Productivity of Turi (Sesbania grandiflora) as a multi purposes plant by eco enzyme application

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Abstract. Turi (Sesbania grandiflora) is a multi-purpose plant, including leaves for animal feed, flowers for human food and wood for wood pellets. Eco enzyme is produced from the fermentation of fruits containing enzymes and organic acids. The application of Eco enzyme, among others as biocatalyst to improve plant productivity. This paper aims to study dilution of Eco Enzym which was applied to Turi plants to increase its productivity. This study used a completely randomized design, namely: T1: Eco enzyme dilution 1: 100; T2: 1: 200; T3: 1: 300 whereas there were 5 replications. Parameters were plant height, stem diameter, number of branches, leaf width and number of flowers. The results of this research were that the parameters of plant height, leaf of width, number of flowers had significant effect by the 1:100 dilution treatment (p<0.05). However, there was no significant effect on stem diameter and and the number of branches. The best response to eco enzyme was 1: 100.

1. Introduction
Forage is one of the requirements in raising livestock. Along with climate change, forages that have high adaptability are needed, including Turi plants. Turi plants can be harvested both in the rainy and dry seasons. Turi plants are included in the legume group which has good nutrition for animal feed because of its high protein content and good protein quality. The nutritional content of Turi is 36.3 g protein, 7.5 g fat, 47.1 g carbohydrates, 1684 mg Ca, 258 mg phosphorus (P), 21 mg Na, 2.005 mg K, 25.67 mg b-carotene, 1.00 mg thiamin, 1.04 riboflavin, 9.17 mg niacin and vitamins (A, B1 and C) [1].

Turi plants need to be grown on farms for their many benefits. In addition to leaves for animal feed, other benefits are flowers for human food, wood for wood pellets and seeds are useful as medicine. To optimize the benefits of Turi, it is necessary to find a way for the plant to grow well, among others, through the application of eco enzymes.

Eco Enzymes are organic substances consisting of organic acids, protein chains, and mineral salts. Eco-enzymes produced by fermenting fruits can also be combined with vegetables, tap water and molasses. The enzymes contained include protease, amylase and lipase and many other enzymes according to the fruit or vegetable used [2,3]. Fermentation lasts at least for 100 days meanwhile if it fermented more than 100 days does not affect the quality. According to [4,5] Eco enzyme can be applied to compose, decompose, transform and catalyze. The purpose of this paper was to study eco enzyme dilution and its application on Turi plant height, stem diameter, number of branches, number of leaves, leaf width and number of flowers.

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2. Materials and Methods

2.1. Materials

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

2.1.1. Making Eco enzyme. 2 kg molasses were mixed with 20 litres non chlorine water in a plastic container. Fruit waste consisting of raw pineapple, raw banana and raw papaya 6 kg chopped in diameter of 3 cm was placed in the container. The mix in the container was leave anaerobically for 100 days. After 100 days, the mix was filtered resulted in filtered extraction, called eco enzyme. Eco enzyme then diluted according to treatment and then used for watering plants.

2.2. Methods

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

\[ P_0 = \text{Control} \]
\[ P_1 = 1:300 \text{ (1.2 ml EE: 360 ml of water)} \]
\[ P_2 = 1:200 \text{ (1.8 ml EE: 360 ml of water)} \]
\[ P_3 = 1:100 \text{ (3.6 ml EE: 360 ml of water)} \]

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

Parameters were plant height, stem diameter, number of branches, leaf width and number of flowers.

3. Result and Discussion

3.1. Plant Height

The effect of giving eco enzyme dilution on the plant height of Turi (Sesbania grandiflora).

| Treatments | Repetations | Average |
|------------|-------------|---------|
| P_0        | 126         | 93      | 141     | 132     | 87      | 115.8  |
| P_1        | 103         | 115     | 107     | 95      | 96      | 103.2  |
| P_2        | 127         | 164     | 128     | 101     | 114     | 126.8  |
| P_3        | 139         | 146     | 205     | 107     | 115     | 142.4  |

Table 1. Plant height (cm) Turi (Sesbania grandiflora) by application eco enzyme dilution

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 enzyme 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 142.4 cm, the lowest average plant height in either treatment 1: 300 (P2) or control (without eco enzyme). This shows that 1:100 dilution caused the plant growth better than other treatments. The 1:100 dilution caused the enzyme concentration in the treatment to be higher than in the other treatments. Enzymes function as catalysts that make the use of macronutrients effective in the growing media, so that plants have high productivity. In addition, eco enzyme contains 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 enzyme nutrient content, including K (0.91 ppm), P (6.13 ppm), N (0.05%), C-Organic (0, 38%). Dilution 1: 100 causes the nutrient content to be higher than other dilution levels.
Lingga and Marsono [6] stated 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 [6].

