INTERNATIONAL PROCEEDING OF
LAW & ECONOMIC
IPLE 2020

ISBN: 978-623-6763-07-0

AN APPLICATION OF LIQUID ORGANIC FERTILIZER FOR THE GROWTH AND PRODUCTION OF PAKCOY (Brassica rapa L) ON CHICKEN MANURE AND CHARCOAL GROWTH MEDIA

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Abstract

Pakcoy(Brassica rapa L) is an annual plant originating from the Brassica species which is easy to obtain at an economical price and contains ingredients needed by humans such as minerals, vitamins and fiber. This study aims to determine the response of water hyacinth liquid organic fertilizer and chicken manure compost planting medium with husk charcoal to the growth and production of pakcoy (B. rapa L). This research was conducted at Jalan Ikan Bandeng, Tanah Tinggi Village, East Binjai District, Binjai City using a Factorial Randomized Block Design (RBD) consisting of 2 factors, 16 combinations and 2 repetitions. The treatment of growing media (M) was 4 levels, namely: M0 = Control, M1 = 1:1 (Charcoal + Chicken Manure Compost), M2 = 2:1 (Charcoal + Chicken Manure Compost) and M3 = 1:2 (Charcoal rice husk + chicken manure compost). There are 4 levels of water hyacinth liquid organic fertilizer (P), namely: P0 = control (using plain water), P1 = 60 ml/500 liters of water/polybag, P2 = 120 ml/500 liters of water/polybag, and P3 = 180 ml /500 liters of water/poly bag. Parameters observed were plant height, number of leaves, leaf area per sample, production weight per plot, plant fresh weight per sample and net consumption weight per sample. The results of the research on planting media of chicken manure compost with rice husk charcoal had a significant effect on all observed parameters. The results of the study applying water hyacinth liquid organic fertilizer had no significant effect on the parameters of plant height, number of leaves, leaf area, net weight consumed per sample, fresh weight of plants per sample and had a significant effect on the parameter of production weight per plot.
Keywords: *Pakcoy, growing media, POC water hyacinth*

1. INTRODUCTION

Sawi is an annual plant from the Brassica genus group which is divided into several types, one of which is the pakcoy plant. Pakcoy plant (Brassica rapa L) is a plant that is easily available at an economical price. Pakcoy plants are included in vegetable plants which are useful, because they are a source of vitamins, minerals and fiber needed for body health and and increase the effect of the nutrients they provide on the quality of human life (Rizal, 2017).

The results of the production of organically cultivated vegetable plants have in fact begun to develop among Indonesian people. The production of pakcoy mustard (B. rapa L) fluctuated in 2012, 2013 and 2014 (BPS and Directorate General of Horticulture, 2015).

Planting media is the main component used when farming. The use of planting media must also be adjusted to the type of plant to be planted. In general, there are several criteria in determining the right planting medium, namely the planting medium must be able to maintain humidity in the area around the roots, provide enough air, and be able to withstand the availability of nutrients (Dalimoenthe, 2013).

Soil organic matter affects the physical, chemical and biological properties of the soil. If the soil organic matter content decreases, it can result in a decrease in crop yields due to non-optimal plant growth. The use of organic fertilizers in plants can increase the organic matter content of the soil. Organic fertilizers are made from organic materials such as plants, livestock manure and living things that have died (Apzani et al., 2017).

Chicken manure can be used as one of the wastes produced by both laying hens and broilers which have great potential as organic fertilizer. The composition of manure varies greatly depending on the physiological characteristics of the chickens, the ration eaten, the housing

ISBN: 978-623-6763-07-0

environment including temperature and humidity. Chicken manure is one of the organic materials that affect the physical, chemical and plant growth properties. Chicken manure has high levels of nutrients and organic matter and low water content. This process occurs gradually by releasing simple organic matter for plant growth (Khairina, 2017).

Chaff charcoal is rice husk that has been burned with incomplete combustion. Charcoal husk is a porous and sterile growing medium from rice husk which can only be used for one growing season by burning dry rice bran over a stove, and pouring clean water over the coals before turning into ashes. The results obtained are husk charcoal (grilled husks) (Gustia, 2013).

