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# Effect of Eco Enzymes Dilution on the Growth of Turi Plant (*Sesbania grandiflora*)

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Novelty statement:This study reveals that dilution of Eco Enzyme turned out to have a good effect on the growth of Turi plant (*Sesbania grandiflora*). The procedures and parameters standardised in this research can be used for growing of Turi.

**Abstract.**Eco Enzymes (EE) is one of the products of fermentation that comes from fruits and vegetables wastes. Enzymes and organic acid in Eco Enzymes has a positif effect on plant growth. This study aims to investigate dilution of Eco Enzymes and its application to improve the growth of Turi plants. This research used the completely randomized design method (CRD). The treatments consisted of P1 (1:300), P2 (1:200), dan P3 (1:100), and there were 5 replications. Parameters were plant height, stem diameter, number of branches, number of leaves and leaf width. The results of this research were that 1:100 dilution treatment had significant effect ($p<0,05$) on the the parameters of plant height, stem diameter, number of leaves and leaf width. However there was no significant effect on the number of branches. The best response to Eco Enzymes was 1: 100 dilution.

**Keywords:** dilution, eco enzymes, plant growth, turi

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## 1. Introduction

Waste is a product material all human activities that has not utilized. Every day the amount of waste produced increases due to the increasing use and number of people. In Indonesia alone, the average amount of waste produced per day is 1 kg per person or 220,000 tons of national waste per day. Waste is divided into two, namely organic waste and nonorganic waste [1].

Organic waste can be utilized become Eco Enzymes. Dr. Rosukon found Eco Enzymes in 2006 and succesfully manage organic waste into something useful. According [2] Eco Enzymes ia a composite organic substance made up of organic acids, protein chains (enzymes), and mineral salts produced by the fermentation of waste vegetable, fruits peel, sugar, and water. According to [3] Eco Enymes can be applied to compose, decompose, transform and catalyze.

The principle of the process of making Ecoenzymes is similar to the process of making compost while in making Eco Enzymes non chlorine water and mollases are added into fruits or vegetables wastes. The process for fermentation takes three months [4]. There are protease, amylase, and lipase activity in Eco Enzymes which can be used to degrade proteins,

carbohydrates and lipids. Eco Enzymes also possess pathogen killing or pathogen inhibiting properties [1]. The purpose of this study was to investigate Eco Enzymes dilution and its application on Turi plant height, stem diameter, number of branches, number of leaves and leaf width.

## 2. Materials and Methods

### 2.1. Materials

Materials were consisted of turi plants, Eco Enzymes, growing media (top soil, roasted husks and compost), polybags, cameras, calipers, gauges.

