

Conference Paper

Improving Knowledge and Skills in Farming with Verticulture Hydroponics

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ABSTRACT

Farming with verticulture hydroponics is a trend in urban areas. Verticulture hydroponics can overcome land limitations, is easy to implement, and can take advantage of used goods. Kampung Kapas Lor Kulon Surabaya is a densely populated village and buildings, minimally greened, and seems shabby. The purpose of community service carried out is to improve the knowledge and skills of verticulture hydroponic farming in Dasa Wisma RT 04 Kapas Lor Kulon Surabaya. The methods used are observation, analysis of potentials and problems, implementation through counseling and training, and evaluation. Evaluation is carried out through questionnaires before and after training, as well as monitoring in the field. The hydroponic system used is an axis system, and a DFT (*Deep Flow Technique*) system. The results of the evaluation showed that there was an increase in knowledge and skills in the trainees. Knowledge of the notion of verticulture hydroponics increased quite sharply from 21.25% to 95%. Hydroponic farming skills have also improved, ranging from seed seeding, and plant removal, to plant care. The mothers' awareness of using second-hand goods to grow crops is also very good.

Keywords: Farming, hydroponics, verticulture

Introduction

Densely populated settlements in large cities such as the city of Surabaya are commonly found. This form of settlement is commonly referred to as a village. In general, the existing villages have poor physical conditions, are inhabited by low-income people, the availability of public facilities is poor, the population density is quite high, and the availability of green open space is very limited.

Urban farming provides a considerable benefit to urban communities and the government. *Urban farming* makes an area more lively, neatly organized, and beautiful. *Urban farming* serves as a place to provide food, an education center for the younger generation, and a recreational vehicle (Hamzens, et al., 2018). It can even increase income, and fulfill family consumption (Anggrayni et al., 2015). At the government level, it can strengthen the country's food security, improve the community's economy, improve urban ecology, and maintain Indonesia's social and cultural values (Rachmatullah et al., 2016). In the environment, the presence of *urban farming* activities also helps fulfill and increase the area of RTH (Green Open Space). Reforestation has benefits including providing freshness, comfort, and beauty in the environment, nourishing the environment, maintaining air circulation, and as a place for facilities and infrastructure for recreational activities (Hakim, 2012). *Urban farming* on limited land in the city can be done by hydroponics, verticulture, aquaponics, and *wall gardening* methods.

Currently, farming with verticulture hydroponics is a trend in the community. Verticulture hydroponics is the most suitable solution to overcome land limitations. Vertical crop cultivation

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is a farming concept suitable for areas with limited land (Nofrinda, 2017; Roidah, 2014). A verticulture farming system is an agricultural cultivation system that is carried out vertically or stratified. Land use in this system becomes very efficient because the amount planted is more (Maya, 2012). Hydroponics is the cultivation of plants without soil, using nutrient solutions for plant growth and development (Resh, 1998). Hydroponics is a method of growing plants in mineral nutrient solutions using water as a solvent (Rakocy, 2012). This method is considered an effective solution alternative to environmental sustainability since it uses only 10% of the water from conventional methods (Roidah, 2014). Hydroponics applies innovative, environmentally friendly, advanced, reliable, and flexible food production technologies (Li et. al., 2017). Hydroponics does not recognize the seasons so it produces higher productivity (Lonardy, 2006).

Verticulture systems can be combined with hydroponics referred to as verticulture hydroponics. Verticulture hydroponics is a form of agricultural technology that can be used as an architectural element (Asikin et al., 2016). Verticulture hydroponic planting models can be carried out in different ways, depending on the conditions of the premises. Attractive verticulture hydroponics design can visually improve the quality of the environment. Pots for growing hydroponics can also take advantage of used items such as plastic drink bottles, plastic cups, plastic buckets, food styrofoam, and others. These second-hand items if arranged properly will give beauty value.

Kampung Kapas Lor Kulon is a city village located in the East Surabaya area. This village has a high population density and buildings. The greening in this village is very minimal, and it seems shabby. This is due to the lack of existing land, and the awareness of the community is very low. By providing training in farming with verticulture hydroponics, it is hoped that it can improve the knowledge and skills of mothers to grow verticulture hydroponics by utilizing their home or village yards and used goods. In addition, it is also to increase public awareness so that the village environment becomes clean, green, and attractive.

Material and Methods

The method carried out has several stages, namely observation, analysis of potential problems, implementation, and evaluation. Evaluation is carried out through questionnaires distributed before and after the training, as well as monitoring in the field. There are 12 indicators used to see the level of understanding and skills (Rosdiana, 2019). The training activities were carried out for the mothers of Dasa Wisma Kampung Kapas Lor Kulon, RT 04, RW 06, Kapasmadya Baru Village, Tambaksari District, Surabaya.

