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Production of Several Types of Vegetables in the Composition of the Growing Media Cultivated in a Verticulture

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ABSTRACT

Mitigation of the risk of decreasing food security in urban areas can be done through the use of yardland through urban agriculture which is currently being carried out by urban communities since staying at home is one of the family's independent food solutions by cultivating short-lived vegetables (3-4 weeks) with a multilevel agricultural cultivation system. or ver-tical. The purpose of this study was to determine the composition of the growing media which resulted in the best production of three types of veg-etable crops cultivated vertically. The research was carried out in the ex-perimental garden of the Faculty of Agriculture, UPN "Veteran" Jawa Timur, Surabaya which was arranged in a completely randomized design (CRD), and was repeated 3 times. Factor 1 is the Composition of Planting Media which consists of 4 kinds of composition, namely: Soil, Compost, and Manure, namely: 1:1:1 (K1); 1:1:2 (K2); 1:2;1 (K3), and 1:2:2 (K4). The second factor is the type of vegetables (J), which consists of 3 types, namely: Pakcoy Mustard Plants (J1), Kangkung Plants (J2), and Red Spinach Plants (J3). The results showed that there was a significant interaction between plant height and vegetable production, where the K4J3 combination produced the highest production and was significant different with other treatment combinations.

Keywords: Agriculture, production, verticulture

Introduction

Increasing public awareness of the benefits of vegetables amid a pandemic is increasing day by day. Among the vegetables that almost all people like are mustard, red spinach, and kale, because the vegetables have an economical price and are easy to get and taste fresh, and contain many vitamins A, B, and C which are good for the health of the body.

The importance of vegetables for health, both nutritional and fiber content, encourages people to be more fond of vegetables, especially the Mustard Pakcoy plant, Kale and Red Spinach. The growing demand in accordance with the population increase needs to be anticipated with efforts in the cultivation of vegetable crops. Noting its diverse uses in everyday life, some types of vegetables become very easy to market. Thus, if cultivated properly and correctly, it can provide great benefits.

The shifting function of land in urban areas causes agricultural land in urban areas to become narrower, then the concept of urban farming becomes a solution, where urban farming is utilizing narrow land and limited to urban areas to be used as a place to grow crops so that with limited land can do farming activities. One example of farming activities that can be done in urban areas is with a verticulture system. By utilizing space vertically, gardening becomes more enjoyable with an improved quantity. Housing that does not have yard land but still has open space can still be

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used as a producer of plants for example on top of buildings or attached to building walls (Djuwendah et al., 2021).

Viticultural cultivation of plants is an efficient way of land use by applying the main principle of abundant sunlight utilization, where plants are arranged in containers or multi-story buildings. The viticulture planting method is very suitable for farmers or entrepreneurs who have narrow land in urban areas, where crops are grown vertically using crop shelves as needed.

The success of verticulture cultivation is determined by the composition of planting media. The composition of planting media is one of the important factors that determine success in the cultivation of vegetable crops. Planting media will determine the good growth of plants that ultimately affect production. Planting media has the function to sustain plants, provide nutrients and provide a place for plant roots to grow and develop. Through the medium of planting plants get most of their nutrients. Characteristics of good viticulture planting media is a planting media that has a composition that serves to absorb and deliver water and nutrients and does not affect the decrease in the pH of the growing media. The planting medium should also serve as a root binder and an intermediary for nutrient solutions. The composition of planting media that is commonly used is soil, compost, and manure where the composition of the three media is relatively cheap and easy to obtain.

The biological properties of soil that are good for the growth of mustard plants are soils that contain a lot of organic matter (humus) and various nutrients that are useful for plant growth, and in the soil bodies or soil, organisms are decomposing organic matter so that the biological properties of good soil will increase plant growth (Cahyono, 2003). Soils with colloidal properties can bind nutrients, and through the water, the nutrients can be absorbed by plant roots by the principle of cations exchange. Compost serves to hold water in the soil and little nutrients, while manure guarantees the availability of nutrients needed by plants slowly release. The results of research conducted by Juniyanti et al. (2016) showed that the composition of planting media consisting of soil, husk charcoal, and cow manure by comparison (1:1:3) produces the wet weight of the highest and different kale plants.

The purpose of this study is 1). To find out the combination of the treatment of the composition of the planting media and which type of vegetables are growing and the best results in verticulture cultivation. 2). Review the composition of planting media (soil: compost: manure) which produces the best vegetable growth and yield in viticulture cultivation, and 3). Which type of vegetable is best in viticulture cultivation.

