Team Number: LAHS72
School Name: Los Alamos High School
Area of Science: Agriculture
Project Title: Hydroponic subsistence agriculture: Commercial vs. Individual in New Mexico

Interim Report

In spanish colonial times, acequias were the main form of agriculture in New Mexico, supplying all of the communities food without importing food. As of 2005, 3 million acre feet/year of water was consumed to produce agriculture- 78% of the total water supply in New Mexico.[1] An additional $4 billion dollars of food was imported into New Mexico just as of 2010.[2] And by 2050 the earth will be home to as many as 10 billion people[3], a population that the present food system cannot not reach. Because of New Mexico's poor economy, it will need to be prepared to self provide for its citizens in the future. This project looks into the effects of administering a commercial agricultural system in New Mexico to decrease imports or whether or not individuals would be able to produce enough food for themselves and create a surplus.

Scaling the commercial farming down to a small household system. The same idea for both scales, investing at the beginning to gain more in the end. The experiment with hydroponics should produce more product per resource input compared to conventional farming. That means conserving water, no pesticides, and producing more abundant food than any other form of farming besides hydroponics. The goal of the computer program is to find out if money can be saved over long term and making Santa Fe a self-sustaining city in terms of producing food.

The pictures below show the work that was done to physically model a hydroponics system in a greenhouse. It was built to determine how much water can be saved by using a hydroponics system compared to conventional farming techniques as a control variable. It will also be used to test other variables such as time, quality, quantity of plant growth, and energy consumed. The hydroponics system is expected to save copious amounts of water, but it will consume more energy because of the water pump running almost continuously. The expectation is that the benefit of the need of less water will outweigh the negative consumption of energy required by the water pump. Because the hydroponics system in the greenhouse will save water, it will be beneficial to a city like Santa Fe because the city lacks water but has much more availability to energy through solar power. The hydroponics system will serve as the agent model for this project. So far, the project consists of a successful model of a hydroponics system growing lettuce and a model of traditional farming methods growing the same species of lettuce. No computer modeling has been worked on thus far, but the project will be completed using a python code. The computer program will use certain variables described previously, to predict water and energy consumption, as well as the amount of imports and exports in the county of Santa Fe in a fully operational greenhouse based on past data. For instance, we will change specific variables in the code, including water input, energy consumption, output of food, size of the city to support the greenhouse, and the population of the city.

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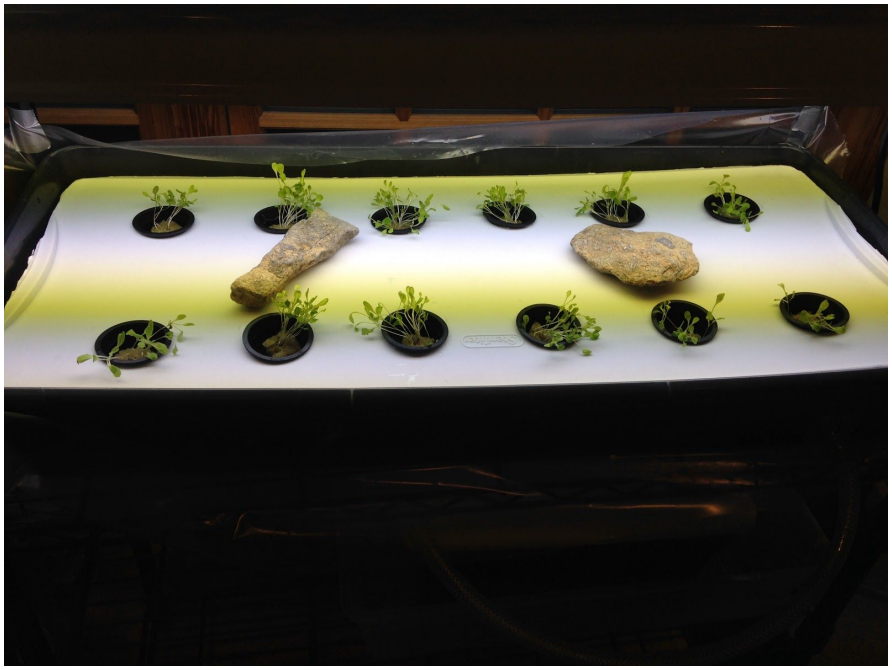

Figure 1 Shows the Model Green House

Figure 2 Illustrates the Model of Conventional Farming Methods