RESPONSE OF GROWTH MUSTARD PLANT PAKCHOY (*BRASSICA CHINENSIS* L.) THE COMPOSITION OF PLANT MEDIUM AND DOSAGE OF NPK BY VERTICULTURE

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ABSTRACT.
Sri Utami, Dafni Mawar Tarigan, Itqon Fahmi Syair. 2018. Respons of Growth Mustard Plant Pakchoy (Brassica chinensis L.) to Composition of Plant Medium and Dosage of NPK by Verticulture. The community consumption needs for vegetables are increasing, but mustard pakchoy production is still lacking, so research is needed on various aspects of cultivation techniques including fertilization. The study aimed to obtain the composition of plant medium and dosage of NPK by verticulture. This research was conducted at Deli Serdang in Agustus to September of 2017. Split Plot Design with 3 replicates. The composition of plant medium as the main plot consisted of M_1 (charcoal husk: compost: soil), M_2 (compost: coconut fiber: soil), M_3 (coconut fiber: charcoal husk: soil). The dosage of NPK as subplot consisted N_1 (1.5 g-plant), N_2 (3 g-plant). N_3 (4.5 g-plant). The results indicated that the composition of plant medium (charcoal husk: compost: soil) significantly affected on leaf chlorophyll, leaf area, fresh weight of plant and dry weight of the plant. The dosage of NPK (4.5 g-plant) significantly affected on leaf area, fresh weight of plant and harvest index. The interaction between the composition of plant medium with dosage NPK not significantly to all parameters.
Keywords: the plant, mustard pakchoy, the composition of plant medium, the dosage of NPK, verticulture

A. INTRODUCTION

Mustard pakchoy includes leaf vegetable plants that have high economic value after cabbage, flower cabbage and broccoli. Pakchoy leaves are dark green and white or green leaf stalks (Rukmana, 1989; Green-Seed, 2004). Vegetable plants need support for the growth. The increase mustard pakchoy yield could be done through proper fertilization. Compound fertilizer, which is a fertilizer containing two or more plant nutrients (macro and micro), for example, NPK (Rosmarkam and Yuwono, 2002). Nitrogen, phosphor, and potassium are important factors and must always be available to plants because they function as metabolic processes and biochemistry of plant cells (Nurtika and Sumarni 1992). Nitrogen is a constituent of amino acids, proteins, and enzymatic processes. That abundant nitrogen increases rapid growth and greater development in dark stems and leaves (Mengel and Kirkby, 1987; Foth, 1988). Phosphorus is is a builder nucleic acid, phospholipids, bio-enzymes, proteins, metabolic compounds, and is part of ATP that is important in energy transfer (Sumiati 1983). Potassium plays a role in water metabolism in plants, nutrient absorption, regulation of breathing, transpiration, enzyme work, and carbohydrate translocation, forming a stronger stem, and is very influential on crop yield both quantity and quality (Silver-Young, 1999). The dose of NPK fertilizer 0.6 g per plant is the most efficient dose to be given to curly chili which produces high yields and more leaves (Wulandari et al. 2018). Application of NPK 15-15-15 as basic fertilizer at a dose of 0.5 t / ha or 1.0 t / ha, giving the same cabbage weight production results (Sumiati, 2006).

Efforts to increase the growth of mustard pakchoy need to be done. One way, by using the right planting media. Planting media has an important function for plants as a place to plant and develop plants and provide water and nutrients for plants. In general, planting media can be categorized into two, i.e. the soil and non-soil planting media. The properties of different materials used as growing media exhibit direct and indirect effects on plant growth and productivity. Some technical and economic factors play a role when choosing substrates. At the beginning of Gravel or Sand, later materials such as peat, vermiculite, perlite have been used commonly (Celikel, 1999). The selected medium has confirmed to requirements for optimal growth. The planting media that can be applied for verticulture are soil, compost, cocopeat, and charcoal from the hull. Meanwhile, materials of the verticulture include gunny sack, carpet, and plastics (Noverita, 2005). Increased awareness of nutritional needs leads to increased demand for vegetables in general and mustard in particular. The problem that often arises is the difficulty of supplying vegetables continuously. To deal with such cases, a planting system is needed that can guarantee continuous

