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Vertical gardening as a sustainable food production strategy in higher education institutions: A feasibility study at the University of Baguio

RESEARCH ARTICLE

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Abstract

This study assessed the feasibility of establishing a vertical garden using the Kratky hydroponic method at the University of Baguio as a sustainable approach to urban food production and environmental stewardship. The project evaluated the system's viability in terms of space efficiency, resource conservation, and structural adaptability within a university setting. A low-cost and eco-friendly design was developed using recycled PET bottles, repurposed wood, coco peat, and locally available nutrient solutions. Results demonstrated that the Kratky hydroponic system is well suited for limited urban spaces. The vertical garden was successfully installed in an underutilized area behind the Centennial Building parking lot, maximizing vertical space without requiring extensive land use. The system operated without electricity, pumps, or complex equipment, with each plant sustained by only 0.75 liters of nutrient solution throughout its growth cycle. This passive approach minimized water and energy consumption while preventing nutrient runoff and promoting efficient resource utilization. The modular structure, composed of lightweight and recycled materials, proved adaptable for installation, relocation, and replication in various campus locations, including rooftops and wall facades. Furthermore, the design required no major structural modifications, making it suitable for integration into existing infrastructure. The findings indicate strong potential for broader campus adoption and community-level replication, contributing to food security, environmental sustainability, and experiential learning opportunities. The initiative supports the United Nations Sustainable Development Goals, particularly SDG 2 (Zero Hunger), SDG 11 (Sustainable Cities and Communities), and SDG 12 (Responsible Consumption and Production). Overall, the study presents a practical and replicable model for sustainable food production in educational institutions and other urban environments.

Keywords: Kratky Hydroponic Method, Resource Efficiency, Sustainability, Urban Agriculture, Vertical Gardening

INTRODUCTION

The concept of vertical gardening, a form of urban agriculture, has gained increasing attention as a sustainable solution for food production in densely populated areas. Vertical gardens, also known as green walls or living walls, involve growing plants on vertical surfaces, which can maximize space efficiency in urban settings. According to Pérez-Urrestarazu et al. (2016), vertical gardens offer numerous environmental benefits, including improved air quality, reduced urban heat, and enhanced aesthetic appeal. These systems can play a crucial role in addressing the challenges of urbanization by providing green spaces that contribute to ecological sustainability and human well-being (Pérez-Urrestarazu et al., 2016; Patni et al., 2020).

Studies by Specht et al. (2014) highlight the potential of vertical farming to increase local food production, reduce transportation emissions, and promote self-sufficiency in urban areas. By utilizing innovative technologies such as hydroponics and aeroponics, vertical gardens can achieve high yields with minimal resource input, making them an attractive option for sustainable food systems (Specht et al., 2014; Kalantari et al., 2017). This approach aligns with the goals of the United Nations Sustainable Development Goals (SDGs), particularly SDG 2: Zero Hunger, by enhancing food security through efficient land use and sustainable agricultural practices.

In addition, Orsini et al. (2017) emphasize the role of urban agriculture in education, providing hands-on learning experiences in sustainability, horticulture, and environmental science. By incorporating vertical gardens into educational institutions, students gain practical knowledge and skills in sustainable agriculture, fostering a deeper understanding of environmental stewardship and innovation (Orsini et al., 2017; Krajhanzl et al., 2014; Specht et al., 2016). This educational aspect is particularly relevant for universities seeking to integrate sustainability into their curricula and promote environmental awareness among students.

Wong et al. (2010) found that green walls can significantly lower surface temperatures and reduce energy consumption in buildings, contributing to climate resilience in urban areas. By improving urban microclimates and promoting biodiversity, vertical gardens align with SDG 13: Climate Action, supporting cities in their efforts to adapt to and mitigate climate change impacts (Wong et al., 2010; Grohmann et al., 2019; Costa et al., 2020).

