

Researcher uses genetics to help tree production

By Kim Griffiths
Reporter

Creating a million plants from a single plant embryo sounds like a florist's dream, but to a forest specialist with the Texas Agricultural Extension Service, new plant biotechnology techniques are helping to radically shorten the time needed to improve forests and forest products.

A recent study by the USDA forest service indicated a growth in the demand for forest products is expected to nearly double by 2030.

"Forest yield is strongly dependent on the genetic improvement of forest trees, which for Texas means more drought-tolerant plants," says Dr. R.L. Newton, physiologist with the Agricultural Extension Service.

"However, the long generation time of trees has hindered progress of even the most modern breeding programs."

Harvest cycles of forests are typically 20 to 100 years or more.

Gene-splicing and tissue culture technologies offer a way to circumvent the long generation cycles while producing genetically superior plants able to sustain the drought-like Texas climate.

In dry years, the mortality rate for tree seedlings at East Texas sites may exceed 60 percent, making water deficits the single greatest drawback for Texas' agricultural economy.

Biotechnology research by Newton in cooperation with the Texas Forest Service is shortening the period required to test pines for drought resistance.

"We are trying to determine if selection for drought tolerance can be predicted in very early stages of plant development," Newton said.

The tests are being done on six families of the loblolly pine species, the chief wood source in Texas.

"Through close collaboration with forest service geneticist, professor Johannes van Buijtenen, we have found three families of loblolly pine to be drought-tolerant and three drought-sensitive, in the field," Newton said.

"A rapid laboratory procedure called tissue culture using cloning techniques enables us to evaluate large numbers of seed sources in 8 to 10 weeks."

This cloning process calls for the scientist to place the faster growing seeds into a hormone enriched agar media where it produces from 50 to 100 cotyledon calluses each capable of producing a single tree.

Each callus is then placed in a liquid media where about 18 will reach the "shoot and root" stage. Gene transferring or splicing techniques can then be used to help select for highly drought-tolerant characteristics.

"The efficiency of gene transfer is not very high and is restricted to only a few host systems," Newton said, "but in the next five years or so, improved tissue culture methods will provide for rapid propagation of genetically superior trees."

"Recent similar studies have been done in this lab in collaboration with Dr. R.H. Smith on a sorghum system and results show a large accumulation of the amino acid proline in drought-tolerant callus, just as in the whole plant systems."

"This may ultimately help to understand the role of genetic control in the tolerance mechanism, not just in loblolly pines, but in other plants as well."

"Such understanding is an essential prerequisite to success in genetic engineering of trees and other higher plants," Newton said.

Superior trees which have already been selected for drought tolerance and rapid growth characteristics can then be propagated quickly in large numbers and used as planting stock in special sites.

Because it takes a pine 10 to 15 years just to produce seeds, biotechnology techniques, such as tissue culture should reduce a tree improvement cycle by a decade or more.

"The significance lies in our ability to eventually double both the production and volume of current forest lands with higher quality lumber and therefore meet unprecedented future demands for forest products," Newton said.



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