Plants with Altered Pectin and Lignin Biosynthesis and with Improved Growth and Recalcitrance

TECHNOLOGY CA-SEA
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INVENTORS

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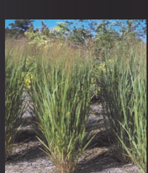

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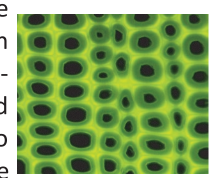
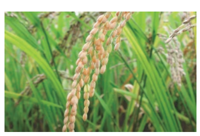
Introduction

There is increasing interest in the use of biomass for biofuel production as an environmental friendly and socio-economically responsible fuel alternative. Bioenergy originates biomass generated by CO_2 fixation by land plants. Approximately 70% of plant biomass is estimated to be present in plant cell wall .As we are currently using only 2% of plant cell wall-based biomass, there is a great opportunity to use this valuable resource as a raw material for the production biofuels and commodity chemicals . The plant cell wall provides mechanical support to the plant and contributes to plant growth and development. Carbohydrates, proteins and phenolic (e.g., lignin) compounds are the major components in the plant cell wall with cellulose, hemicellulose and pectin comprising the major polysaccharides in the wall. Pectins, are enriched in the primary wall of dicot plants, are essential for plant growth, development, signaling, and cell adhesion and have diverse structural characteristics that greatly contribute to wall function. The goal of using bioenergy crops for bio-ethanol production in the United States is well established. However, cost effectiveness is one of the major limitations for this industry and intimately associated with biomass recalcitrance caused in part by lignin, pectin and xylan. The major barrier is the cost of the bacterial and fungal enzymes needed to degrade the plant cell wall. Therefore, an approach to find good candidate recalcitrance genes which can be modified to produce genetically modified plant cell walls from which sugars can more easily be released, and thus, which would serve as raw materials for bio-ethanol industry, is key for greatly reducing the amount of enzymes, chemicals and/or energy demand used to circumvent biomass recalcitrance.



Summary

Dr. Mohnen's group at The University of Georgia has identified a clade of genes that are associated with the control of the biosynthesis of both pectin and lignin (and possibly xylan). Mutations of these genes in certain plants (including switch grass and *Populus*) lead to considerable reduction of recalcitrance (*v.* wild type) , as shown by means of bacterial degradation of modified biomass. Furthermore, *Populus* plants bearing some of these mutations have exhibited a considerable increase in height and stem diameter (*v.* wild type). Plants bearing these mutations may prove suitable for economically viable extraction and use of carbohydrates from plant cell wall, as recalcitrance is greatly reduced and rate of overall growth of modified plants increases.



Advantages and Some Potential Applications

- Sustainable and viable use of biomass as source of biofuels and commodity chemicals from fermentative processes
- Production of biomass with reduced recalcitrance
- Increased yield of carbohydrates from biomass
- Increased growth rates (thus of amount of biomass/mass/year) reflected in both height and diameter of plants
- Modifications have been tested in different species of plants, with similar results

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