JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL.4 NO. 1 January 2022

DOI :https://doi.org/10.36378/juatika.v4i1.1838
eissn 2656-1727
pissn 2684-785X
Hal : 215 – 223

Local Resources Utilization For Planting Media Materials In Limapuluh Kota As A Replacement For Rockwool On Pakchoy (*Brassica rapa* L) Growth And Production

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ABSTRACT

The development of technology in agriculture is currently speedy, with innovations that can increase the production and quality of agricultural products. Supporting the hydroponic cultivation system's success is by applying porous and well-aerated media and the availability of sufficient nutrients for plant growth and plant production. The availability of Rockwool is difficult to obtain in the 50 Kota Regency. It needs to utilize local potential as a planting medium alternative, such as using bricks and husk charcoal. The research was conducted in a completely randomized design with three replications. The treatments tested for the composition of the growing media using the Drip flow technique (DFT) system included: Rockwool, Husk Charcoal (50%) + Bricks (50%), Husk Charcoal (25%) + Bricks (75%). Based on the results and discussion of the analysis previously described, the conclusions obtained from the research that has been carried out are as follows: Treatment of the use of various types of growing media on the observation of growth and production of hydroponic Pakcoy plants gives significantly different results on the observation variables of leaf length, leaf width, and the number of leaves and plant total wet weight.
Keywords: *Husk Charcoal, Bricks, Drip Flow Technique* (DFT)

1. INTRODUCTION

Agricultural cultivation becomes an assurance in providing food ingredients and a venture with a promising economic prospect at this moment and in the future. The current agricultural development is very fast with the creation of innovations that can increase agricultural crops and production quality. Hydroponic cultivation is one solution for plant cultivation in a small and narrow farming field with low soil quality (Purwaningsih, 2020).

The hydroponic system also becomes the solution for the problems of the narrow farming field because hydroponic cultivation can be carried out using vertikultur or planting cultivation arranged in a stratified way. This method aims to utilize narrow and limited fields optimally. One hydroponic vertikultur form is the *Drip flow technique* (DFT) system. Hydroponic is one of the solutions for the people who have an inadequate field to cultivate the plant.

The factor determining the success in hydroponic plant cultivation is by utilizing porous media and excellent aeration and the availability of adequate nutrients for plant production and growth (Perwitasari et al., 2012). Rockwool media in Lima Puluh Kota Regency is still hard to obtain, so that the farmers must buy Rockwool from outside of the area and through an online shop. This situation indirectly increases the capital for hydroponic business production. This regency has plenty of husks which is the residue of processed rice. According to Lima Puluh Kota Regency CBS (Central Bureau of Statistics), in 2020, the rice crops were 4.16 tons. The Lima Puluh Kota Regency also has many bricks production places, especially in Harau and Akabiluru Regencies, with plenty of red-yellow podzolic soil. Podzolic soils belong to the order Ultisols (Haitami and Wahyudi, 2019).

Rockwool for water holding capacity is not the same in each type because it is affected by the density and orientation of its fibers (Warjoto et al., 2020). The utilization of local potential in Lima Puluh Kota Regency is a growing media alternative such as utilizing bricks and husk charcoal.

Based on the previous research, Perwitasari et al. (2012) state that utilizing growing media without planting media combinations significantly affects Pakchoy production and growth. Therefore, it is necessary to study growing media composition to determine its effect on Pakchoy plant growth and yield. This research objective is to determine the effect of growing media combination on Pakchoy plant growth and yield and determine which treatment is the most suitable for Pakchoy plant growth and yield.

2. RESEARCH METHOD

Location and Time

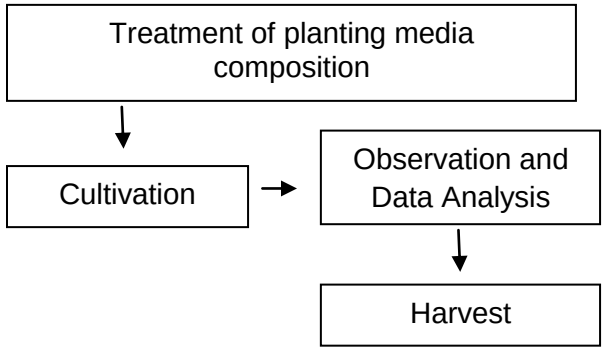
This field research was carried out in Kenagarian Sarilamak, Harau Subdistrict, Limapuluh Kota Regency. Overall, the research activities were conducted from April 2020 until October 2020.

Tools and Materials

The materials used in this research are Pakchoy plant seeds; Hydroponic installation materials, e.g., flannel fabric, Rockwool media, husk charcoal, bricks, nutritional ingredients in AB mix.

