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Utilization of Organic Garbage as "Eco Garbage Enzyme" for Lettuce Plant Growth (*Lactuca Sativa L.*)

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Abstract: Waste is a material that is wasted from all the results of human activities or natural processes that are not utilized. Based on the form, the waste is classified into three parts one of which is solid waste which is often called the waste. Dump trash that increasingly pollute the environment requires a technique to manage waste into something useful, especially organic market waste. Alternative market waste processing, especially organic vegetables and fruit skin waste that is done is making an eco-friendly bio pesticide called eco garbage enzyme. Eco garbage enzyme will be applied as a bio pesticide to be used on hydroponic vegetable crop of lettuce. This study aims to process organic waste market as eco garbage enzyme and to know its influence on the growth of lettuce plant. The method used in this research is descriptive quantitative. This research produces eco garbage enzyme which is the result of semi aerobic fermentation that can be applied as an environmentally friendly bio pesticide. Eco garbage enzyme gives a real influence on root length, stem circumference, and dry weight of lettuce plant with the best concentrations of eco garbage enzyme is 10 cc / L.

Keywords: eco garbage enzyme, lettuce, garbage

1. Introduction

Waste is a material that is wasted from all the results of human activities or natural processes that are not utilized. Based on the form, the waste is classified into three parts one of which is solid waste which is often called the garbage. Garbage can be positive and negative economic value, which is a positive economic value of waste if it can be utilized into something useful and has a high value. Garbage can be sorted / processed based on the nature and the material phase of the waste. Based on the material phase can be divided into three categories namely solid phase, liquid, and gas. According to Slamet (2002), sorting by nature is divided into two types: organic and inorganic waste. In addition, the garbage can also be sorted based on the classification of household waste, commercial waste, building waste, and public facility waste.

The waste management / segregation planning is made of a law that is expected to be able to handle the garbage problem in order to be managed. Looking at urban especially Denpasar city, handling of garbage management is very urgent considering the daily garbage reaching 850 ton / day (Ris, 2016). The government hopes that the handling of waste management based on Law No. 18 of 2008 can be implemented. In addition, Law No. 32 of 2009 on Environmental Protection and Management can also be used for basic waste management. Garbage management is also inseparable from Bali Provincial Regulation No. 5 of 2011 on waste management which mentions waste management is an effort to handle garbage in changing the characteristics, composition, and amount of waste. Particularly the city of Denpasar, the government has implemented the garbage bank of Denpasar City in accordance with the Decree of the Mayor of Denpasar No. 188.45 / 195 / HK / 2015 which states the sorting and processing of organic and inorganic waste into goods of economic value and efficient to reduce the waste

load in TPA Final Disposal). According to a study of Fairus, et al. (2011), the utilization of organic waste can be used as alternative energy of biogas and briquette precursors. Besides being used as biogas and briquettes, waste management can be used as a pesticide. This is supported by the results of research conducted Yuantari (2011) mentions many farmers use organochlorine pesticides in eradicating pests which according to farmers can improve yield but very dangerous for health and pollute the environment. Based on the many findings that mention pesticides interfere with health and pollute the environment, the findings of pesticides are environmentally friendly implemented by efforts to reduce environmental pollution and produce healthy harvest. Dump trash that increasingly pollute the environment requires a technique to manage waste into something useful, especially organic market waste.

This is supported by the research of Jana, et al. (2006) shows the observations made in the market of market waste piles Badung which has the largest percentage of organic waste reached 71.51%, its makes a discovery in managing organic waste to be used as compost. Alternative market waste processing, especially organic vegetables and fruit skin waste that is done is making an eco-friendly bio pesticide called eco garbage enzyme.

Eco garbage enzyme is the utilization of fruit and vegetable leather waste mixed with brown sugar and water which is then fermented. According Saravan, et al (2013) mentioned the effectiveness of eco garbage is very effective to manage waste in composting to minimize pest disturbance. In addition, according to research results Bo, et al (2007) mentions vegetable waste is very effective in the formation of volatile fatty acids (VFA) and nutrients such as nitrogen content that is useful for plants. The market waste management, especially vegetable and fruit bark waste used as eco garbage enzyme will be applied as an environmentally

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friendly bio pesticide that will be used on hydroponic vegetable crop lettuce so as to realize healthy life style.

This study uses lettuce vegetables due to the results of research Shinde, et al. (2012) showed that lettuce vegetables can grow well when given pesticides. This is supported by the results of Miskiyah research, et al. (2009) which mentions the most contamination of pesticide residues in lettuce plants. Utilization of market organic waste, especially vegetable and fruit waste as an "eco garbage enzyme" in lettuce plants needs to be done to reduce the pile of market organic waste and chemicals contained in pesticides by replacing artificial pesticides with natural pesticides.

