Eksakta : Berkala Ilmiah Bidang MIPA
VOLUME 23 NO 01 2022, pp 55-63
ISSN : Print 1411-3724 — Online 2549-7464
DOI : https://doi.org/10.24036/eksakta/vol23-iss01/311

Eksakta
Berkala Ilmiah Bidang MIPA
http://www.eksakta.ppj.unp.ac.id/index.php/eksakta

Article

Biomol Potential from Vegetable Market and Tofu Factory Waste for Cleared Land Crops

Nourma Yulita[1*], Mohammad Agus Prayitno[2], Sultan Ahmad Fausan[1]

[1]Department of Natural Science Education, Faculty of Education and Teacher Training (FTIK), State Islamic Institut of Kendari, Kendari, Indonesia
[2]Department of Biology Education, Faculty of Science and Technology, State Islamic University of Walisongo Semarang, Semarang, Indonesia

Article Info

Article history :

Received February 20, 2022
Revised March 10, 2022
Accepted March 21, 2022
Published March 30, 2022

Keywords :

Dose,
mustard greens,
biomol

Abstract. This research was conducted in Cialam Caya Village, Konda Subdistrict, South Konawe Regency, in July - September 2021. The purpose of the study was to determine the effect of various doses of Biomol on the growth and yield of mustard greens. This study was arranged in a Randomized Block Design (RAK) which consisted of 7 treatments with biomol doses, namely: control (without biomol), P1 50 ml, P2 100 ml, P3 150 ml, P4 200 ml, P5 250 ml, P6 300 ml, 3-time treatment repetition to produce 21 experimental units. The results of this study concluded that the administration of biomol had a very significant effect on the growth and yield of mustard greens (plant height, number of leaves, fresh weight and dry weight) and the best dose of biomol for mustard greens (*Brassica Juncea* L.) was at a dose of 200 ml.

Corresponding Author :
Nourma Yulita
Faculty of Education and Teacher Training (FTIK), State Islamic Institut of Kendari, Kendari, Indonesia
Email : nourmayulita@iainkendari.ac.id

1. Introduction

The traditional market in Cialam Caya Village, Konda Subdistrict, is the largest in Southeast Sulawesi Province's South Konawe Regency. The Cialam Caya Village Market of Konda Subdistrict is a center for vegetable commodities and a gathering spot for traveling traders to fill their wares due to the habits of people who want to eat vegetables. Cabbage and mustard greens are the most

extensively sold veggies, according to preliminary findings at the Cialam Caya Village Market of Konda Subdistrict. Many cabbage and mustard greens are not sold as a result of this process, and they may end up as vegetable market waste. Market waste, such as mustard greens and cabbage, is the vegetables that are no longer fit for sale or eating due to deterioration. According to Kurniawan (2018) [1], the disadvantage of cabbage and mustard green waste is its high water content (over 90%), which causes it to deteriorate quickly and necessitates its sale or processing right away. In addition, there is a tofu factory in the Cialam Caya Village of Konda Subdistrict that produces a lot of organic waste.

Organic waste in the form of vegetable and tofu factory waste has begun to garner attention, according to the facts on the ground [17]. Every day, more waste is produced, making it increasingly difficult to find a disposal location. The traders in the market's corner just collect the waste of cabbage and mustard greens. The garbage officer will carry the gathered material to the final disposal site. In the meantime, tofu factory waste is occasionally used as animal feed. Given the vast volume of lost vegetable and tofu factory waste, this vegetable and tofu factory waste has the potential to be exploited. In the Cialam Caya Village Market of Konda Subdistrict, the utilization of vegetable and tofu factory waste is currently not being used properly. In the discipline of microbiology, the waste problem can be solved by fermenting it for at least 5 days.

