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Effect of Fermentation Duration and Dosage of Eco Enzyme Use on Nutrient Content of Kepok Banana Stem (*Musa Paradisiaca L.)*

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Abstract. Kepok banana stems are waste from banana plantation which can be used as an alternative to animal feed. The low crude protein and high fiber are the main problems in Kepok banana stems. Fermentation is one way that can be used to improve the quality of Kepok banana stems. Fermentation used in this study by using Eco enzymes. This research lasted for 3 months starting from July to September 2021 at Compost Center Jl. Biotechnology University of North Sumatra, Laboratory of Nutrition and Animal Feed Animal Husbandry Study Program, Faculty of Agriculture, University of North Sumatra. The research design used was a completely randomized design (CRD) with 3 x 3 factorial pattern with 3 replications, while factor I was various doses of Eco enzymes and factor II was fermentation time. The parameters studied were moisture content and dry matter, crude fat, crude protein, crude fiber, and ash using proximate analysis. Based on the results of the study, it was found that fermentation of Kepok banana stems using Eco enzyme at a dose of 5% of the weight of the substrate for 7 days was optimum and efficient in increasing crude protein and reducing crude fiber.

Keywords: crude fiber, crude protein, eco enzymes, fermentation, kepok banana stem

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1. Introduction

Banana plants are wet-trunked plants, have pseudo-stems composed of leaf sheaths. This plant has fibrous roots, the roots grow on stem tubers, and will grow to a depth of 75-150 cm [1]. Banana plants have several benefits in each part, namely fruit for consumption, and its antiseptic content is able to heal wounds [2]. Banana stem extract contains several types of phytochemicals, namely saponins with the most flavonoids and tannins which have antibacterial and antimicrobial effects. In a study conducted by [3] it was found that the Mauli banana stem extract could inhibit the growth of Staphylococcus mutans and Staphylococcus aureus.

Fermentation is the process of breaking down organic compounds into simpler compounds by involving the role of microorganisms, the technology to improve the quality of feed ingredients is by fermentation. With fermentation, the nutritional quality of feed ingredients increases. One of the fermenters that can be used in fermenting corn stalks is Eco Enzyme [4].

Eco-enzymes are an example of the utilization of organic waste into products with higher use values. Rosukon from Thailand in 2006. Eco-enzymes are fermented organic wastes from kitchen

waste (fruit and vegetable waste), sugar (brown sugar, or cane sugar), and non chlorin water using certain microorganisms such as yeast and bacteria [5].

The composition of organic materials in Eco-enzymes are organic acids, enzymes, and mineral salts that can be used to compose, decompose, convert and catalyze. In the livestock sector, Eco enzymes can function as natural disinfectants to inhibit the growth of harmful microorganisms, eliminate unpleasant odors [6].

Based on this, the authors are interested in conducting research on the use of various doses of Eco enzymes on fermented banana (*Musa Paradisiaca L*.) stems.

2. Materials and Method

2.1. Materials

The materials used are banana weevil, pineapple, ketapang, oranges, molasses, water as an ingredient for making Eco enzymes and banana stems as an object of fermentation.

2.2. Methods

The research design used was 3x3 factorial RAL, with 3 replications.

Factor 1. Dosage of using Eco enzyme solution (A)

A1 = 1%
A2 = 3%
A3 = 5%

Factor 2. Fermentation Time (B)

B1 = 3 day
B2 = 5 days
B3 = 7 days

3. Results and Discussion

3.1. Water content

The results of the analysis of the moisture content of fermented kepok banana stems with Eco enzyme doses of 1, 3, and 5% and the fermentation time of 3, 5, and 7 days can be seen in “Table 1” below:

Table 1. Moisture content of Kepok banana stems fermented by Eco enzymes (%)

Eco Enzyme Dosage	Fermentation Time			Average
	B_1	B_2	B_3	
A_1	6,85	6,58	7,77	$7,07^{b}$
A_2	6,76	6,78	7,61	$7,05^{b}$
A_3	6,71	6,78	7,27	$6,92^{a}$
Average	$6,77^{A}$	$6,71^{A}$	$7,55^{B}$	

Note: Superscripts with different notations in the same column and row showed a very significant difference (P<0.01).

