Name(s)

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Project Number

J1805

Project Title

Validating Novel Algorithm-Generated Crop Rotations: A Second Year Study

Abstract

Objectives

My research aims to validate the effectiveness of algorithm-generated crop rotations that I found last year.

Methods

Previously, I wrote an algorithm in C++ that found crop rotations based off of a self compiled database of nutrients crops consume and produce. I tested three algorithm-generated crop rotations against respective controls (the same crop planted four times consecutively). Each crop rotation or control has four, three-week stages, one for each crop in the rotation. I am able to compare the 4th stage of each crop rotation with the 4th stage in the respective control to see whether the crop rotation is successfully conserving nutrients in the soil. All other variables such as light and temperature were kept constant.

Results

The experiment shows a drastic decrease in height over time in both corn and cabbage controls. This data demonstrates the problem of nutrient depletion and the need for crop rotations.

Corn rotation 1 outperforms the control in all three measurements. In addition, Corn rotation 2 outperforms the control in two out of the three measurements. The p-value from a student T TEST on stage 1 heights and stage 4 heights continues to support my hypothesis.

For cabbage, data on average heights and germination success rates show that there is no significant difference between the control and the crop rotation. This hints that cabbage may not be affected by crop rotations and is not a significant producer or consumer of nutrients.

Conclusions

Both of my algorithm-generated corn crop rotations outperforms the control significantly which supports my hypothesis. Results for cabbage crop rotations did not show significant differences between the rotation and the control. However, because of the exemplary performance of both corn crop rotations, I conclude that my algorithm-generated crop rotations are able to solve for the problem of nutrient depletion and ultimately, the usage of chemical fertilizers. I was able to show the potency of my crop rotations. My research suggests that successful crop rotations can be generated using an algorithm.

Summary Statement

I showed that my algorithm-generated crop rotations can successfully conserve nutrients in the soil.

Help Received

My mentor Ms. Peng from The Harker School gave me tips on the structure of my experiment. An email exchange with Prof. Ehrhardt from Stanford University, Dr. Telenko, and Dr. Nielson from Purdue University provided insights on corn diseases and crop rotations.