Literature Review

Vertical gardening has emerged as an innovative strategy for addressing urban food production, environmental sustainability, and resource efficiency in densely populated areas. Studies across Europe and Asia demonstrate that vertical gardens maximize limited urban spaces, improve air quality, mitigate urban heat island effects, enhance biodiversity, and contribute to climate resilience (Orsini et al., 2017; Grohmann et al., 2019; Perini & Rosasco, 2013; Wong et al., 2010; Chen et al., 2017; Middel et al., 2018; Darvishi Boloorani et al., 2020; Karimi et al., 2019; Tanaka et al., 2020; Nakamura et al., 2021). These benefits support broader sustainability goals, including the European Green Deal and the United Nations Sustainable Development Goals (SDGs).

Vertical gardening also contributes significantly to urban food security. Research indicates that vertical farming systems, particularly those utilizing hydroponic and aeroponic technologies, can increase local food production, reduce food miles, and support self-sufficiency in cities where land availability is limited (Kalantari et al., 2017; Thomaier et al., 2015; Specht et al., 2014; Chen et al., 2017; Dolezal et al., 2020; Ghosh et al., 2019; Lee et al., 2020; Sato et al., 2019; Kanno et al., 2020; Takeda et al., 2021). Such systems have proven particularly relevant in highly urbanized regions such as Germany, Japan, Hong Kong, Tokyo, Osaka, Shanghai, Bangkok, Beijing, and Jakarta.

Beyond food production, vertical gardens have become valuable educational tools. Studies show that school- and university-based gardening initiatives function as living laboratories that provide experiential learning in sustainability, environmental science, horticulture, nutrition, and urban agriculture (Austin et al., 2017; Specht et al., 2014; Röhricht et al., 2018; Schermer et al., 2019; Shinoda et al., 2018; Takahashi et al., 2019; Tanaka et al., 2020; Chong et al., 2021; Boonserm et al., 2021; Lee et al., 2020; Wang et al., 2019). These initiatives promote environmental stewardship, community engagement, and awareness of sustainable food systems among students and local communities. Economic studies likewise highlight the long-term viability of vertical gardening. Although initial establishment costs may be substantial, benefits such as reduced energy consumption, potential income from produce sales, and enhanced urban sustainability often outweigh these investments (Cheng, 2021; Schermer et al., 2019; Specht et al., 2014; Díaz-Poblete et al., 2021; Singh et al., 2022; Ghosh et al., 2019; Sato et al., 2019).

In the Philippines, vertical gardens in schools have demonstrated potential for revenue generation, reduced food procurement costs, support for feeding programs, workforce development, agripreneurship, and stronger partnerships with local communities and organizations (Philippine Rice Research Institute, 2022; Agricultural Training Institute, 2023; Department of Education, 2023; Dale et al., 2023; Estrada & Roxas, 2023).

Among available hydroponic technologies, the Kratky method has gained attention because of its simplicity, affordability, and resource efficiency. Developed by Bernard Kratky, this passive hydroponic system operates without pumps, aeration devices, or electricity, making it suitable for educational institutions and urban communities with limited resources (Kratky, 2005). Research has shown that the method can achieve yields comparable to more sophisticated hydroponic systems while using significantly less water and energy (Resh, 2013; Go & Kim, 2020). Furthermore, its compatibility with recycled materials supports responsible consumption and sustainable urban agriculture practices. Consequently, the Kratky method offers a practical and scalable approach for establishing vertical gardens that promote food security, environmental sustainability, and experiential learning in institutions such as the University of Baguio.

Conceptual Framework/Paradigm of the Study

This study is anchored on three interconnected concepts: Sustainability, Food Security, and Vertical Gardening Systems, which collectively guide the feasibility assessment of establishing a vertical garden at the University of Baguio.

