Genetic approaches will aid development of higher biomass-yielding, sustainable trees for bioenergy feedstocks

July 1 2016

Scientist inspects poplars grown for use in bioenergy feedstocks research. Credit: US Department of Energy

Large, fast-growing poplar trees and other woody plants are desirable starting points, or feedstocks, for producing transportation fuels. The challenge is that the wood-forming materials resist chemical breakdown. Overcoming this recalcitrance is a main goal in bioenergy feedstocks research. Scientists took on this challenge by examining how gene regulatory networks control a plant's resistance to breakdown. They developed two new methods to understand the recalcitrance of woody material.

These approaches will expedite molecular genetics protocols in the model woody plant and bioenergy feedstock, the western balsam poplar or Populus trichocarpa, and facilitate essential genome-wide studies of wood formation and biomass productivity. The methods should broadly apply to other woody species, enabling comparative analyses of the evolution of genetic regulation and modifications relating to or arising from nongenetic influences. Understanding these processes will aid efforts to develop higher biomass-yielding feedstocks.

The first method developed by the researchers, who were funded by the U.S. Department of Energy Genomic Science program, reveals systematic and extensive modification of the chromatin immunoprecipitation (ChIP) procedure. This widely used process for identifying chromatin-associated DNA-protein interactions in nonwoody plants and animals will make the procedure usable for the first time with wood-forming tissues. The team also identified genome-wide specific transcription factor–DNA interactions associated with the regulation of wood formation. The second method describes new higher-yielding, faster isolation and transfection processes for obtaining high-quality protoplasts from the wood-forming tissue of P. trichocarpa. Protoplasts are useful for transient transgene expression–based studies, particularly for woody plants that are difficult to genetically transform and for which mutants are unavailable.

More information: Ying-Chung Lin et al. A simple improvedthroughput xylem protoplast system for studying wood formation, *Nature Protocols* (2014). DOI: 10.1038/nprot.2014.147

Provided by US Department of Energy