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ENHANCE VERTICULTURAL TECHNIQUE CHAIN LIQUID SUPPLEMENTARY

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ABSTRACT

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The demand for pakcoy vegetables in urban areas is quite high, but these vegetables must be supplied from outside the city or suburban areas. The limited land available is one of the reasons why urban communities cannot produce their vegetables. Urban farming is the right solution to overcome the problem of limited land. One of the urban farming technologies that can be applied is vertical plant cultivation. The purpose of this study was to determine the response of pakcoy plants to liquid complementary fertilizer in a vertical system. The materials used were green fortune pakcoy seeds, liquid complementary fertilizer, compost, husk charcoal, and NPK fertilizer while the tools used were polybags and bamboo racks. The research variables observed were the number of leaves, leaf width, plant height, plant fresh weight, and plant dry weight. The results showed significant differences in plant height, leaf width, and several leaves seen after the plants were 21 DAP. The P4 treatment with a concentration of 2.5 cc/liter of liquid Complementary Fertilizer (PPC) and in the best plant height, leaf width, number of leaves, fresh weight, and dry weight of pakcoy plants.

Keywords: cultivation, pakcoy mustard, verticulture, urban

1. INTRODUCTION

Viticulture is a technique of farming in a narrow space/land by utilizing vertical fields as a place for farming which is carried out in stages. The importance of food as the most basic need for every human being makes fulfilling food needs a top priority in development. Food security includes factors of availability, distribution, and consumption. Availability means an adequate supply of food to meet the needs of the population. The distribution factor is to realize an effective and efficient distribution system to ensure that the community can obtain food in quantity, quality, and at affordable prices. While consumption means directing the pattern of food utilization to meet the rules of quality, diversity, nutritional content, and halalness (Prabowo, 2010).

Fertilization is a very important component in agriculture because fertilization is one component that can increase yields very significantly, especially for rice plants. But nowadays, farmers tend to think that the more fertilizer they give, the higher the yield they will get. Giving the wrong dose of fertilizer can result in higher production costs but plants are more prone to pests and diseases.

Efforts to fulfill food needs face many challenges and obstacles due to changing conditions and the increasing number of cases of pests and plant diseases causing a decrease in crop yields. Therefore, it is necessary to develop a new strategy for optimizing land use to increase the adequacy, security, and food self-sufficiency of the community. The yard is considered to have important functions and benefits for every household, therefore the Ministry of Agriculture 2011 developed the Sustainable Food House Area Program (KRPL), which is a concept of yard land management by

applying the principles of family food security and self-reliance,

Yard land has potential if it is managed optimally and planned. Yards can provide benefits in supporting the nutritional needs of families as well as for beauty (aesthetics) (Rauf, Rahmawaty, & Budiati, 2013). Furthermore, Suryani, et al (2017) stated that vegetable cultivation in urban areas has an important role in ensuring a sustainable food supply for urban residents. Types of environmental plants, such as climate change, and land conversion, which can be planted in the yard include vegetables, fruits, medicines, ornamental plants, and so on. Besides being able to be used for daily consumption, crops from the yard can also be sold as a side business for family members (Dwiratna, et al, 2016).

2. LITERATURE REVIEW

2.1. Plant

Pakcoy (Brassica rapa L.) is a type of vegetable plant that belongs to the Brassicaceae family. The pakcoy plant originates from China and has been widely cultivated after the 5th century in southern and central China and Taiwan. This vegetable is a new introduction in Japan and is still in the same family as Chinese vegetable. Currently pakcoy is widely developed in the Philippines, Malaysia, Indonesia and Thailand. (Setiawan, 2014).

Pakcoy is an annual plant that can only be harvested once. Pakcoy mustard can be harvested at the age of 40-60 days (planted from seed) or 25-30 days (planted from seed) after planting (Prastio, 2015). Suitable planting areas are from an altitude of 5 meters to 1,200 meters above sea level. Pakcoy plants can grow both in hot and cold places, so they can be cultivated from the lowlands and highlands. However, in reality the results obtained are better in the highlands. Pakcoy plants are resistant to rain, so they can be planted all year round. In the dry season that needs to be considered is regular watering. (Setiawan, 2014).

