Aeroponic production of lettuce promotes biomass and root growth in comparison to hydroponic production methods.

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INTRODUCTION

- Hydroponics: Roots are grown in an inert substrate then suspended in a nutrient rich solution.
- Aeroponics: Roots are suspended in the air where nutrient dense aerosol droplets are sprayed onto the roots at timed intervals.

METHODS

- 10 *Lactuca sativa* 'White Boston' plants grown for 53 days
- Standard hydroponic fertilizer used for both systems
- Growth parameters and water use taken weekly
- Fresh and dry weight taken at maturity
- Dried plant samples used for nutrient analysis

Aeroponic System

- An Arduino Mega Microcontroller controls the pump
- Spray intervals
  - Seedling stage: 30 sec on 4-min off
  - Vegetative stage: 30 sec on 8-min off
  - Mature stage: 30 sec on 6-min off

Hydroponic System

- Deep Water Culture

OBJECTIVES

- Develop and build a working aeroponic system
- Compare aeroponic and hydroponic lettuce production systems

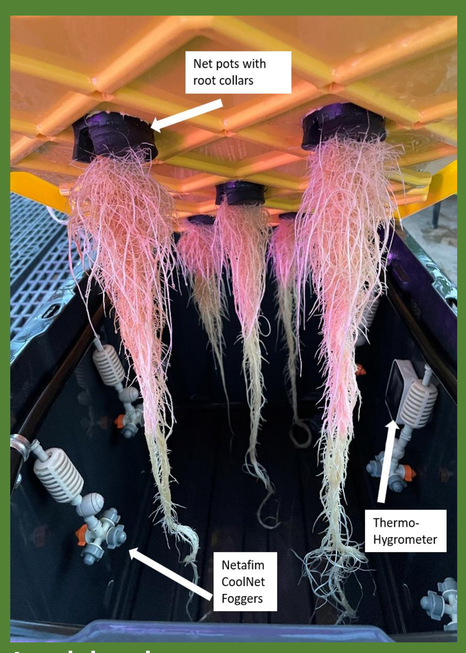
Figure 1. Experimental design setup of aeroponic and hydroponic systems.

Scan the QR Code to **view a video** of how the aeroponic system works.

Lettuce grown in an **aeroponic system** produced **double the yield** when compared to a **hydroponic system**

Hydroponic Lettuce:
Week 5
Fresh Weight: 67g

Aeroponic Lettuce:
Week 5
Fresh Weight: 211g



Inside the aeroponic rooting chamber

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RESULTS

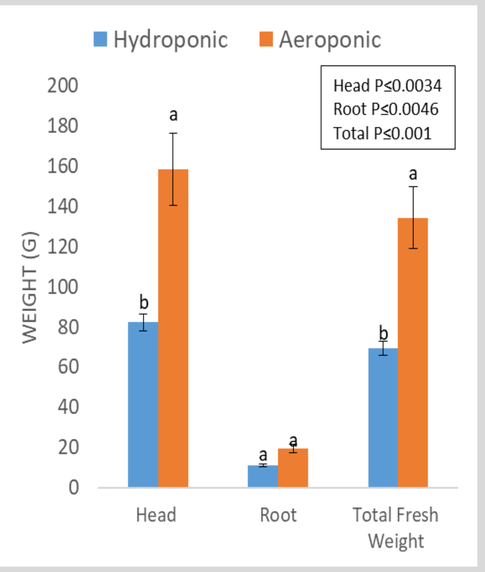

Figure 2. Average fresh weight at harvest. Aeroponic treatment produced double the amount of head weight.

