

**HOUSEHOLD PRODUCTION OF CILANTRO (*Coriandrum sativum* L.)
USING A WICK SYSTEM**

CRISTIAN B. FIGURACION

An Undergraduate Thesis Submitted to the Faculty of the Department of Agricultural
Engineering, College of Engineering, Central Luzon State University,
Science City of Muñoz, Nueva Ecija, Philippines
in Partial Fulfillment of the Requirements
for the Degree of

**BACHEOR OF SCIENCE IN AGRICULTURAL
AND BIOSYSTEMS ENGINEERING
(AB Land and Water Resources Engineering)**

JULY 2023

TABLE OF CONTENTS

	PAGE
LIST OF TABLE	viii
LIST OF FIGURES	ix
LIST OF APPENDIX TABLES	x
LIST OF APPENDIX FIGURES	xi
ABSTRACT	xii
INTRODUCTION	1
Background of the Study	1
Statement of the Problem	3
Objectives of the Study	4
Significance of the Study	4
Scope and Limitations of the Study	5
Time and Place of the Study	5
REVIEW OF RELATED LITERATURE	6
Hydroponics	6
Wick Hydroponic System	6
Hydroponics Growing Media	7
Perlite	8
Nutrient Solution	9
Characteristics of Cilantro	10
Cilantro Growing Conditions	10
Temperature	11
Spacing	11
Acidity or Alkalinity, pH	11
Electrical Conductivity (EC)	12
Total Dissolved Solids	12
METHODOLOGY	13
Conceptualization of the Study	13

Materials	15
Pre-determination of Growing Media	15
Determination of Wick Density	16
Data Gathering in Determination of Wick Density	16
Total Time of Saturation	16
Water Consumed	16
Rate of Water Delivery	17
Rate of Transmission	17
Experimental Layout of Determination of Wick Density	17
Wick System Setup	18
Cilantro Production	20
Planting	20
Growing	20
Pest and Disease Control	20
Water and Nutrient Management	21
Harvesting	21
Data Gathering in Cilantro Production	21
Water Quality Parameters Monitoring	21
Data Gathering Post Production	22
Stem Length of the Individual Plant	22
Weight of the Harvested Plant	22
Experimental Layout of Cilantro Production	22
RESULTS AND DISCUSSION	24
Wick Density	24
Rate of Water Delivery	24
Rate of Transmission	25
Wick Hydroponic System	26
Water Quality Parameters	27
Electrical Conductivity	27
Total Dissolved Solids	28
pH	29
Water Temperature	30

Cilantro Yield	31
Stem Length	31
Number of Leaves	33
Total Weight	34
SUMMARY, CONCLUSION AND RECOMMENDATION	36
Summary	36
Conclusion	38
Recommendations	39
LITERATURE CITED	40
APPENDICES	43
Appendix Tables	44
Appendix Figures	53

LIST OF TABLE

TABLE		PAGE
1	Materials and purposes	15
2	CAM table of rate of transmission	26
3	CAM table of average stem length of treatments	33

LIST OF FIGURES

FIGURE		PAGE
1	Wick hydroponic system	7
2	Conceptual design of the study	14
3	Experimental layout of wick density	18
4	Top view of the hydroponic setup	19
5	Cross-sectional view of the hydroponic system	19
6	Cotton wick view of the hydroponic system	19
7	Experimental layout of cilantro production	23
8	Average rate of water delivery	24
9	Average rate of transmission	25
10	Wick hydroponic system setup	27
11	Daily average EC measurements	28
12	Daily average TDS measurements	29
13	Daily average pH measurements	30
14	Daily average water temperature	31
15	Average stem length of treatments	32
16	Average number of leaves between treatments	34
17	Average total weight between treatments	35

LIST OF APPENDIX TABLES

APPENDIX TABLE		PAGE
1	Raw data of electrical conductivity collected during cilantro production	44
2	Raw data of total dissolved solids collected during cilantro production	45
3	Raw data of pH collected during cilantro production	46
4	Raw data of water temperature during cilantro production	47
5	Raw data of yield collected after harvest	48
6	Raw data of yield collected after harvest	49
7	Raw data of yield collected after harvest	50
8	Output of one-way ANOVA of average rate of water delivery	51
9	Output of one-way ANOVA of average rate of transmission	51
10	Output of one-way ANOVA of average stem length of treatments	51
11	Output of one-way ANOVA of average number of leaves of treatments	52
12	Output of one-way ANOVA of average total weight of treatments	52

LIST OF APPENDIX FIGURES

APPENDIX FIGURE		PAGE
1	Recording parameters in wicking density (Hour 0)	53
2	Recording parameters in wicking density (Hour 2)	53
3	Recording parameters in wicking density (Hour 4)	54
4	Preparation of nutrient box	54
5	Preparation of growing trays	54
6	10 days after sowing the seeds	55
7	17 days after sowing seeds	55
8	24 days after sowing seeds	56
9	31 days after sowing seeds	56
10	38 days after sowing seeds	57
11	Adding tap water to nutrient boxes	57
12	pH, EC, and TDS measurements	58
13	Initial height measurement	58
14	Harvesting of cilantro	58
15	Harvested cilantro plants at 50 days	59

ABSTRACT

FIGURACION, CRISTIAN B., Department of Agricultural and Biosystems Engineering College of Engineering, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines, **July 2023**, **HOUSEHOLD PRODUCTION OF CILANTRO (*Coriandrum sativum* L.) USING A WICK SYSTEM**

Adviser: ELMAR M. VILLOTA, Ph.D.