Material and Methods

The research was conducted at the Urban Agricultural Field Laboratory, Campus of the Faculty of Agriculture, UPN "Veteran" Jawa Timur. Jl. Raya Rungkut Madya, Gunung Anyar, Surabaya (place height of 3 m above sea level.) in August to September 2021 using 4 (four) verticulture units each unit consisting of 7 rows of plants along 1.5 m arranged vertically with 4 levels. This study is a factorial study consisting of 2 (two) factors arranged in a complete random design (RAL). The first factor is the composition of the planting media (soil: compost: manure // v:v:v) (K) consisting of: K1 (1:1:1), K2 (1:1:2), and K3 (1:2:1). The second factor is the type of vegetable (J), which consists of 3 types, namely: Mustard Pakcoy Plant (J1), Kale Plant (J2), and Red Spinach Plant (J3). Of the two factors, there are 9 combinations of treatments repeated 3 times, so that 27 units of experiments were obtained. The placement of each viticultural experimental unit on a multilevel shelf is done randomly and the randomization results are shown in Figure 1. Observed include plant height, number of leaves, harvest age and weight of plants, as well as harvest index. Observational data from each changer are analyzed statistically with an analysis of variance (Annova). If showing a real influence (F table > F count) will be carried out further tests to find out the difference in each treatment using the LSD test 5%.

Figure 1. Verticulture model for vegetable cultivation

Results and Discussion

Plant height

Based on the results of statistical analysis of the combination of treatment of planting media composition on plant height 3 (three) types of vegetables cultivated verticulture see a real interaction. The combination of the composition treatment of soil planting media, compost and manure by comparison (1:1:2) in red spinach (K3J3) produces the highest plant height and differs markedly from other treatment combinations (Table 1).

Table 1. The effect of the combination of media composition treatment on the height of plants of some types of vege-tables cultivated verticulturally.

Treatment of Planting Media Composition	Plant height (cm)		
	Mustard (J_1)	Kale (J_2)	Red spinach (J_3)
Soil:Compost:Manure (1:1:1) (K_1)	24.76 a	26.21 b	30.24 c
Soil:Compost:Manure (1:2:1) (K_2)	25.45 ab	26.74 b	33.68 d
Soil:Compost:Manure (1:1:2) (K_3)	27.36 b	28.89 c	36.90 e
LSD 5%		1.44	

* The numbers followed by the same letter show no real difference in the 5% LSD test

Table 1 shows that the combination of K3J3 treatments produces the best plant height and is markedly different from other treatment combinations. Nevertheless, the treatment of K3 produces the highest plant height in mustard plants, kale, and red spinach. There was an increase in the height of mustard, kale, and red spinach in K3 treatment, by 10.50%, 10.23%, and 22.02% compared to the K1 treatment. According to Samekto (2006) that compost helps nutrient-poor soils provide nutrients needed by seedlings, improves soil structure so that seed roots can grow properly, and can carry out their function in absorbing nutrients needed by seedlings more optimally so that with the addition of compost can increase the growth of high plants.

Number of leaves and harvest age

The results of statistical analysis of the effect of the treatment of planting media composition on the number of leaves and harvest age of the three types of vegetable plants showed no real interaction, but every single factor, both the composition of the planting media and the type of vegetable plant showed a noticeable influence. The average number of leaves and harvest life of

the three types of vegetable crops by the influence of the composition of verticulturated planting media is presented in Table 2.

In Table 2 it is known that the K3 treatment produces the highest number of leaves at harvest and is different from the K1 treatment, although it is not really different from the K2. There was an increase in the number of leaves when harvested by K3 treatment by 27.10% compared to the K1 treatment. Table 2 also shows that at the same age, the red spinach plant has the largest number of leaves and differs markedly when compared to the number of mustard plant leaves, as well as kale plants.

According to Goldsworthy and Fisher (1992), the number of leaves will be affected by the height of the plant, with the increasing the plant height, the number of nodes will increase so that the number of leaves will increase because the leaves appear from the node.

Table 2. The effect of the treatment of the composition of planting media on the number of leaves 3 (three) types of vegetable plants cultivated verticulturally

Treatments	Number of Leaves (Strands)	Harvest Age (DAP)
Composition		
Soil:Compost:Manure (1:1:1) (K_1)	21.18 a	37.33 b
Soil:Compost:Manure (1:2:1) (K_2)	24.35 ab	32.18 ab
Soil:Compost:Manure (1:1:2) (K_3)	26.92 b	30.29 a
LSD 5%	5.36	5.86
Vegetables		
Pakcoy mustard (J_1)	15.67 a	33.45 ab
Kale (J_2)	26.24 b	36.12 b
Red spinach (J_3)	31.33 b	30.23 a
LSD 5%	5.36	5.86

*The numbers followed by the same letter show no real difference on the 5% LSD test, DAP = Day After Planting

Against the age of the plant, the treatment of the composition of K3 planting media produces the shortest verticulture-grown vegetable harvest life and is different from the K1 treatment, but not a real difference from the K2 treatment.

