

The Development Of Lettuce (*Lactuca Sativa*) Vegetables Using A Hydroponic System In Narrow Home Gardens In Tanamodindi Sub-District, Palu City, Central Sulawesi

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Abstract.

This community engagement activity was conducted on Merpati Street, Tanamodindi Sub-District, Palu City, Central Sulawesi Province, in collaboration with Internship Students (MBKM) from Tadulako University. The village faces issues regarding the utilization of narrow home gardens. The objectives of this community engagement are: 1) to enhance the knowledge of the surrounding community regarding the utilization of narrow home gardens to create added value for household income; 2) to promote vegetables as a nutritious source for consumption; 3) to increase the knowledge of both the community and students about effective hydroponic farming methods suitable for narrow home gardens. The method used in this activity was a participatory approach, where the team, MBKM students, and the surrounding community actively engaged in cooperative efforts. The primary targets of this training were students and community members involved in hydroponic vegetable cultivation in narrow home gardens on Merpati Street, Tanamodindi Sub-District, Palu City Central Sulawesi Province. The results of this community engagement activity include increased knowledge regarding using narrow home gardens for additional income generation and promoting nutritious vegetables for human consumption Education.

Keywords: *Straw Mushroom, Food Security, Community Participation and welfare.*

I. INTRODUCTION

Lettuce plants have a taproot and fibrous root system. The roots attach to the stem. The roots absorb the nutrients needed by lettuce plants [1], [2]. Roots absorb water and nutrients from the soil and anchor the plant stem [3], [4]. The lettuce plant stem branches are a site for leaf attachment. Lettuce leaves are round-shaped, with a length of 25 cm and width of 15 cm. Lettuce leaves come in various colors, including fresh green, dark green, and, in some cultivars, red. The leaves are tender and crisp, with a slightly sweet taste. Yellow flowers are densely arranged. The lettuce inflorescence varies from compact to loose, composed of numerous flower clusters [5], [6] Hydroponics can be defined as a method of plant cultivation that utilizes water without using soil as a medium, supplemented with a nutrient solution called AB Mix containing all the essential elements required for plant growth and yield. One of the plants that can be cultivated hydroponically is lettuce [7], [8] In 2020, the population of Palu City, Central Sulawesi, was recorded at 373,218 people, according to the Central Statistics Agency of the Palu Province. Moving into 2021, it continued to increase to 377,030 people. This is attributed to the fact that Palu City is Central Sulawesi Province's capital. In 2022, the population increased to 381,572 people (Central Statistics Agency). Therefore, in this community engagement, we implemented a solution to utilize narrow home gardens as additional family income and produce lettuce vegetables consumed as nutrition for the human body [9], [10].

With the continuous growth of the population each year, available land is primarily allocated for housing development, office facilities, and public infrastructure within the Palu City area. Consequently, the availability of agricultural land is decreasing. Therefore, the challenge lies in how narrow home gardens can add value to family income amidst the increasing population every year. The solution that needs to be implemented is the approach of hydroponic farming systems among households by utilizing narrow home gardens as agricultural land. Lettuce vegetables can be applied to household backyard farming land [11], [12]. The content of vegetables is rich in vitamins, which are highly beneficial for the human body as antioxidants (Indonesia, 2017). The area of Palu City, on average, has residential neighborhoods with the potential for cultivating lettuce vegetables in their backyard gardens. However, some local residents lack

awareness and the capability to utilize their backyard gardens, while others have already used their yards by planting vegetables, fruits, and ornamental plants. The condition of residents' backyard gardens on Merpati Street, Tanamodindi Sub-District, which have utilized their narrow backyard gardens, can be seen in the following picture.