A wick hydroponic system uses a fabric thread (cotton or nylon) to absorb water and nutrients from a reservoir, delivering them to plants in pots or trays. *Coriandrum sativum* L., also known as coriander or cilantro, is an aromatic herbaceous annual herb belonging to the Umbelliferae Apiaceae family. Cilantro faces challenges when grown in active hydroponic systems like NFT or drip systems, which are costly and require extensive maintenance, making them unsuitable for most growers. Cilantro's longer maturity period and delicate taproot further complicate its cultivation. To overcome these issues, a study investigated the use of a wick hydroponic system as a more accessible and sustainable method for growing cilantro hydroponically. The main goal of the study is to fabricate a wick hydroponic system for cilantro production. The study aimed to determine the optimal wick density to be used and assess the system effectiveness of growing cilantro in terms of yield.

Complete Randomized Design (CRD) layout was used in determining the wick density. One-way analysis of variance was used to analyze the treatments and means are compared using least significant difference (LSD). Wick density treatments were 2x2 inch (T_1), 3x3 inch (T_2), and 4x4 inch (T_3) with three (3) replications. The experiment assessed the rate of water delivery and rate of transmission. Random Complete Block Design

(RCBD) layout was used to evaluate the wick system. One-way analysis of variance was used to analyze the treatments and means are compared using least significant difference (LSD) Wick system treatments were based on plant spacing: 4-inch spacing (T_1), 3-inch spacing (T_2), and 2-inch spacing (T_3) with three (3) replications.

In the determination of wick density, results showed no significant difference in water delivery rate among the treatments. However, the rate of transmission differed significantly, with 2x2 inch (T_1) performing best with a rate of transmission of 1.08 in/hr. This is due to the lower volume causing increased transmission rates. Thus, a wick density of 1 wick per 2x2 inch area was used.

Throughout the 50-day production period, efforts were made to maintain ideal ranges for Electrical Conductivity (EC) and Total Dissolved Solids (TDS). However, the pH of the nutrient solution continuously increased over time, likely due to nutrient absorption by the growing cilantro plants.

After 50 days, 20 plants were selected from each treatment and replication to harvest for data collection. Stem length showed a significant difference between 4-inch spacing (T_1) and both 3-inch spacing (T_2) and 2-inch spacing (T_3), while no significant differences were observed in average number of leaves and total weight among the treatments.

Keywords: Wick hydroponic system, cilantro, wick density

LITERATURE CITED

- Altine (n.d.). Wick System Hydroponics Pros and Cons and everything you need to know. Retrieved from <https://plantsheaven.com/wick-system-hydroponics-pros-and-cons/>
- Asaduzzaman, Kobayashi, Y., Mondal, F., Matsubara, H., Adachi, F., & Asao, T. (2013). Growing carrots hydroponically using perlite substrates. Retrieved from <https://doi.org/10.1016/j.scienta.2013.04.038>.
- D'Anna, C. (2019). Wick System Hydroponic Gardens. Retrieved from <https://www.thespruce.com/hydroponic-gardens-wick-system-1939222>
- Dao, T. (2021). Best pH and EC Values for Your Hydroponic Nutrient Solution. Retrieved from <https://www.her86m2.com/green-living/best-ph-and-ec-values-for-your-hydroponic-nutrient-solution>
- Drost, D. (2018). Cilantro/Coriander in the Garden. Retrieved from <https://extension.usu.edu/yardandgarden/research/cilantro-coriander-in-the-garden#:~:text=Planting%20and%20Spacing,a%20continued%20harvest%20is%20desired.>
- Eden Green Technology, (2022). Everything You Need to Know About Hydroponic Cilantro. Retrieved from <https://www.edengreen.com/blog-collection/hydroponic-cilantro-guide#:~:text=While%20growing%20your%20cilantro%2C%20keep,40%20and%2075%20C%20B0F>
- Eigenbrod, C., & Gruda, N. (2014). Urban vegetable for food security in cities. A review. Retrieved from <https://link.springer.com/content/pdf/10.1007/s13593-014-0273-y.pdf>
- Folnivic, T. (2021). "Improvements in Agricultural Technology Increase Farm Yields". Retrieved from <https://blog.agrivi.com/post/improvements-in-agricultural-technology-increase-farm-yields#:~:text=With%20advances%20in%20technology%2C%20farmers,improvement%20and%20less%20resource%20use>
- Grant, A. (2022). What Is Perlite: Learn About Perlite Potting Soil. Retrieved from <https://www.gardeningknowhow.com/garden-how-to/soil-fertilizers/perlite-potting-soil.htm>