The advantage of roasted husks is that they can improve the physical and chemical properties of the soil, as well as protect the microorganisms found in the soil and act as an absorbent to suppress the number of pathogenic microbes. The roasted husks used are the result of incomplete combustion of rice husks, so that black roasted husks are obtained, and not white husk ash. Rice husk has good aeration and drainage, but still contains pathogenic organisms or organisms that can inhibit plant growth. Therefore, before using husks as a planting medium, to destroy pathogens, the husks are burned first (Supriati and Ersi, 2011).

Water hyacinth (Eichornia crassipes) is an aquatic plant that can grow quickly in the tropics. Water hyacinth plants are able to absorb various substances contained in water, both dissolved and suspended (Hasanudin and Suroso, 2013).

One of the plants that can be used as organic fertilizer is water hyacinth. Water hyacinth is one of the plants whose existence is considered a weed in the waters. This is because water hyacinth can grow quickly and disrupt life in water. Therefore, an alternative way is needed to help reduce this weed population. One alternative that can be used is to use water hyacinth as organic fertilizer (Apzani et al., 2017).

Based on the description above, it is necessary to conduct research on "Providing Liquid Organic Fertilizer for Growth and Production of Pakcoy Plants (Brassica rapa L) in Planting Media of Chicken Manure and Husk Charcoal". The aims of this study were:

1) To find out the response of chicken manure compost and husk charcoal to the growth and production of pakcoy (Brassica rapa L);

2) To determine the response of water hyacinth liquid organic fertilizer to the growth and production of pakcoy plants (B. rapa L); 3) To determine the interaction of chicken manure compost and husk charcoal and water hyacinth liquid organic fertilizer on the growth and production of pakcoy plants (B. rapa L).

2. LITERATURE E REVIEW

2.1. Terms of Growing Cucumber Plants

Pakcoy plants grow well in lowland and highland areas, ranging from an altitude of 5 meters above sea level to 1,200 meters above sea level (above sea level). Usually this plant is cultivated in areas that have an altitude of 100 meters above sea level to 500 meters above sea level. Pakcoy can also grow in places where the air is hot or cold, so it can be cultivated in both low and high plains. A good climate for growing pakcoy is an area that has a temperature of 150 - 300C, has rainfall of more than 200 mm/month, and sunshine between 10-13 hours. Air humidity suitable for the growth of pakcoy is between 80-90% (Sutirman, 2011).

Pakcoy plants can be planted in various types of soil, but the most suitable soil conditions for pakcoy plants are fertile, loose soil containing organic matter and a good irrigation system. In less fertile soils, it is necessary to add more organic fertilizers and artificial fertilizers containing macro nutrients and micro nutrients. The chemical nature of the soil that needs to be considered is the degree of acidity (pH) of the soil. Pakcoy plants are tolerant of the optimum pH range: 6.0 – 6.8 (Siswadi et al., 2015).

2.2. Growing Media

Organic-based planting media has many advantages over soil media, namely the quality does not vary, is lighter in weight, does not contain disease inoculums, and is cleaner. The use of organic materials as a planting medium is far superior to inorganic materials. This is because organic matter is able to provide nutrients for plants. In addition, organic matter also has macro and micro pores that are almost balanced so that the resulting air circulation is quite good and has high water absorption (Dalimonethe, 2013).

Chicken manure manure is expected to improve the physical, chemical and biological properties of the soil, so as to increase yields. The addition of manure to the soil can improve the physical properties of the soil such as the ability to hold water, porosity and volumetric weight of the soil. The interaction between manure and soil microorganisms can improve aggregate and soil

ISBN: 978-623-6763-07-0

structure to become loose (Marlina et al., 2015).

The addition of organic matter such as manure to the soil can improve soil aggregation so as to increase the number of soil pores and eventually become a suitable medium for plant growth because the root reach is wider so that nutrient absorption is easier. By expanding the reach of roots and increasing nutrient uptake, it is expected that fertilization efficiency will increase so that plants can grow well (Marlina et al., 2015).

Fertilizer from chicken manure is included in the cold fertilizer category. Chicken manure contains Nitrogen (1.00%), Phosphorus (0.80%), Potassium (0.40%), and Water (55%) (Lubis and Mohammad, 2019).