2.2. Liquid complementary fertilizer

Fertilization is an effort to provide nutrients needed by plants to increase the supply of nutrients in the soil. In general, fertilization is done through the roots, but application through the leaves and stems can also be done in the form of a solution. Nutrients can be supplied through the soil. although it is not completely absorbed by the plant so that the results obtained feel less favorable, the absorption will be better if it is supported by good physical and chemical fertility. Especially for micro nutrients, the amount of fertilization is small but its availability must be fulfilled, it cannot be replaced with other nutrients.

Liquid complementary fertilizers are processed materials that contain many nutritional elements for plants, both macro and micro elements which are very good for improving soil structure, neutralizing soil pH, spurring plant growth starting at roots, stems and leaves and fertilization to maximize crop production yields and reduce damage. result of pest attack. In urban or residential areas, the limited land available for agricultural use is one of the current agricultural problems. This causes the need for engineering so that in this narrow area, organic vegetables can still be presented for the purposes of daily life. Availability of food in sufficient quantities at all times is an undeniable necessity.

2.3. Verticulture

Verticulture is an agricultural cultivation system that is carried out vertically or tiered both indoor and outdoor. This vertical farming system is a reforestation concept that is suitable for urban areas and limited land. For example, a 1 meter area may only be able to grow 5 plants with a vertical system for 20 plant stems. Verticulture is not only a vertical garden, but this idea really stimulates someone to create a treasure trove of biodiversity even in a narrow yard. The vertical structure makes it easier for users to create and maintain it (Liferdi, 2011).

Vertical farming is not only a source of food but also creates a pleasant natural atmosphere. There are a lot of models, materials, sizes, and vertical containers, just adjust it according to the

conditions and desires. In general, it is rectangular, or similar to stairs, with how many steps or a number of shelves. Materials can be bamboo or paralon pipes, used cans, even sheets of rice sacks, because one of the philosophies of verticulture is to use used objects around us (Liferdi, 2011).

3. METHOD

The materials used are green fortune pakcoy seeds, liquid complementary fertilizer, compost, husk charcoal, and NPK fertilizer while the tools used are polybags, and bamboo racks. Research Design The study was conducted using a Randomized Block Design (RAK) with 6 treatments and 3 (three) replications. The type of treatment was P1 = 0 cc/liter of water (control); P2= 1.5 cc/liter concentration; P3= 2.0 ccl/liter recommended concentration; P4 = 2.5 cc/liter recommended concentration; P5 = 3.0 cc/liter recommended concentration; P6 = 3.5 cc/liter concentration.

Making planting media begins by mixing the three soil ingredients, husk charcoal and compost in a ratio of 2: 1: 1, after the ingredients are mixed well, the planting media materials are put into polybags. Seedling starts from soaking the pakcoy seeds with water (warm) for 1/2 - 1 hour to moisturize the seed coat so that the skin pores enlarge. Proceed to the next stage, which is inserting the seeds in each hole of the seedling tray and then closing it again with the media. Watering the nursery is sprayed with a sprayer if the media starts to dry. The seedlings are covered with newsprintmanufacture of Vegetable Compost Fertilizer.

4. RESULTS AND DISCUSSION

4.1. High Response of Pakcoy Plants to Liquid Complementary Fertilizer

Table 1. Response of pakcoy plant height to liquid complementary fertilizer

Treatment	Plant height(cm)				
	7 HST	14 HST	21 HST	28 HST	35 HST
P1	11.62 a	18.38 a	18.38 a	21.41 a	21.76 a
P2	12.22 a	23.27 a	23.27 c	22.94 a	23.25 b
P3	12.00a	23.50 a	23.50 c	23.50 b	23.50 b
P4	12.02 a	26.07 a	26.07 d	25.55 c	26.03 c
P5	10.89a	23.79 a	23.79 c	23.79 b	23.79 b
P6	10.94 a	19.97 a	19.97 b	21.33 a	21.66 a