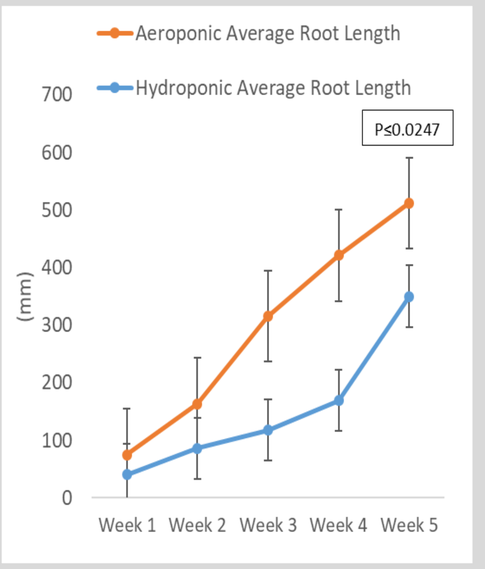

Figure 3. Average root length for each week of growth.

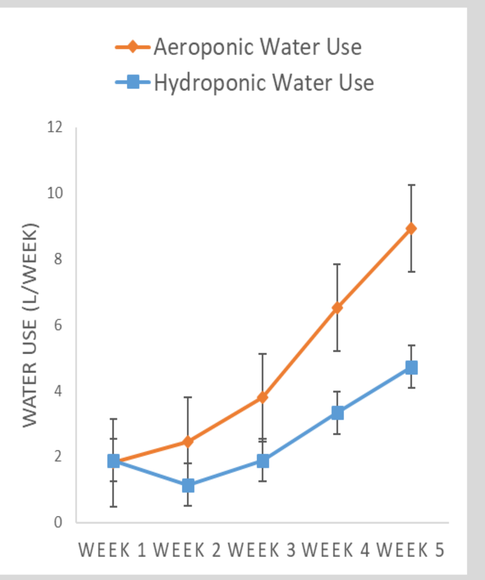

Figure 4. Weekly water consumption for each system.

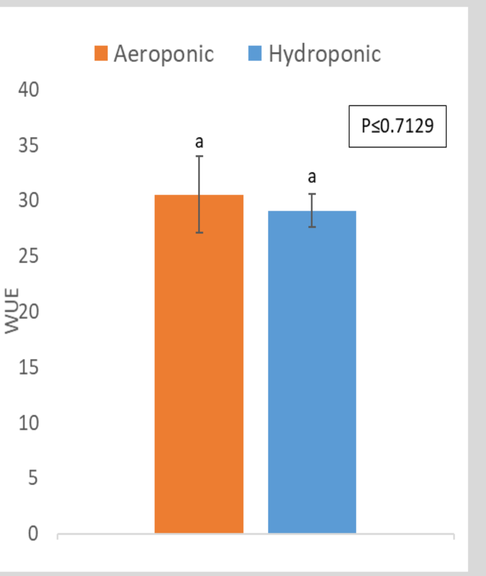

Figure 5. Water use efficiency shown to be higher in the aeroponic treatment.

Abstract

As the world population increases and the amount of arable land decreases, controlled environment agriculture (CEA) could serve as a solution for this impeding problem. CEA utilizes mainly soilless production systems that allow the grower to apply the exact nutrient concentration and water needed by the plant to the root zone in the form of a diluted solution over a scheduled period. Hydroponics and aeroponics are some examples of soilless production systems. The objectives of this study were to build and design an aeroponic system and deep-water hydroponic system then compare the two production systems through lettuce production. Ten *Lactuca sativa* cv. 'White Boston' seeds were sown into rock wool and grown for 53 days until they reached maturity. It was observed that the aeroponic system produced double the amount of biomass and more extensive root systems when compared with the hydroponic system. Nutrient concentrations were very similar between both the aeroponic and hydroponic systems; however, sulfur (S), zinc (Zn), and iron (Fe) were found in significantly higher amounts in the aeroponic system. This could be attributed to the larger overall root mass in the aeroponic system. Water use efficiency was numerically higher in the aeroponic system; however, the aeroponic system used double the amount of water than the hydroponic system did. This was expected because the aeroponic system produced double the yield and needed more water to produce that biomass. Overall, the aeroponic system outperformed the hydroponic system when growing lettuce. More research needs to be done to determine how well the aeroponic system compares to a hydroponic system when scaled up to a commercial size.