Adding rice husk charcoal to the growing media will be beneficial, including making fertilization more effective because in addition to improving soil properties (porosity, aerase), rice husk charcoal also functions as a binder of nutrients (when there is an excess of nutrients) which will be used by plants when there is a shortage of nutrients then the nutrients are released slowly according to the needs of the plant or slow release (Kolo and Raharjo, 2016). One of the soil enhancing materials that can be utilized is rice husk charcoal because it has a pH between 7.5 – 9. The high pH value of rice husk charcoal can be used to increase the pH of peat soils. An increase in peat soil pH is followed by an increase in the availability of nutrients for plants. Rice husk charcoal contains SiO2 (52%), C (31%), K (0.3%), N (0.18%), P (0.08%), and Ca (0.14%) (Andrhea et al., 2018).

2.3. Water hyacinth Liquid Organic Fertilizer

Water hyacinth is a plant with a very fast growth rate, this aquatic plant is considered an aquatic weed because it causes many losses, namely reduced productivity of water bodies such as taking up space and nutrients which are also needed by fish. Water hyacinth is a potential organic material, because based on previous studies that water hyacinth production in Bangladesh can reach more than 300 tons per hectare per year (Juliani et al., 2017).

The chemical content of water hyacinth contains 78.47% organic matter, 21.23% organic C, 0.28% total N, 0.0011% total P, and 0.016% total K so that from these results water hyacinth has the potential to be utilized as organic fertilizer because water hyacinth has elements needed by plants to grow (Juliani et al., 2017).

2.4. Papaya Leaf Vegetable Pesticide

Papaya plants have the potential as vegetable insecticides because they contain alkaloids and flavonoids which are highly toxic to insects. The use of papaya leaf extract on mustard plants can inhibit the biological activity of caterpillar pests (Julaily et al., 2013).

Plant protection has an important role in determining food production. With effective and efficient plant protection techniques, pest and disease populations can be controlled so as not to cause losses and guarantee optimal yield potential. The use of vegetable pesticides is a way to replace the role of chemical pesticides (Surya and Rizka, 2016).

3. METHODS

This research was carried out on Jalan Ikan Bandeng, Tanah Tinggi Village, East Binjai District, Binjai City with a height of 30 meters above sea level. The research was carried out from December 2019 to January 2020.

The design used in this study was a factorial randomized block design (RBD) consisting of 16 treatments with 2 replications, so that a total of 32 plots were obtained.

a. Treatment of Planting Media (M) there are 4 levels, namely:

M0 = Control
M1 = 1:1 (Charcoal Husk + Chicken Manure Compost)
M2 = 2:1 (Charcoal Husk + Chicken Manure Compost)
M3 = 1:2 (Charcoal Husk + Chicken Manure Compost)

b. There are 4 levels of water hyacinth (P) liquid organic fertilizer treatment, namely:

P0 = Control (using plain water)
P1 = 60 ml/500 liters of water/poly bag
P2 = 120 ml/500 liters of water/poy bag
P3 = 180 ml/500 liters of water/poly bag

4. RESULTS AND DISCUSSION

ISBN: 978-623-6763-07-0

3.1. Plant Height per Sample (cm)

Yield average plant height (cm) effect of chicken manure and rice husk charcoal and water hyacinth liquid organic fertilizer on growth and production of pakcoy (B. rapa L) at 1, 2 and 3 weeks after planting after being tested for different averages using Duncan's Distance Test 5% and 1% can be seen in Table 1.

Table 1. Mean Plant Height (cm) of Pakcoy (Brassica rapa L) with the Treatment of Chicken Manure and Charcoal Husk and Water Hyacinth Liquid Organic Fertilizer at 1, 2, and 3 Weeks After Planting (MST)

Treatment	Plant Height (cm)		
	1 MST	2 MST	3MST
Growing Media (M)			
M0	11.02 aA	9.77 aA	11.56 aA
M1	23.03 abA	13.55 aBA	16.41 aBA
M2	25.72 bA	17.40 chap	20.74 aBA
M3	17.00 a.b	13.80 aBA	17.07 bB
Water hyacinth Organic Fertilizer (P)			
P0	9.60 aA	14.08 aA	16.70 aA
P1	8.36 aA	11.80 aA	15.03 aA
P2	8.90 aA	13.83 aA	16.48 aA
P3	9.70 aA	14.82 aA	17.57 aA

Note: Numbers in the same column followed by the same letter mean that they are not significantly

Pakcoy plant height (B. rapa L) on the growing medium of chicken manure compost with husk charcoal had a very significant effect at 1, 2 and 3 weeks after planting (MST), at 3 weeks after planting. The highest mean was in treatment M2 (Charcoal Husk + Chicken Manure Compost 2: 1) which was 20.74 cm and the lowest average was in treatment M0 (Control) which was 11.56 cm. In the treatment M0 is very significantly different from M2, M1, M3. Meanwhile, M2 is not significantly different from M1 and M3.

