# EVALUATING GROWTH EFFECTS FROM AN IMIDACLOPRID TREATMENT IN BLACK WILLOW AND EASTERN COTTONWOOD CUTTINGS

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Black willow (*Salix nigra* Marsh.) and eastern cottonwood (*Populus deltoides* Bartram ex Marsh.), two species native in the Lower Mississippi Alluvial Valley, have importance in short rotation woody crop (SRWC) systems for biomass production (Ruark 2006). For these tree species, the cottonwood leaf beetle (*Chrysomela scripta* Fabricius) is one of the most serious pests of young trees in nurseries and plantations (Anonymous1989). Defoliation during infestations by this beetle is documented to impact height growth of cottonwood in newly established plantings (Coyle and others 2002). Nebeker and others (2006) reported significant reductions in a measure of volume production of approximately 50 percent after two growing seasons occurring in untreated trees as compared to trees protected from insect damage by using chemical control. Losses of this magnitude indicate a risk to the economic viability of SRWC, and the use of a treatment to control potential loses may be advisable. Applied as a safeguard against possible insect infestations, the establishment practice of treating cuttings prior to planting with the systemic insecticide, imidacloprid, is recommended (Bayer CropScience 2009). Besides the benefits of insect control, there are reports of enhanced growth rates in material treated with imidacloprid, with effects extending into a second growing season (Robison and Rousseau 2007). Growth enhancement may be due to modified physiological processes expressed in both stressed and optimal nutrient and water regimes (Chiriboga 2009). Enhanced growth of cuttings treated with imidacloprid could offset the cost of this treatment and enhance the economic viability of SRWC production.

In spring 2010, an operational experiment designed to examine SRWC production systems and harvest methods was initiated in Ouachita Parish, Louisiana (USDA FS-SRS-4155-2011 study plan on file. Center for Bottomland Hardwoods Research, 432 Stoneville Road, Stoneville, MS 38776). That experiment included both black willow and eastern cottonwood cuttings. A standard treatment with imidacloprid was included in the protocol as a common practice for preparation of all cuttings prior to planting in order to provide protection from defoliation by cottonwood leaf beetle. Approximately 40,000 cuttings of each tree species were treated according to protocol. Black willow cuttings, collected in the winter and stored under water for several weeks, were produced from whips of naturally regenerated willow collected adjacent to the Holt Collier National Wildlife Refuge near Hollandale, MS. Eastern cottonwood cuttings were produced immediately from freshly collected whips of Texas clone S7C8 grown by Big River Nursery, Winnsboro, LA. After production, all cuttings were kept refrigerated until needed for planting. Shortly before planting, cuttings were treated with a particular formulation of imidacloprid applied according to the label instructions as a 24 hour soak of 16 fluid ounces per 100 gallon solution for the partially hydrated black willow cuttings or a 24 hour soak of 8 fluid ounces per 100 gallon solution for the unhydrated eastern cottonwood cuttings (Bayer CropScience 2009).

In order to examine the magnitude of enhanced growth rates that may derive from this imidacloprid treatment of cuttings, a study was initiated in Stoneville, MS. This study, ancillary to the operational experiment, examined the height growth and basal area production of black willow and eastern cottonwood plantations established in May 2010. A small, random selection of cuttings was obtained from those produced

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**Table 1—Growth analysis following second-year growing season for plot-level average tree height (H) and plot-level total basal area production (B) comparing cuttings treated prior to planting with a 24 hour soak in an imidacloprid solution versus untreated controls. Average tree height was calculated for surviving trees only, and total basal area production is summed over surviving trees effectively assigning zero growth to those that died during the study. Note that total basal area is not expressed per unit area. A positive treatment difference indicates that the treatment mean is greater than the control**