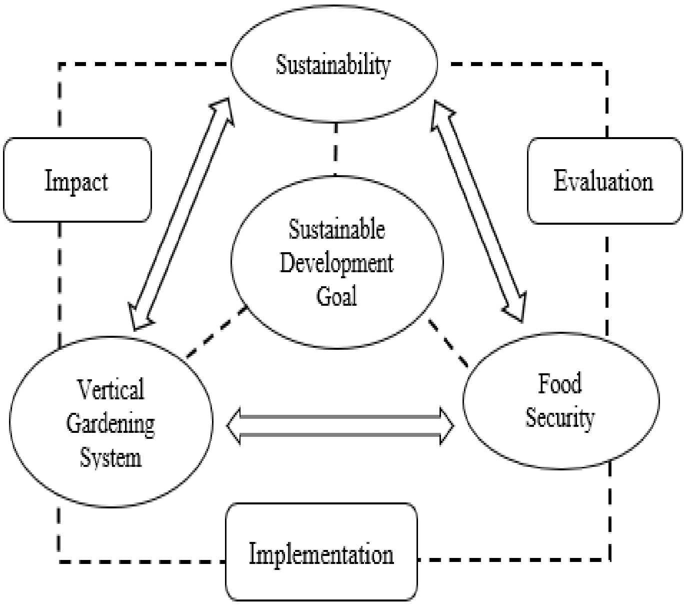

Figure 1: *Conceptual Framework*

At the core of the framework is Sustainability, which emphasizes meeting present food production needs without compromising the ability of future generations to meet their own needs. Sustainability encompasses environmental, social, and economic dimensions and aligns with the United Nations Sustainable Development Goal (SDG) 2 on ending hunger, improving nutrition, and promoting sustainable agriculture (United Nations, 2015). Vertical gardening supports sustainability through resource-efficient food production that minimizes land, water, and energy consumption while promoting environmental awareness and stewardship within the university community (Despommier, 2010).

A second component is Food Security, which refers to ensuring reliable access to safe, nutritious, and sufficient food. Vertical gardening has been recognized as an effective strategy for enhancing food security in urban environments where land is limited (Specht et al., 2014). By increasing local food production, a vertical garden can reduce dependence on external food sources and provide fresh produce for students, faculty, and staff. This contribution directly supports SDG 2 and promotes sustainable food systems within educational institutions (United Nations, 2015).

The third component is Vertical Gardening Systems, which provide innovative approaches to urban agriculture through hydroponic, aeroponic, and soil-based methods (Kozai, 2016). These systems optimize space utilization, increase production efficiency, and enable food cultivation in constrained urban environments (Despommier, 2010). The study evaluates the suitability of these systems for the environmental and structural conditions of the University of Baguio.

The framework assumes that the effective implementation of a vertical gardening system strengthens sustainability and food security by promoting resource-efficient food production and reducing reliance on conventional agricultural land. The interaction among these components is expected to result in improved food availability, sustainable agricultural practices, environmental stewardship, and experiential learning opportunities for students. Ultimately, the framework supports the development of a sustainable campus-based food production model aligned with SDG 2 and SDG 11 (Sustainable Cities and Communities) (United Nations, 2015).

Significance of the Study

This study is significant because it evaluates the feasibility of establishing a vertical garden at the University of Baguio as a sustainable approach to urban food production. The project promotes environmental stewardship through resource-efficient food production while providing educational opportunities in sustainable agriculture, horticulture, and environmental science. As a living laboratory, the vertical garden can enhance experiential learning and environmental awareness among students and faculty.

The study also contributes to food security by exploring the potential of local food production within the university, reducing reliance on external sources and providing access to fresh produce. In addition, the project may improve campus sustainability by creating green spaces that enhance air quality, reduce urban heat, and support biodiversity. Beyond the university, the findings can serve as a model for other educational institutions and urban communities seeking sustainable food production solutions. The study further contributes to the growing body of knowledge on vertical gardening and urban agriculture, providing insights into its practical and economic viability.

Finally, the project supports the attainment of the United Nations Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action), by promoting sustainable food systems, resilient urban environments, and environmentally responsible practices.

Objectives of the Study

The aim of the study is to evaluate the feasibility of establishing a vertical garden at the University of Baguio to enhance food production and sustainability, supporting the university's commitment to sustainable practices and providing a model for innovative urban agriculture solutions and alignment with institutional goals:

1. To assess the feasibility of using the Kratky hydroponic method for a vertical garden at the University of Baguio, considering factors like space, resource efficiency, and structural adaptability.
2. To identify potential locations for installing a Kratky-based vertical garden within UB, considering sunlight exposure, water access, and sustainability.
3. To identify plant species that thrive under the Kratky hydroponic method and are suitable for UB's climate and nutritional goals.

