CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

S1809

Project Title

A Novel Strategy for Augmented NUE: The Use of Actinomycetic Transmembrane Metabolism in Agricultural Crops: Year 3

Abstract

Objectives/Goals

Nitrogen Use Efficiency (NUE) is of major concern to growers, especially to those who farm in semi porous soils. Actinomycete bacterium is found in many types of soil, but most concentrated in organic compost. Worm fecal matter is of high quantity of these useful bacteria, which assists in immobilization in the nitrogen process, as well as supplies nitrogen into the mass flow in the soil system. This study was performed to determine if the NUE can be increased when affected by the addition of pinpointed microorganisms found in worm feces.

Methods/Materials

The affects of Actinomycete additives on nitrogen use efficiency were assessed under controlled open conditions in a 12 week growth trial, with UN-32 (TRT 1) and UN-32 plus microorganism liquid (TRT 2) applied to 162 short rooted Lactuca sativa (Romaine Lettuce) and Brassica oleracea (Green Commit Broccoli). The worm feces was turned into liquid form through a system known as bacterium cultivation: a 72 hour process by which microorganisms are put under ultimate conditions for production, and then applied as an alternative water source during nitrogen treatments.

Results

Confidence intervals for the Romaine Lettuce (TRT 1: (0.40575, 0.72592) μ = 0.565 ó = 0.204, TRT 2: (0.255579, 0.56254) μ = 0.409 ó = 0.1954) and Green Commit Broccoli (TRT 1: (0.06312, 0.21369) μ = 0.1409 ó = 0.087, TRT 2: (0.11619, 0.26381) μ = 0.19 ó = 0.0827) root and leaf biomass testing proved the resulting yield for the crops which received the UN-32 and microorganism liquid to be greater than the crops which received UN-32. T-tests for Broccoli provided more evidence that the microorganism solution positively affects nitrogen use efficiency.

Conclusions/Discussion

An optimum confidence interval and standardized z-score suggested that the use of Actinomycete bacterium to transport nitrogen, utilizing their near undistinguishable cell wall, is a viable solution to inadequate NUE; resulting in a 38% NUE efficiency increase for broccoli, and a 43% NUE efficiency increase for lettuce.

Summary Statement

By pinpointing Actinomycete bacterium, and cultivating it in liquid form, I created a microorganism solution that increases nitrogen-use-efficiency in short rooted agricultural crops by 38-43%.

Help Received

Used lab equipment and facility at Research for Hire Agricultural Research Farm under the supervision of John Corkins