobel Wisconsin (43N lat., 90W long.). The mother trees were located in Nicolet National Forest (SS1) and in Chequamegon National Forest (SS2) in northern Wisconsin. Seedlings in the undercut treatment were undercut at 15 cm depth when seedlings were approaching the end of the second flush of growth. Seedlings were lifted at 20 cm depth after one season of growth in April 1994. They were characterized by height; numbers of permanent first-order lateral roots on the upper and lower 10 cm of the taproot; diameters at-, 10 cm below-, and 2 cm above- root collar.

Taproot length and distribution of lateral roots along the taproot were significantly impacted by treatment. Auxin, especially high concentration, shortened taproot length and increased the proportion of lateral roots in the upper 10 cm of the taproot. However, total number of first-order lateral roots was not significantly different among cultural practices for either seed source. Root collar diameter as well as stem diameter (2 cm above root collar) was impacted by both seed source and treatment. For SS1, high concentration auxin treatment resulted in smaller diameters than control or undercut treatments. In contrast, control seedlings displayed smaller diameters compared to other treatments for SS2, although the difference was only significant for undercut versus control comparison. Taproot diameters (10 cm below the root collar) were decreased by auxin treatment and increased by undercutting. Shoot height was not significantly affected by any treatment for either seed source. We also quantified the number of growth flushes; however, this was uniform among seed sources and treatments as observed in the past over a broader range of conditions.

Thus, root morphology can be manipulated by undercutting and auxin treatments. These treatments appear to alter the root system with less impact on the shoot system of the seedling. Seedling height was not impacted although both root collar diameter and stem diameter were altered by the treatments for at least one seed source. Further, such influences on the shoot were modified by seed source whereas root diameter was dependent only on treatment. Undercutting and auxin treatments alter the distribution of first-order lateral roots along the taproot without impacting the total number of lateral roots. The impacts of these differences in root morphologies on outplanting performance and seedling establishment is being tested.

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