Fig 1. Effective and Efficient Utilization of Narrow Home Gardens by Tanamodindi Sub-District Residents

In Figure 1, we see the condition of narrow home gardens belonging to the residents being effectively and efficiently utilized, located at Merpati Street, Tanamodindi Sub-District, Palu City. One of the objectives of these residents is to cultivate vegetable plants in their home gardens for personal consumption and for sale. However, the program has not been running smoothly yet due to the lack of permanent labor to manage these backyard plots. Mr. Faruq is concerned about vegetable cultivation in the community's backyard gardens. According to him, the local community generally has backyard gardens with the potential for cultivating vegetable plants. However, they often plant them directly into the soil without considering whether the soil is suitable for vegetable and fruit cultivation, which could generate household income through the sale of the harvest. Mr. Faruq explained that even in limited space, it is possible to generate additional household income. However, an investment ranging from 7 to 9 million IDR is required to purchase basic materials such as PVC pipes, lightweight steel frames, taso, and others essential for vegetable cultivation in narrow home gardens. In addition, Tanamodindi Sub-District is also located in a dry area, so it is crucial to utilize the water supply as efficiently as possible. This ensures that vegetable cultivation using water is effective and efficient for optimal growth. Some residents still plant using soil as a medium because they lack knowledge about planting using hydroponic systems or other methods that utilize water as a medium. The backyard utilization technique implemented by Mr. Faruq on Merpati Street, which includes the harvesting process in narrow home gardens, can be seen in the following picture.



Fig 2. Harvesting Process in Narrow Home Gardens of Tanamodindi Village Residents



Fig 3. Results of Weighing in the Harvesting Process in Home Gardens

Narrow home yards planted with vegetables now yield produce for self-consumption, and the surplus can be marketed as side income for the family. Figure 2 shows the well-maintained vegetable crops that have been harvested. Hydroponic technology is suitable for overcoming the problem of narrow home yards because cultivating plants without soil is known as soilless culture or hydroponics [13], [14]. Hydroponics has two basic principles: the Nutrient Film Technique (NFT) and substrate hydroponics [15], [16]. These principles are applied based on the availability of funds and land. The hydroponic cultivation technique is a method used to produce pesticide-free, high-quality, healthy, uniform agricultural products that can be used continuously. The working principle of NFT involves placing plant roots in a shallow layer of water. This water must circulate and contain nutrients tailored to the plant's needs [17], [18]. Furthermore, hydroponic plants can also serve as attractive interior designs in home gardens [19], [20]. The main factors in the growth of hydroponic plants are the growing medium and the required nutrients (Maitimu & Suryanto, 2018). The growing medium determines the quality and quantity of hydroponic plants [21], [22]

II. RESULT AND DISCUSSION

This activity is a Community Service Program carried out for students and the local community located on Merpati Street, Tanamodindi Sub-District, Palu City, Central Sulawesi. The implementation of this Community Service activity begins with the preparation of basic materials. The preparation includes assembling the hydroponic installation, which consists of PVC pipes that have been perforated for ease of use in the Lettuce Vegetable Planting Process. Subsequently, equipment and materials are prepared. The hydroponic installation created is the NFT hydroponic installation using PVC pipes as a substitute for the Gully, sized 1 m x 2 m (Figures 4 and 5).

The assembly process of the hydroponic installation was conducted by Agriculture students majoring in Agribusiness under the direct guidance of Dr. Arifuddin Lamusa, MP. IPM is one of the lecturers at the Faculty of Agriculture, Tadulako University. This assembly process directly involved students and the local community residing in the Merpati Housing Area, Tanamodindi Sub-District, Palu City. The implementation activities were conducted in one monthly meeting, supervised directly by Dr. Arifuddin Lamusa, who served as both a lecturer and an instructor in the field. These meetings took place at the house of one of the residents on Merpati Street, Tanamodindi Sub-District, on December 6, 2023. During these meetings, students and the surrounding community were directly involved, and their activities included the following:

1. Implementation Stage



Fig 4. The Measurement Process of the Hydroponic Installation



Fig 5. The Drilling Process of PVC Pipes for Lettuce Plants

In Figures 4 and 5 above, the assembly process of this hydroponic installation framework made of PVC pipes is depicted. The first step is to measure the length of the hydroponic installation framework according to the narrow space available in the house's backyard. The steps are as follows.

