# GENETICS OF YIELD AND BIOMASS COMPOSITION OF SHRUB WILLOW BIOENERGY CROPS BRED AND SELECTED IN NORTH AMERICA

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Fast-growing shrub willow is a proven bioenergy crop in Europe and is being adopted commercially in regions of North America. Breeding and selection of shrub willows adapted for field conditions in North America have been conducted at SUNY's College of Environmental Science and Forestry since 1998. From more than 2,000 individuals produced through breeding in 1998 and 1999, a number have been selected for improved biomass yield in two field trials with small, replicated plots. A comparison of first- and second-rotation yield results from these trials will be presented, demonstrating that the yield of a number of varieties exceeded that of the best current production variety, 'SV1'. The highest mean yield in these small plots was 40 percent higher than that of 'SV1', which typically yields 4 to 5 dry tons $ac^{-1}$ $yr^{-1}$. A selected number of these high-yielding varieties have been scaled-up and planted in yield trials established using production-style spacing on several sites in the United States, Canada, and Northern Ireland to evaluate yield potential across a range of environmental conditions. To encourage commercial deployment, seven varieties were patented and have been licensed to a nursery for commercial scale-up and sale of planting stock. Current and future work is focused on characterizing the genetic basis for differences in biomass composition among diverse high-yielding varieties. High-resolution thermogravimetric analysis has been used to characterize the chemical composition of biomass harvested from more than 100 varieties in the SUNY-ESF breeding program. Initial characterization of willow genes encoding key enzymes in lignin, cellulose, and hemicellulose biosynthesis will be presented.

KEY WORDS: cellulose, lignin, molecular biology, *Salix*, thermogravimetric analysis, wood composition

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