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Application of Urban Waste Organic Fertilizer on the Growth of Mustard Plants (Brassica Juncea L.)

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ABSTRACT

Purpose of this study was to determine the effect of urban organic fertilizer and garden soil on the growth of mustard greens. Implementation at Experimental Garden Faculty of Agriculture, Merdeka University Surabaya Jl. Ketintang Madya VII / 2 Surabaya. This research method used a randomized block design (RAK), where the treatment used (1) factor, namely urban waste organic fertilizer consisting of 8 levels of treatment and repeated 3 times to obtain good results. The parameters of the observations carried out were observing plant length, number of leaves, plant wet weight, observations were made from the age of 14 DAS to 35 DAS with intervals of once a week. The results showed that the treatment of the effect of urban waste organic fertilizer on the growth of mustard greens can be concluded as follows: (1) There is a significant interaction in the treatment of organic fertilizers on the variable number of leaves aged 14 DAS and plant wet weight. The best results were shown in the treatment dose of 15% urban waste organic fertilizer and 85% soil (P3); (2) Treatment of urban waste organic fertilizer at a dose of 15% and soil 85% has a very significant effect on plant length growth at 14 DAS and plant wet weight at harvest and (3) Application of urban waste organic fertilizer with a composition of 15% and soil is 85%. The optimal dosage is able to bind nutrients and provide nutrients according to the needs of the mustard plant.

Keywords: Mustard Plants, Organic Fertilizer, Municipal Waste.

1. INTRODUCTION

Growth of Mustard Plants (Brassica juncea, L.) is a type of vegetable that is popular with the community and has economic value and is rich in essential substances (protein, carbohydrates and fats), vitamins and minerals. Sawi is a type of leaf vegetable that has high economic value in Indonesia and several countries in the world. Based on data from the Central Statistics Agency (BPS) on the 1991 Agricultural Survey of Vegetable Crop Production in Indonesia, the harvested area of mustard greens is 35,868 hectares (4.35%) of the national vegetable harvested area; with a production of 322,164 tons (7.23%) of the national vegetable production (Rukmana, 1994: 12). For mustard plants, it is generally grown in the lowlands. This plant is not only resistant to heat (high), but also easily flowers and produces seeds naturally in Indonesia's topical climate conditions, so it does not have to rely on imported seeds (Rukmana, 1994: 34).

Organic fertilizers are fertilizers derived from the materials of living things or living things that have died, including animal manure, litter, garbage, and various intermediate products from

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living organisms (Sumekto, 2006: 1). There are several kinds of organic fertilizers, namely manure, green manure, bokashi, and compost (Purwendro and Nurhidayat, 2007: 15).

Organic fertilizer is a type of fertilizer made from organic materials derived from plants and animals which can be converted into available nutrients for plants. In MOA No.2 / Pert / Hk. 060/2/2006, regarding organic fertilizers, it is stated that organic fertilizers are fertilizers which mostly or entirely consist of organic material derived from plants and / or animals that have gone through an engineering process, can be solid or liquid which is used to supply organic materials to improve their properties (Ali, Purwanti, & Hidayati, 2019). physical, chemical, and biological soil. This definition indicates that organic fertilizers are aimed more at the C-organic content or organic matter rather than the nutrient content; the value of C-organic is what makes it different from inorganic fertilizers.

Application of organic matter is one way to improve soil quality, although the nutrient content of organic matter is generally lower than chemical fertilizers. For example, macro nutrients from plant residues range from 0.7 - 2% nitogen, 0.07 - 0.2% phosphorus and 0.9 - 1.9% potassium, while manure is 1.7 - 4% nitrogen, 0 , 5 - 2.3% phosphorus and 1.5 - 2.9% potassium. Overall, organic matter has complete potential to improve soil physical, chemical and biological properties. The benefits of organic matter are physically improving structure and increasing the capacity of the soil to store water. Chemically, it increases soil buffering capacity against changes in pH, increases cation exchange capacity, decreases P fixation and acts as a reservoir for secondary and micro elements. Biologically, it is a source of energy for soil microorganisms that play an important role in the process of decomposition and release of nutrients in the soil ecosystem (Sanchez, 1976).

The potential for organic waste, especially from densely populated urban areas is very high. Most of the waste from residential areas (households) is in the form of organic waste, the proportion of which can reach 78%. This organic waste is generally biodegradable, that is, it can be broken down into simpler compounds by the activity of soil microorganisms. The decomposition of this organic waste will produce material that is rich in the elements needed by plants, so it is very well used as organic fertilizer. Meanwhile, the raw materials for making organic fertilizers come from the local environment and are quite cheap (Sulistyawati et al., 2009).

Recycling urban waste from household waste into organic fertilizer (compost) is important to reduce the impact of pollution caused by garbage. The impact of pollution by waste includes water pollution caused by waste water (leachate), air pollution caused by foul smelling air, pollution by the presence of garbage which can have side effects of spreading disease outbreaks (Sudradjat, 2006).

