Inventions & Innovation Project Abstract

Plant Phenotype Characterization System

Functional genomic research is required in order to accelerate the improvement of plants used for biofuels, biopower, biochemicals, carbon sequestration, and materials. Functional Genomics is characterized by high throughput or large-scale experimental methodologies combined with statistical and computational analysis of the results. It is not unusual for thousands of samples to be studied in order to deduce the function of a single gene. For example, RIEKEN has announced a 60,000 plant campaign for their studies of the model plant, Arabidopsis.

The ability to analyze plant root structure and function in a timely, cost efficient manner is critical to meeting DOE Biomass Program goals. There is no existing high throughput technology today that supports plant root characterization.

Our objective is to develop a high-throughput, nondestructive, noninvasive root characterization system based upon low-voltage digital x-ray radiography. In order to meet our objective we will develop special plant substrate material, plant containers, and x-ray radiography image processing algorithms.

We will achieve our objective by consulting with experts in the areas of plant physiology and polymer chemistry to define and achieve the properties necessary for polymer substrates and containers. Initial proof of concept work has shown that we can grow plants in low density polymer substrates and containers suitable for low energy x-ray radiographic imaging. Using prototype growth media/containers we will conduct growth and imaging trials at the Institute for Agriculture, The University of Tennessee using plant samples provided by Sponsor Arborgen, LLC. X-Ray radiography and image analysis will be provided by Sponsor Industrial Analytics Corporation. Dr. Stan Wullschleger of Oak Ridge National Laboratory will serve as a consultant representing the needs of the DOE Biomass research community to our project.

Our project will primarily enable “output trait” and “value-added trait” transgenic products. These products are more complicated to develop as they involved mutiple metobolic pathways. Instrumentation which allows for gene function identification, such as ours, will accelerate the development of these products. Typical DOE desired energy related traits include increase biomass yield per acre, increase BTU content per pound of product, and lower energy processing cost per pound of product.

Our technology is an enabling technology for the DOE Biomass Program. The effect of the application of this technology will be to accelerate progress in a wide range of genetic modification programs, of which biomass is one. We believe that research acceleraton can produce overall improvements in the range of 30 percent.

Contact

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