Biomol is an extract made from the fermented product of vegetable market cabbage and mustard green trash [18,19,20,21,22]. Biomol is made by crushing vegetable waste, sprinkling it with a lot of salt, and then storing it in a tightly sealed container for several days. The solution is then filtered and ready to use as an organic liquid fertilizer [2]. The use of a liquid fertilizer containing biomol extract helps to meet the soil's nutritional requirements [23,24,25,26,27]. Because it contains microorganisms that break down organic debris, encourage development, and act as a biological controller, Biomol solution is suitable for use as an organic pesticide [3]. Several researchers, including (Sasmita et al., 2014) [4], have conducted biomol research, with the conclusion that administering local microorganisms (MOL) from the fruit promotes asexual growth in sweet potato plants. According to the findings of (Rahmah et al., 2014) [5], liquid organic fertilizers of varied concentrations had an effect on corn development. The combining of vegetable and tofu factory waste into organic fertilizer distinguishes this study from the two others, that will be conducted by the researcher.

In fact, many individuals in Konda Subdistrict's Cialam Caya Village utilize chemical fertilizers instead of organic fertilizers for their cleared land's food crops. Chemical fertilizers have increased nutrient elements that are easier to obtain, even at high prices. Continuous use of chemical fertilizers results in a loss of key nutrients in the soil and a deterioration in fertility. As a result, in addition to being uneconomical for food crops on the house's cleared land, it also pollutes the soil and water environment. As a result, organic fertilizers that are both non-toxic to plants and readily available in the environment are required, one of which is biomol, which is made up primarily of vegetable and tofu factory waste.

On general, the community around the Cialam Caya traditional market of Konda Subdistrict has used vegetable waste for food plants in their cleared land of the house, but simply put it on the ground around food plants in the hopes of degrading into compost. Kale, spinach, and fruits are just a few of the many food crops that the inhabitants of Cialam Caya Village, Konda Subdistrict, raise on their cleared land. Because people restrain themselves to going to the market, the food plants in this house's cleared land appear to be valuable during the Covid-19 outbreak.

Processing vegetable market and tofu factory waste into biomol is efficient, simple, inexpensive, and environmentally friendly, and it is projected to boost food crop yields during the Covid-19 pandemic. Aside from these considerations, it is important to undertake a study titled "Biomol Potential from Vegetable Market and Tofu Factory Waste for Cleared Land Corps".

2. Experimental Section

The method used in this research is true experiment [28,29,30,31]. The type of research was a Randomized Block Design (RAK) with biomol treatment with 7 levels and 3 groups; there were 21 experimental units consisting of: P0 0 ml; P1 50 ml; P2 100 ml; P3 150 ml; P4 200 ml; P5 250 ml; and P6 300 ml.

Tools and Materials: (1) Making of Biomol, Biomol solution was made by mixing a solution of sugar and EM-4 into water with a ratio of 50 ml of sugar solution: 50 ml of EM-4: 1 liter of water, then let stand for one day. Organic waste (vegetable residue) taken from the market was cut into small pieces of approximately 1-2 cm, then dried, then mixed with tofu factory waste (2:1:1). Furthermore, the material was put into a tightly closed tub. The temperature was not more than 40°C. Biomol will be ready for use after seven days of fermentation, according to Ariska et al. (2012) [6]; (2) preparation of verticulture shelves, the verticulture shelves were formed of gutters stacked in layers with wooden supports with a model like steps. The gutter is 900 cm in length, 10 cm in width, and 10 cm in height. The gutters were then stacked vertically like a ladder on the wood, with up to 5 gutters per vertical shelf and a 30 cm gap between gutters. Each level of the gutter was used to create a duplicate.

Figure 1. Tofu Factory Waste Dregsinto Biomol

Research Procedure: (1) Preparation of Seedling Media; (2) Nurseries, (3) Labelling; (4) Giving Treatment, (5) The I (First) Transferring and Planting Mustard Green to the Verticulture Shelves, (6) The II (Second) Transferring and Planting Mustard Green to the Verticulture Shelves, (7) Maintenance, (8) Harvesting; (9) Observations with data collected, namely plant height (cm), number of leaves (strands), fresh weight (g), dry weight (g).