- Measure each PVC pipe that will be cut, as shown in the above figures.
- Cut four pieces of 2-inch diameter PVC pipes to a length of 100 cm each (resulting in four pieces).

- Drill four holes in each pipe section, with an 18-20 cm distance between each hole.
- Cut four pieces of $\frac{3}{4}$ inch-diameter pipes to lengths of 80 cm each, four pieces of 60 cm each, two pieces of 90 cm each, and fourteen pieces of 10 cm each.



Fig 6. The Process of Making Installation Support Legs



Fig 7. Finishing Stage of Installation Support Legs

Figures 6 and 7 show the students and the surrounding community's process of making table legs using lightweight steel taso rafters. This is because the taso rafters can last long, resist rust, and are easy to shape for making the table legs. The steps involved in the making are as follows:

1. Eight table legs will be made, each supporting nine gutters.
2. Twelve pieces of lightweight steel taso rafters, each 1 meter long, are prepared for the table legs, and eight pieces of 1-meter-long taso rafters are prepared to connect the table legs.
3. The sections of taso rafters are assembled to form a cube.
4. Each rack can hold nine gutters, with the spacing adjusted accordingly.
5. The supports are installed on one side of the legs to form a 20–30 degree angle, allowing water to flow into the gutters (see Figures 6-7)

2. Hydroponic Lettuce Seedlings Ready for Planting

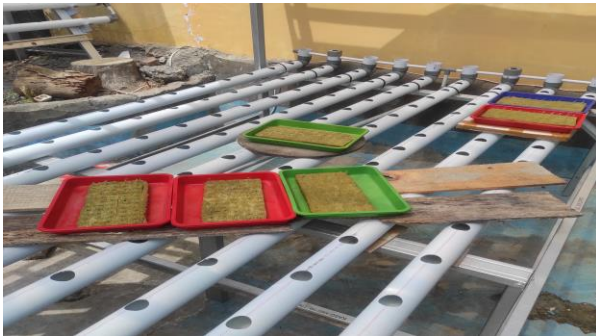


Fig 8. The Process of Making Installation Support Legs



Fig 9. Finishing Stage of Installation Support Legs

Nursery of lettuce vegetable plants. The steps for nursery are as follows.

1. Store rock wool according to the size of the tray.
2. Cut the rock wool into square shapes.
3. Embed 2-3 seeds in each piece of rockwool.
4. Prepare a nutrient solution with a ratio of 10:2 (20 ml Nutrient for 100 ml clean water).
5. Provide water mixed with the nutrient solution in the tray until the rock wool is submerged in 2-3 cm deep water.
6. Place the tray containing the seedlings away from direct sunlight.
7. Maintain regularly by providing a nutrient solution when the tray appears very dry to prevent the rock wool from drying out.
8. The germination period is 14-16 days.

III. CONCLUSION

The activity aims to assess participants' basic capabilities in practicing lettuce vegetable cultivation techniques using hydroponic methods. This community service activity is aimed at exploring how narrow residential land can be utilized as an additional source of family income while also providing vegetables for household consumption. Therefore, our community service activity focused on demonstrating how lettuce vegetable cultivation techniques with hydroponic systems can be easy and profitable. We conducted this directly in the field so that students and the community could implement these techniques in narrow home yards by utilizing human resources and determination to pursue lettuce vegetable cultivation. The lettuce plants in this counseling activity have rapid growth because the plants are ready for harvest on the 36th day after being transferred to the installation. Characteristics of lettuce plants ready for harvest can be seen in Figures 1-2, including broad, wavy, and bright green leaves. Lettuce plants are ready for harvest at the age of 60 days or two months. Therefore, in this counseling session, lettuce growth can be considered rapid.

IV. ACKNOWLEDGMENTS

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