In Figure 1 it can be explained that the results of the regression analysis of the effect of the planting medium of chicken manure compost with rice husk charcoal on the height of the pakcoy plants at the age of 3 weeks after planting (MST). The planting medium of chicken manure compost with husk charcoal had an effect on plant height 3 weeks after planting. The highest plant height was in the M2 treatment (Charcoal Husk + Chicken Manure Compost) with a height of 20.74 cm.

The lowest plant was in the control treatment (M0) with a height of 11.56 cm. This shows that different media compositions will have different effects on plant height.

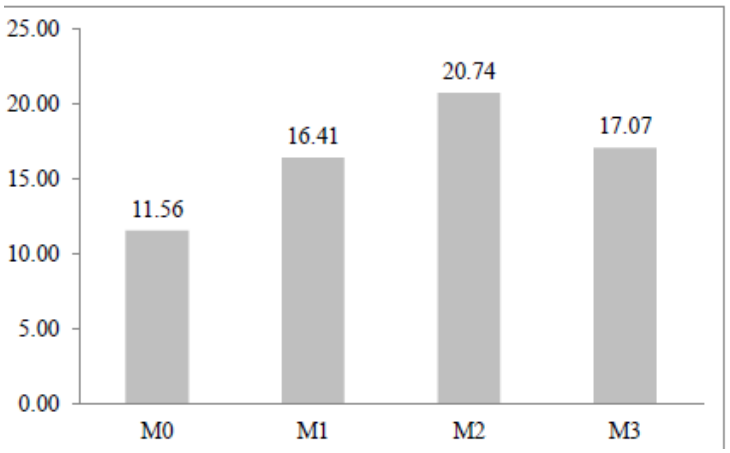

Figure 1. The relationship between growing media of chicken manure compost and husk charcoal to plant height 3 WAP

The parameters for observing plant height (cm) at week 1, 2, and 3 showed that the

ISBN: 978-623-6763-07-0

highest mean was in treatment M2 (Charcoal Husk + Compost Chicken Manure 2: 1) which was 20.74 cm while the lowest average was in treatment M0 (Control), namely 11.56 cm and it can be seen that the planting medium used has a very significant effect on the height of the pakcoy plant. This is because chicken manure and rice husk charcoal compost can improve soil properties and the ability to bind nutrients and has a high content of nutrients and organic matter which can help the pakcoy plant grow in height. This is in accordance with Dalimoenthe (2013) which states that the planting medium used must be adjusted to the type of plant to be planted. In general,

Based on the results of statistical data analysis showed that the application of water hyacinth liquid organic fertilizer on the growth and production of pakcoy plants (B. rapa L) did not significantly affect the parameters of plant height (cm), number of leaves (strands). This is because the N nutrient given by the water hyacinth liquid fertilizer is not sufficient for the pakcoy plant and there is no reaction given by the water hyacinth liquid fertilizer to the plants so that growth becomes stunted. This is in accordance with Erawan and Andi, (2013) stating that if the N element supplied by liquid organic fertilizer is well available, the plant will experience good growth.

3.2. Number of Leaves (strands)

The results of observations after being analyzed statistically showed that the planting medium of chicken manure compost with rice husk charcoal had a very significant effect on the number of leaves (strands). Meanwhile, the application of water hyacinth liquid organic fertilizer and the interaction of planting media with chicken manure compost and rice husk charcoal and water hyacinth liquid organic fertilizer had no significant effect on the number of leaves (strands).

The results of the average number of pakcoy leaves (B. rapa L) given chicken manure compost and husk charcoal and water hyacinth liquid organic fertilizer at the age of 1, 2 and 3 weeks after planting can be seen in Table 2.