METHODOLOGY

Study Design

This study employed a feasibility research design, focusing on the application of the Kratky hydroponic method for a potential vertical garden at the University of Baguio. Feasibility studies are essential for assessing the practicality, sustainability, and potential challenges of implementing an innovative agricultural system in a given setting (Creswell & Plano Clark, 2017). The research did not include a control group; instead, it was a single-method evaluation aimed at determining whether the Kratky hydroponic system could be effectively utilized in the university's environment. The study assessed factors such as plant growth performance, material efficiency, and site suitability to determine the viability of scaling up the method.

Research Materials

The study utilized materials selected for their availability, affordability, and suitability for the Kratky hydroponic method. Primary growing containers consisted of 120 repurposed 1.5-liter PET bottles, which served as individual plant reservoirs. The use of recycled bottles supported sustainable resource utilization and aligned with SDG 12 (Responsible Consumption and Production). Each bottle was wrapped with ½-inch heat insulation material to minimize algae growth and regulate nutrient solution temperature. A commercially available hydroponic nutrient solution formulated for leafy vegetables was used to provide the essential macro- and micronutrients required for plant growth. Brown coco peat served as the growing medium because of its high water-retention capacity, adequate aeration, and biodegradable nature, making it suitable for passive hydroponic systems.

A total of 120 seedlings, consisting of 40 Green Ice Lettuce, 40 Romaine, and 40 Bokchoy, were transplanted into the system at 20 days old. These crops were selected due to their adaptability to hydroponic cultivation, short growth cycles, nutritional value, and high consumer demand.

Costing and Resource Allocation

A basic costing analysis was conducted to determine the financial feasibility of the vertical garden. The total establishment cost was ₱820.00, excluding labor, which was provided voluntarily by the Campus Planning and Development Office (CPDO). Recycled PET bottles and repurposed wooden frames sourced from the university incurred no cost, while purchased materials included heat insulation (₱300.00), coco peat (₱200.00), string wire (₱200.00), and seedlings (₱120.00). The low-cost setup demonstrates that a Kratky-based vertical garden can be established affordably using recycled and locally available materials, enhancing its sustainability, scalability, and potential for replication within educational institutions and urban communities.

Research Methods

The study began with securing approval from the Research Innovation, Extension, and Community Outreach (RIECO) Office and coordinating with the Campus Planning and Development Office (CPDO) to identify a suitable site for the vertical garden. Site selection was based on sunlight exposure, water accessibility, and structural suitability for hydroponic cultivation. The selected location was an underutilized area behind the Centennial Building parking lot at the University of Baguio. A vertical garden utilizing the Kratky hydroponic method was then established. The structure was constructed by CPDO personnel using recycled wood materials previously used during the university's Panagbenga Festival activities, while repurposed 1.5-liter PET bottles served as plant reservoirs. The bottles were secured to the wooden frame using string wire and insulated to minimize temperature fluctuations and algae growth.

The hydroponic system employed a nutrient solution prepared at a concentration of 5 mL per liter of water, with approximately 0.75 liters supplied to each reservoir.

Brown coco peat was used as the growing medium because of its moisture retention and aeration properties. A total of 120 seedlings, consisting of 40 Green Ice Lettuce, 40 Romaine, and 40 Bokchoy plants, were transplanted at 20 days old into the hydroponic setup.
Following transplantation, plant growth and system performance were monitored throughout the cultivation period. Observations focused on assessing the feasibility of the Kratky-based vertical garden in terms of space utilization, resource efficiency, structural adaptability, and its potential for sustainable food production within the University of Baguio.

Ethical Considerations
The study was conducted in accordance with institutional ethical guidelines and sustainability principles. Approval was obtained from the Research Innovation, Extension, and Community Outreach (RIECO) Office of the University of Baguio, and coordination was undertaken with the Campus Planning and Development Office (CPDO) for site selection and implementation. Environmental responsibility was observed through the use of recycled PET bottles and repurposed wood materials, supporting resource efficiency and SDG 12 (Responsible Consumption and Production). All materials used were non-toxic and environmentally safe, and the project was implemented with minimal disruption to campus operations. Throughout the study, data were collected, analyzed, and reported objectively to ensure transparency, accuracy, and scientific integrity in assessing the feasibility of the Kratky-based vertical garden system.