- Grow Your Health Gardening, (2018). Ideal hydroponic plant TDS range charts. Retrieved from <https://growyourhealthgardening.com/hydroponic-gardening/ideal-hydroponic-ppm-plant-ranges-chart/>
- Hassani, N. (2022). What Is Organic Matter and What Does It Do? The Importance of Organic Matter for Your Garden Soil. Retrieved from <https://www.thespruce.com/what-is-organic-matter-1401911>
- Maher, M., Prasad, M., & Raviv M. (2008). Organic soilless media components. Retrieved from <https://doi.org/10.1016/B978-044452975-6.50013-7>
- Mahr, S. (2017). Cilantro / Coriander, *Coriandrum sativum*. Retrieved from <https://hort.extension.wisc.edu/articles/cilantro-coriander-coriandrum-sativum/#:~:text=Cilantro%20grows%20best%20in%20well,time%20you%20would%20plant%20lettuce>
- Manhart, Sv. (2022). Phenological development of coriander (*Coriandrum sativum* L.) depending on genotype and some meteorological factors. *Bulgarian Journal of Crop Science*, 59(5) 70-74
- Maxim, D. (2014). Perlite toxicology and epidemiology - A review. *Perlite toxicology and epidemiology - A review*. Retrieved from 10.3109/08958378.2014.881940
- McKeil, J. (2020). What is pH and Why Does it Rise? A Complete and Updated Guide. Retrieved from <https://www.happyhydro.com/blogs/growing-cannabis/what-is-ph-and-why-does-it-rise>
- Md. Asaduzzaman, Kobayashi, Y., Md. Mondal, F., Ban, T., Matsubara, H., Adachi, F., & Asao, T. (2013). Growing carrots hydroponically using perlite substrates. *Scientia Horticulturae*, Volume 159, Pages 113-121, ISSN 0304-4238. Retrieved from <https://doi.org/10.1016/j.scienta.2013.04.038>
- Meredith, L. (2022). What Is Cilantro? Retrieved from <https://www.thespruceeats.com/best-ways-to-preserve-cilantro-1327880>
- Meselmani, M. (2021). Nutrient Solution for Hydroponics. Retrieved from <https://www.intechopen.com/online-first/80089>
- Mojares, J. (2013). Urbanization and its effect in the calabarzon area, philippines. Retrieved from https://d1wqtxtslxzle7.cloudfront.net/49191027/Mojares_Urbanization_jgip.pdf?1475098752=&response-content-disposition=inline%3B+filename%3DURBANIZATION_AND_ITS_EFFECT_

IN_THE_CALAB.pdf&Expires=1617779667&Signature=guPBDX9PX0P0Sm
UrRA3iWTRCUHhFAxMe-V5XBMBEMx

- Paarakh, P. (2009). *Coriandrum sativum* Linn. A Review. Pharmacologyonline 3: 561-573 (2009). Department of Pharmacognosy, The Oxford College of Pharmacy, Bangalore 560 078, Karnataka, India.
- Robinson, B. (2019). What Are Hydroponic Systems and How Do They Work? Retrieved from <https://www.freshwatersystems.com/blogs/blog/what-are-hydroponic-systems>
- Shiffler, A. (2023). How to grow cilantro indoors. Retrieved from <https://herbsathome.co/how-to-grow-cilantro-indoors/>
- Trees.com (2022). Hydroponic Growing Media 101 – The Ultimate Guide. Retrieved from <https://www.trees.com/gardening-and-landscaping/growing-media>
- Wei, J., Liu, Z., Zhao, Y., Zhao, L., Xue, T., & Lan, Q. (2019). Phytochemical and bioactive profile of *Coriandrum sativum* L. Food Chemistry, Volume 286, Pages 260-267. ISSN 0308-8146, Retrieved from <https://doi.org/10.1016/j.foodchem.2019.01.171>
- Woodard, J. (2019). What Are Hydroponic Systems and How Do They Work? Retrieved from <https://www.freshwatersystems.com/blogs/blog/what-are-hydroponic-systems>
- Worldometers (2022). World Population. Retrieved from <https://www.worldometers.info/world-population/>
- Xiaotao, D. (2018). Electrical conductivity of nutrient solution influenced photosynthesis, quality, and antioxidant enzyme activity of pakchoi (*Brassica campestris* L. ssp. *Chinensis*) in a hydroponic system. Retrieved from [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6114716/#:~:text=The%20electrical%20conductivity%20\(EC\)%20is,conditions%20%5B7%2C%208%5D](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6114716/#:~:text=The%20electrical%20conductivity%20(EC)%20is,conditions%20%5B7%2C%208%5D)