Table 2. Average number of leaves (strands) of Pakcoy (B. rapa L) treated with chicken manure compost and husk charcoal and water hyacinth liquid organic fertilizer at 1, 2 and 3 weeks after planting (MST)

Treatment	Number of Leaves (strands)		
	1 MST	2 MST	3MST
Growing Media (M)			
M0	4.33 Aa	6.54 aA	7.92 aA
M1	5.54 Aa	9.17 abA	11.54 abA
M2	6.42 bA	10.67 bA	14.04 bA
M3	5.92 Aa	9.96 abA	12.54 bA
Water hyacinth Organic Fertilizer (P)			
P0	5.67 aA	9.71 aA	11.59 aA
P1	5.46 aA	8.17 aA	10.58 aA
P2	5.38 aA	9.38 aA	12.09 aA
P3	5.17 aA	9.08 aA	11.79 aA

Note: Numbers in the same column followed by letters that are not the same mean significantly different at the 5% level (lowercase letters) and very significantly different at the 1% level (uppercase letters)

Table 2 explains that the planting medium of chicken manure compost with husk charcoal had a very significant effect at the age of 1, 2 and 3 weeks after planting, at the age of 3 weeks after planting the highest average number of leaves was in the M2 treatment (Charcoal husk + Chicken Manure Compost 2 : 1) namely 14.04 strands and the lowest average was found in treatment M0 (Control) namely 7.92 strands. In the treatment of M2, M3 and M1, they were very significantly different from M0. Meanwhile, M2 and M3 are not significantly different from M1.

In Figure 2, it is explained the effect of the planting medium of chicken manure compost with husk charcoal on the number of leaves (strands) of pakcoy at the age of 3 weeks after planting (MST). It can be explained that the planting medium of chicken manure compost with rice husk charcoal had an effect on the number of leaves after 3 weeks. The highest number of leaves per leaf was in treatment M2 (Charcoal Husk + Chicken Manure Compost (2:1) with the highest number of leaves 14.04 leaves. The lowest plant was in treatment M0 (Control) with the lowest number of leaves 7.92 leaves.

ISBN: 978-623-6763-07-0

This shows that the composition Different media will have different effects on the number of plant leaves.

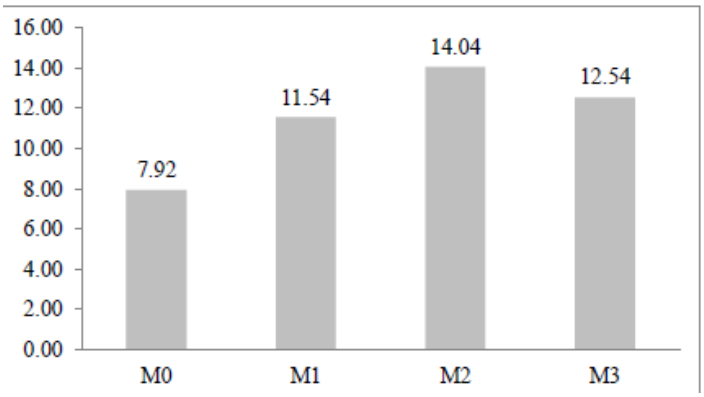

Figure 2. The relationship between growing media of chicken manure compost and husk charcoal on the number of leaves (strands) 3 WAP.

In the observation parameter the highest average number of leaves (strands) was found in treatment M2 (Charcoal husk + chicken manure compost 2:1) which was 14.04 cm while the lowest average was found in treatment M0 (Control) which was 7.92 and the same was the case with area leaves (cm2) week 1, 2, and 3 showed that the highest mean was in treatment M2 (charcoal husk + chicken manure compost 2:1) which was 9447.31 cm2 and the lowest average was in treatment M0 (Control) which was 2622.55 cm2 It can be seen that the growing media of chicken manure compost with husk charcoal has a very significant effect on the number of leaves and leaf area of the pakcoy plant. This is because the provision of chicken manure compost and husk charcoal at the same time is able to provide sufficient and balanced nutrients for plant needs. This is in accordance with Marlina et al.

3.3. Production Weight per Plot (gram)

The results of observations after statistical analysis showed that the planting medium of chicken manure compost with husk charcoal had a very significant effect on production weight per plot (g). Whereas the application of water hyacinth liquid organic fertilizer had a significant effect on production weight per plot (g), and the interaction of planting media with chicken manure compost and rice husk charcoal and water hyacinth liquid organic fertilizer had a significant effect on production weight per plot (g) (Table 3).