production with a gradual planting system (Setiawan, 1995). Verticulture is one of effort to agricultural of narrow as urban farming (Sitawati, et al. 2016). Verticulture is a vertical farming technique that applies a terraced farming system. Such a technique does not require a wide area and it could utilize the land efficiently, and it may be applied to houses with no yard (Pongarrang et al. 2013). Planting medium affects the growth of the plant, which is grown in verticulture. The interaction between the planting medium and verticulture container could increase yield (Noverita, 2005). Therefore, this study is needed to obtain an effective and efficient composition of the planting medium and NPK fertilizer dosages that can be applied vertically in mustard's plant pakchoy culture to support food security programs.

A. MATERIALS AND METHODS

This research was conducted at Deli Serdang in Agustus to September of 2017, and the materials used in this study were mustard seeds pakchoy of Nauli F1variety, charcoal husk,compost, coconut fiber, soil, NPK fertilizer 16:16:16, verticulture rack. The research was conducted using Split Plot Design with 2 (two) factors: the composition of plant medium as the main plot consisted of M_1 (charcoal husk: compost: soil), M_2 (compost: coconut fiber: soil), and M_3 (coconut fiber: charcoal husk: soil), the dosage of NPK as subplot consisted N_1 (1.5 g-plant), N_2 (3 g-plant) and N_3 (4.5 g-plant), with 3 (three) replicates. Data were analyzed by using ANOVA Test. The result that the ANOVA test shows the real effect is the Duncan Multiple Range Test. The parameters were observed leaf chlorophyll, leaf area, fresh weight of plant and dry weight of the plant and harvest index.

B. RESULTS AND DISCUSSION

Leaf Chlorophyll

The obtained leaf chlorophyll content of mustard pakchoy treated on the composition of plant medium is the highest chlorophyll in M_1 (charcoal husk: compost: soil) and the lowest is in M_3(coconut fiber: charcoal husk: soil) This figure 1 shows that the treatment of the composition M_1 has a high content of nitrogen and carbon nutrients and plays a role in the preparation of chlorophyll and plays an important role in the formation of coenzymes. The media and nutrient composition treatment gave significantly different results on the variable number of leaves, leaf area, and leaf chlorophyll content at various ages of mustard pakchoy (Perwitasari et al. 2012)

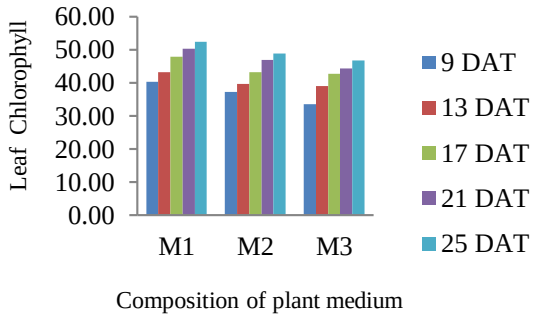


Figure 1. Histogram of Leaf Chlorophyll on the Composition of Plant Medium in Various Plant Age

The rice charcoal husk media is a medium that has gone through a combustion process so that the carbon content is high and easily decomposed. In addition, rice charcoal husk has a high absorption because it has a larger pore so that it can absorb nutrients that are nearby to be stored in the pore (Agustinet al. 2014). The organic medium contained substrates, which have a various physical condition, decompose over time, and decompose rate (Olle et al. 2012). The leaf chlorophyll content was significantly influenced by the levels of N, P, and K and declined with decreasing doses of fertilizer treatments during the treatment period due to growth (Hossain, 2010).

Leaf Area

The obtained leaf area mustard pakchoy treated on the composition of plant medium is the widest leaf areaat the age of 25 days after planting, in M_1 (charcoal husk: compost: soil) compared to M_2 and M_3 treatments (Figure 2). This shows that the treatment of the composition M_1 has availability of nutrient N is sufficient so that the growth and development of leaves can take place maximally. High nitrogen and carbon nutrients can also help in the process of forming vegetative organs such as leaves. The wider the leaf, the more chlorophyll and the rate of photosynthesis increases. Nitrogen nutrients can stimulate the growth of organs associated with photosynthesis and can improve the yield of leafy plants and broad plant leaves with a greener color (Sutrisno and Ratna, 2015).