| Species | Analysis variable | Overall mean | Treatment difference | Treatment MS | Error MS | F-test significance level |
|---|---|---|---|---|---|---|
| Willow | H (*feet*) | 13.89 | -0.57 | 0.49874 | 0.00537 | 0.0108 |
| | B ($feet^2$) | 0.81 | -0.10 | 0.01460 | 0.01580 | 0.4378 |
| Cottonwood | H (*feet*) | 17.70 | 0.32 | 0.15681 | 0.22032 | 0.4877 |
| | B ($feet^2$) | 1.15 | 0.15 | 0.03302 | 0.06326 | 0.5451 |

according to protocol for the operational experiment, as well as a selection of cuttings that were not treated and held in reserve to be used as controls (300 cuttings for each species for each treatment). With each species examined in independent trials, the experimental design was a randomized complete block with two treatments (control and imidacloprid treated) and three replications. Each experimental unit was composed of 100 cuttings, planted on a 20 by 5 rectangular pattern with 5 feet between planting spaces in both dimensions. Following each growing season, all tree heights and diameters at breast height (4.5 feet) were obtained. Following the second growing season, insect damage ratings were assessed by recording the presence/absence of shoot tip damage and dieback of the season's terminal growth.

The analyses of the measurements obtained in October 2011 following the second growing season are reported here. The incidence of insect damage was unremarkable in the first growing season based on casual assessments throughout the season. During the second growing season, cottonwood leaf beetle was absent or present only at very low levels. For the insect damage assessment, in both species there were no differences among treatments. Populations of defoliating insects have a high level of variation in spatial and temporal occurrence, and at this location during the conduct of this study, populations were very low. This condition should provide for an unconfounded comparison of enhanced growth due to the physiological impacts of the imidacloprid treatment, in the absence of any growth impacts due to defoliation. The only statistically significant result (at $\alpha = 0.05$) was obtained for the average height of black willow trees, with the untreated control plots having a 6.84 inches taller height than the average in treatment plots (table 1). This increase is not considered to be of a practical magnitude. The basic conclusion is that using imidacloprid under operational constraints may not provide enhanced growth performance, though trees were not considered to be stressed at any time during the two growing seasons and defoliation was not problematic.

## LITERATURE CITED


Anonymous. 1989. Insects and diseases of trees in the South. 1997 reprint. Protection Rep. R8-PR16. Atlanta: U.S. Department of Agriculture Forest Service, Southern Region. 98 p.

Bayer CropScience. 2009. Poplar/cottonwood cuttings/whip application recommendations. ADMIRE® PRO systemic protectant label: 62.

Chiriboga, A. 2009. Physiological responses of woody plants to imidacloprid formulations. Columbus, OH: The Ohio State University. 130 p. M.S. thesis.

Coyle, D.R.; McMillin, J.D.; Hall, R.B.; Hart, E.R. 2002. Cottonwood leaf beetle (Coleoptera: *Chrysomelidae*) defoliation impact on *Populus* growth and above-ground volume in a short-rotation woody crop. Agricultural and Forest Entomology. 4: 293-300.

Nebeker, T.E.; Stone, W.D.; Beatty, T.K. 2006. Impact of herbivory by cottonwood leaf beetle on three selected cottonwood clones: year 2 results. In: Connor, K.F., ed. Proceedings of the 13th biennial southern silvicultural research conference. Gen. Tech. Rep. SRS-92. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station: 420-423.

Robison,T.L.; Rousseau, R.J. 2007. Cottonwood leaf beetle control with imidacloprid soaked cuttings. In: Buckley, D.S.; Clatterbuck,W.K., eds. Proceedings, 15th central hardwood forest conference. e-Gen. Tech. Rep. SRS-101. [CD-ROM]. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station: 198-205. http://www.treesearch.fs.fed.us/pubs/27398. [Date accessed: December 5, 2011].

Ruark, G. 2006. Woodys have biomass potential. Inside Agroforestry. 15(3). Lincoln, NE: U.S. Department of Agriculture, National Agroforestry Center: 3, 11.