Note: P1= 0 cc/liter of water (control); P2= 1.5 cc/liter concentration; P3= 2.0 ccl/liter recommended concentration; P4 = 2.5 cc/liter recommended concentration; P5= 3.0 cc/liter recommended concentration; P6 = 3.5 cc/liter concentration. Numbers followed by the same letter are not significantly different

4.2. Response of Pakcoy Leaf Number to Liquid Complementary Fertilizer

Table 2. Response of the number of leaves of pakcoy plants to liquid complementary fertilizer

Treatment	Number of leaves (strands)				
	7 HST	14 HST	21 HST	28 HST	35 HST
P1	5.92 a	11.33 a	11.32 a	13.00 a	11.42 a
P2	5.83 a	10.87 a	13.37 a	13.97 a	14.20 a
P3	5.67 a	10.67 a	13.58 a	14.17 a	14.67 a
P4	5.33 a	10.77 a	14.10 a	15.10 a	15.53 a
P5	5.83 a	10.92 a	12.92 a	14.00 a	14.17 a
P6	5.42 a	10.58 a	12.00 a	12.92 a	12.42 a

Note: P1 = 0 cc/liter of water (control); P2 = 1.5 cc/liter; P3= 2.0 ccl/liter recommended concentration; P4 = 2.5 cc/liter recommended concentration; P5= 3.0 cc/liter recommended concentration; P6 = 3.5 cc/liter concentration. Numbers followed by the same letter show no significant difference

4.3. Response of Pakcoy Leaf Width to Liquid Complementary Fertilizer

Table 3. Response of leaf width of pakcoy plants to liquid complementary fertilizer

Treatment	Leaf width(cm)				
	7 HST	14 HST	21 HST	28 HST	35 HST
P1	4.62 a	7.96 a	8.34 a	8.65 a	7.42 a
P2	4.62 a	8.05 a	9.85 a	10.19 a	1.51 a
P3	4.65 a	7.68 a	10.08 a	10.37 a	1.56 a
P4	4.48 a	8.09 a	11.97 b	12.17 b	1.40 a
P5	4.84 a	7.75 a	10.02 a	10.17 a	1.37 a
P6	4.19 a	7.43 a	8.47 a	8.78 a	8.40 a

Note: P1 = 0 cc/liter of water (control); P2 = 1.5 cc/liter; P3= 2.0 ccl/liter recommended concentration; P4 = 2.5 cc/liter recommended concentration; P5= 3.0 cc/liter recommended concentration; P6 = 3.5 cc/liter concentration. Numbers followed by the same letter show no significant difference

4.4. Response of Pakcoy Plant Fresh Weight to Liquid Complementary Fertilizer

Table 4. Response of weight Response of pakcoy plant fresh weight to pe fertilizer complete liquid

Treatment	Average (grams)	Notation
P4	313.00	A
P5	280.83	a
P3	267.53	a
P2	247.33	a
P6	241.27	a
P1	213.87	A

Note: P1 = 0 cc/liter of water (control); P2 = 1.5 cc/liter; P3= 2.0 ccl/liter recommended concentration; P4 = 2.5 cc/liter recommended concentration; P5= 3.0 cc/liter recommended concentration; P6 = 3.5 cc/liter concentration. Numbers followed by the same letter show no significant difference

4.5. Dry Weight Response of Pakcoy Plants to Liquid Complementary Fertilizer

Table 5. Response of pakcoy plant dry weight to supplementary fertilizer cair

Treatment	Average (grams)	Notation
P4	26.03	A
P5	23.79	A
P3	23.50	A
P2	23.25	A
P6	21.76	A
P1	21.66	A

