CANOPY STRUCTURE, LIGHT INTERCEPTION, AND LIGHT-USE EFFICIENCY IN WILLOW

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According to the light-use efficiency model, differential biomass production among willow clones may be attributed to either the differences in the amount of light intercepted, or the efficiency with which the intercepted light is converted to aboveground biomass, or both. We tested this model on a second-rotation willow coppice in its first growing season at an existing genetic selection trial at Tully, NY. We investigated the variation in aboveground biomass production (AGBP) in relation to the percent incoming radiation intercepted ($IPAR_F$) and light-use efficiency (ε) for five willow clones grown in a short-rotation woody crop (SRWC) system. The study was conducted during a 2-month period (June 15 to August 15, 2001) when growing conditions were deemed most favorable. The objectives were to: (1) assess the relative importance of $IPAR_F$ in explaining variation in AGBP; and (2) identify the key drivers of variation in ε from a suite of measured leaf and canopy-level traits. We hypothesized that variation in AGBP would be more closely related to $IPAR_F$ than ε and that ε variation would be closely related to traits that maximized canopy photosynthesis. AGBP varied nearly threefold among genotypes (3.55 to 10.02 Mg ha^{-1}), while ε spanned a twofold range (1.21 to 2.52 g MJ^{-1}). At peak leaf area index (LAI), $IPAR_F$ ranged from 66 percent to 92 percent. Nonetheless, AGBP was strongly related to $IPAR_F$ and ε. An additive model combining photosynthesis on leaf area basis, leaf mass per unit area, and light extinction coefficient produced the most compelling predictors of ε. The results suggest that in a post-coppice willow, the ability to maximize $IPAR_F$ and ε early in the growing season is advantageous for maximizing biomass production. From these clonal differences, productivity and yield improvements can be achieved by selection of superior genotypes in the short-rotation coppice system.

KEY WORDS: aboveground biomass, *Salix* sp., short-rotation woody crops

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