CLSU International Journal of Science and Technology
www.clsu-ijst.org
ISSN 2507 -9638 (online)

The CLSU International Journal of Science and Technology was previously published as CLSU Scientific Journal since 1965.

Relationships of Water Quality Parameters for Hydroponic Production of Kale *(Brassica oleracea)* with In-Ground Passive Cooling System

Charlotte Joy Aprisun P. Catigday; Chito F. Sace, Vitaliana U. Malamug, and Christopher S. Pascual.

Department of Agricultural and Biosystems Engineering, College of Engineering, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines

Email for correspondence: catigdaycharlotte@yahoo.com

Submitted: January 26, 2023. Accepted: June 15, 2023. Published Online: August 31, 2023.

Abstract

Greenhouses in Philippines are encountering high ambient air temperature problem. Along with this, the water quality directly affects the growth, development and yield of hydroponically grown plants. This study was conceptualized through the principle of cooling the nutrient solution that will effectively regulate plant's growth and yield with relatively low investment and easier management. One of the essential elements of a functional hydroponics system is water quality monitoring, hence this study utilized a monitoring system for water quality parameters. Nutrient solution was closely monitored to maintain and ensure that nutrient levels are not too low to inhibit growth and not too high to be potentially toxic. The study was conducted to develop a monitoring system for environmental and water quality parameters of in-ground passive cooling system for hydroponic production of kale. Specifically, the study aimed to determine the relationships of water quality parameters such as pH, EC, TDS, and temperature for kale production, compare the performance of an in-ground passive cooling system (IGPCS) and without cooling system (Control) on hydroponically grown kale, and to evaluate the water productivity of the in-ground passive cooling system. This study utilized both in-ground passive cooling system (IGPCS) and control (without cooling system) to compare its performance based on the growth and yield of the kale, and to determine the water productivity of utilizing IGPCS. In addition, water quality parameter such as pH, EC, TDS, and temperature were closely monitored using the installed monitoring system, and relationships of these water quality parameters were established. The gathered data were analyzed using trend analysis in Microsoft Excel, Analysis of variance (ANOVA) was computed in Completely Randomized Design (CRD) and comparison among means were compared using Least Significant Difference (LSD) Test at 5% level. Results revealed that EC and TDS of nutrient solution are inversely proportional to pH and temperature of nutrient solution, moreover EC and TDS are directly proportional, also with pH and temperature of nutrient solution. The performance of the IGPCS and without cooling system is comparable with growth and yield of kale in terms of leaf length, leaf width, number of leaves, weight and yield at harvest, but are significantly affected by the location of growing pipes where crops received less and ample amount of sunlight. Since the temperature of IGPCS was reduced up to 3°C, kale plants with cooling system uptake less water compared to without cooling system and results to higher productivity. Therefore, regulating one of the water quality parameters directly affects other water quality parameters, so relationships of these water quality parameters were established through close monitoring of water quality parameters using the monitoring system. Utilization of IGPCS reduced the temperature of the nutrient solution up to 3°C which gave higher yield (44.01 g/plant) than without cooling system (41.18 g/plant). Kale production in tropical areas can have higher yield using the in-ground passive cooling system that reduced water consumption, resulting to higher productivity.

Keywords: in-ground passive cooling; water quality; hydroponics; kale; water productivity