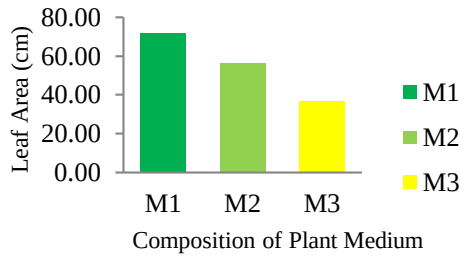


Figure 2. Histogram of Leaf Area on the Composition of Plant Medium at the Age 25 days after planting (DAT)

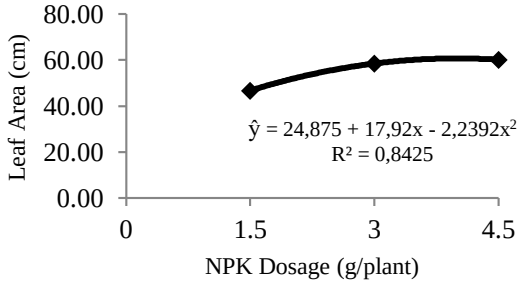


Figure 3. Graph of the relation between Leaf Area with NPK Dosage at the Age 25 days after transplanting (DAT)

The application of NPK dose showed the significant effect to leaf area is a quadratic graph with the equation $\hat{y} = 24.875 + 17.92x - 2.2392x^2$, $R^2 = 0.8425$ (Figure 3). NPK dose treatment on N_3 (4,5 g / plant) shows the widest leaf compared to other treatments, this is due to the addition of the right NPK dose will produce better growth and development for mustard pakchoy, but if the dose is excessive then it can inhibit the development and crop production. The leaf function as the main organ in photosynthesis, in which the wider the leaf area, light interception, and CO_2 fixation will be higher so that higher photosynthesis will effect on the yield of assimilating (Lakitan, 2008). The application of NPK showed a significant effect on numbers of leaf, yield, and quality of strawberry (Sitawati et al. 2016).

Fresh Weight of Plant

The obtained leaf area mustard pakchoy treated on the composition of plant medium in M_1 is the heaviest fresh weight of plants compared to M_2 and M_3 treatments (Figure 4). This is due to the treatment of the composition of the planting medium M_1 (charcoal husk: compost: soil) is porous, light, not dirty and can hold water to the maximum so that moisture can be maintained and the treatment of the composition of the M_1 growing media there are many nutrients derived from husk charcoal, compost, and soil. Plant growing media affect plant growth and development to get optimal results (Fatimah and Handarto, 2008).

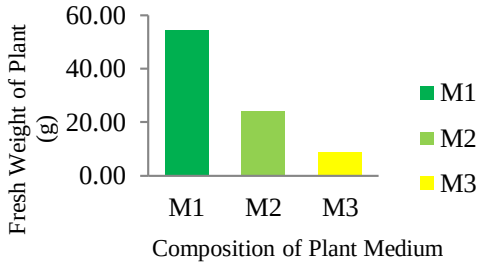


Figure 4. Histogram of Fresh Weight of Plant on The Composition of Planted Medium at the Age 25 days after transplanting (DAT)

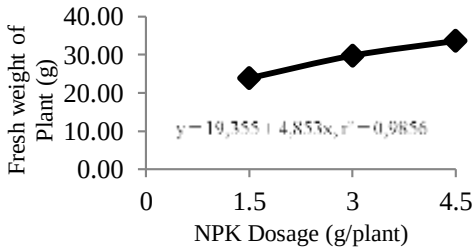


Figure 5. Graph of the relation between Fresh Weight of Plant with NPK Dosage at the Age 25 days after transplanting (DAT)