2. Research Methods

This study included experimental research with quantitative descriptive method due to the treatment of experimental group to perform preparation and identify stem circumference, stem length, wet weight of plant, dry weight of plant, and number of leaves. This research will be designed using single factor experiment that is because this research is only influenced by one factor that is concentration. The study was also designed from the preparation stage of eco garbage enzyme materials, the manufacture of eco garbage enzyme, testing on growing vegetables lettuce. The design of the research is the method performed by Rosukan (1986) shown in the following diagram.

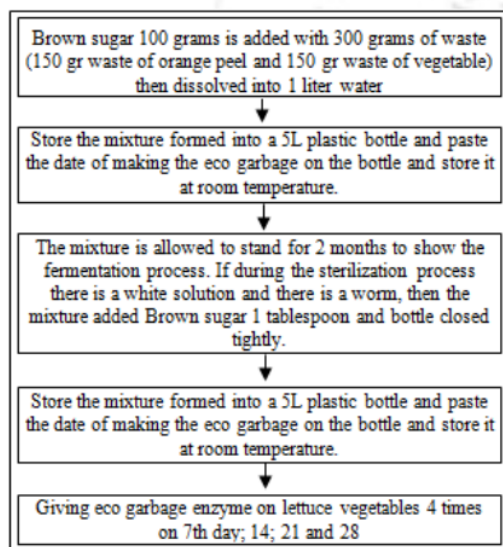


Figure 1: research design

2.1 Place and Time of Research

This research was conducted at UPT Laboratory. Lab. Analytical UNUD and Hydroponic Bali and held for 5 months.

2.2 Population and Sample

2.2.1 Population

This population size research is the whole vegetable crop of lettuce contained in hydroponic paralon of 100 plants.

2.2.2 Sample

This research uses 25 samples of plants

2.3 Data Analysis

The data obtained in this study will be analyzed using a variety analysis using BNT Test processed using SPSS version 23.0

3. Findings and Discussions

3.1 Organic Waste Management Process Becomes Eco Garbage Enzyme

The process of making eco garbage enzyme is conducted for 2 months starting from September until November with the first step is to process and sort the market waste, especially organic waste of vegetable and fruit waste. The preparation of eco garbage enzyme is done by weighing the material from fruit and vegetable waste, brown sugar, and water with the ratio of vegetable and fruit waste 3, brown sugar 1, and water 10 which is then stored in 5 L plastic bottle.

Eco garbage enzyme is fermented semi-aerobic for 2 months and produces a light brown solution. The eco garbage enzyme solution was then tested to determine the macro and micro nutrient content. Based on the results of the highest macro element content test of potassium macro element (K) of 203 mg / L and phosphorus (P) of 21.79 mg / L. Potassium content (K) will be shown in the growth of many leaves and not perforated. In addition to the potassium macro element, in the eco garbage enzyme solution of phosphor (P) which can be shown in a good root system on the growth of lettuce plants. A macro nitrogen element (N) with a small content in the solution of the eco garbage enzyme will affect the high growth of the lettuce plant.

3.2 Effect of Eco Garbage Enzyme as Environmentally Friendly Pesticide an Against Lettuce Plant

Giving eco garbage enzyme results in improved growth measurements of lettuce plants, this is supported by the results study of Saparinto (2013) is showed that lettuce plants that grow well have a height of 30 cm. Table 1 shows the average result of eco garbage enzyme concentration on plant height.

Table 1: The average effect of eco garbage enzyme on plants

Concentration of eco garbage enzyme	Average of Harvest Results				
	I	II	III	IV	V
0 cc/ L	9.50 ^a	12.75 ^a	16.18 ^a	25.00 ^a	32.00 ^a
2.5 cc/ L	6.95 ^a	11.50 ^a	12.83 ^a	21.53 ^a	29.63 ^a
5 cc/ L	7.88 ^a	11.88 ^a	14.08 ^a	22.95 ^a	33.00 ^a
7.5 cc/ L	8.88 ^b	13.08 ^b	15.18 ^b	24.73 ^b	33.38 ^a
10 cc/ L	10.20 ^b	13.90 ^b	16.08 ^b	26.63 ^b	33.63 ^b

Description: The same letter on the back of the numbers in each column shows no significant difference in the BNT test of 5%

The average difference in plant height is the best tendency in plant height which is affected by eco garbage enzyme with concentration of 10 cc / L, this is because the effect of low macro element N is 0,056%. This is also supported by the result of 5% BNT test analysis which shows the amount of $F_{\text{calculate}}$ due to the effect of eco garbage enzyme 0.70 so it is not significant because the level of significance is less than F_{table} BNT 5%, it shows the giving of eco garbage enzyme gives unreal effect against lettuce height.