Tools used in this research were hydroponic installation, scale, cutter knife, bucket, meter, spraying tube, seeding tray, and stationery.

Research Stages



Making for Growing media Composition

The research made growing media composition conform to the treatment used. The growing plant made was consisted of 50% husk charcoal + 50% bricks and 25% husk charcoal + 75% bricks. The Rockwool treatment provides a 2.5 cm x 2.5cm x 2.5 cm size of Rockwool.

Hydroponic Installation

The hydroponic installation used a Deep Flow Technique (DFT) system with three levels of pyramid shape, in which every installation has six water pipes. Every one installation represents one

research repetition by implementing three treatments.

Seedling and Planting

Seeds were sown on the nursery tray conforming to the seeds requirement, the needs of which are calculated first. The seedling was planted using Rockwool media, and the growing media composition corresponds to the treatment. This way makes it easier to move the plant into the pot net. The seedling process lasts approximately 14 DAS (Days After Seedlings), or the seeds have appeared young roots and three leaves that have opened completely. The seedlings that have grown into young plants were then moved into the pot net already prepared in hydroponic installation.

Treatment application

The treatment was in the growing media composition when the young plants moved into the pot net or planting container in hydroponic installation. The treatment was already measured, conforming to the growing plant composition.

Maintenance

Maintenance on hydroponic cultivation was carried out by paying attention to the nutrition availability, monitoring water supply/nutrition, controlling plant's Pests and disease. The availability of nutrition was checked every day whether it needed to be added nutrition or not. The nutrition allotment was equal for all treatments, either dose or quantities.

Harvest

Harvest was carried out based on an age assessment of 35 DAP and by observing characteristics of plants suitable for commercial sale. Harvesting was carried out manually by separating the plants from growing media. The plants were harvested to all the plants part, and then they were scaled to find out their fresh weight.

Observation Variable

The observed variable includes growth and production. Growth variable covers leaves length, leaves wide, and leaves quantity. The observation of growth and production variable was included on 35 DAP. The production variable is the fresh weight of the plant per sample.

Experiment Design

This research was conducted by applying a Completely Randomized Design with three treatments. The treatment tested was growing media composition was inserted into the pot net by the height of 7 cm, the composition was: 1) Control of Rockwool, 2) Husk Charcoal (50%) + Bricks (50%), and 3) Husk Charcoal (25%) + Bricks (75 %)

Analysis Method

Data processing was carried out by implementing the analysis of variance with an F-test. If the F-count of treatment is more significant than 5% table F, it was continued with Duncan's New Multiple Range Test (DNMRT) of 3% level.

3. RESULT AND DISCUSSION

Leaves Length

The analysis result of the Duncan Multiple Range Test (DMRT) on the leaves length parameter in the age of 35 DAP observation with varied types of growing media treatment is presented in Table 1.

Table 1 The average of Pakchoy leaves length at the observation age of 35 DAP with various types of growing media treatment.

Treatment	Result *)
Rockwool	18.8 b
Husk Charcoal 50% + Bricks 50%	22.4 a
Husk Charcoal 25 % + Bricks 75%	20.8 ab

*) Remark: different notations indicate a significant difference on α = 5%

At the observation age of 35 DAP, the highest average leaves are 22.4 cm with growing media treatment of husk charcoal 50% + Bricks 50%. The average lowest leaves are 18.8 cm at the age of 35 DAP with Rockwool growing media treatment.

The Duncan Multiple Range Test (DMRT) analysis results conducted on the leaves length parameter with the composition of growing media treatment reveals the average result at 35 DAP age. The treatment of growing media composition significantly influences the leaves length parameter at the age of 35 DAP.

A husk charcoal 50% + Bricks 50% combinational treatment creates an excellent growing media for plant flourishment. Husk charcoal contains some nutrients such as SiO2 by 52% level and C by 31%, while Fe2O3, K2O, MgO, CaO, MnO, and Cu with a small amount and some other organic substance content (Gustia, 2013). The availability of nutrients allows the nutritional requirement of Pakchoy vegetative growth to be fulfilled aside from being obtained from AB mix, and the nutrient is also derived from Husk Charcoal. The availability of nutrients in the nutrient solution significantly determines the plants' growth in the hydroponic system (Khodijah and Kusmiadi, 2021).

The brickbat growing plant has the strength to tie up an aeration and drainage system in the growing media (Mustofa et al., 2018). The temperature, aeration, and moisture level will be different between one media with the other conforming to the material used as the media so that it influences plant's growth and yield because bricks have more significant cracks and pores and can store more many nutrients but still can maintain the moisture. The circumstance of 50% husk charcoal + 50% bricks growing plant combination can make the leaves length higher because it has sufficient nutrients stored for the plants' whenever they need. This treatment is not significantly different with husk charcoal 25% + Bricks 75% treatment. The effect of making growing media in this research aligns with Perwitasari et al. (2012) reporting that utilizing different growing media using the hydroponic system will generate different growth to Pakchoy plant.

