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Higher Yielding Biomass Plants Developed Utilizing Newly Discovered Cell Wall Structures and Proteins

TECHNOLOGY CASE
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Introduction

Biomass is a renewable resource that has shown promise to reduce dependence on petroleum based fuels. However, the cost of biomass-based fuels historically has not been competitive relative to oil or other energy resources. Most biomass initiatives for increasing the conversion rate of biomass to biofuel focus on modifying cell wall components, which have traditionally been viewed as a complex interaction of cellulose, hemicellulosic and pectic polysaccharides. A major barrier in converting biomass into fuels is that a plant's cell walls have built up a natural protection to microbes and enzymes that are used to break apart these cell wall structures to free up sugar resources.

In contrast, the researchers have invented a transgenic plant that has decreased recalcitrance and increased plant stem and root growth, which will directly translate into higher volumes of convertible sugar. Transgenic plants are defined as having at least one genetic modification that results in an altered expression of a coding region. The researchers were able to create an improved plant species after first making several key scientific discoveries pertaining to plant cell walls.

Foremost, the researchers identified novel plant cell wall structures in which cell wall pectin and hemicellulose glycans are linked to structural proteins such as arabinogalactan protein (AGP) and extensin/proline-rich protein AGP protein hybrids. More specifically, the researchers identified a new complex proteoglycan from Arabidopsis cell walls, APAP1 (Arabinoxylan-Pectin-Arabinogalactan Protein1), which consists of pectin and arabinoxylan glycan modules covalently linked to an arabinogalactan protein AGP57C.

This new research suggests a complex proteoglycan network in plant cell walls. This different view of cell wall attributes has enabled a new pathway for the development of techniques and transgenic plants with higher biomass potential. The manipulation of AGPs will produce more degradable plant biomass for biofuel production. Furthermore, the invention allows for the prediction of novel genes, genes combination, novel mutants and variants that can lead to additional transgenic plants.

Summary

The researchers have created transgenic plants, which have a higher biomass potential given increased plant size. The new plants also have a decreased resistance to enzymes, which in turn will decrease the cost of converting the plant into biofuel. The new framework allows for understanding cell wall synthesis better, and subsequently enables the creation of more transgenic plants.

Advantages and Some Potential Applications

- The invention of higher yielding transgenic plants will directly increase the efficiency of converting biomass into biofuel.
- The discovery can enable the creation of additional transgenic plants for more effectively converting biomass into biofuel.
- The technique allows for the prediction of novel genes, gene combinations, mutants, and variants for more economical biofuel production.