Nitrate-Responsive Synthetic Promoter Produces Nitrate-Regulated Gene Expression in Plants

Tech ID: 19949 / UC Case 2010-073-0

BACKGROUND

Inorganic nitrogen is a vital nutrient for plants. Soil nitrate provides as much as 90 percent of the nitrogen taken up by most plants and leads to a dramatic change in gene expression, which is critical to direct the productivity and survival of the plant. Consequently, nitrate is commonly provided by way of fertilizer to improve crop yield. However, many crop plants are inefficient in their ability to utilize the nitrogen. For example, corn and wheat typically only utilize 50 percent of the nitrogen applied to the soil and paddy rice may recoup as little as 30 percent. Nitrogen not used by crops may contribute to severe environmental problems, including pollution of ground water, run-off into nearby bodies of water, and release of greenhouse gases into the atmosphere. Plants take up and assimilate nitrate in response to its availability in the soil and the demands of the plant, but with varying efficiency among species. Understanding and improving the ability of particular plant species to respond to and utilize nitrogen could therefore lead to increased crop productivity and decreased water and air pollution.

TECHNOLOGY DESCRIPTION

UC San Diego investigators have developed a synthetic nitrate-inducible promoter (NRP), which is acutely responsive to nitrate levels in the soil. When fused to DNA encoding a protein or RNA and then inserted into transgenic Arabidopsis plants, this synthetic promoter will express the RNA or protein at levels in direct correlation with the amount of nitrate the plant is exposed to. This promoter has been successfully used to identify genes and elements important for nitrate responsiveness.

APPLICATIONS

- This promoter could be used in commercially relevant food crops to discover critical genes important to the productivity and survival of the plant.
- This synthetic NRP could also be utilized to drive transgene expression in GM crops in a nitrate inducible manner.
  - Driving the expression of genes determining the efficiency of nitrogen utilization and other nitrate responsive pathways will allow for engineering increased efficiency of nitrogen utilization and improved crop productivity.
  - Improved crop responsiveness to soil nitrate would lead to lower requirements for toxic fertilizers and reduce the impact of crop fertilization on contamination of the water and air.

RELATED MATERIALS

- A Genetic Screen for Nitrate Regulatory Mutants Captures the Nitrate Transporter Gene NRT1.1. Wang R, Xing X, Wang Y, Tran A, Crawford NM. Plant Physiol. 2009 Sep;151(1):472-8.
- Published Patent Application: NITRATE-RESPONSIVE PROMOTER (International Publication Number WO 2011/028929)

INTELLECTUAL PROPERTY INFO

This technology is available for licensing in the U.S. A commercial sponsor for product development is sought.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,927,807	01/06/2015	2010-073

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OTHER INFORMATION

KEYWORDS

nitrate-inducible promoter (NRP), transgene expression, nitrate-regulated gene expression, nitrogen utilization, improved crop productivity, soil nitrate, nitrate regulatory mutant, nitrate transporter gene, plant physiology, fertilizer, increased crop productivity, decreased water, air pollution

CATEGORIZED AS

- **Agriculture & Animal Science**
  - Plant Traits
  - Transgenics
- **Research Tools**
  - Expression System
  - Nucleic Acids/DNA/RNA
- **Materials & Chemicals**
  - Agricultural

RELATED CASES

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