Here is the result of the average effect of eco garbage enzyme on the number of lettuce leaves shown in table 2.

Table 2: The average effect of eco garbage enzyme concentration on the number of lettuce leaves

Concentration of eco garbage enzyme	Average of Harvest Results				
	I	II	III	IV	V
0 cc/L	6.00 ^a	6.75 ^a	6.25 ^a	8.25 ^a	11.75 ^a
2.5 cc/L	6.75 ^b	5.75 ^b	4.75 ^b	7.00 ^b	14.00 ^b
5 cc/L	6.00 ^c	6.00 ^c	4.75 ^c	7.75 ^c	14.75 ^c
7.5 cc/L	6.00 ^c	5.75 ^c	7.00 ^d	9.00 ^d	16.25 ^d
10 cc/L	7.25 ^c	8.00 ^c	7.75 ^d	9.50 ^c	18.75 ^c

Description: The same letter on the back of the numbers in each column shows no significant difference in the BNT test of 5%

Table 2 shows the average effect of eco garbage enzyme concentration on the number of leaves that produce the highest mean at the concentration of eco garbage enzyme at 10 cc / L, this is because the high macro content of K in eco garbage enzyme solution causes more and less hollow leaves or diseased. Based on the results of analysis using 5% BNT test which shows the value of $F_{\text{calculate}}$ due to the effect of eco garbage enzyme on the number of leaves valued at 0.73 so not significant because far from F_{table} BNT 5%. This shows the provision of eco garbage enzyme that does not give a real effect on the number of leaves on the lettuce plant.

The average effect of eco garbage enzyme concentration on the circumference of lettuce stem is shown in Table 3.

Table 3: The average effect of eco garbage enzyme concentration on the circumference of lettuce stem

Concentration of eco garbage enzyme	Average of Harvest Results				
	I	II	III	IV	V
0 cc/L	0.15 ^a	2.10 ^a	2.38 ^a	2.13 ^a	3.00 ^a
2.5 cc/L	0.14 ^b	1.80 ^b	1.93 ^b	2.18 ^b	3.20 ^b
5 cc/L	0.14 ^c	1.70 ^c	1.65 ^c	4.75 ^c	3.40 ^c
7.5 cc/L	0.13 ^c	1.70 ^d	2.68 ^d	4.88 ^d	5.62 ^d
10 cc/L	1.08 ^d	2.50 ^d	2.70 ^c	5.30 ^c	5.80 ^c

Description: The same letter on the back of the numbers in each column shows no significant difference in the BNT test of 5%

Based on table 3 shows the highest average that is at the concentration of eco garbage enzyme 10 cc / L. The results

are supported from the results of research Cahyono (2005) which indicates a lettuce bar has a diameter ranged from 2 - 3.5 cm. The result of BNT test analysis in analyzing the effect of giving eco garbage enzyme to the lettuce stem circumference gave no significant effect, this is because the value of $F_{\text{calculate}}$ analysis result of 0.80 is lower than 5% F_{table} BNT.

The average effect of giving eco garbage enzyme on lettuce root growth is shown in Table 4.

Table 4: The average effect of eco garbage enzyme concentration on root growth of lettuce plant

Concentration of eco garbage enzyme	Average of Harvest Results				
	I	II	III	IV	V
0 cc/L	7.38 ^a	7.68 ^a	11.25 ^a	14.75 ^a	11.50 ^a
2.5 cc/L	5.63 ^b	8.28 ^b	4.08 ^b	11.00 ^b	21.00 ^b
5 cc/L	6.20 ^c	9.45 ^c	9.38 ^c	14.75 ^c	21.50 ^b
7.5 cc/L	7.73 ^d	9.73 ^d	14.53 ^d	15.50 ^c	21.50 ^c
10 cc/L	9.55 ^c	10.05 ^c	14.98 ^c	15.83 ^d	22.00 ^d

Description: The same letter on the back of the numbers in each column shows no significant difference in the BNT test of 5%

Based on the average in table 4 shows the best long-term tendency to increase the growth of lettuce plants that is the concentration of eco garbage enzyme of 10 cc / L. The effect showed an unreal effect on the growth of lettuce with eco garbage enzyme can be shown from BNT test result which shows that the value of $F_{\text{calculate}}$ analysis results of 0.75 does not exceed the value of F_{table} BNT 5%.