Leaves Wide

The Duncan Multiple Range Test (DMRT) analysis results of containing have the leaves wide parameter at the observation age of 35 DAP with the various treatment of growing media types; it is presented in Table 2.

Table 2. The average of Pakchoy leaves wide at the observation age of 35 DAP with the various treatment of growing media.

Treatment	Result
Rockwool	11.6 b
Husck charcoal 50% + Bricks 50%	13.3 a
Husck charcoal 25 % + Bricks 75%	12.3 ab

*) Remark: Different notation shows a significant different on α = 5%

At the observation age of 35 DAP, the highest average leaves broad is 13.3 cm seized by husk charcoal 50% + Bricks 50% growing media treatment. After analysis, this treatment is not significantly different with 25% husk charcoal + 75% Bricks treatment. The lowest average of growing media treatment is 11.6 cm, with Rockwool growing media treatment at the observation age of 35 DAP.

The Duncan Multiple Range Test (DMRT) analysis results on leaves wide parameter with the growing media composition treatment show the average score at the age of 35 DAP. The treatment of growing media composition significantly affects the leaves' broad parameter at the age of 35 DAP.

On the brickbat growing media, the plants' root takes longer to utilize nutrients available in the media as the growing support comes from the intake axis capillary activity compared to the root activity that directly absorbs nutrients available from the AB mix and husk charcoal. As a result, the root shape in brickbat growing media is more like wrapped around and flourishing between the pores of small brickbat instead of flourishing toward the ground heading for nutrient direction.

Nutrient absorption of husk charcoal 50 % + 50% Bricks treatment remains optimum, and this is proven by the highest average value of the leaves broad. Husk charcoal is easier to be decomposed (Indrawati et al., 2012).

The media's ability to absorb nutrient liquid will influence nutrient availability within the media. Good aeration will be attained if the media can hold water and help gas exchange coming out from the media. Low nutrient availability will inhibit the physiological growth process for the plant.

Leaves Quantity

The analysis result of the Duncan Multiple Range Test (DMRT) the parameter of leaves quantity at the observation age of 35 DAP with various growing media treatment is presented in Table 3.

Table 3. The average of Pakchoy leaves quantity at the observation age of 35 DAP Rata-rata jumlah daun Pakcoy pada umur pengamatan 35 HST.

Treatment	Result
Rockwool	12.7 b
Husk Charcoal 50% + Bricks 50%	15.2 a
Husk Charcoal 25 % + Bricks 75%	13.6 ab

*) Remark: different notation shows a significant difference on α = 5%

At the observation age of 35 DAP, the highest average of leaves quantity is 15.2 sheets of leaves with 50% husk charcoal + Bricks 50% growing media treatment. The lowest average is 12.7 sheets of leaves at the observation age of 35 DAP using Rockwool growing media treatment.

The analysis result of the Duncan Multiple Range Test (DMRT) carried out on the parameter of leaves quantity using growing media composition treatment shows the average value at the age of 35 DAP. The treatment of growing media composition significantly influences the parameter of leaves quantity at the age of 35 DAP. The influence of utilizing growing media composition parallels Perwitasari et al. (2012), reporting that applying different growing media compositions in the hydroponic system can yield on different leaves broad to Pakchoy plant.

The treatment with the highest average value for the number of leaves was shown in the treatment of growing media 50% husk charcoal + 50% bricks, because the combination of this planting media has nutritional resistance, aeration, good drainage and sufficient nutrient content, so it can be absorbed plant roots.

The observation variable on the leaves quantity indicates the cell division activity occurred. It is assumed that the leaves quantity increment was caused by micro and macronutrient availability within the solution and growing media, especially in the usage of husk charcoal. Plant's response to nutrition influences Pakchoy vegetative growth (Afthansia and Maghfoer, 2018). The availability of nutrients holds an essential role for pakchoi growth because it supplies the leading food for the Pakchoy plant (Bahzar and Santoso, 2018).

Treatment of 50% husk charcoal and Bricks 50% growing media with the highest average value is on the leaves quantity because it can store water from the supply provided for Pakchoy plant growth. It has better nutritional absorption and can maintain moisture and paste the root. Bricks have strength with better drainage and aeration. Bricks media also functions to paste the root (Mustofa et al., 2018).