RESULTS AND DISCUSSION

This section presents the key findings of the feasibility study on establishing a vertical garden using the Kratky hydroponic method at the University of Baguio. The results are discussed in relation to the study's objectives, focusing on critical aspects such as space utilization, resource efficiency, and structural adaptability. Through a systematic evaluation of plant survival, material functionality, and site performance, the study assesses the practicality and sustainability of implementing a vertical garden in an urban educational setting.

Feasibility of using the Kratky Hydroponic Method for a Vertical Garden at the University of Baguio

The study confirmed the feasibility of establishing a vertical garden using the Kratky hydroponic method at the University of Baguio. Feasibility was assessed based on space utilization, resource efficiency, structural adaptability, and economic viability. Results indicate that the system is practical, sustainable, and suitable for implementation in an urban academic setting.

Space Utilization
The vertical garden was successfully established in an underutilized area behind the Centennial Building parking lot. Site selection was based on sunlight exposure, water accessibility, structural suitability, and minimal disturbance from campus activities. Interviews with personnel from the Campus Planning and Development Office (CPDO) confirmed that the site receives 3–4 hours of direct morning sunlight, has immediate access to a water source, and is located in a low-traffic area suitable for hydroponic cultivation.

Table 1. *Feasibility Matrix for Site Evaluation*

Criteria	Evaluation Level	Indicators / Description	Assessment at UB Site
Space	**High**	≥ 8 m² of uninterrupted area; accessible; clear vertical and horizontal layout options	9m x 4m area (36 m²); unobstructed; supports modular vertical expansion
Sunlight Exposure	**High**	≥ 3 hours of direct sunlight per day; morning light preferred; no overhanging obstructions	3–4 hrs of direct morning light; open to sky; ideal for leafy greens
Water	**High**	Immediate access to functioning faucet or irrigation point (<5 meters); no need for plumbing modifications	Faucet located adjacent to site; no plumbing extension needed
Structure	**High**	Existing wall, fence, or durable surface can hold vertical load; strong base for mounting containers	Cement wall + recycled wood frame; can support PET bottle modules

The feasibility matrix (Table 1) rated the site highly in terms of space availability, sunlight exposure, water accessibility, and structural support. The 36 m² area provided sufficient room for modular expansion, while the use of recycled wooden frames and PET bottle reservoirs maximized vertical space without requiring additional land development.

The findings demonstrate that the Kratky system can be effectively integrated into existing campus infrastructure and support the efficient use of limited urban space. This supports previous studies highlighting the suitability of vertical gardens in land-constrained environments (Despommier, 2010; Specht et al., 2014).

Resource Efficiency

he Kratky hydroponic system demonstrated high resource efficiency due to its passive operation, requiring no electricity, pumps, or water circulation systems.

Table 2. *Feasibility Matrix on Resource Efficiency and System Sustainability*

Criteria	Evaluation Level	Indicators / Description	Assessment of UB System
Resource Efficiency	**High**	Minimal inputs (no electricity or pumps); uses recycled materials and water-efficient system	No pumps, no electricity; PET bottles and wood recycled
Maintenance Needs	**Low**	Passive system; requires only occasional nutrient monitoring and cleaning	Kratky system requires no refilling; low-labor upkeep
Environmental Resilience	**High**	Adaptable to weather conditions; minimal risk of nutrient loss or structural damage	System insulated, protected from wind; nutrient sealed
Cost-Effectiveness	**High**	Low setup cost, minimal operational cost, strong return on investment	₱820 setup cost; up to ₱8,000 return/cycle

As shown in Table 2, the system achieved high ratings in resource efficiency, environmental resilience, and cost-effectiveness, while requiring minimal maintenance.

