

Abstract

In the past few decades, world agriculture food industry faced many rising challenges, including farmland degrading, soil contamination, labor and transportation cost increase, land shortage, demographic change, and resource depletion. Soilless culture is becoming more common and hydroponic cultivation stands out for its increased productivity, enhanced efficiency, and economic and environmental sustainability. In order to optimize a hydroponic system, this study implemented and experimented on different forms of hydroponic systems for lettuce and basil production with different environmental variables control, including nutrient solution, lighting, water flow, and control system. Vertical dripping system with piping, vertical dripping system with tower setup, and horizontal nutrient film technique system are three system designed, experimented, and analyzed. Results have shown that a minimum light intensity is required in all stage of growth, including seedling, and that additional lighting benefits growth and a higher yield. Nutrient solution has been developed and optimized in commercial application and literature is quite adequate, and the increase of certain element only affects taste of grown plants. Inconsistency is inherent in the system due to the water and nutrient uptake, and due to lighting exposure and position of different samples.

Keywords: soilless culture, hydroponics, sustainability, energy consumption, LED lighting, lettuce, basil