

## Using Low Energy X-ray Radiography to Evaluate Root Initiation and Growth of *Populus*

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*Populus* roots have been studied less than aboveground tissues. However, there is an overwhelming need to evaluate root initiation and growth in order to understand the genetics and physiology of rooting, along with genotype × environment interactions. The Plant Root Visualization and Characterization System (PRVCS; Phenotype Screening Corporation, Seymour, TN, USA) is a novel imaging technique for non-destructive root studies using low energy x-rays to characterize roots as the plants develop. We compared the PRVCS with traditional rooting study methods to test whether the x-ray technique had validity for rooting studies of *Populus*. Our objective was to compare root initiation and growth between trees grown in traditional media (i.e. sand and peat + vermiculite) with those grown in substrates having low- and medium-water retention properties (LWR, MWR, respectively). We grew four trees of *Populus* clones DN70 (*P. deltoides* Bartr. ex Marsh. × *P. nigra* L.), NC14104 (*P. deltoides* × *P. suaveolens* Fischer subsp. *maximowiczii*), and NM6 (*P. deltoides* × *P. suaveolens* subsp. *maximowiczii*) in each of the four media and harvested the trees at leaf plastochron index of nine. Height, leaf area, and total dry mass were determined for all trees, while eleven and six rooting traits were examined for those grown in traditional media and substrates, respectively. Root systems in the substrates were imaged using the PRVCS. Trees grown in the substrates exhibited 70% of the leaf area of those grown in the traditional media, while rooting in the substrates was <50% of the sand and peat + vermiculite. Despite differences in magnitude of root length and number of roots, clonal ranking was consistent between traditional and x-ray analysis methods. The PRVCS yielded rooting data that were fundamentally similar to traditional methods (despite magnitude differences), which validated its potential to increase our fundamental knowledge of *Populus* root systems.



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