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Compost is obtained from the weathering of plant materials or organic waste such as straw, husks, leaves, grasses, organic waste from factory processing, and organic waste that occurs due to human treatment. (Mustamar, 2009: 21) Biologically, worms play a major role in converting organic matter into humus so that it can improve soil fertility. The worm droppings are in the form of casts containing 40% humus compared to the top of the soil where the worms live (Yuliprianto, 2010: 194-195).

Earthworms are considered to be reliable engineers of soil ecosystems. These animals use organic materials and soil as food. Soil organic matter and fine-textured soil that is easy to digest, excreted as granular aggregates which are rich in nutrients for plants. The activity of earthworms in making soil burrows helps to absorb surface water more effectively and also facilitates the growth of plant roots in penetrating soil layers. The impact of earthworm activity makes the surrounding environment an environment that has the carrying capacity for the activities of other organisms. (Yuliprianto, 2010; 181)

Composting with worms is faster than microorganisms. Vermicomposting (fertilizer derived from worm droppings) is suitable for organic waste with a high water content. The vermicomposting system consists of three main stages, namely determining the type of earthworm for vermicomposting, the multiplication stage of earthworms, and composting. (Yuliprianto, 2010; 211). Garbage is a problem that must be overcome by all people in society by utilizing organic waste in the form of leaves that fall from trees in the surrounding environment to be used as organic fertilizer. One of the products produced from these wastes is solid compost, namely leaf compost. In addition to fulfilling the need for fertilizer for the campus environment itself, the leaf compost is also commercialized, and can also be used as material for making vermicompost. The mustard plant has the requirements to grow and give good results. These requirements include soil, climate and nutrition. Mustard plants should be planted in loose soil, contain lots of nutrients and are easily penetrated by water. The use of fertilizers in the planting medium is expected to increase the growth and production of mustard plants. The advantages of vermicompost (vermicompost), because it has complete basic nutrition, contains substances such as hormones and a number of microorganisms that are beneficial for plant growth and also reduce environmental health.

The benefits of household urban organic waste are organic fertilizers which are obtained from the weathering of organic waste from human (household) treatment. The compost treatment involves adding a decomposer or activator microorganism to the material. The benefits of compost from household waste are:

1. Save more than 50% of the cost of using land for landfills (TPA), because all organic waste is reprocessed and used for agricultural needs on a large scale.

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2. Organic waste processing does not pollute the environment, so that water, soil and air pollution can be reduced.
3. Organic waste that is processed properly can provide a source of income and employment for the organic fertilizer industry.
4. TPA can be used as a field school, which is to learn how to properly manage waste (Zainal et al., 2008).
5. Overall, organic matter has complete potential to improve soil physical, chemical and biological properties. The benefits of organic matter are physically improving structure and increasing the capacity of the soil to store water. Chemically, it increases soil buffering capacity against changes in pH, increases cation exchange capacity, decreases P fixation and acts as a reservoir for secondary and micro elements. Biologically, it is a source of energy for soil microorganisms that play an important role in the process of decomposition and release of nutrients in the soil ecosystem.

The nutrient content of household municipal waste organic fertilizer cannot be directly applied to fertilize plants, but must undergo a composting process first. Several reasons for household waste need to be composted before being used as plant fertilizer, among others:

1. If the soil contains enough air and water, the decomposition of organic matter takes place rapidly, thus disrupting plant growth;
2. The breakdown of fresh matter supplies very little humus and nutrients to the soil;
3. The structure of fresh organic matter is very coarse and has little water absorption, so that when immersed it will cause the soil to crumb:
4. Making compost using household waste is a way of storing organic material before it is used as fertilizer. Organic fertilizers from household waste with various kinds of decomposers and other mixed materials that have been produced are subjected to chemical analysis.

From the analysis, it is known that the pH status, C-organic content, C / N ratio, other macro and micro elements. The benchmarks for the quality of the organic fertilizers produced were organic C content, C / N ratio and N-total. The results of the analysis of household waste compost produced by BPTP East Java showed that the C-organic content ranged from 15.41 to 18.89, the C / N-ratio ranged from 11.8812.04 to 18.29, and the total-N was around 0, 58 - 1.57%. From laboratory tests, it is known that household waste organic fertilizer with Promi decomposer plus manure, bran, and drops contains high C-organic. According to Zainal et al. (2008) stated that charcoal or carbon contained in organic matter is a source of energy for microorganisms. In the process of digestion by microorganisms, a combustion reaction occurs between the elements

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carbon and oxygen to become calories and carbon dioxide (CO2). This carbon dioxide is released into gas, then the decomposed nitrogen element is captured by microorganisms to build their bodies. When these microorganisms die, nitrogen will stay with the compost and become a source of nutrition for plants. This means that apart from being a source of nutrients (releasing nutrients especially N in a relatively fast time), this organic fertilizer can also be used as a source of soil organic matter.