Note: P1 = 0 cc/liter of water (control); P2 = 1.5 cc/liter; P3= 2.0 ccl/liter recommended concentration; P4 = 2.5 cc/liter recommended concentration; P5= 3.0 cc/liter recommended concentration; P6 = 3.5 cc/liter concentration. Numbers followed by the

same letter show no significant difference

4.6. High Response of Pakcoy Plants to Liquid Complementary Fertilizer

Analysis of variance and BNJ test at 5% level for plant height showed a significant effect on pakcoy plant height. The difference in plant height which was quite significant or significantly different was seen at the P4 level treatment with a concentration at the level of 2.5 cc/liter of water. Compared with other treatments. Significant differences were seen after the plants were 21 DAP. In treatment P4 looked the highest and significantly different from other treatments. this is because the nutrients in the treatment can be met and can encourage or support the plant growth process. The response of pakcoy plant height to liquid complementary fertilizer can be seen in Table 1. The difference in plant height can be seen after the plant is 28 days after planting. The average fresh weight of pakcoy plants in treatment P4 (2, 5 cc/liter of water) fresh weight at a significant level compared to the fresh weight of pakcoy plants in treatment P1 (control). Observations at the age of 35 days after planting (DAT) showed the highest average plant fresh weight (260.07 g) in the P4 treatment (2.5 cc/liter of water) and the lowest average plant fresh weight (180.38 g). in treatment P1 (control). Giving fertilizer through the leaves is more effective because it can be directly absorbed by plants. Giving fertilizer through the leaves is more effective because it can absorb the nutrients directly and quickly, besides that it is also beneficial because it avoids root damage and can overcome micro element deficiencies.

4.7. Response of Pakcoy Leaf Number to Liquid Complementary Fertilizer

Analysis of variance and BNJ test at the 5% level for the number of leaves of pakcoy plants showed a significantly different effect between treatments on the number of leaves of pakcoy plants. The response of the number of leaves of pakcoy plants to liquid complementary fertilizer can be seen in Table 2. The increase in the number of leaves was significantly different in the P4 treatment with a concentration at the level of 2.5 cc/liter of water. while the lowest was at the P1 (control) level. This is because plants have obtained macro and micro nutrients or substances that can support the process of forming leaf tissue. The nutrients needed by hydroponic plants are nitrogen, phosphorus, calcium, magnesium, manganese, sulfur, boron and zinc. The presence of the most severe overdose of a food substance is rare. This is almost in addition to being total if not immediately corrected, but it can be damaging if the overdose has to be really severe. This can happen if the fertilizer is not thawed first

4.8. Response of Pakcoy Leaf Width to Liquid Complementary Fertilizer

Analysis of variance and BNJ test at 5% level for leaf width of pakcoy plants showed a significant effect on leaf width of pakcoy plants. The increase in leaf width was significantly different at the P4 level treatment with a concentration at the level of 2.5 cc/liter of water. compared to other treatments. The response of the leaf width of the pakcoy plant to the effect of the concentration of liquid complementary fertilizer can be seen in Table 3. The process of plant growth has been obtained through roots and leaves which include macro and micro nutrients so that it can support the formation of leaf tissue. Macro and micro nutrients are given through the leaves by spraying. is a complete foliar fertilizer. in liquid form with content of 11% N, 10% P2O5 and 6% K2O as well as other complementary nutrients.

4.9. Response of Pakcoy Plant Fresh Weight to Liquid Complementary Fertilizer

Analysis of variance and BNJ test at 5% level for fresh weight of pakcoy plants compared to other treatments. The weight of treatment P4 with a concentration at level 2.5 showed a significant difference to the fresh weight of pakcoy plants if cc/liter of water compared to other treatments, while the lowest was at level P1 (control). The response of pakcoy plant fresh weight to liquid complementary fertilizer can be seen in Table 4.This will increase the growth and development of the plant concerned. In addition, the concentration of 2.5 cc/liter of water turned out to be the right concentration so that the absorption process through the leaves could be carried out optimally. As is

known, nutrient absorption through leaves is closely related to membrane permeability. This is because the mechanism of nutrient absorption by leaves is a diffusion process and for certain nutrients through an active transport mechanism. Fertilizer can not only be given through the soil can also be given through the leaves of plants. The process of absorption of macro and micro nutrients given through the leaves is faster when compared to fertilization through the soil. Loss of fertilizer due to washing, evaporation, and fixation will be smaller because fertilizer can be directly absorbed by plants. The advantages of using foliar fertilizers are that plants shoot shoots faster and plants are not easily damaged and fertilization through leaves in the dry season is more efficient because fertilizers given through leaves are already in a state ready to be absorbed, so that they are directly absorbed by plant leaves. influenced by pH and groundwater conditions. The absence of one of the macro and micro nutrients can cause disruption of plant growth.