Water Efficiency

Each plant was sustained by approximately 0.75 liters of nutrient solution throughout the growing cycle without requiring refilling. This significantly reduced water consumption compared to conventional farming systems, where substantial losses occur through runoff and evaporation (Kalantari et al., 2017). Such efficiency is particularly relevant in urban and resource-constrained settings.

Nutrient Use Optimization

The static nutrient solution enabled gradual nutrient uptake by plants, minimizing nutrient loss and eliminating runoff. This finding is consistent with studies indicating that non-circulating hydroponic systems enhance nutrient-use efficiency while reducing environmental impacts (Resh, 2013; Kratky, 2005). The use of commercially available nutrient solutions also supports scalability and accessibility for future implementation (Go & Kim, 2020).

Material and Energy Conservation

The system utilized recycled PET bottles, repurposed wooden frames, and coco peat as the growing medium, supporting sustainable resource use and reducing waste. The absence of electrical requirements further enhanced energy efficiency and operational resilience. These findings support previous research emphasizing the value of low-cost, low-impact materials in sustainable urban agriculture (Perini & Rosasco, 2013; Kalantari et al., 2017; Kratky, 2005; Dolezal et al., 2020).

Structural Adaptability

The Kratky system exhibited high structural adaptability due to its lightweight and modular design. The pilot installation required no permanent modifications to existing infrastructure and could be relocated or expanded with minimal effort. Potential expansion areas identified within the campus include the Legacy Building, Building D, roof decks, and unused wall spaces. The use of recycled PET bottles and wooden frames reduced structural load while eliminating the need for plumbing and electrical systems. These characteristics align with findings that lightweight and modular vertical farming systems are particularly suitable for educational institutions and urban environments (Thomaier et al., 2015; Kozai, 2016; Grohmann et al., 2019). Furthermore, integrating vertical gardens into campus infrastructure can enhance environmental quality and support sustainable campus development (Wong et al., 2010; Perini & Rosasco, 2013).

Economic Feasibility and Cost Analysis

The pilot vertical garden was established at a total cost of only ₱820.00, excluding voluntary labor contributions from CPDO personnel and student assistants. Recycled PET bottles and repurposed wooden materials significantly reduced setup costs, while purchased materials included insulation, coco peat, string wire, and seedlings.

Harvest estimates indicated that 120 plants (40 Green Ice Lettuce, 40 Romaine, and 40 Bokchoy) could produce approximately 30 kg of vegetables per cycle, generating an estimated market value of ₱5,000–₱8,000. This substantially exceeds the initial investment and demonstrates the economic viability of the Kratky system for institutional food production.

Table 3. *Estimated Harvest Yield and Potential Market Value of Leafy Vegetables*

Crop	Quantity Planted	Estimated Yield (kg)	Market Price Range (₱/kg)	Potential Revenue Range (₱)
Green Ice Lettuce	40	10	₱150 – ₱390	₱1,500 – ₱3,900
Romaine Lettuce	40	10	₱270 – ₱300	₱2,700 – ₱3,000
Bokchoy	40	10	₱80 – ₱110	₱800 – ₱1,100
Total	**120 plants**	**30 kg**	—	**₱5,000 – ₱8,000**

Potential locations for installing a Kratky-based vertical garden within UB, considering sunlight exposure, water access, and sustainability

The study identified several suitable locations for expanding the Kratky-based vertical garden at the University of Baguio (UB), based on sunlight exposure, water accessibility, structural suitability, and sustainability considerations. The pilot site behind the Centennial Building parking lot demonstrated excellent conditions, including direct sunlight, proximity to a water source, and minimal pedestrian disturbance. Its successful conversion into a productive vertical garden highlighted the potential of repurposing underutilized campus spaces for sustainable food production while supporting SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production).

Additional locations with strong potential for implementation include the UB Gymnasium and Building D vicinity, which offers open, sunlit areas and access to logistical support from the Campus Planning and Development Office (CPDO); the Legacy Building rooftop and balconies, which provide ideal conditions for rooftop gardening and educational integration; academic building facades, particularly sun-exposed exterior walls suitable for green wall installations; and UB Square and other open courtyards, which can serve as visible demonstration sites that promote community engagement and environmental awareness.