The verticulture hydroponic systems used in this training are the wick *system* and the DFT (*Deep Flow Technique*) system. The wick system is the easiest system to implement and can take advantage of second-hand goods. The working principle of the wick system is to distribute plant nutrients through stagnant water with the help of wicks. The working principle of the DFT stem is to distribute nutrients to plants through running water and stagnate about 2-5 cm. Plant care with the DFT system is also easier.

Results and Discussion

Kampung Kapas Lor Surabaya is a village with a fairly high density of buildings and population. The population density reaches 315 inhabitants/km². The density of houses per hectare is quite high, reaching more than 100 houses, and there is no distance between houses. The condition of the village is not visually attractive. The impression of slums and aridity is found in many places. We encounter many narrow alleys and houses with limited area. The houses in this village have very limited yards, even many do not have yards or terraces. Many second-hand items are placed on the street adding to the shabby impression. The existing open space is only in the form of streets or alleys of the village itself with very limited greening. The greening carried out by the community today is still limited to ornamental plants, which cannot be used for daily needs.

Observations are made through interviews and field observations. A deep w-the-top was conducted with rt 04 chairman and group leader Dasa Wisma. Direct observation in the Lor Kulon

Cotton village to get a real picture related to the potential and obstacles physically and non-physically. From the results of the observations made, there are potentials and problems, namely: the head of the RT has a strong desire to make his village green and clean by involving the community, young mothers of Dasa Wisma who are quite active, the awareness of the community to make their village green and clean is very lacking, has not utilized the existing used goods.

Training activities are divided into two stages. The first stage is, to begin with, an explanation of the material about farming with verticulture hydroponics. To facilitate understanding, each participant was given a training module. The materials provided include 1) An overview of environmental cleanliness and cleanliness; 2) Understanding hydroponics verticulture; 3) Types of verticulture; 3) Tools and materials used; 4) Preparation of planting media; 5) Vegetable plant breeding; 6) Maintenance of vegetable crops. The types of verticulture and materials described are more emphasized on the use of used goods. In this counseling activity, demonstrations were also given to make hydroponic containers from used materials, namely from used bottles of mineral water and drinks, *styrofoam* lunch boxes, and used plastic basins.

Before entering the training activities for growing vegetables with hydroponics, Dasa Wisma mothers were given an in-depth explanation of hydroponics. Several things must be considered for hydroponic farming, namely sunlight, air (oxygen and carbon dioxide), water, air temperature, and nutrients. Hydroponic plants need eye-day rays of at least 4 hours per day. The level of oxygen dissolved in water is in the range above 6 ppm. The water needed in addition to clean is also available in sufficient quantities. Air temperature is related to the type of plant to be planted, some plants correspond to cold temperatures and plants correspond to hot temperatures. Providing proper nutrition will result in a good and fresh crop.

In the training activities, Dasa Wisma mothers are invited to practice directly the following activities: 1) Sowing vegetable seeds: at this stage, it is taught to place the seeds one by one on the cut rockwool measuring 2.5 cm x 2.5 cm, and given a hole in the middle, then doused with water to make it moist (Figure 1); 2) Memin- dah plant: done when the plant has removed the true leaves, strong enough and not easy to collapse, the roots have come out, it takes approximately 2 weeks for the kale plant, on this occasion, it is taught how to put the wick on the net pot, then proceed with placing the plant in the net pot, 3) Provide a solution of water and nutrients in the basin: taught how to mix AB mix fertilizer with an aqueous solution, comparison of water with AB mix fertilizer, 4) Plant preparation: to maintain oxygen levels, every morning stirring must be done by hand on the existing water, as well as the addition of water when the amount of water is reduced by 50%. The DFT system is in principle the same as the axis system. The difference is in the dose of solution and nutrition, this is due to the larger capacity of the water tank. In addition, in this DFT stem, no stirring of water is needed to produce oxygen, because there are already pumps and hoses that regulate oxygen levels.



Figure 1. The seriousness of participants in sowing seeds on a *Rock Wall*

The participants of the training activity consisted of 20 Dasa Wisma mothers. The age of participants 27 years to 45 years was 10 people (50%), aged 46 years to 65 years were 7 people (35%), and over 65 years old were 3 people (15%). This shows that there are more young or adult

mothers than elderly mothers, and there are fewer elderly mothers. In terms of participant education, it can be detailed elementary school 3 people (15%), junior high school 6 people (30%), high school 8 people (40%), and higher education 3 people (15%). High school education occupies the first level, then Junior High School education, while those with elementary and tertiary education are the same number.