In Table 2 it is also shown that each type of vegetable, both mustard, kale, and red spinach plants genetically have different plant ages, and based on observations, red spinach plants have the fastest and most real harvest age compared to the harvest age of kale plants, as well as mustard plants. Red spinach plants are easy to cultivate, do not require high production costs, and can be grown in a short time (about 25 days) (Saparinto, 2013).

Different plant cultivation techniques are very noticeably affecting the observation of plant height, and the wet weight of headers. But it is no real difference in the number of leaves of the Mustard plant. Different planting media are very real against the height of the plant, the wet weight of the header, but no real difference in the number of leaves (Munthe et al., 2018).

Plant weights and harvest index

Based on the results of statistical analysis of the combination of treatment between the composition of planting media to plant weights and the harvest index of all three types of vegetables cultivated verticulturally showed a real interaction. The combination of the treatment of soil planting media composition, compost and manure by comparison (1:1:2) in red spinach (K3J3) produces the highest crop weight and harvest index and differs markedly from other treatment combinations (Table 3).

Table 3. The effect of the combination of planting media composition treatment on plant weights and harvest index of 3 (three) types of vegetables cultivated verticulturally

Treatment of Planting Media Composition	Fresh Weights of Plants (g)		
	Mustard pakcoy (J_1)	Kale (J_2)	Red spinach (J_3)
Soil:Compost:Manure (1:1:1) (K_1)	66.67 c	38.72 a	59.77 bc
Soil:Compost:Manure (1:2:1) (K_2)	72.23 c	45.63 a	67.50 c
Soil:Compost:Manure (1:1:2) (K_3)	80.98 d	58.24 b	74.29 d
BNT 5%		7.33	
	Harvest Index		
	Sawi (J_1)	Kangkung (J_2)	Bayam Merah (J_3)
Soil:Compost:Manure (1:1:1) (K_1)	0.74 ab	0.69 a	0.71 a
Soil:Compost:Manure (1:2:1) (K_2)	0.81 ab	0.81 ab	0.86 ab
Soil:Compost:Manure (1:1:2) (K_3)	0.83 ab	0.84 ab	0.89 b

In Table 3 and Figure 2, it was shown that the fresh weight of the three highest plants was shown by the treatment of the composition of the planting medium on mustard plants (K3J1). However, the treatment of K3 in mustard plants, kale, and red spinach showed the highest fresh weight compared to K1 and K2 treatment.

In table 3 it is also known that the best harvest index is shown by the treatment of the composition of soil planting media, compost, and manure (1:1:2) in red spinach plants (K3J3). Another phenomenon was also shown that the K3 treatment produced the best harvest index for each type of plant. The addition of compost and manure to soil media can increase the total dry weight of red spinach plants (Yosandy et al., 2018). Thus, it is known that the growth of red spinach plants is more influenced by nutrient solutions while anthocyanin content is influenced by nutrients in soil media (Aini et al., 2018). The carbohydrate synthesis occurs in the green parts of the plant, especially the part of the plant leaves that get direct sunlight, using nutrients absorbed by plants as raw materials, called the process of photosynthesis

Figure 2. Plants condition 30 days after planting

The planting media serves as a place for roots to cling, It is also a nutrient provider for plants. The planting media can be improved by giving organic materials such as compost, manure, or other organic materials. Perwitasari et al. (2012) state that spinach planting media enriched with organic fertilizers, such as manure and compost have a real effect on the increase in plant height, leaf area, leaf area, and fresh weight, and total dry weight in pakcoy plants. Crumb structured soil is very good for plant growth and development because it contains organic matter that is a source of nutrients for plants. Manure and compost have advantages in renovating plant growing media, the advantage is that it can improve physical fertility, chemistry, and soil biology (Dewi, 2004).

Meanwhile, compost media, in addition to being able to restore the properties of the soil, both physical, chemical, and biological, compost is also a facilitator in the absorption of nutrient N that is needed by plants (Prihmantoro & Indriani, 2003).

Conclusion

F. oxysporum, 61% against *F. palustris*, and 62% against *T. viridae*. Advised, this isolate also

The composition of planting media has a real effect on the number of leaves, the age of the plant, the fresh weight of the plant and the index of the harvest of all three types of vegetables. The combination of soil planting media composition, compost and manure (1:1:2) produces the best growth and yield in red spinach plants (K3J3) compared to other treatment combinations. The composition of soil planting media, compost and manure (1:1:2) (K3) produces the three types of vegetables with the most number of leaves and the shortest harvest age. The red spinach plant produces the largest number of leaves and the shortest harvest life compared to the mustard pakcoy and kale plants.

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