The average of wet weight measurements can be seen in Table 5 which shows the highest tendency of wet weight obtained by the concentration of eco garbage enzyme 10cc / L, this is because the number of cells and the size of the increase and reflect the protoplasm increases. The process of protoplasm is through a metabolic process in which water and inorganic salts are converted into food reserves in photosynthesis processes useful for generating energy in the process of plant growth. Here is the average table of wet lettuce weight measurement results shown in table 5.

Table 5: The average effect of eco garbage enzyme concentration on wet weight of lettuce plant

Concentration of eco garbage enzyme	Average of Harvest Results				
	I	II	III	IV	V
0 cc/L	0.97 ^a	2.06 ^a	6.57 ^a	13.08 ^a	46.38 ^a
2.5 cc/L	0.51 ^a	1.97 ^b	2.91 ^a	11.10 ^a	79.10 ^a
5 cc/L	0.71 ^a	1.05 ^b	3.30 ^b	24.78 ^a	80.38 ^a
7.5 cc/L	0.73 ^a	1.05 ^b	8.48 ^c	24.90 ^b	80.38 ^b
10 cc/L	1.05 ^a	5.05 ^b	9.26 ^c	25.30 ^b	81.48 ^b

Description: The same letter on the back of the numbers in each column shows no significant difference in the BNT test of 5%

Based on the results of BNT test analysis showed $F_{\text{calculate}}$ value of 0.74 which gives no significant effect between eco garbage enzyme concentrations on wet weight of lettuce plant. This is because the increase in wet weight can occur if there is an increase in the number of leaves on the lettuce

plant.

Table 6 shows the average effect of eco garbage enzyme concentration on dry weight of lettuce plant.

Table 6: The average effect of eco garbage enzyme concentration on dry weight of lettuce plant

Concentration of eco garbage enzyme	Average of Harvest Results				
	I	II	III	IV	V
0 cc/ L	0.04 ^a	0.13 ^a	0.44 ^a	0.61 ^a	1.08 ^a
2.5 cc/ L	0.00 ^b	0.02 ^b	0.19 ^b	0.45 ^b	1.63 ^b
5 cc/ L	0.01 ^b	0.03 ^c	0.10 ^c	0.89 ^c	1.72 ^c
7.5 cc/ L	0.02 ^c	0.10 ^d	0.55 ^d	1.00 ^d	2.79 ^d
10 cc/ L	0.04 ^d	0.22 ^c	0.58 ^c	2.21 ^c	6.07 ^c

Description: The same letter on the back of the numbers in each column shows no significant difference in the BNT test of 5%

Table 6 shows the highest average dry weight of lettuce plants given eco garbage enzyme at a concentration of 10 cc/ L while the smallest mean weights in the treatment with eco garbage enzyme concentration of 2.5 cc / L. This indicates that nutrient concentrations are less likely to cause growth plants become obstructed while the high concentration of nutrients can increase plant growth well.

Based on the results of the analysis using BNT test which showed an unstable influence between the concentration of eco garbage enzyme to dry weight on the plant, this is shown from the $F_{\text{calculate}}$ result of 1.28 which is below the 5% F_{table} BNT value but the K4 treatment gives a real effect on the growth of plants with other treatments, this proves the higher dry weight in the plant shows the more leaf surface area so that the higher the absorption of sunlight. Dry weight is also influenced by the availability of nutrients in plants, this is supported by research Ratna (2002) which mentions the nutrients available in plants can increase the dry weight on the plant.

3.3 Best Eco Garbage Enzyme Concentration for Lettuce Growth

Based on the results of this study shows the tendency of the best concentration to influence the growth of lettuce crop is 10 cc / L, this is due to the tendency of the results that significantly influence between the concentration of eco garbage enzyme with the growth of lettuce on the plant height, the number of leaves, stem circumference, root length, wet weight, and dry weight of the lettuce plant.

4. Conclusions and Suggestions

4.1 Conclusions

Based on the above research results can be concluded that is:

- 4.1.1 The process of making eco garbage enzyme is carried out for 2 months through semi-aerobic process with a ratio of 3 pieces of fruit and vegetable: 1 brown sugar: and 10 water;

- 4.1.2 Giving eco garbage enzyme to the growth of lettuce plants gives a real effect on stem circumference, root growth, and dry weight of plants;

- 4.1.3 The best concentration trend of eco garbage enzyme for lettuce growth is concentration 10 cc / L.

4.2 Suggestions

The advice given is:

- 4.2.1 the need for further research on the application of eco garbage enzyme in fruit and tuber crops, this is due to high eco garbage enzyme test result with macro phosphorus (P) and potassium (K) elements which is a much needed element in fruit plants and bulbs;
- 4.2.2 An application of eco garbage enzyme is necessary to contribute to the use of waste so as to provide a clean environment without waste.

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