Table 3. Average Production Weight Per Plot (g) of Pakcoy (Brassica rapa L) in the Treatment of Chicken Manure Compost with Charcoal Husk and Water Hyacinth Liquid Organic Fertilizer at 1, 2, and 3 Weeks After Planting (MST)

Treatment	Production Weight Per Plot (g)
Growing Media (M)	
M0	100.00 aA
M1	426.25 bA
M2	751.25 cB
M3	517.50 bcB
Water hyacinth Organic Fertilizer (P)	
P0	362.50 aA
P1	363.75 aA
P2	567.50 aA
P3	501.25 aA

Note: Numbers in the same column followed by letters that are not the same mean significantly different at the 5% level (lowercase letters) and very significantly different at the 1% level (uppercase letters)

In Table 3 it is explained that the planting medium of chicken manure compost with husk charcoal had a very significant effect at the age of 1, 2 and 3 weeks after planting, at the age of 3 weeks the highest production weight per plot (g) was in the M2 treatment (Charcoal husk + Chicken Manure Compost 2 : 1) which is 751.25 (g) and the lowest average is found in treatment M0 (Control) which is 100 (g). In the treatment M0 is significantly different from

ISBN: 978-623-6763-07-0

M2, M3 and M1. Meanwhile, M2 is not significantly different from M3.

In the observed parameter production weight per plot (g), the highest average was found in treatment M2 (charcoal husk + chicken manure compost 2:1), namely 751.25 (g) and the lowest average was found in treatment M0 (control), namely 100 (g) It is known that the planting medium of chicken manure compost with rice husk charcoal has a very significant effect on production weight per plot (g), wet weight of plants per sample (g) and net weight of consumption per sample (g) of pakcoy plants. This is because the provision of chicken manure compost with husk charcoal can be classified as sufficient nutrient for plants and plays a role in supporting plant growth, where good plant growth can increase production.

This is in accordance with Djemin et al., (2013) which states that chicken manure compost helps improve soil structure lacking organic matter and strengthens roots. This compost also contains macro nutrients including N, P, and K which can assist in plant growth and production, the provision of husk charcoal has a role in improving the soil structure to make it more porous so that plant roots can easily absorb nutrients. This is in accordance with Supriyanto and Fidryaningsih, (2010) who stated that rice husk charcoal is a soil enhancer capable of improving soil properties in efforts to rehabilitate land and improve plant growth.

Based on the results of statistical data analysis, it showed that the interaction of planting media with chicken manure compost and rice husk charcoal with water hyacinth liquid organic fertilizer on the growth and production of pakcoy (Brassica rapa L) had a very significant effect on the production weight per plot (g). M0P0 is very significantly different from M2P2. This is because the interaction of the planting media of chicken manure compost and husk charcoal and the application of water hyacinth liquid organic fertilizer can be seen that the planting media and liquid organic fertilizer complement each other, whereas the application of chicken manure compost and rice husk charcoal shows a positive plant growth response. better than the control plants, because chicken manure compost and rice husk charcoal are organic materials, each of which has a role in supporting plant growth, chicken manure compost plays a role in providing a number of nutrients to support plant growth while water hyacinth has the potential to be used as organic fertilizer because it has the necessary nutrients plants to grow, and applying liquid organic fertilizer to plants will be more easily absorbed by plants through the roots because the elements in it have decomposed. This is in accordance with Hadisuwito (2012) which states that the more organic fertilizer given, the higher the plant growth. The organic matter contained in water hyacinth has been decomposed by microorganisms so that the organic matter in liquid organic fertilizer helps provide N elements for plants. chicken manure compost plays a role in providing a number of nutrients to support plant growth while water hyacinth has the potential to be used as organic fertilizer because it has the nutrients needed by plants to grow, and the application of liquid organic fertilizer to plants will be more easily absorbed by plants through the roots because the elements the elements in it are decomposed. This is in accordance with Hadisuwito (2012) which states that the more organic fertilizer given, the higher the plant growth. The organic matter contained in water hyacinth has been decomposed by microorganisms so that the organic matter in liquid organic fertilizer helps provide N elements for plants. chicken manure compost plays a role in providing a number of nutrients to support plant growth while water hyacinth has the potential to be used as organic fertilizer because it has the nutrients needed by plants to grow, and the application of liquid organic fertilizer to plants will be more easily absorbed by plants through the roots because the elements the elements in it are decomposed. This is in accordance with Hadisuwito (2012) which states that the more organic fertilizer given, the higher the plant growth. The organic matter contained in water hyacinth has been decomposed by microorganisms so that the organic matter in liquid organic fertilizer helps provide N elements for plants. and applying liquid organic fertilizer to plants will be more easily absorbed by plants through the roots because the elements in it have decomposed. This is in accordance with Hadisuwito (2012) which states that the more organic fertilizer given, the higher the plant growth.