In making eco enzyme, molasses is added. Molasses is used by microorganisms to ferment fruits to produce organic acids such as citric acid. pH eco enzyme 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 enzyme 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 Enzyme dilution

| Treatments | Repetations | Average |
|------------|-------------|---------|
|            | U1          | U2      | U3      | U4      | U5          |        |
| P0         | 16.7        | 15.2    | 17.5    | 17.1    | 14          | 16.1a   |
| P1         | 15.9        | 16.1    | 16.5    | 14.7    | 14          | 15.44a  |
| P2         | 16.5        | 16.7    | 15.9    | 16.3    | 16.2        | 18.94a  |
| P3         | 17.2        | 18.6    | 23.6    | 19.1    | 16.2        | 18.94a  |

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

Table 2 shows that there is no difference in stem diameter with the application of the treatment although there is a tendency for the 1:100 dilution treatment to have a larger stem diameter. 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. 1:100 dilution causes protein components derived from enzymes to support better Nitrogen intensity. This is because the presence of N nutrients can encourage vegetative growth of plants [7].

3.3. Number of Branches
The effect of giving eco enzyme 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 enzyme dilution

| Treatments | Repetations | Average |
|------------|-------------|---------|
|            | U1          | U2      | U3      | U4      | U5          |        |
| P0         | 9           | 10      | 15      | 13      | 9           | 11.2a   |
| P1         | 9           | 11      | 15      | 13      | 13          | 12.2a   |
| P2         | 10          | 15      | 9       | 9       | 11          | 10.8a   |
| P3         | 9           | 9       | 14      | 12      | 13          | 11.4a   |

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 enzyme did not have a significant effect on the growth of the number of branches. However, on dilution of 1:100 in this study, it was found that number of sub branches were more than other treatments. This was because the energy and nutrients obtained are only concentrated on one of the growths, namely stem elongation or branch formation [8]. 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.
3.4. Width of Leaf
The effect of giving eco enzyme dilution on the width of leaf Turi (*Sesbania grandiflora*) was presented on Table 4.

| Treatments | Repetations | Average |
|------------|-------------|---------|
| P₀         | 0.4         | 0.4     |
| P₁         | 0.6         | 0.4     |
| P₂         | 0.4         | 0.4     |
| P₃         | 0.6         | 0.4     |

Table 4. Width of Leaf (cm) Turi (*Sesbania grandiflora*) due to application Eco enzyme dilution

Giving different dilution of eco enzyme 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 0.66, the lowest average plant leaf width in the control treatment (P₀) is 0.44. 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 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]. There are other differences due to the varied growth patterns of plants, which is in accordance with the statement by Sarido and Junia [10] who stated 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.

3.5. Number of flowers
The effect of giving eco enzyme dilution on number of flowers of Turi (*Sesbania grandiflora*)

| Treatments | Repetations | Average |
|------------|-------------|---------|
| P₀         | 0.4         | 0.4     |
| P₁         | 0.6         | 0.4     |
| P₂         | 0.6         | 0.4     |
| P₃         | 0.6         | 0.4     |

Table 5. Number of flowers Turi (*Sesbania grandiflora*) due to application of eco enzyme

Giving different dilution of Eco Enzymes gave a significant effect on the number of flowers of Turi plants. It can be seen in Table 4 where the highest average number of flowers in treatment 1:100 (P₃) is 0.66, the lowest average plant leaf width in the control treatment (P₀) is 0.44. 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 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]. There are other differences due to the varied growth patterns of plants, which is in accordance with the statement by Sarido and Junia [10] who stated 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 enzyme 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 brane, leaf width and number of flowers.
References
[1] Slamet J S 2002 *Kesehatan Lingkungan* (Gadjah Mada University Press: Yogyakarta)
[2] Arun C and Sivashanmugam P 2015 *Process Saf. Environ. Prot.* 94 471
[3] Selvakumar P and Sivashanmugam P 2017 *Fuel Process. Technol.* 165 1
[4] Tang F E and Tong C W A 2011 *Int. J. Environ. Chem, Geol and Geop Eng.* 5 887
[5] Saravan P, Sathish K S, Ignes A and Ajithan C 2013 *Utilization of Food Waste* 2 14
[6] Lingga P dan Marsono 2004 *Petunjuk Penggunaan Pupuk* (Penebar Swadaya: Jakarta)
[7] Sarief E S 2015 *Kesuburan dan Pemupukan Tanah Pertanian* (Pustaka Buana: Bandung)
[8] Hidayati Y 2014 *Jurnal Pena Sains* 1 40
[9] Hamim 2004 *Journal of Biosciences* 11 29
[10] Sarido L and Junia 2017 *Jurnal Agrivor* 16 65
[11] Guntoro W, R Y A and P D U 2016 *Jurnal Ilmu-Ilmu Pertanian* 14 59