Figure 2. Observations of Data Collection

The purpose of data analysis was to assess the influence of treatment on the observed variables, and then F (ANOVA) was used to analyze each observation. If there was a real effect, a follow-up test with a 5% Honestly Significant Difference (HSD) would be conducted. A Randomized Block Design Variety Print Analysis was used to statistically analyse observational data from each treatment.

3. Results and Discussion

3.1 Plant Height

Analysis of variance showed that the administration of Biomol at observations 2-5 MST had a very significant effect on the average plant height. The average plant height of 2 MST - 5 WAP is presented in Table 1.

Table 1. Average Plant Height (cm) aged 2-5 MST at Various Biomol Doses.

Treatment	Weeks after Planting			
	2 MST	3 MST	4 MST	5 MST
P0 0 ml	09,30	12,15cb	16,56c	19,66c
P1 50 ml	09,95c	13,40cb	18,25cb	27,64b
P2 100 ml	12,54b	14,09b	21,63ba	31,31ba
P3 150 ml	12,12b	16,72ba	22,31ba	32,68a
P4 200 ml	13,99a	20,18a	28,44a	35,74a
P5 250 ml	11,97b	18,04a	25,25a	28,73ba
P6 300 ml	12,11b	16,26ba	23,48ba	28,07b
5% HSD	19,66c	19,66c	19,66c	19,66c

Remarks: The average value followed by the same letter in the same column, not significantly different at the 5% HSD test level

The results of the 5% HSD test in Table 1 show that the Biomol treatment with a dose of 200 ml (P4) obtained higher plants, but at 3 MST, which was not different from the 150 ml (P3), 250 ml (P5), and 300 ml (P6) treatments. At 4 MST observation, it was different from 100 ml (P1), 150 ml (P2), 250 ml (P5), and 300 ml (P6), and at 5 MST observation, it was not different from 100 ml (P2), 150 ml (P3), and 250 ml (P5) while the lowest plant height was in the control treatment (P0).

The Biomol dosage treatment had a very substantial effect on plant height at 2-5 MST, according to the results of the analysis of variance. Biomol produced the best plant growth results at a dose of 200 ml when compared to the other doses. Because the nitrogen included in Biomol is the most important nutrient, plants' needs for nitrogen are larger than other nutrients, a dose of 200 ml Biomol is capable of supplying nitrogen in accordance with the amount required for growth and development in mustard green. According to Erawan et al., element N is involved in plant vegetative growth, nitrogen is an important ingredient for cell division and elongation, and so N is a component of protoplasm. According to Erawan et al. (2013) [7], element N plays a role in plant vegetative growth, nitrogen is a necessary component for cell division and elongation, and so N is a constituent of protoplasm, which is widely distributed in tissues such as growing points.

The decrease in height development of mustard green after P4 treatment was suspected because the fertilizer dose was not balanced or exceeded the quantity required by the plant after P4 treatment (200 ml of liquid Biomol). According to Nissa (2016) [8], correct and balanced nutrition is required since nutritional deficits or excess nutrients can promote non-optimal plant growth. Excess phosphorus inhibits plant growth owing to N-P bonds that make it harder for plants to absorb nitrogen, while excess calcium alters soil pH, causing plants to become stunted, leaves to turn yellow, and plants to be low, according to [9].

The P3 treatment had the highest average value, indicating that the macro and micronutrient content of the liquid Biomol was enough for the caisim mustard green's needs. Growing plants, according to Parintak (2018) [10], will offer optimal productivity if sufficient nutrients are supplied. According to Gunawan et al., (2011) [11], the leftovers of fruits and vegetables include 23 mg of calcium and 12 mg of phosphorus, which aid in the growth of caisim mustard green height.