Based on the results of the analysis of variance, it was found that there was a significant effect (P<0.05) on different dose treatments. [7] states that the break down of carbohydrates by microorganisms will be in line with the loss of energy in the form of heat, CO2, water so that the water content can increase. The higher the dose given, the greater the introduction of starter microbes during fermentation so that microbial development increased.The duration of fermentation had a very significant effect (P<0.01) on changes in the moisture content of the banana stem fermented by Eco enzymes. [8] stated that the results of the fermentati on process were lactic acid, acetic acid, butyric acid, ethanol, fermentation gases (CO2, CH4, CO, NO, and NO2), water and heat. Based on the results of the analysis of variance, it was found that there was no interaction between dose treatment and fermentation time which was very significant (P<0.01) on the water content. Each treatment that was given a different dose experienced an increase in water content which indicated that the microorganisms were working to break down glucose.

3.2. Dry Ingredients

The results of dry matter analysis of fermented Kepok banana stems with Eco enzyme doses of 1, 3, and 5% and fermentation time of 3, 5, and 7 days can be seen in “Table 2” below:

Table 2. Dry matter of Kepok banana fermented by Eco enzyms (%)

Eco Enzyme Dosage	Fermentation Time			Average
	B1	B2	B3	
A1	93,14	93,41	92,22	$92,92^{a}$
A2	93,23	93,21	92,38	$92,94^{a}$
A3	93,28	93,22	92,72	$93,07^{b}$
Average	$93,22^{B}$	$93,28^{B}$	$92,44^{A}$	

Note: Superscripts with different notations on the same column and row show very noticeable differences (P<0.01).

Based on the results of various analyses it is known that there is a real influence (P<0.05) on different dosage treatments.Thisis in accordance with the statement of [9] stated that the decrease or increase in dry material levels is caused by the utilization of a number of nutrients by lactic acid bacteria in silag to produce acid. [10] states that the greater the carbohydrate content, the dry material content decreases because of the ability of lactic acid bacteria in utilizing dissolved carbohydrates so that the water content released is higher and causes dry material levels to

decrease.The length of fermentation has a very noticeable effect (P<0.01) on the change in the dry ingredients of banana stems, the fermented eco enzymes. [11] which states that increased water content during ensilase causes the content of dry silage material to decrease, causing an increase in dry material loss. The higher the water produced during ensilase, the more dry the dry material is lost. Based on the results of the variety analysis it is known that there is no interaction between the treatment of doses and the length of fermentation that is very real (P<0.01) to the content of dry ingredients.

3.3. Crude Protein

The results of the analysis of crude protein of fermented banana stems with doses of eco enzymes that are 1, 3, and 5% and the length of fermentation of 3, 5, and 7 days can be seen in table 5 below:

Table 3. Crude protein stems of Kepok bananas fermented by Eco enzymes (%)

Eco Enzyme Dosage	Fermentation Time			Average
	B1	B2	B3	
A1	4,29	5,56	6,42	5,42
A2	4,40	5,6	6,56	5,52
A3	4,44	5,69	6,47	5,53
Average	$4,38^{A}$	$5,61^{B}$	$6,48^{C}$	

Note: Superscripts with different notations in the same column and row showed a very significant difference (P<0.01).

Based on the results of the variety analysis it is known that there is no real influence (P>0.05) on different dosage treatments.The increase in protein levels in each treatment resulted from the formation of a single protein cell and amino acids derived from the substrate into a microbial N attached to the [12] which states that the high increase in protein on the substrate due to the high microbial population and the impact on the high crude protein content because microbes are mostly composed of proteins. [13] stated that the protein degradation that occurs is influenced by the activity of bacteria that develop in each treatment because microbes will degrade organic matter fo rits growth. Long fermentation has a very notice able effect (P<0.01) on the rough protein changes of banana stems, thefermented eco enzyme.This is in accordance with the opinion of [14] that in the fermentation process there will be an increase in the amount of cell mass which will later increase the protein levels in th esubstrate. Based on the results of the variety analysis it is known that there is no interaction between dosage and length of fermentation (P>0.05) against crude proteins.