4.10. Dry Weight Response of Pakcoy Plants to Liquid Complementary Fertilizer

Analysis of variance and BNJ test at 5% level for dry weight of pakcoy plants showed a significant effect on fresh weight of pakcoy plants. The dry weight was quite significant at the treatment level P4 with a concentration at the level of 2.5 cc/liter of water while the lowest was at the level P1 (control). The response of fresh weight of pakcoy plants to liquid complementary fertilizer can be seen in Table 5. Average dry weight of pakcoy plants in the P4 treatment (2.5 cc/liter of water) the dry weight was significantly higher than the fresh weight of the pakcoy plant in the P1 (control) treatment. The age of observation was 35 days after planting, the highest average plant dry weight was (260.07 g) in treatment P4 (2.5 cc/liter of water) and the lowest average plant fresh weight was (180.38 g) in treatment P1 (control). This shows that the effect of the treatment is significantly different in the process of forming plant tissue after the water content in the cells is lost or very small. If the amount of nutrients provided is sufficient to meet the needs of the plant, it will be able to increase the growth and development of the plant concerned. In addition, the concentration of 2.5 cc/liter of water turned out to be the right concentration so that the absorption process through the leaves could be carried out optimally. As is known, nutrient absorption through leaves is closely related to membrane permeability. This is because the mechanism of nutrient absorption by leaves is a diffusion process and for certain nutrients through an active transport mechanism. If the amount of nutrients provided is sufficient to meet the needs of the plant, it will be able to increase the growth and development of the plant concerned. In addition, the concentration of 2.5 cc/liter of water turned out to be the right concentration so that the absorption process through the leaves could be carried out optimally. As is known, nutrient absorption through leaves is closely related to membrane permeability. This is because the mechanism of nutrient absorption by leaves is a diffusion process and for certain nutrients through an active transport mechanism. If the amount of nutrients provided is sufficient to meet the needs of the plant, it will be able to increase the growth and development of the plant concerned. In addition, the concentration of 2.5 cc/liter of water turned out to be the right concentration so that the absorption process through the leaves could be carried out optimally. As is known, nutrient absorption through leaves is closely related to membrane permeability. This is because the mechanism of nutrient absorption by leaves is a diffusion process and for certain nutrients through an active transport mechanism. Nutrient absorption through leaves is closely related to membrane permeability. This is because the mechanism of nutrient absorption by leaves is a diffusion process and for certain nutrients through an active transport mechanism. Nutrient absorption through leaves is closely related to membrane permeability. This is because the mechanism of nutrient absorption by leaves is a diffusion process and for certain nutrients through an active transport mechanism.

5. CONCLUSION

The results of the study concluded that the liquid supplementary fertilizer with a concentration of 2.5 cc/liter of water gave the best plant height, leaf width, number of leaves, fresh weight and dry weight of pakcoy plants. Verticulture is a technique of farming in a narrow space/land by utilizing

vertical fields as a place for farming which is carried out in stages. The importance of food as the most basic need for every human being makes fulfilling food needs a top priority in development. Food security includes factors of availability, distribution and consumption. Availability means an adequate supply of food to meet the needs of the population. The demand for pakcoy vegetables in urban areas is quite high, but these vegetables must be supplied from outside the city or suburbs. The limited land available is one of the reasons why urban communities cannot produce their own vegetables. Urban farming is the right solution to overcome the problem of limited land. One of the urban farming technologies that can be applied is vertical plant cultivation.

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