UNIVERSITI TEKNOLOGI MARA

JIIICaS 2024
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PROCEEDINGS OF JOHOR INTERNATIONAL INNOVATION INVENTION COMPETITION AND SYMPOSIUM 2024 (JIIICaS 2024)

"Flourish and Nurturing Sustainable Innovation for a Prosperous Nation"

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JOHOR INTERNATIONAL INNOVATION, INVENTION COMPETITION AND SYMPOSIUM

Editorial Board

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Preface

In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.

This e-book compiles the extended abstracts that submitted to Johor International Innovation Invention Competition and Symposium 2024 (JIIICaS2024), where JIIICaS2024 is a virtual platform for all creative minds to share and present their invention and innovation. Each abstract gives a brief background on the innovation or project.

We hope that this e-book will help the readers to get to know the innovation done by the students and get some ideas to develop future innovation products.

Foreword Rector

Assalamualaikum warahmatullahi Wabarakatuh, Salam Sejahtera, Salam Malaysia MADANI and Salam UiTM Dihatiku.

In the name of Allah, the Most Gracious, the Most Merciful.

It is a great honor to welcome you to the Johor International Innovation, Invention, Competition, and Symposium 2024 (JIIICaS 2024). This event connects various disciplines, focusing on education and engaging educators, students, researchers, and innovators from all walks of life.

Innovation is not just about ideas; it demands perseverance, creativity, and determination to turn those ideas into reality. The remarkable projects showcased today highlight the dedication and spirit of all participants. Initiatives like this not only explore new technologies but also cultivate skills and leadership among our youth. At Universiti Teknologi MARA (UiTM) Johor Branch, we are fully committed to fostering a dynamic culture of innovation, promoting the commercialization of new products, and encouraging meaningful collaborations with industry and society.

As we celebrate this event, I would like to extend my heartfelt gratitude to all sponsors, judges, the College of Computing, Informatics and Mathematics, UiTM Pasir Gudang Campus as the event organizer, as well as to the researchers and participants for their hard work in making this event a success. Let us continue striving for innovation and excellence. May the ideas presented today inspire us and lay the groundwork for future achievements.

Thank you.

Associate Professor Dr. Saunah Zainon
Rector
Universiti Teknologi MARA (UiTM)
Johor Branch

(A-ST010) THE EFFECT OF GROWTH PLANT IN VERTICAL FARMING STRUCTURE

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ABSTRACT

Vertical farming has emerged as a sustainable solution to agricultural challenges, offering efficient resource utilization and increased crop yields. In this study, a prototype was created using PVC pipes and local materials, occupying a space area of 0.16 m^2 and accommodating 32 plants with dimensions of 1.7 m height, 0.4 m width, and 0.4 m length. Over a 30-day observation period, spinach consistently grew with leaf sizes averaging 6 cm, lengths of 20 cm, and 10 leaves per pot. Temperature, electrical conductivity, and pH level were investigated, with spinach showing suitable average temperature (25.5°C to 26.7°C), electrical conductivity (1.35 mS/cm), and slightly acidic pH (6.3). This research significantly contributes to the fields of vertical farming and sustainable urban agriculture.

Keywords: Vertical farming, plant, temperature, electrical conductivity, pH level

1.0 INTRODUCTION

Vertical farming is a groundbreaking way of growing crops in vertically stacked layers, mostly in controlled indoor spaces like warehouses or high-rise buildings (Olabimpe, 2024). Unlike traditional farming, which requires large areas of land, vertical farming makes the most of vertical space, leading to higher crop yields per square meter (Lee, Y.Y.et.,al 2024). This method of farming uses advanced technologies like hydroponics, aeroponics, and aquaponics to provide plants with water, nutrients, and light in a controlled setting (Birkby, 2016 and Olabimpe, 2024). It comes with several benefits, such as saving water, reducing the need for pesticides, and cutting down on transportation costs and carbon emissions from food distribution. Additionally, vertical farming can help tackle food security issues, especially in crowded cities where there's not enough land for traditional farming (Kouloumprouka et., al 2024, Sugiyanto, and Pirdo 2024). However, it also has challenges like high upfront costs, energy use, and the need for technical expertise (Arcasi et., al 2024, Carotti et., al 2024. and Zhang, et., al 2024). Despite these challenges, ongoing technological advancements and growing interest in sustainable agriculture are fueling the growth of vertical farming as a promising solution to meet the food needs of our ever-expanding global population. In vertical farming, controlling plant growth involves controlling various factors like temperature, light, water, and carbon dioxide levels (Sugiyanto et., al 2024).

2.0 OBJECTIVE

There are three objectives in these studies. (1) To design and fabricate the vertical farming method. (2) To measure the performance of the growth plant by temperature, electrical conductivity, and pH parameters. (3) Observation of the plant's growth in physical dimensions such as leaf length, counts, and size of leaf diameter.

3.0 METHODOLOGY

A flow chart of the methodology of the whole process is illustrated in Figure 1. The process of design and fabrication known as the final prototype used PVC material that has a 10 cm diameter pipe that can accommodate 32 net pots inside. Figure 2 display the required vertical farming sizes.