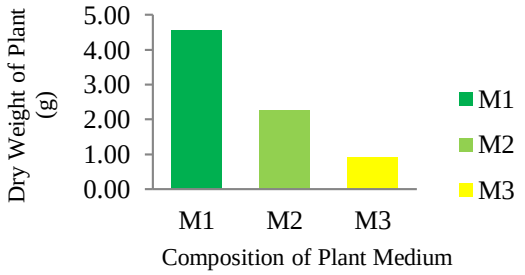
The fresh weight of the plant is affected by the number of leaves, the more the number of mustard leaves, the fresh weight of the plant will be heavier and can provide maximum production. Application of nitrogen in pakchoy plants increases fresh weight and dry weight of plants at the age of 25 days after planting (Utami, 2005). The increasing the number of plants leaves it will automatically increase the fresh weight of the plant because the leaves are a sink for plants. In addition to vegetable plants are organs that contain lots of water, so that with the increasing number of leaves the plant water content will be high, causing the plant's fresh weight to be higher (Sarido and Junia, 2017).

The application of NPK dose showed the significant effect on the fresh weight of the plant is a linear graph with the equation $\hat{y} = 19,355 + 4,853x$, $r = 0,9856$ (Figure 5). NPK dose treatment on N_3 (4,5 g / plant) shows the heaviest fresh weight of mustard pakchoy compared to M_2 and M_1 treatments. The application of N, P, and K could increase the growth

and yield of tomato (Subhan et al. (2007). The application of N, P, and K would increase growth, height, and diameter of the plant, as well as its production (numbers of flower, numbers of fruit, and weight of fruit per plant), which are higher on tomato (Nurtika, 1992).

Dry Weight of Plant

The obtained dry weight of the mustard pakchoy treated on the composition of plant medium in M_1 (charcoal husk: compost: soil) is the heaviest dry weight of plant compared to M_2 and M_3 treatments (Figure 6). The nitrogen fertilizer application rate stronger affected dry matter production (Booij et al. 1996). According to Irawan and Kafiar (2015) that dry weight is an indication of the success of plant growth, because the dry weight is an indication of clean photosynthesis results that can be deposited after the water content is dried. Dry weight shows the ability of plants to take nutrients from growing media to support their growth. With increasing dry weight of plants associated with plant metabolism or the presence of better plant growth conditions for ongoing metabolic activities of plants such as photosynthesis. Thus the greater the dry weight indicates the photosynthesis process takes place more efficiently. The greater the dry weight the more efficient photosynthesis process occurs and the productivity and development of tissue cells are higher and faster, so that plant growth becomes better.



Harvest Index

NPK dosage fertilizer gives a significant influence on the harvest index of mustard pakchoy at the age of 25 days after planting.

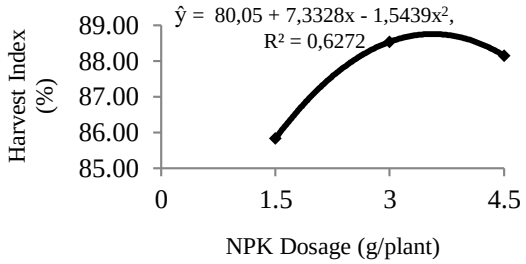


Figure 7. Graph of the relation between Harvest Index and NPK Dosage at the 25 days after planting (DAT)

The harvest index was affected by application of NPK dosage. In Figure 7 shows a significant difference in NPK dosage treatment. The application of NPK dosage 3 g-plant has the highest harvest index (88.54 %). High harvest index values indicate that varieties are able to distribute more assimilated to leaves. The lowest harvest index NPK dosage 1.5 g-plant (85.84 %). A low harvest index value is meaningless low plant ability in photosynthetic efficiency. Harvest index can used as a benchmark for high or low plant productivity (Kurniadie, 2002). The application of higher NPK dosage of 4.5 g causes a decrease in the harvest index (88.15%). According to Danesh-Shahraki, et al. (2008) the highest Nitrogen level interferes with the efficiency of partitioning and results in more distribution of dry matter into various parts of the plant than the reproductive organs and consequently decreases the harvest index value.

C. CONCLUSIONS

The results indicated that the composition of plant medium charcoal husk: compost: soil (M_1) significantly affected on leaf chlorophyll, leaf area, fresh weight of plant and dry weight of the plant. The dosage of NPK 4.5 g-plant (N_3) significantly affected leaf area, fresh weight of plant and harvest index. The interaction between the composition of plant medium with dosage NPK not significantly to all parameters.

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