For its usage as growing media, one has to pay attention to one thing: this media has a drawback in nutrients. Hence, this media's usage needs to be added by adding nutrition from artificial fertilizer or organic substance whose nutrient composition is adjusted with the plants' requirement. One of the drawbacks of bricks as a growing plant is nutrient-poor. On the other hand, the advantage of brick as growing media is its strength, not easy to rot. Consequently, this media is suitable to be placed at the bottom of the pot because it has better drainage and aeration ability (Evinola, 2019).

The characteristic of husk charcoal has excellent porosity and drainage properties but a low ability to absorb and store nutrients. Husk charcoal is challenging to absorb water and get rid of excess water (Perwitasari et al., 2012). The properties of husk charcoal are hard to absorb water and maintain moisture and are not quickly unraveled and broken. Utilizing husk charcoal as growing media should be combined with media that has better water retention so that the utilization is more optimum and the root can easily absorb nutrients and have better growth.

Wet Weight

Plants' wet weight is after harvest before the plant wither and loses water. Additionally, the plant's wet weight is the total weight of the plant crown and the

plant's root weight, which indicates the plant's metabolic activity results.

The analysis result of the Duncan Multiple Range Test (DMRT) in the wet weight (gr) parameter at the observation age of 35 DAP by various growing media treatments is presented in Table 4.

Pakchoy is included on a plant containing plenty of water in its stem, so the condition of wet weight is constantly fluctuating (Perwitasari et al., 2012). The wet weight includes the stem and leaves, meaning that the accumulation of photosynthesis was influenced by nutrient availability.

Table 4. the average of Pakchoy wet weight at the observation age of 35 DAP with various growing media treatments.

Treatment	Result
Rockwool	121,5 b
Husk Charcoal 50% + Bricks 50%	155,7 a
Husk Charcoal 25 % + Bricks 75%	163,5 a

*) Remark: different notation indicates significant different on a α = 5%

At the observation age of 35 DAP, the highest average of wet weight is 163.5 grams using Husk Charcoal 25% + Bricks 75% growing media treatment the lowest average is 121.5 grams using Rockwool growing media at the observation age of 35 DAP.

The Duncan Multiple Range Test (DMRT) analysis results on the parameter of leaves quantity using compositional growing media treatment show the average value at the age of 35 DAP. The compositional growing media treatment significantly affects the parameter of leaves quantity at the age of 35 DAP. In this age, the highest wet weight average is 163.5 grams using husk charcoal 25% + 75% Bricks growing media treatment, and it is not significantly different with husk charcoal 50% + 50% Bricks treatment; the wet weight is 155.7 grams. Meanwhile, husk charcoal 25% + Bricks 75% Rockwool treatment is significantly different with the average value by 121.5 grams.

The canopy on the Pakcoy plant is an essential part of the photosynthesis process. The leaves have chlorophyll contributed to conducting photosynthesis. The more leaves quantity, the result will also be more prominent. The plant's weight is derived from the growth result (Primarine et al., 2020)

The leaves are also the organ to synthesize food or food reserve. In this treatment, the high crown fresh weight was caused by the relatively high leaves quantity. The plant's total wet weight comes from the canopy weight and root weight. From the above observation analysis result above, it is assumed that husk charcoal and bricks growing media derive direct nutrient intake from the nutrition flow so that the wet weight of the Pakchoy plant is heavier using this media than other media. The leaves in the Pakchoy plant contain more water than other organs. Consequently, with more leaves quantity, the plants' water content is also higher so that the fresh weight logically heavier than before (Sarido and Junita, 2017).

Flannel fabric in growing media is helpful for brickbat and husk charcoal media. It is not carried away by nutrient

stream flow by utilizing capillary aid through the pot net axis to absorb the nutrient until the plant root reaches out the nutrition flow surface. It becomes one reason for the roots' fast-growing and flourishment to obtain nutrients directly from the nutrient stream. The nutrient within the water is circulated corresponding to the plants' need so that the root can flourish within the nutritional solution (Wibowo and Asriyanti, 2013).

In this research, the effect of growing media utilization aligns with (Perwitasari et al., 2012), reporting that different growing media in the hydroponic systems produce different wet weights in the Pakchoy plant.

4. CONCLUSION

Using husk charcoal + bricks composition can replace Rockwool usage as a growing plant. The usage of various growing media treatments on the plants' growth and hydroponic Pakchoy production generate different significance on the observational parameter such as leaves length, leaves wise, leaves quantity, and total wet weight of the plant. The highest average of wet weight is 163,5 grams using 25% husk charcoal + 75% Bricks composition treatment. Agronomically, husk charcoal 25% + Bricks 75% is better than Rockwool growing media.

ACKNOWLEDGEMENT

This research was funded by Payakumbuh Polytechnic DIPA in 2020

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