The critical value of the C / N ratio of an organic material for the occurrence of decomposition is below 30, above which the value of organic matter will be difficult to decompose (Stevenson, 1986 and Handayanto, 1995). The amount of C / N ratio indicates whether organic matter is easy to decompose. A high C / N ratio indicates the presence of relatively large amounts of weathered soil material (eg cellulose, fat and wax), on the other hand, the smaller the C / N ratio, the easier it is to decompose organic matter. By composting the ratio of organic matter can reach 20 to 15, so that a decrease in the C / N ratio means that nitrogen availability for plants increases. The optimum C / N ratio has a range between 20-25 (N content around 1.4 - 1.7%) which turns out to be ideal for maximum decomposition because there will be no nitrogen release through mineralization from organic waste above the amount required by microorganisms. A good C / N ratio is between 20-30 and will be stable when it reaches a ratio of 15. Too high a C / N ratio causes the process to run slowly because of the low nitrogen content. The C / N ratio will achieve stability when the decomposition process is complete. According to Djuarnani et al. (2009), a good C / N ratio is between 20-30 and will be stable when it reaches a ratio of 15. Too high a C / N ratio results in a slow process due to low nitrogen content. The C / N ratio will achieve stability when the decomposition process is complete.

2. RESEARCH METHOD

This research method uses a randomized block design (RBD), where the treatment uses (1) factor, namely urban waste organic fertilizer consisting of 8 treatment levels and repeated 3 times so as to obtain good results. The parameters of the observations carried out were observing plant length, number of leaves, plant wet weight, observations were made from the age of 14 DAS to 35 DAS with intervals of once a week.

3. RESULTS AND DISCUSSION

Plant Height The

Results of the variance analysis showed that the interaction of various treatments of urban waste organic fertilizer on plant length at all observation ages did not show a significant difference.

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(Appendix 1). The average plant length for various treatments of urban waste organic fertilizer can be seen in Table 1. Table 1 shows that the treatment dose of organic waste fertilizer 20% (P4) majority has the longest plant length at all observation ages, each of which is 11.67 cm (age 14 DAS); 16.17 cm (age 21 DAS); 21.33 cm (age 28 DAS) and 24.17 cm (age 35 DAS). While the length of the plant is shown in the treatment without doses of organic waste fertilizer (P0).

Table 1. The Average Length of Mustard Plants (cm) at Various Observation Ages (Days After Transplating).

Treatment	Average shoot length (cm)			
	14	21	28	35
P0	5.67 a	8.00 a	10.00 a	13.50 a
P1	10.33 b	14.33 b	16.33 b	18.83 b
P2	11, 50 b	17.83 c	19.17 c	21.33 c
P3	11.33 b	15.50 b	19.67 cd	22.50 cd
P4	11.67 b	16.17 bc	21.33 d	24.17 d
P5	11 , 00 b	15.50 b	20.17 cd	23.33 d
P6	10.83 b	14.17 b	18.50 c	22.00 c
P7	11.17 b	15.33 b	19.50 cd	23.33 d
BNT 5%	1.69	2.18	1.91	1.93

Note: Figures accompanied by the same letter in the same column show no significant difference (LSD 5%).

Number of Leaves

The results of the analysis of variance show that there is no significant interaction of various treatments of urban waste organic fertilizer at the observation age of 14 DAS and shows a real interaction at the observation age of 21 DAS, 28 DAS, and 35 DAS. The average number of leaves in various treatments of urban waste organic fertilizer can be seen in table 2.

Table 2. Average Number of Mustard Leaf Plants at Various Observation Ages (Days After Transplanting)

Treatment	Average Number of Mustard Plant Leaves			
	14	21	28	35

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P0	3.67	5.33 a	7.33 a	9.00 a
P1	5.17	7.67 b	11.33 b	15.83 bc
P2	5.33	8, 83 b	12.33 bc	16.33 bc
P3	5.50	8.67 b	13.50 c	18.50 bc
P4	5.50	9.17 b	12.67 bc	14.00 b
P5	5.17	9.17 b	12.67 bc	19.33 c
P6	5.67	9.33 b	12.17 bc	15.00 bc
P7	5.33	8.83 b	11.67 bc	14.83 bc
BNT 5%	tn	1.86	1.86	4.75

Note: Figures accompanied by the same letter in the same column show no significant difference (LSD 5%).

tn: not real

Table 3 shows that the treatment dose of 30% urban waste organic fertilizer (P6) shows the highest number of leaves at the observation age of 14 DST and 21 DST, respectively 5.67 and 9.33 strands. Treatment dose of 15% urban waste organic fertilizer (P3) showed the highest number of leaves at the age of 28 DAS observation, namely 13.50 pieces. The 25% dose treatment of urban waste organic fertilizer (P5) showed the highest number of leaves at the observation age of 35 DAS, namely 19.33 pieces. While the lowest number of leaves was shown in the treatment without urban waste organic fertilizer (P0). And at the age of 14 DAS observation, the number of plant leaves showed no significant difference. (attachment 2)

Root Length and Plant Wet Weight The

Results of the analysis of variance showed that there was a significant interaction of various dosage treatments of urban waste organic fertilizer on root length and plant wet weight at the end of the observation.