The suitability of these locations is supported by studies emphasizing the integration of vertical farming into underutilized urban spaces such as rooftops, building exteriors, and institutional courtyards (Specht et al., 2014). The use of recycled PET bottles and repurposed wood further reflects resource-efficient urban agriculture practices recommended by Kratky (2005) and Thomaier et al. (2015). Likewise, the identification of multiple campus sites aligns with the concept of zero-acreage farming (ZFarming), which incorporates food production into existing building infrastructure without requiring additional land resources (Thomaier et al., 2015). This approach also supports adaptable urban agriculture models suitable for educational institutions (Kozai, 2016).

Overall, the findings indicate that UB possesses several structurally and environmentally suitable areas for vertical garden expansion. The Kratky method's simplicity, affordability, and adaptability make it a viable strategy for sustainable food production, environmental education, and campus greening initiatives, reinforcing the university's commitment to sustainable development and innovation (Specht et al., 2014; Thomaier et al., 2015; Kratky, 2005; Kozai, 2016).

Plant species that thrive under the Kratky hydroponic method and are suitable for UB's climate and nutritional goals

Baguio City's cool subtropical highland climate, characterized by temperatures ranging from 14°C to 24°C and high humidity levels, provides favorable conditions for hydroponic cultivation, particularly for leafy vegetables and herbs (Weather Atlas, 2024). These environmental conditions support crops that perform well in passive hydroponic systems such as the Kratky method. Leafy greens, including lettuce (Lactuca sativa), romaine, butterhead, spinach (Spinacia oleracea), arugula (Eruca vesicaria), and kale (Brassica oleracea), were identified as highly suitable due to their adaptability to cooler climates, rapid growth cycles, and high nutritional value. These crops are rich in vitamins A, C, and K, iron, calcium, and dietary fiber, supporting the University of Baguio's goals of promoting food security and healthy nutrition (Sprouteer, 2023).

Herbs such as basil (*Ocimum basilicum*), mint (*Mentha spp.*), cilantro (*Coriandrum sativum*), and parsley (*Petroselinum crispum*) were also found to be compatible with the Kratky system. Their compact growth habits, resilience under varying light conditions, and nutritional and medicinal benefits make them ideal for vertical garden applications (Green & Prosperous, 2023).

Although fruiting crops such as tomatoes (*Solanum lycopersicum*), bell peppers (*Capsicum annuum*), and cucumbers (*Cucumis sativus*) can be grown using the Kratky method, they require greater nutrient inputs, structural support, and environmental management, making them less suitable for passive hydroponic systems in Baguio's climate (Henry's Hydroponics, 2023).

Overall, the findings indicate that nutrient-dense leafy greens and herbs are the most suitable crops for Kratky-based vertical gardens at the University of Baguio. These species thrive under local climatic conditions while supporting the university's objectives of sustainability, food security, and improved campus nutrition (Weather Atlas, 2024; Sprouteer, 2023; Green & Prosperous, 2023).

CONCLUSION AND RECOMMENDATION

The findings of the study confirm that establishing a vertical garden using the Kratky hydroponic method is a feasible and sustainable strategy for the University of Baguio. The system demonstrated efficient use of space, water, energy, and recycled materials while adapting well to the university's urban environment. Leafy vegetables such as lettuce, romaine, and bokchoy thrived under Baguio's climatic conditions, supporting the university's goals of food security, nutrition, and environmental sustainability. The lightweight and modular design of the system also allows for easy replication and expansion across different campus locations. Based on these findings, the University of Baguio is encouraged to expand the initiative to other suitable areas on campus, provide training for students and personnel involved in its maintenance, and promote faculty-student collaborative research to further enhance the productivity, educational value, and long-term sustainability of vertical gardening as a model for urban agriculture in higher education institutions.

Declaration of Generative AI use in the Writing Process

During the preparation of this work, the author(s) utilized ChatGPT to assist with refining the structure of the manuscript, improving clarity and coherence, and aligning the content with journal formatting and submission requirements. The content generated by the tool was carefully reviewed, edited, and validated by the author(s). The author(s) accept full responsibility for the accuracy, originality, and integrity of the final manuscript.

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