The variation in mustard green height at each concentration of the solution was owing to the fact that liquid Biomol includes nutrients that promote mustard green height growth. Plants can consume liquid Biomol with a concentration of 200 ml/L of water in the form of macro and micro nutrients that enter through the leaf mouth (stomata) during the vegetative growth period, resulting in the best plant height when compared to the concentration above it.

3.2 Number of Leaves

Number of Leaves. The results of the analysis of variance showed that 2–5 MST observations had a very significant effect. The average number of leaves of plants of 2-5 MST is presented in Table 2.

Table 2. Average Number of Leaves of Plants (Strands) aged 2-5 MST at Various Doses of Biomol

Treatment	Weeks after Planting			
	2 MST	3 MST	4 MST	5 MST
P0 0ml	4,04cb	6,03cb	8,07cb	9,80cb
P1 50ml	4,10b	6,67b	8,60b	9,40cb
P2 100ml	4,87a	6,93b	8,87b	10,80b
P3 150ml	5,20a	7,20b	9,27b	10,13b
P4 200ml	5,50a	7,80a	10,07a	12,40a
P5 250ml	4,93a	7,07b	8,93b	10,87b
P6 300ml	N6 300kg	N6 300kg	N6 300kg	N6 300kg
BNJ 5%	0,53	0,44	0,61	1,15

Remarks: The average value followed by the same letter in the same column, not significantly different at the 5% HSD test level

Based on the results of the 5% HSD test in Table 4.2, it is showed that the Biomol treatment at a dose of 200 ml (P4) gave the highest number of leaves compared to other treatments, but at 2 MST, it was not different from 100 ml (P2), 150 ml (P3) 250 ml (P5), and 300 ml (P6). The lowest number of leaves was found in the control treatment P0 (without Biomol).

The Biomol dosage treatment had a very substantial effect on the number of leaves at 2-5 MST, according to the analysis of variance. Biomol produced the most leaves at a dose of 200 ml when compared to the other doses. This demonstrates that a dose of 200 ml Biomol is capable of supplying nitrogen in the amount required for the growth and development of mustard greens, as nitrogen nutrients play a critical role in plant vegetative growth, such as plant height and leaf number.

Treatment P4 had a higher average growth rate of plant leaves than treatments P0 to P3, according to statistics. Treatment doses of vegetable and tofu factory waste ranging from 50 ml to 200 ml Biomol are thought to be able to satisfy the ideal conditions for plant nutritional needs. Meanwhile, the P5 treatment dose (250 mL liquid Biomol) was thought to be more than the amount of nutrients required by mustard greens. According to Firdaus et al., (2014) [12], if the nutrients provided surpass the amount that the plants require, the increase in the number of plant leaves will not occur ideally. Excess nitrogen fertilizers can induce plant poisoning by lowering soil pH and binding other nutrients, making it difficult for plants to absorb them.

The P3 treatment (250 mL liquid Biomol) produced the highest average value for the number of leaves produced by the caisim mustard green. When compared to other treatments, the P3 treatment (250ml liquid Biomol) contained nitrogen (N) and phosphorus (P) nutrients in accordance with the needs of mustard greens. In line with Indrajaya and Suhartini (2018) [13] assertion that if plants are provided enough nitrogen, their need for other nutrients such as phosphorus increases to compensate for their rapid growth rate. The elements in liquid Biomol are not in excess or deficiency, allowing the mustard greens to thrive to their full potential. A rise in the number of leaves on caisim mustard greens can also be linked to the height of the plant. When a plant grows taller, the number of growth tips on its leaves increases, resulting in more leaves.

3.3 Fresh Weight

The results of the analysis of variance showed that the treatment tested had a significant effect on the fresh weight of the mustard greens. The average plant fresh weight for each treatment is presented in Table 3.