Table 3. Average Root Length and Fresh Weight per Plant at the End of the Observation

Treatment	Average Value of Age Observation 35 Days After Planting	
	Root Length per Plant	Wet Weight per Plant
P0	31.17 a	34.42 a
P1	49.03 b	118.27 b

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P2	47.67 b	206.70 c
P3	57.17 bc	313.82 e
P4	47.67 b	275.35 de
P5	53.33 bc	282.32 de
P6	52.67 b	187.58 c
P7	67.17 c	247.78 d
BNT 5%	14.26	54.21

Note: Figures accompanied by the same letter in the same column show no significant difference (LSD 5%).

Table 3 shows that the treatment dose of 35% urban waste organic fertilizer (P7) has the longest root length of 67.17 cm and the treatment dose of 15% urban waste organic fertilizer (P3) has the heaviest wet weight of 313.82 gr. Meanwhile, the shortest root length and lowest wet weight were owned by the treatment without urban waste organic fertilizer (P0).

Discussion

The results showed that the 15% dose treatment of urban waste organic fertilizer (P3) gave the best results on the growth and yield of mustard plants. This is because the application of organic fertilizers can increase soil fertility and improve soil structure, where a good soil structure causes the roots to develop properly, so that the absorption of nutrient elements is maximized. In accordance with the opinion of Nurhayati (2000), which states that the smooth absorption of nutrients by plants depends on the supply of groundwater which is closely related to the capacity to hold water by the soil. And supported by Sutejo (2002) who said that organic fertilizers have an important function compared to inorganic fertilizers, namely that they can loosen the soil surface layer (topsoil), increase the population of microorganisms, increase absorption and water retention capacity which can increase overall soil fertility.

The 15% dosage treatment of urban waste organic fertilizer (P3) gave the best growth and development of mustard plants compared to other treatments. This is because the treatment of 15% urban waste organic fertilizer and 85% soil has an optimal composition. The addition of 15% organic fertilizer to the soil is able to bind nutrients and provide nutrients according to their needs so that the presence of organic fertilizers in the soil content provides growth and development of

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mustard plants. In accordance with Yunus' opinion (1991), the organic matter contained in organic fertilizers is able to unite and bandaging soil particles into larger soil grains.

The soil grains are able to store nutrients and provide them when the plants need them. In addition, the organic fertilizer that is given can create a balance of nutrients in the soil and improve the physical quality of the soil by making the soil texture, porosity and soil structure better so that the absorption of nutrient elements is optimal. Hairiah et al., (2000) added that organic matter can increase the soil's cation exchange capacity and reduce the loss of nutrients added through fertilization so that it can increase fertilization efficiency.

Yulipriyanto (2010) states that organic fertilizers are not far from reliable soil ecosystem engineers, namely earthworms. These animals use organic materials and soil as food. Soil organic matter and fine textured soil that is easy to digest, excreted as granular aggregates which are rich in nutrients for plants. The activity of earthworms in making soil burrows helps to absorb surface water more effectively and also facilitates the growth of plant roots in penetrating soil layers. The impact of earthworm activity makes the surrounding environment an environment that has the carrying capacity for the activities of other organisms.

4. CONCLUSION

The results showed the effect of the type of urban waste organic fertilizer treatment on the growth and yield of mustard greens, the treatment of organic fertilizers had a very significant effect on the growth of mustard plant length and wet weight of the plant, while the growth in the number of leaves was significantly different at 14 days DAS. . The best results were shown in the treatment dose of 15% urban waste organic fertilizer and 85% soil (P3).

The application of urban waste organic fertilizer to mustard plants is better to use a composition of 15% and soil 85%. This is because the treatment of organic waste fertilizers has an optimal composition. The addition of 15% organic fertilizer to the soil is able to bind nutrients and provide nutrients according to the needs of the mustard plant.

Suggestion

The research results are suggested to conduct soil analysis and compost which will be used first before application to plants. It is intended that nutrient elements are absorbed by plants in appropriate doses, neither deficiency nor excess for optimal plant growth and production. In addition, it is recommended to use a combination of organic fertilizers and chemical fertilizers, in addition to being able to meet the nutrients needed by the combination plants, it is also expected to be able to produce fresh mustard plants.

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