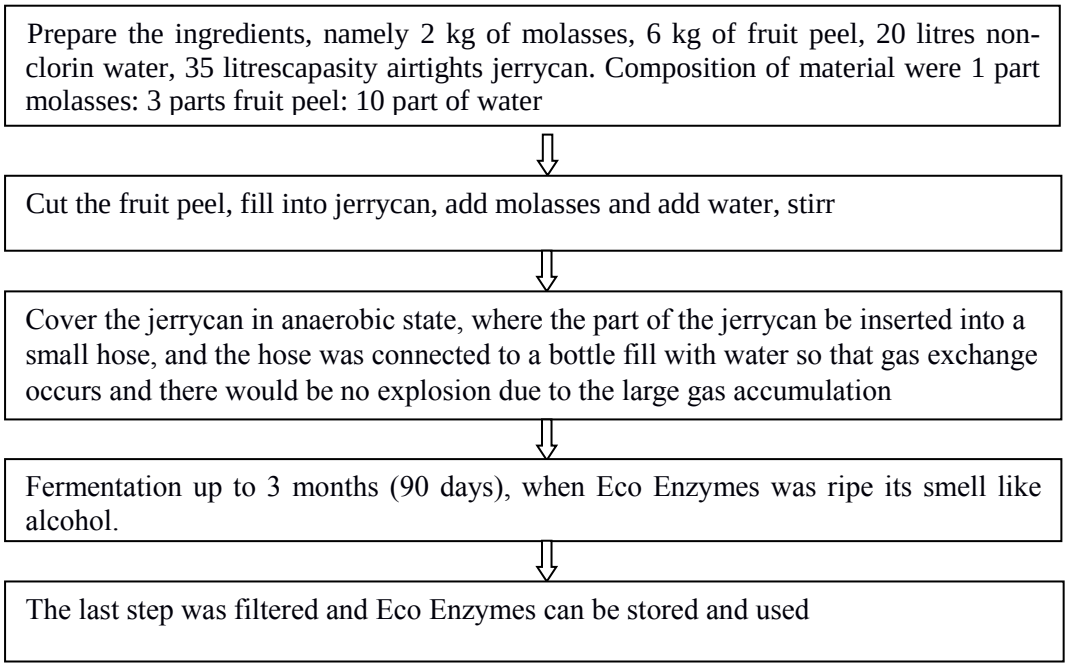
### 2.2. Methods

The research method was used a completely randomized design (CRD) and was consisted of 4 treatments and 5 replications:

P0 = Control
P1 = 1:300 (1.2 ml EE : 360 ml of water)
P2 = 1:200 (1.8 ml EE : 360 ml of water)
P3 = 1:100 (3.6 ml EE: 360 ml of water)

Turi seeds were planted in polybags with a capacity of 5 kg and watered every day according to the field capacity in this research which was 360 ml / polybag.

### 2.3. Making Eco Enzymes



### 2.4 Parameters observed

#### 2.4.1 Plant height

Measured from the soil surface to the highest part of the Turi plant in units of centimeters. Measured once every 14 days

#### 2.4.2 Stem diameter

Measured rod diameter 10 cm above the ground using a caliper. Measured every 14 days

#### 2.4.3 Number of branches

Calculated by counting all branches that appear on each plant from each treatment. Counted once every 14 days.

#### 2.4.4 Number of leaves

Counted all leaves that have been completely open in each treatment. Counted once every 14 days.

#### 2.4.5 Leaf width

Measured leaf width using a tape measure or ruler, measured on the widest leaf in each treatment. Measured once every 14 days.

## 3. Result and Discussion

### 3.1. Plant Height

The effect of giving Eco Enzymes dilution on the plant height of Turi (*Sesbania grandiflora*)

**Table 1.** Plant height (cm) Turi (*Sesbania grandiflora*) by application Eco Enzymes dilution

| Treatments | Repetations | | | | | Average |
|---|---|---|---|---|---|---|
| | U1 | U2 | U3 | U4 | U5 | |
| $P_0$ | 92 | 69 | 81 | 96 | 68 | $81.2^{ab}$ |
| $P_1$ | 69 | 91 | 56 | 79 | 53 | $69.6^{b}$ |
| $P_2$ | 82 | 3 | 50 | 55 | 67 | $51.4^{b}$ |
| $P_3$ | 100 | 112 | 144 | 72 | 80 | $101.6^{a}$ |

Description: Different superscriptions in the same row or column indicate a significant difference in the Duncan test ($p < 0.05$).

Giving different dilution of Eco Enzymes gave a significant effect on the plant height of Turi. It can be seen in "Table 1" where the highest average plant height in treatment 1: 100 (P3) is 101.6 cm, the lowest average plant height in treatment 1: 200 (P2) is 51.4 cm. This shows that 1:100 dilution caused the plant growth better then other treatments. This is in accordance with the statement [5] which states that Eco Enzymes contain nutrients needed by plants for vegetative growth. Based on the results of soil science laboratory analysis of the Faculty of Agriculture, University of North Sumatra in 2020, Eco Enzymes nutrient content, including K (0.91 ppm), P

