

POTENTIAL CHLORIDE AND SODIUM UPTAKE FOR 2- TO 11-YEAR-OLD *POPULUS* IRRIGATED WITH LANDFILL LEACHATE IN THE NORTH CENTRAL UNITED STATES

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In the north central United States, regulators and resource managers need information about wastewater-applied chloride (Cl^-) and sodium (Na^+), as well as the response to these salts of *Populus* genotypes grown over an entire rotation. In this study, we have combined our 2-year establishment biomass and salt uptake field data with previously published regional field test biomass data to estimate uptake potential and field-scale application thresholds for years 2 to 11 of a *Populus* rotation. Our objective was to estimate uptake of Cl^- and Na^+ throughout a rotation, with emphasis on developmental stages that tolerate increased application rates of high-salinity irrigation without environmental consequence. Mid-rotation projected uptake was stable for years 2 and 3 but increased from years 3 to 6. Estimated cumulative uptake was maximized during year 6 when clonal responses ranged from 22 to 175 $\text{kg Cl}^- \text{ ha}^{-1} \text{ yr}^{-1}$ and 8 to 74 $\text{kg Na}^+ \text{ ha}^{-1} \text{ yr}^{-1}$. The estimated annual uptake for clones was highly variable and dependent on specific clone $\times$ site interactions. Annual uptake during year 6 ranged from 8 to 54 $\text{kg Cl}^- \text{ ha}^{-1} \text{ yr}^{-1}$ and 3 to 23 $\text{kg Na}^+ \text{ ha}^{-1} \text{ yr}^{-1}$. Full-rotation plantation uptake mirrored mean annual growth in forest trees with the greatest projected uptake during 4 to 9 years (Cl^-) and 4 to 8 years (Na^+). Annual uptake was maximized during year six for Cl^- (32 $\text{kg ha}^{-1} \text{ yr}^{-1}$) and Na^+ (13 $\text{kg ha}^{-1} \text{ yr}^{-1}$) when peak accumulation was 2.7 times greater than year 11. We present salt uptake estimates along with stages of plantation development that are conducive to variable Cl^- and Na^+ application and that are necessary for decision-making required by regulators, resource managers, and researchers who must achieve regulatory compliance while maintaining ecological sustainability.

KEY WORDS: salt accumulation, poplar, wastewater recycling, sustainable forestry, short-rotation woody crops

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