The results of the evaluation carried out showed an increase in knowledge in training participants about the term hydroponics and the meaning of hydroponics. If before the training, only 45% of the term hydroponics was found to be 100%, and those who knew the meaning of hydroponics from 20% to 100%. Participants' knowledge of verticulture terms and the meaning of verticulture before training was also very low. 15% of participants knew the term verticulture, 70% of participants did not know, and 15% of participants were undecided. Only 5% knew the meaning of verticulture, 90% of participants did not know the meaning of verticulture, and 5% of participants doubted the meaning of verticulture. Knowledge of verticulture terms and meanings increased sharply to 90%, although there were still 10% of participants who did not understand them (Table 1). The level of knowledge about verticulture hydroponics before training averaged 21.25%, increasing to an average of 95%. The increase in participants' knowledge after this high training is due to sequential explanations, as well as using language that is easy to understand. In addition, each participant was given a training module equipped with interesting pictures and photos.

Participants' knowledge of open space before training was quite high at 90%, only 10% of participants did not know. All trainees know that planting requires care. Likewise, participants' knowledge of plants requires very high fertilizer or nutrients, namely 95% of participants (Table 1). These three things of knowledge can be used as the basic capital to increase participants' interest and concern in utilizing existing open spaces, caring for plants, and providing nutrition to plants.

Table 1. Questionnaire evaluation results before and after training

No.	Question	Interested (%)		No Interested (%)		Doubt (%)	
		After	Before	After	Before	After	Before
1	Do moms know about Open Space?	90	100	10	0	0	0
2	Have you ever heard of the term Hydroponics?	45	100	50	0	5	0
3	Do moms know the meaning of Hydroponics?	20	100	70	0	10	0
4	Have you ever heard of the term Verticulture?	15	90	70	10	15	0
5	Do moms know the meaning of Verticulture?	5	90	90	10	5	0
6	Does planting require care?	100	100	0	0	0	0
7	Does the plant need fertilizer?	95	100	0	0	5	0
8	Can second-hand goods be used for planting?	70	100	10	0	20	0
9	Have moms ever planted a plant	80	80	20	20	0	0
10	Are mothers interested in growing vegetables	95	100	0	0	5	0
11	Are you interested in growing vegetables in a hydroponic way?	95	100	0	0	5	0
12	Is mom interested in using second-hand goods for planting?	85	100	0	0	15	0

Participants' knowledge about the use of used goods for farming activities before the training was in the sufficient category, namely 70% of participants knew it, 10% did not know, and 20% of participants hesitated. After the training, all participants understood that used items can be used for planting. The interest of participants in utilizing used goods to plant before training was quite high, namely 85% interested, and hesitant 15%. The attraction of participants to utilize used

goods becomes 100% after the training (Table 1). Based on this, the results of monitoring in the field showed that there was an awareness of participants in terms of the use of existing used goods (Figure 2).



Figure 2. Use of styrofoam and used mineral water bottles

Training activities that involve participants practicing technology directly and evaluations in the field can be used as an evaluation of improving the skills of Dasa Wisma RT 04 mothers. There were only 20% of participants who had never planted, but the participants' interest in terms of growing vegetables by hydroponics before training was very high, which was 95%. At the time of the training, the participants seemed very enthusiastic about following the entire course of the event. Seed-sowing skills can be seen from the results of monitoring in the field (Figure 3). Likewise, with the results of the treatment that has been carried out by Dasa Wisma mothers, it can be seen that kale vegetable plants grow well and are healthy (Figure 4).



Figure 3. Seeding results of one of the trainees



Figure 4. Vegetable plants that grow well and are healthy



Figure 5. Hydroponic verticulture DFT systems that have not been successful

The practice of verticulture with the DFT system has not shown its success. This was blamed for repairing the village road which caused the viticulture hydroponic rack to be placed in one of the residents' houses (Figure 5). Improper placement of shelves causes the plant not to get the maximum amount of sunlight.

Conclusion

Training on verticulture hydroponic farming for mothers of Dasa Wisma RT 04 Kampung Kapas Lor Kulon Surabaya can improve knowledge and skills. The increase in participants' knowledge of the meaning of verticulture hydroponics increased quite sharply from 21.25% to 95%. The interest of participants in using used goods for planting activities from 85% before the training to 100%, and the results of monitoring in the field showed that there was very good public awareness of to use of used goods. The improvement of participants' skills is seen during training and monitoring in the field. The mothers of Dasa Wisma RT 04 are skilled in sowing seeds, moving plants, and caring for plants. The increasing knowledge and popularity of the community are expected to make Kampung Kapas Lor Kulon Surabaya clean, green, and attractive.

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