(6.13 ppm), N (0.05%), C-Organic (0, 38%), and a pH of 4.26. Dilution 1:100 causes the nutrients contained are higher than other dilution levels. This is the possibility that causes the plant height with a 1:100 dilution is better than the other dilution levels. In addition, in the 1:100 dilution, it is possible that the concentration of enzymes is higher than other dilutions where enzymes are biocatalysts so that plant roots can absorb nutrients in the growing media better. Lingga and Marsono (2004) states that a growth from the height of a plant is caused by an event of cell division and extension which is dominated at the tip of the plant's shoot. This process is a synthesis of proteins obtained by plants from the environment such as organic matter in the soil. The addition of organic matter containing N will affect the total N content and help plant cells and maintain the process of photosynthesis which in turn can affect plant height growth.

In making Eco Enzymes, molasses is added. Molasses is used by microorganisms to ferment fruits to produce organic acids such as citric acid. pH Eco Enzymes are generally acidic due to their organic acid content. Acidic conditions are good for the production of phytohormones (auxin, gibberellin and cytokinins) which play a role in increasing vegetative growth, generative and fruit ripening.

### 3.2. Stem Diameter

The effect of giving Eco Enzymes dilution on the stem diameter of Turi (*Sesbania grandiflora*) is presented in "Table 2".

**Table 2.** Stem diameter (mm) Turi (*Sesbania grandiflora*) by application Eco Enzymes dilution

| Treatments | Repetations | | | | | Average |
|---|---|---|---|---|---|---|
| | U1 | U2 | U3 | U4 | U5 | |
| $P_0$ | 13.9 | 12.6 | 11.4 | 12.8 | 12.1 | $12.6^b$ |
| $P_1$ | 11.9 | 12.6 | 11.4 | 13.8 | 11.7 | $12.3^b$ |
| $P_2$ | 10.9 | 10.8 | 11.9 | 11.1 | 10.7 | $11.1^c$ |
| $P_3$ | 14.2 | 15.0 | 15.4 | 13.6 | 12.9 | $14.2^a$ |

Description : Different superscriptions in the same row or column indicate a very significant difference in the Duncan test ($p < 0.01$).

It can be seen in "Table 2" where the highest average plant stem diameter in treatment 1: 100 (P3) is 14.22, the lowest average plant stem diameter in treatment 1: 200 (P2) is 11.08. It is known that one of the factors that influence stem diameter growth is the element N which will increase cell enlargement thus affects the stem diameter, especially in younger plants. This is because the presence of N nutrients can encourage vegetative growth of plants, including the formation of chlorophyll in the leaves so that it will spur the rate of photosynthesis. The faster the rate of photosynthesis, the stem diameter of Turi plants will increase [6].

### 3.3. Number of Branches

The effect of giving Eco Enzymes dilution on the number of branches of Turi (*Sesbania grandiflora*) is presented in "Table 3".

**Table 3.**Number of branches Turi (*Sesbania grandiflora*) due to application Eco Enzymes dilution

| Treatments | Repetations | | | | | Average |
|---|---|---|---|---|---|---|
| | U1 | U2 | U3 | U4 | U5 | |
| $P_0$ | 8 | 9 | 12 | 12 | 8 | 9,8[a] |
| $P_1$ | 8 | 10 | 7 | 12 | 6 | 8,6[a] |
| $P_2$ | 5 | 5 | 9 | 8 | 11 | 7,6[a] |
| $P_3$ | 5 | 9 | 14 | 10 | 13 | 10,2[a] |

Description: Different superscriptions in the same row or column show no significant difference in the Duncan test ($p < 0.05$).

Giving different dilution of Eco Enzymes did not have a significant effect on the growth of the number of branches of the Turi plant. It can be seen in "Table 4" where the highest average number of plant branches in treatment 1: 100 (P3) is 10.2, the lowest average number of plant branches in treatment 1: 200 (P2) is 7.6. This is because the energy and nutrients obtained are only concentrated on one of the growths, namely stem elongation or branch formation. If the plant tends to experience stem growth, the plant will be tall but the growth of the branches will be less and vice versa. [7] That two things are important to know a plant tissue or organ response to hormones, namely hormone concentration and sensitivity to a hormone. Different tissues will be able to respond differently to different hormones.

