Tree Genetic Engineering Research Cooperative

Oregon State University

Forest Biotechnology: modifying trees to meet the wood and environmental needs of a growing world

A National Science Foundation Industry/University Cooperative Research Center since 1999

Center Mission and Rationale

The Tree Genetic Engineering Research Cooperative (TGERC) seeks to develop genetic technologies based on research in plant molecular biology that are likely to have application to forest industries. Key research themes are genetic control of flowering, environmental analysis of transgenic plantations, and use of gene transfer for functional genomics. Research projects are focused on poplars (cottonwoods and aspens) and eucalyptus as commercial objects and scientific models.

TGERC levers member contributions more than 40-fold through joint member support, through major institutional resources from Oregon State University, and from a number of federal competitive grants. Recent grants for TGERC-associated projects have been obtained from the State of Oregon and the United States Department of Agriculture, Department of Energy, Environmental Protection Agency, Forest Service, and National Science Foundation. Regular members of TGERC contribute to research through financial and in-kind contributions. They help to direct research, receive early notification of research results, and obtain intellectual property benefits. Associate members make in-kind contributions but do not provide financial support or receive intellectual property benefits.

Regenerating transgenic poplars in a Petri dish.

Research Products

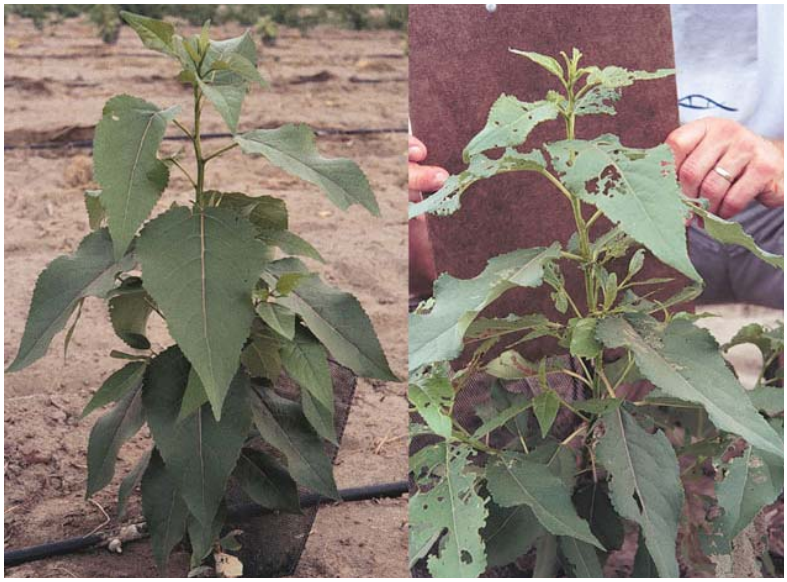
- ***Non-flowering trees***. Six new genes that play key roles in flower development have been isolated and tested in transgenic plants. They will be useful for engineering male- and female-sterile trees, facilitating regulatory and public approval of transgenic plantations.

- ***Gene flow from plantations***. The extent of gene flow from hybrid plantations to the wild is being studied and used to predict the effects of deploying fertile and sterile transgenic trees with new traits. These analyses are critical for regulatory approval of engineered plantations.

- ***Gene transfer method***. An *Agrobacterium*-based method was developed that is effective on a variety of commercial lines of hybrid cottonwoods. It has been used to generate over 2,000 lines of transgenic poplars and over 20 field trials of transgenic trees.

- ***Enhanced transgene expression***. A matrix attachment region placed near to genes demonstrated the ability to enhance the rate of transformation, and the level of gene expression, in aspens and cottonwoods. This improves the efficiency of trait delivery in transgenic trees.

- ***Roundup® resistant trees***. Two hundred lines of transgenic aspens and cottonwoods were generated and their tolerance to herbicide studied at three field sites. A number of the lines have demonstrated high levels of



Two trees from an experimental planting in eastern Washington, USA. Pictured on the left is a BT-engineered tree resistant to beetle damage, and on the right a susceptible non-transgenic tree.

Expression of the poplar LEAFY gene, useful for control of flowering, in a young floral bud of black cottonwood.

tolerance and no detectable growth loss after multiple Roundup® applications.

- ***Insect resistant trees***. One hundred lines of transgenic aspens and cottonwoods were generated that contain a synthetic gene from the cry3a strain of *Bacillus thuringiensis*. All of the lines showed strong resistance to the cottonwood leaf beetle — a devastating pest of poplars — and enhanced growth rate.

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