Ecological Sustainability of Alternative Biomass Feedstock Production for Environmental Benefits and Bioenergy

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The incorporation of intensive forestry with waste management fills a much-needed niche throughout numerous phytotechnology applications. There is a growing opportunity to incorporate sustainable recycling of waste waters as irrigation and fertilization for alternative biomass feedstock production systems. However, the success of short rotation woody crops is largely based upon the selection of genotypes that are productive on the sites where they are deployed. Given the inherent genetic variability within the genus *Populus* and the availability of clonal material beyond what is typically used, our current research activities include revising and combining crop and tree improvement protocols (i.e. using phytorecurrent selection) to select favorable *Populus* genotypes that perform well across a variety of contaminants (generalists) or that can be used for specific concerns (specialists). The information presented highlights the results of numerous studies where we tested the: 1) establishment success of growing the trees for both environmental benefits and bioenergy, 2) efficacy of using waste water effluent including landfill leachate to fertigate bioenergy crops, 3) uptake of nutrients/contaminants into tree root, woody (stems + branches), and leaf tissue, and 4) environmental impact of waste water fertigation on soil and water quality. This collective effort helps scientists and resource managers acquire information about genotype × contaminant interactions that contribute to deployment of closed loop energy systems that are ecologically sustainable, while the general public maintains environmental quality and the natural resource base on which local and regional agriculture, forestry, and recreation depend.

Keywords: hybrid poplar, phytoremediation, *Populus*, tree improvement, waste management

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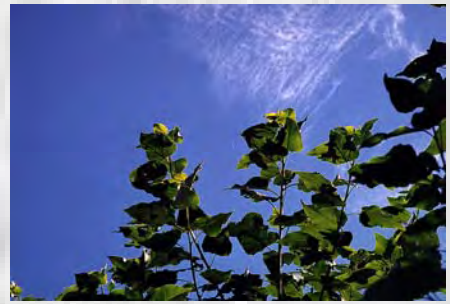

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