### 3.4. Number of Leaves

The effect of giving Eco Enzymes dilution on number of leaves of Turi (*Sesbania grandiflora*)

**Table 4.**Number of leaves (sheets)Turi (*Sesbania grandiflora*) due to application of Eco Enzymes

| Treatments | Repetations | | | | | Average |
|---|---|---|---|---|---|---|
| | U1 | U2 | U3 | U4 | U5 | |
| $P_0$ | 1923 | 2084 | 2120 | 2038 | 1883 | 2009.6[b] |
| $P_1$ | 2594 | 2081 | 2344 | 2568 | 2119 | 2341.2[b] |
| $P_2$ | 1813 | 2745 | 2479 | 2410 | 2647 | 2418.8[b] |
| $P_3$ | 2099 | 2226 | 3028 | 2696 | 3000 | 2609.8[a] |

Description: Different superscriptions in the same row or column indicate a significant difference in the Duncan test ($p < 0.05$).

Giving different dilution of Eco Enzymes gave a significant effect on the number of leaves of Turi plants. It can be seen in "Table 4" where the highest average number of plant leaves in treatment 1: 100 (P3) were 2609.8, the lowest average number of plant leaves in the control treatment (P0) were 2009.6. This was because leaves are one of the most important plant organs which serve as a place for the photosynthesis process to occur. More leaves allow for more photosynthesis to occur and the energy produced is used to form and maintain leavesquality. Nutrients obtained are used in the growth of leaf width, the increasing rate of photosynthesis will produce carbohydrates, which are the basic ingredients for protein synthesis and other compounds to compose plant organs and plant life activities so that leaf synthesis becomes intense [8].

### 3.5. Width of Leaf

The effect of giving Eco Enzymes dilution on the width of leafTuri (*Sesbania grandiflora*)

**Table 5.**Width of Leaf (cm)Turi (*Sesbania grandiflora*) due to application Eco Enzymes dilution

| Treatments | Repetations | | | | | Average |
|---|---|---|---|---|---|---|
| | U1 | U2 | U3 | U4 | U5 | |
| $P_0$ | 0.3 | 0.4 | 0.3 | 0.5 | 0.3 | $0.4^b$ |
| $P_1$ | 0.4 | 0.4 | 0.3 | 0.5 | 0.5 | $0.4^b$ |
| $P_2$ | 0.5 | 0.6 | 0.4 | 0.4 | 0.3 | $0.4^b$ |
| $P_3$ | 0.6 | 0.7 | 0.7 | 0.5 | 0.5 | $0.6^a$ |

Description: Different superscriptions in the same row or column indicate a significant difference in the Duncan test ($p < 0.05$).

Giving different dilution of Eco Enzymes gave a significant effect on the growth of the width of leaf Turi plants. It can be seen in "Table 5" where the highest average width leaf in treatment 1: 100 (P3) is 0.6, the lowest average plant leaf width in the control treatment (P0) is 0.36. This is due to the different nutrient content in each treatment. The higher or lower the nutrient given, the more it affects plant growth and development and can result in poisoning (excessive) or lack of nutrients, and the nutrients given according to their needs will help better plant growth and development. The provision of sufficient N and P elements can help convert the carbohydrates produced in the photosynthesis process into protein so that it will help increase the width, length and number of leaves [9]. And there are other differences due to the varied growth patterns of plants, which is in accordance with the statement [10] whom states that the length of time in the growth pattern depends on the plant or plant organ. The increase in growth progressively decreases with time until it reaches a climax.

## 4. Conclusion

Based on the research that has been carried out, it is concluded that giving Eco Enzymes a dilution of 1: 100 on the growth of Turi (plants*Sesbania grandiflora*) gives the best results on plant height growth, stem diameter, number of leaves. and leaf width but not on the number of branches.

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