The organic matter contained in water hyacinth has been decomposed by microorganisms so that the organic matter in liquid organic fertilizer helps provide N elements for plants. and applying liquid organic fertilizer to plants will be more easily absorbed by plants through the roots because the elements in it have decomposed. This is in accordance with Hadisuwito (2012) which states that the more organic fertilizer given, the higher the plant growth. The organic matter contained in water hyacinth has been decomposed by microorganisms so that the organic matter in liquid organic fertilizer helps provide N elements for plants.

5. CONCLUSION

ISBN: 978-623-6763-07-0

From the results of the research and discussion conducted, it can be concluded as follows:

1) The planting medium of chicken manure compost with husk charcoal had a very significant effect on the parameters of plant height (cm), number of leaves (strands), and weight of plant production per plot (g).
2) The application of water hyacinth liquid organic fertilizer at different doses did not significantly affect the parameters of plant height (cm), number of leaves (strands), but had a significant effect on the parameter of production weight per plot (g).
3) The interaction between the effect of the planting medium of chicken manure compost and husk charcoal and the application of water hyacinth liquid organic fertilizer had a significant effect on the production weight parameter per plot (g). However, it did not significantly affect the parameters of plant height (cm) and number of leaves (strands).

6. REFERENCES

Apzani, W., Wardana, HW, and Arifin, Z. (2017). Effectiveness of Water Hyacinth (Eichhornia crassipes) Fermented Liquid Organic Fertilizer for Trichoderma spp. on Lettuce (Lactuca sativa L.) Growth. Sangkareang Mataram Journal. 3(3): 1-9.

Aryza, S., Lubis, Z., Indrawan, M. I., Efendi, S., & Sihombing, P. (2021). Analyzed New Design Data Driven Modelling of Piezoelectric Power Generating System. Budapest International Research and Critics Institute-Journal (BIRCI-Journal), 4(3), 5537-5547.

Aryza, S., & Lubis, Z. (2019, November). Enhanced of Speed Monitoring Brushless DC (BLDC) Equipment and Controller Based on Arduino. In Journal of Physics: Conference Series (Vol. 1361, No. 1, p. 012049). IOP Publishing

Andrhea, BA, Erlida, A., and Sri, Y.2018 Effect of Applying Rice Husk Charcoal and Trichoazolla Compost on Growth and Yield of Upland Rice (Oryza sativa L.) in Peatlands. Riau University. JOM FAPERTA UR VOL.5

Anastasia, R Moi., Pandiangan, D., Siahaan, P and Tangapo A, M., "Testing Liquid Organic Fertilizer from Water Hyacinth (Eichhornia crassipes) on Mustard Plant Growth (Brassica juncea)", Journal of Mipa Unsrat Online, Vol. IV, No.1, 2015.

Central Statistics Agency (BPS) and Directorate General of Horticulture, 2015. Horticulture Production Statistics 2014. Central Statistics Agency and Directorate General of Horticulture, Ministry of Agriculture.

Dermawan, 2009. Cultivation of Pak Choy's Plants. Canisius. Yogyakarta.

Dalimoenthe, LS (2013). Effect of Organic Growing Media on Growth and Rooting in the Early Phase of Tea Seeds in Nurseries. Journal of Tea and Quinine Research, 16(1), 1-11.

Djemin, L., Fauzan. Z and D. Suyono. 2013. The Effect of Giving Chicken Manure on the Growth and Yield of Sweet Corn (Zea mays saccharata sturt). North Sulawesi. Gorontalo.

Erawan, D. Wa, O, Y., and Andi, B. 2013. Growth and Yield of Mustard Greens (Brassica juncea L) at Various Doses of UREA Fertilizer. Journal of Agroteknos. 3(1) :19-25

Gustia, H. 2013. The Effect of Adding Burnt Husk to the Growing Media on the Growth and Production of Mustard Greens (Brassica Juncea L.). Jakarta Muhammadiyah University.

Husnaeni, F., and Setiawati, MR (2018). The Influence of Biofertilizers and Inorganic Fertilizers on Azotobacter Population, N Content, and Yield of Pakcoy in the Nutrient Film Technique System. Journal of Biodjati, 3(1), 90-98.

