
Hydroponics Methods and Practices: A Descriptive Assessment of Small-Scale Growers

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Abstract — Hydroponics has gained increasing attention as a sustainable agricultural alternative amid global challenges related to food security, climate change, land degradation, and water scarcity. This study examined the methods and practices of hydroponic farming among small-scale growers, with particular emphasis on plant growth effects, production output, encountered adversities, and coping strategies. Using a quantitative descriptive research design, data were collected through an online survey administered to members of the Facebook group SNAP Hydroponics Growers ($n = 10$). Descriptive statistics, including frequency, percentage, and weighted mean, were employed for data analysis. Findings revealed that hydroponics is perceived to significantly enhance crop quality and yield while reducing pest incidence. Deep Water Culture emerged as the most commonly used system due to its simplicity and efficiency. While respondents did not consider hydroponics difficult or costly to implement, unpredictable weather conditions remained a primary challenge. The study underscores hydroponics' potential as an accessible and sustainable farming approach and highlights the importance of continuous learning, greenhouse utilization, and resource recycling. Implications for agricultural education, policy, and future research are discussed.

Keywords – hydroponics, sustainable agriculture, food security, small-scale farming, descriptive research

I. INTRODUCTION

The rapid growth of the global population, coupled with accelerating climate change and diminishing agricultural resources, has intensified concerns regarding food security and environmental sustainability. The United Nations projects that global food production must increase by approximately 60% by 2050 to meet the nutritional demands of a population expected to exceed nine billion. However, this projected increase faces significant constraints due to land degradation, urban expansion, freshwater scarcity, and climate variability.

Traditional soil-based agriculture has been increasingly challenged by declining arable land, overextraction of water resources, and unpredictable weather patterns. Reports from the Food and Agriculture Organization indicate that while agricultural production has increased dramatically over recent decades, the expansion of cropland has been minimal, resulting in intensified land use and widespread degradation. Moreover, agriculture remains the largest consumer of global freshwater, heightening competition among domestic, industrial, and agricultural users.

Hydroponics—defined as the cultivation of plants using nutrient-enriched water without soil—has emerged as a promising alternative to conventional farming. Research indicates that hydroponic systems can reduce land requirements by up to 75% and water use by as much as 90%, while simultaneously producing high yields and superior crop quality. These advantages position hydroponics as a viable strategy for addressing food production challenges in urban, peri-urban, and land-scarce regions.

Despite its documented benefits, hydroponics remains an evolving practice that requires further empirical investigation, particularly at the small-scale and community levels. Understanding how hydroponic systems are implemented, the methods preferred by practitioners, and the challenges they encounter is essential for improving adoption and informing policy and educational initiatives. This study addresses this gap by examining the methods and practices of hydroponics among small-scale growers in an online farming community.

Specifically, the study seeks to answer the following research questions:

1. What are the demographic characteristics of small-scale hydroponic growers?
2. How does hydroponics affect plant quality, quantity, and growth rate?
3. What hydroponic methods are commonly used by practitioners?
4. What production outputs are achieved through hydroponics?
5. What adversities are encountered, and what strategies are employed to address them?

II. METHODOLOGY

Research Design

This study employed a quantitative descriptive research design, appropriate for examining existing conditions, perceptions, and practices without manipulating variables. The design allowed for systematic documentation of hydroponics methods and experiences among practitioners.

Participants and Sampling

Participants were selected from the Facebook group SNAP Hydroponics Growers, an online community composed of individuals actively engaged in hydroponic farming. A total of 10 respondents participated in the study. Simple random sampling was utilized to minimize selection bias and enhance representativeness.

Research Instrument

Data were gathered using a structured online survey questionnaire administered via Google Forms. The instrument consisted of seven sections covering demographic information, perceived effects of hydroponics, methods used, growth factors, production output, adversities encountered, and suggested solutions. The questionnaire was reviewed and validated by a research adviser to ensure content relevance and clarity.

Data Collection Procedure

Following validation, the survey link was distributed digitally to potential respondents. Participation was voluntary, and responses were collected anonymously to ensure ethical compliance.

Data Analysis

Responses were analyzed using descriptive statistical techniques, including:

- Frequency counts
- Percentages
- Weighted mean

A five-point Likert scale was used to interpret perception-based items, ranging from Strongly Disagree (1) to Strongly Agree (5).

III. RESULTS

Demographic Profile

Most respondents were between 36 and 40 years old, with a mean age of 37.7 years, indicating that hydroponic practitioners were predominantly mature adults. A majority were self-employed (60%), and 70% held a bachelor's degree, suggesting a relatively educated population engaged in hydroponic farming.

Effects of Hydroponics on Plants

Respondents generally agreed that hydroponics positively influences plant growth and quality. The highest weighted mean (4.40) corresponded to the perception that hydroponically grown plants are of high quality. Increased yield and reduced pest susceptibility were also reported, supporting the efficiency of controlled nutrient delivery systems.

Hydroponic Methods Used

Among the systems assessed, Deep Water Culture (DWC) was the most frequently used method, receiving a weighted mean of 4.20 (Strongly Agree). Other methods, such as drip irrigation, nutrient film technique, wick systems, and Kratky method, were rarely utilized.

Effects on Plant Growth Rate

Hydroponics was perceived to accelerate plant growth, particularly due to optimized nutrient solutions (WM = 4.60). However, respondents acknowledged that weather conditions and water temperature still influenced growth outcomes.

Production Output

Half of the respondents reported annual production levels ranging from 100 to 299 kilograms, while some achieved outputs exceeding 900 kilograms, highlighting the scalability of hydroponic systems even at small scales.

Adversities Encountered and Solutions

Respondents disagreed that hydroponics is difficult to learn or prohibitively expensive. The primary challenge identified was unpredictable weather. Strong agreement was observed for solutions such as greenhouse use, continuous learning, and recycling materials to reduce costs and environmental impact.

IV. DISCUSSION

The findings of this study reinforce existing literature that positions hydroponics as an effective and sustainable alternative to conventional agriculture. The predominance of Deep Water Culture among respondents reflects its operational simplicity and suitability for small-scale implementation. Consistent with prior research, hydroponics was found to enhance crop quality and yield while minimizing pest-related issues.

Importantly, the perception that hydroponics is neither difficult nor costly challenges common assumptions that may hinder adoption. While environmental factors such as weather remain influential, the use of greenhouses and adaptive strategies demonstrates the system's resilience.

From an educational perspective, the reliance on self-directed learning and peer consultation underscores the importance of community-based knowledge exchange. These findings suggest that integrating hydroponics into agricultural education curricula and extension programs could significantly enhance food security initiatives.

V. CONCLUSION

Hydroponics represents a viable, accessible, and sustainable agricultural practice capable of addressing contemporary food production challenges. By optimizing resource use and enabling high-quality crop production, hydroponics offers significant potential for small-scale and urban farming contexts.

VI. RECOMMENDATIONS

1. Integrate hydroponics into agricultural and science education programs.
2. Expand government and institutional training initiatives for small-scale growers.
3. Conduct larger-scale studies to validate findings across diverse regions.

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