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Genetically modified endophyte with biofertilizer potential

A genetically modified bacteria (G. diazotrophicus) that is an established plant endophyte and releases high amounts of ammonium when grown on simple sugars

Technology No. 2023-058

IP Status: PCT Pending; **Application #:** PCT/US2023/079189

Applications

- Biofertilizer

Key Benefits & Differentiators

- **Increased nitrogen release:** Gene deletions result in elevated extracellular ammonium
- **Reduced nitrogen loss:** Microbe is an established endophyte with a number of plants
- **High stability:** Modified endophyte forms endophyte-root associations in plant hosts

Technology Overview

The Haber-Bosch industrial process, which produces the majority of conventional fertilizers, requires high energy consumption and significantly contributes to carbon emissions. As a result, environmentally friendly and sustainable alternatives to Haber-Bosch-derived conventional fertilizers are in high demand. As biofertilizers, microbes act as nitrogen-producing biological factories that support plant growth in a sustainable manner.

Researchers at the University of Minnesota have genetically modified the bacteria strain, *Gluconacetobacter diazotrophicus*, which is an established plant endophyte. Compared to the wild-type strain, the modified endophyte produces elevated levels of extracellular ammonium to promote growth. The endophyte property reduces the potential for nitrogen loss, commonly occurring in conventional fertilizers. Demonstrated in the lab, this modified endophyte forms endophyte-root associations in agriculturally relevant crops such as wheat, pennycress, and tomato. These associations support plant growth and have also been reported in the literature to form in many other plant strains. Lastly, this modified endophyte was demonstrated in the

lab to support the growth of an algae strain, *Chlorella sorokiniana*, which is unable to fix nitrogen and is used as a surrogate to mimic the interaction with higher plants. This modified endophyte has commercial potential for wide-scale application across many different agricultural crops as a biofertilizer that can be applied to seeds, plant surfaces, or soils to promote plant growth and lower the requirement for conventional fertilizers.

Phase of Development

TRL: 3-4
Proof of concept, genetically modified endophyte is stable/functional and has been confirmed to support the growth of the plant surrogate, *Chlorella sorokiniana*. It has been confirmed to form endophyte relationships with wheat, pennycress, and tomato plants.

Desired Partnerships

This technology is now available for:

- License
- Sponsored research
- Co-development

Please contact our office to share your business' needs and learn more.

Researchers

- **Brett Barney, PhD** Associate Professor, Department of Bioproducts and Biosystems Engineering
- **Neil Olszewski, PhD** Professor, Department of Plant and Microbial Biology