Hanafiah, KA 2011. Theory and Application Experiment Design 3rd Edition. Eagle. Jakarta

Hasanudin, U., and Suroso, E. (2013). Study of the Effectiveness of Using Water Hyacinth (Eichornia Crassipes) in Reducing Pollutant Loads in Sugar Cane Industry Wastewater. Journal of Agricultural Product Technology & Industry, 18(2), 157-167.

Hadisuwito, S., 2012. Making Liquid Organic Fertilizer. Agromedia Pustaka, Jakarta.

Juliani, R., Simbolon, RFR, Sitanggang, WH, and Aritonang, JB (2017). Water Hyacinth Organic Fertilizer From Lake Toba. Journal of Community Service, 23(1), 220-224.

Julaily, N., Mukarlina and Setyawati, TR 2013. Pest Control in Mustard Greens (Brassica

ISBN: 978-623-6763-07-0

juncea L) Using Papaya Leaf Extract (Carica papaya L). Protobiont Journal, 2(3):171-175.

Kolo, A., and Raharjo, KTP (2016). Effect of Rice Husk Charcoal and Watering Frequency on Growth and Yield of Tomato (Lycopercicom esculentum Mill). Sandalwood Savana, 1(03), 102-104.

Khairina, RA (2017). Application of Goat Manure Compost with Chicken Manure Compost in Increasing the Growth and Yield of Elephant Variety Peanut Plant (Arachis Hypogeae L). Umsb Agricultural Journal: Research and Scientific Studies in the Field of Agriculture, 1(2).

Lubis, ER, and Mohammad, S. 2019. A Complete and Practical Guide to Making the Most Profitable Compost. Garuda Library. Jakarta

Marlina, N., Aminah, RIS, and Setel, LR (2015). Application of Chicken Manure on Peanut Plants (Arachis Hypogeae L.). Bioscientific: Journal of Biology & Biology Education, 7(2).

Onggo, TM, Kusumiyati., and A. Nurfitriana. 2017. Effect of Addition of Burnt Rice Husk Charcoal and Size of Polybags on the Growth and Yield of Tomato Cultivar 'Valouro' Result of Stem Grafting. Cultivation Journal Vol. 16(1).

Rangkuty, D.M. and Hidayat, M. 2019. Using the ECM Approach between Growth of the Current Account Balance and Foreign Exchange Reserve in Indonesia. AJHSSR Journal Vol. 3 (10) pp. 51-57

Rizal S, 2017. The Effect of Nutrition Provided on the Growth of Mustard Greens (Brassica rapa L.) Grown Hydroponically. Palembang PGRI University. Volume 14...No. 1...June 2017...38-44

Rusiadi, et al. 2016. Indonesia Macro Economy Stability Pattern Prediction (Mundell-Flamming Model). IOSR Journal of Economics and Finance Vol. 7(5) pp. 16-23

Surya, E., and Riska Zahara. 2016. The Effect of Papaya Leaf Extract (Carica papaya L) on Leaf Caterpillar Mortality (Plutella xylostella) on Mustard Plants (Brassica juncea L). Serambi Mecca University. Edubio Tropika Journal, volume 4, Number 2, October 2016, p. 1-52.

Supriati, Y., and Ersi H. 2011. Planting 15 Organic Vegetables in Pots. Self-help Spreader. Jakarta.

Siswadi, Romana, A., and Riyo, S. (2015). Effect of Nutrient Concentration and Planting Media on the Growth and Yield of Mustard Greens (Brassica parachunensis) in Verticulture Hydroponic Systems. Innofarm Journal 13.2

Setyaningrum, H. D and Saparinto, C. 2011. Regular Vegetable Harvesting in Narrow Land. Self-help Spreader. Jakarta

Sutirman, 2011. Pakcoy (Pakchoy) Organic Vegetable Business is Profitable. Gunadarma. Yogyakarta.

Sunarjono, H. 2013. Planting 36 types of vegetables. Self-help Spreader. Jakarta

Supriyanto and F. Fidryaningsih. 2010. Utilization of Burnt Rice Husk Charcoal

To Improve Jabon Seeds (Anthocephalus cadamba (Roxb) Miq) in Subsoil Media. Journal of Tropical Silviculture 1(1):24-2.

Utomo, WY, Bayu, ES, and Nuriadi, I. (2014). Performance of several varieties of Pak Choi (Brassica rapa L. ssp. chinensis (L.)) in two types of nutrient solutions using the floating hydroponic method. Agroecotechnology, 2(4).