Table 3. Average Plant Fresh Weight (g)

Treatment	Average
P0 0 ml	6,19d
P1 50 ml	11,13c
P2 100 ml	15,15cb
P3 150 ml	17,16b
P4 200 ml	24,79a
P5 250 ml	19,06b
P6 300 ml	20,97b
BNJ 5%	2,31

Remarks: The average value followed by the same letter in the same column, not significantly different at the 5% HSD test level

Based on the results of the 5% HSD test in Table 3, it is shown that the 200 ml dose of Biomol (P4) gave a higher fresh weight than the other treatments, while the lowest fresh weight was in the control treatment P0, but not significantly different from the 150 ml treatment (P3).

The Biomol dose treatment had a highly significant effect on the average fresh weight, according to the analysis of variance. When compared to the other doses, the 200 ml Biomol dose produced the highest average fresh weight. This is because the leaves have the largest water and nutrient content, resulting in the maximum plant fresh weight. According to Zulputra and Hidayat (2018) [14], plants still require a lot of energy and nutrients to achieve optimal plant fresh weight, so increasing the number and size of cells can achieve optimal results and allow an increase in the optimal water content of plants as well, as water content accounts for the majority of plant fresh weight. Because water is essential for cell turgidity, the leaf cells will grow.

The addition of biomol to the soil can increase soil porosity, preventing the soil from becoming too dense, resulting in improved root respiration. As a result, root development is more extensive in order to obtain nutrients (both macro and micronutrients) from the soil, and vegetative growth is improved. The heavier the biomass weighed on the plant crown, the better the vegetative development. It's thought that the nutrients in biomol are actually used by plants to raise plant weight at the optimal level. The concentration of biomol with a high content of one macro element can be used by plants to develop the vegetative part of the plant for the better at the optimum point, allowing the metabolic process to operate more smoothly. This is in line with Rinanto et al., (2015) [15], who claim that plants require macronutrients to boost photosynthesis and activate enzymes involved in the process.

3.4 Dry Weight

The results of the analysis of variance showed that the treatment tested had a very significant effect on the average dry weight. The average dry weight of plants in each treatment is presented in Table 4.

Table 4. Average Plant Dry Weight (g) at Various Biomole Fertilizer Doses

Treatment	Average
P0 0 ml	67,19d
P1 50 ml	11,13c
P2 100 ml	14,15cb
P3 150 ml	17,16b
P4 200 ml	24,79a
P5 250 ml	19,06b
P6 300 ml	20,97b
BNJ 5%	2,31

Remarks: The average value followed by the same letter in the same column, not significantly different at the 5% HSD test level

The results of the 5% HSD test (Table 4), showed that the 200 ml dose of Biomol (P4) gave the highest dry weight compared to other treatments, while the lowest dry weight was in the control treatment (P0) and was different from other treatments.

The Biomol dose treatment had a highly substantial effect on the average dry weight, according to the analysis of variance. When compared to the other doses, the 200 ml Biomol dose produced the highest average dry weight. This suggests that the photosynthetic process operates more effectively/efficiently as a result of the plant's increased dry weight, which is linked to the presence of superior plant development circumstances for continuous plant metabolic activities like photosynthesis.

This agrees with Setyawati et al., (2012) [16], who believe that dry weight is an indicator of plant development performance since it indicates net photosynthetic effects that can be deposited when the water content is dried. The ability of plants to take nutrients from the growing substrate to

promote their growth is measured in dry weight. Plant metabolism or the presence of enhanced plant development circumstances for plant metabolic processes such as photosynthesis are linked to an increase in plant dry weight. As a result, the more dry weight there is, the more efficient the photosynthetic process is. The more dry weight there is, the more efficient the photosynthesis process is, and the productivity and development of tissue cells is higher and faster, resulting in superior plant growth. Nitrogen, which is found in Biomol as a protein ingredient, helps to increase root growth and leaf development by promoting meristem tissue division.

4. Conclusion

The administration of Biomol at a dose of 200 ml had a very significant effect on plant height growth, number of leaves, and fresh weight and dry weight yield of mustard greens, and the best dose of urea fertilizer for mustard greens (*Brassica juncea* L.) was at a dose of 200 ml.

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