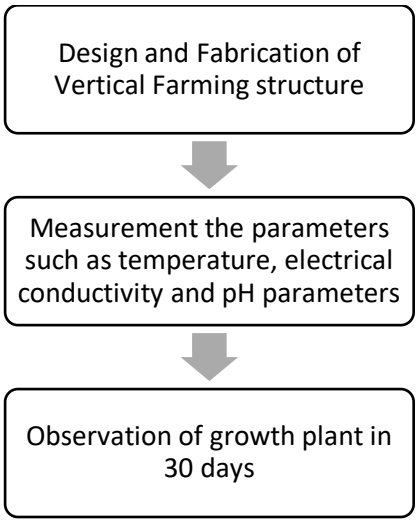


Figure 1: Methodology of vertical farming system

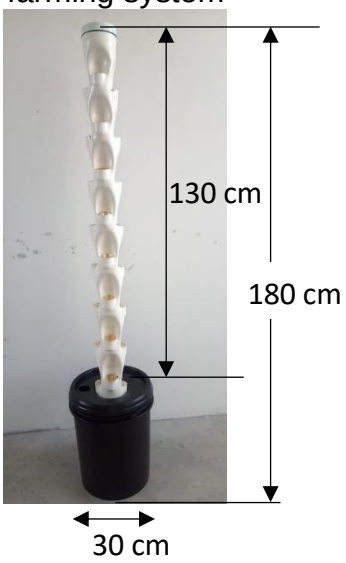


Figure 2: Vertical farming dimension

4.0 RESULTS

4.1 Effect of physically growth plant

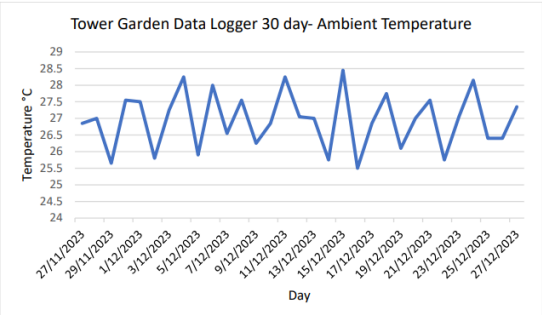
In the vertical farming system, spinach thrived in the outdoor environment, displaying its characteristic white blooms, vibrant green stalks, and slender leaves. Throughout
a 30 day growth period, crucial growth parameters like plant length, leaf count, and leaf diameter were monitored twice daily at 9 a.m. and 6 p.m., as outlined in Table 1. Additionally, pH levels, water temperature, and nutrient concentrations were measured daily using portable meters to ensure optimal growing conditions.

Table 1: Measurement of spinach in 30 days

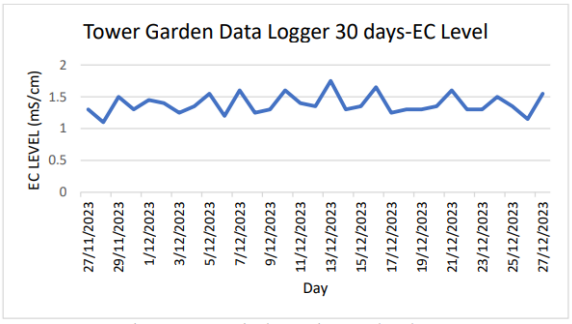
Criteria	Leaves counts	Leaves length (cm)	Leaves diameter(cm)
Minimum	4	10	2
Maximum	10	20	6
Average	7	15	4
Reference	±7	±20	±6

4.2 Effect of temperature, electrical conductivity (EC), and pH level of growth plant

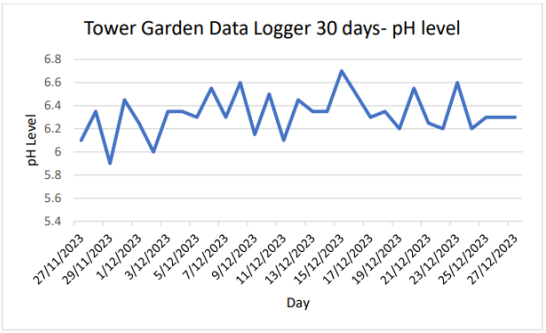
In Figure 3(a), the morning temperature for growing spinach was recorded at 25.7°C between 9 and 11 a.m. However, the temperature rose to 28.3°C from 12 to 2 p.m., reaching its highest point in the afternoon. By 6:00 p.m., the nighttime temperature had decreased to 27°C. It's essential to note that the combination of lower humidity and higher afternoon temperatures could potentially hinder spinach development. The electrical conductivity (EC) values for the 30-day vertical farming trial, depicted in Figure 3(b), remained relatively stable, ranging from 1.1 to 1.8 mS/cm, with an average of 1.35 mS/cm. Figure 3(c) illustrates the pH levels, which ranged from 5.8 to 6.8, averaging 6.3 throughout the trial period. These consistent pH readings indicate ideal pH regulation for optimal plant development, which is crucial for maintaining stable conditions, minimising plant stress, and maximising nutrient availability.



(a)



(b)



(c)

Figure 3: Parameters effect of plant growth. Figure 3(a) effect of temperature, Figure 3(b) effect of EC level and Figure 3(c) effect of pH level

5.0 CONCLUSION

In summary, the project focused on developing a prototype for vertical farming, accommodating 32 plants, and successfully yielded spinach harvests comparable to traditional farming methods. This highlights the potential of small-scale vertical farming to increase local food production, particularly in cities sustainably. Looking forward, advancements in technology like HVAC, LED lighting, and the Internet of Things provide opportunities to improve autonomy and productivity in vertical farming systems, paving the way for continued innovation and expansion in this promising field.

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