UWM RESEARCH FOUNDATION

Technology Overview

New Methods for Creating Male and Female Sterile Plants as well as Restoring Fertility
OTT#1459

TECHNOLOGY

The inventors have developed a unique and efficient strategy to create both male and female sterile Arabidopsis and tobacco plants. The method is extremely unique because unlike most techniques, this method does not interrupt plant growth and development and also allows for plant fertility to be restored.

The method includes the SDS::SDS-BARNASE system which can specifically ablate pollen and megaspore mother cells. Megaspore and pollen mother cells are two small groups of reproductive cells, which are differentiated after all floral organs are established. Ablating pollen and megaspore mother cells only leads to elimination of male and female gametes, but it does not affect differentiation of any other somatic cells and flower development. The SDS gene encodes a meiosis-specific cyclin. The SDS protein is exclusively present in pollen mother cells in anthers and megaspore mother cells in ovules. Therefore, the SDS-BARNASE fusion protein does not create any toxicity in other cells or tissues. To restore plant fertility, they invented the inducible artificial microRNA system (ER::amirBARNASE), which produces the artificial microRNA to inhibit the BARNASE expression.

Transgenic trees (e.g. poplar, eucalypts, and pines) and grasses (e.g. miscanthus and switchgrass) may provide a valuable resource for wood production, biofuels, bioremediation, and many other applications. This research will make commercial uses of those transgenic plants possible.

FEATURES/BENEFITS

- **Male and Female Plant Sterility –** This system allows for sterility of both sexes.
- **Reversible –** Plant fertility can be restored
- **Uninterrupted Growth –** there is no interruption of plant growth and development when using this method.
- **Non-Toxic –** Specific to pollen mother cells and does not cause toxicity in other tissues.
- **Versatile –** Can be utilized in specific transgenic crops or ornamental plants where fruit production is unwanted.

INTELLECTUAL PROPERTY

A U.S. Provisional Patent Application was filed in 2015.

This technology is part of an active and ongoing research program and is seeking partners for development of the final product. It is available for developmental research support/licensing under either exclusive or non-exclusive terms.

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MARKETS

In 2014, the global area of biotech crops continued to increase for the 19th year at a sustained growth rate of 3 to 4% or 6.3 million hectares (~16 million acres), reaching 181.5 million hectares or 448 million acres (Figure 1). Biotech crops have set a precedent in that the biotech area has grown impressively every single year for the past 19 years, with a remarkable 100-fold increase since the commercialization began in 1996. Thus, biotech crops are considered as the fastest adopted crop technology in the history of modern agriculture.

In 2014, a total of 18 million farmers planted biotech crops in 28 countries, wherein over 94.1% or greater than 16.9 million were small and resource-poor farmers from developing countries. The highest increase in any country, in absolute hectarage growth was US with 3 million hectares. In summary, during the period of 1996 to 2014, biotech crops have been successfully grown in accumulated hectarage of 1.78 billion hectares (4.4 billion acres).

INVENTOR

Dave (Dazhong) Zhao

Dave Zhao is currently an Associate Professor of Biological Sciences at the University of Wisconsin-Milwaukee. He received his Ph. D from the Institute of Botany, Chinese Academy of Sciences. His lab has a long-term goal of understanding the molecular mechanisms regarding cell differentiation and plant development using molecular genetic, cell biological, and systems biology approaches. Dr. Zhao continues to work on the technology stated above as well as developing new projects in flower development of other plant species.

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Please reference: OTT ID. 1459

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