POPULUS ROOT SYSTEM MORPHOLOGY DURING PHYTOREMEDIATION OF LANDFILL LEACHATE

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Using *Populus* for phytoremediation of wastewaters, including landfill leachate, is necessary in North America because of increased municipal solid waste generation. *Populus* species and hybrids are ideal for such applications because of their high water usage rates, fast growth, and extensive root systems. Adventitious rooting (i.e., lateral rooting from primordia and basal rooting from callus) of *Populus* is important for phytotechnologies to ensure successful plantation establishment with genotypes that thrive when irrigated with highly variable or specific contaminants. We evaluated differences in root system morphology following establishment with high-salinity municipal solid waste landfill leachate or uncontaminated well water (control). *Populus* clones (NC13460, NC14018, NC14104, NC14106, DM115, DN5, NM2, NM6) were irrigated during 2005 and 2006 in northern Wisconsin and tested for differences in morphology of lateral and basal root types, as well as fine (0 to 2 mm), small (2 to 5 mm), and coarse (> 5 mm) roots. Across treatments and clones, trees averaged 5 roots per root type. Leachate-irrigated trees had 88 percent (lateral) and 106 percent (basal) more roots than those irrigated with water, yet the leachate:water ratio for number of basal roots ranged from 0.5 (NM2) to 2.5 (NC13460). Presence of fine roots with leachate was 97 percent of water irrigation, while trees with leachate had 113 percent (small) and 90 percent (coarse) as many roots versus water. The leachate:water ratio for number of lateral and basal coarse roots ranged from 0.4 (NC14018) to 1.2 (NC14106, NM2) and 0.5 (DM115) to 2.7 (NC14104), respectively. Despite root necrosis and regrowth in 23 percent of the trees, leachate irrigation did not negatively affect root diameter or dry mass ($P > 0.05$). Given that adequate rooting is necessary for plantation establishment, leachate and similar wastewaters are viable irrigation and fertilization sources of *Populus* crops used as feedstocks for biofuels, bioenergy, and bioproducts.

KEY WORDS: poplar genetics, phytotechnologies, tree improvement, waste management, adventitious rooting

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