# FOREST PRODUCTS
Project Fact Sheet

## PRODUCTIVITY OF HIGH-YIELD HARDWOOD SPECIES: BIOCHEMICAL REGULATION OF CROWN ARCHITECTURE

### BENEFITS

- Overcome a major constraint on hardwood fiber production
- Allow more trees to be grown at closer spacings
- Delay onset of competition-induced growth decline
- Enhance economic viability of biomass energy systems
- Increase use of environmentally sustainable renewable resources
- Leverage research on fiber production with ongoing cooperative research among government, industry, and research organizations (e.g., DOE's Biofuels Feedstock Development Program)

### APPLICATIONS

The fundamental knowledge gained from this research will have near-term application in the forest products industry.

## Research at the Molecular Level Will Help Optimize Forestry Practices

A goal of the forest products industry is to optimize the cultural methods and practices of certain fast-growing hardwood tree species to obtain maximum fiber production. For example, a major constraint on the productivity of the eastern cottonwood (Populus deltoides) is broad and diffuse lateral branching that results in poor crown form and inhibited growth in trees that are closely spaced. After two years of early rapid growth, cottonwood clones in plantations often go into a period of declining growth rate as the canopy closes and the stands stagnate. However, inherent clonal differences among interspecific hybrids can be exploited to achieve narrow-crowned clones that will maintain high fiber production despite close tree spacings. Also, since variations occur among clones in how the crown form is altered as canopy closure occurs in a stand of trees, there are opportunities to vary the forestry management practices and take advantage of these differences.

An understanding of the biochemical regulation of crown architecture and its relation to fiber productivity will be invaluable to industry. Such knowledge will allow forestry managers to direct future breeding strategies toward highly productive clones for tree plantations.

A goal of the selection of narrow-crowned clones for the Southeast that remain highly productive throughout the rotation, as represented by this TxD hybrid growing in the Pacific NW.

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ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

## PROJECT DESCRIPTION

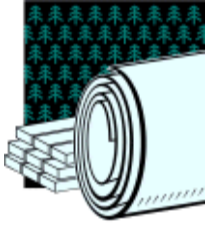
**Goal:** To provide basic scientific information to support the forest product industry's attempt to optimize cultural methods/practices for maximum fiber production.

In order to gain a basic understanding of fundamental plant processes, studies must be carried out over multiple growing seasons; this project is scheduled to last for five years.

Several plant growth regulators (PGRs) are thought to be important in determining crown form: indole-3-acetic acid, which inhibits lateral bud release, and cytokinins, which promote the release of buds from apical suppression. Using poplar pedigrees, the production of auxin and cytokinin will be determined and related to the release of lateral buds on elongating shoots. The study will determine the biochemical regulation of branching and its relationship to the long-term capacity of trees and the stand to maintain fiber production.

## PROGRESS & MILESTONES

- The objectives of the research are 1) a mechanistic understanding of how plant growth regulators influence crown form and therefore productivity; 2) an assessment of PGRs and crown form as canopy closure occurs in a stand; and 3) an assessment of the suitability of growing pure, hybrid, and backcross eastern cottonwood clones at close spacing in plantations in the Southeast.
- Data will be taken from multiple pedigrees to determine if the PGR profiles that correlate with bud release and crown form are universal or restricted to the pedigrees where they were generated.
- Analysis of clones over multiple growing seasons will clarify how the overall crown architecture was established, and correlate biochemical signals with a given crown form.



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