3.4. Crude Fiber

The results of the analysis of crude fiber of fermented banana stems with dosesof Eco enzymes that are 1, 3, and 5% and the length of fermentation of 3, 5, and 7 days can be seen in table 6 below:

Table 4. Crude fiber of banana stems fermented by Eco enzymes (%)

Eco Enzyme Dosage	Fermentation Time			Average
	B1	B2	B3	
A1	17,82	16,46	15,46	16,58
A2	17,61	16,63	15,59	16,61
A3	17,60	16,65	15,68	16,64
Average	$17,68^{C}$	$16,58^{B}$	$15,57^{A}$	

Note: Superscripts with different notations in the same column and row showed a very significant difference (P<0.01).

Based on the results of the variety analysis it isknown that there is no real influence (P>0.05) on different dosage treatments.This is supported by [15] that the decrease in crude fiber occurs in line with the length of fermentation time and the high dose of inokulum, in line with the growth of mycelium, which is at the sametime cellulose and hemiscellulose degrade.Long fermentation has a very noticeable effect (P<0.01) on the changes in crude fiber of banana stems to fermented eco enzymes.This decrease in crude fiber levels is supportedby [16] that in his research it was stated that there was a decrease in crude fiber levels in feed with a composition of 75% of fermented yambarkusing MEP+ inokulan for Gesit tilapia fish culture (*Oreo chromisniloticus L.*). Based on the result so further tests it is known that there is an interaction between the dose and thelength of real fermentation (P<0.05) against crude fiber.

3.5. Crude Fat

The results of the analysis of crude fat of fermented banana stems with doses of Eco enzymes that are 1, 3, and 5% and the length of fermentation 3, 5, and 7 days can be seen in “Table 7” below:

Table 5. Crude fat of banana stems cover fermented by eco enzymes (%)

Eco Enzyme Dosage	Fermentation Time			Average
	B1	B2	B3	
A1	6,33	5,1	5,45	$5,62^{A}$
A2	6,43	5,17	5,66	$5,75^{B}$
A3	6,55	5,26	5,70	$5,84^{B}$
Average	$6,44^{C}$	$5,17^{A}$	$5,60^{B}$	

Note: Superscripts with different notations in the same column and row showed a very significant difference (P<0.01).

Based on the results of various analyses it is known that there is a very real influence (P<0.01) on different dosage treatments. [17] states that eco enzymes made from pine apple and orange waste producea ctive lipase enzymes. The active lipase enzyme can hydrolyze fat into a simpler form of glycerol and fatty acids.Long fermentation has a very noticeable effect (P<0.01) on the changes in crude fiber of banana stems to fermented eco enzymes. Based on there sults of further tests it is known that there is no interaction between dose and length of fermentation (P>0.05) against crude , brown sugar fat.

3.6. Ash Percentage

The results of the analysis of the ash percentages of fermented banana stems with the dose of eco enzymes that are 1, 3, and 5% and the length of fermentation of 3, 5, and 7 days can be seen in "Table 6" below:

Table 6. Ash of banana stems fermented by eco enzymes (%)

Eco Enzyme Dosage	Fermentation Time			Average
	B1	B2	B3	
A1	16,34	15,2	15,44	$15,66^{A}$
A2	16,33	15,65	15,6	$15,86^{B}$
A3	16,55	15,3	15,85	$15,9^{B}$
Average	$16,40^{C}$	$15,38^{A}$	$15,63^{B}$	

Note: Superscripts with different notations in the same column and row showed a very significant difference ($P<0.01$).

Based on the results of various analyses it is known that there is a very real influence ($P<0.01$) on different dosage treatments. The length of fermentation has a very noticeable effect ($P<0.01$) on changes in the ash levels of banana stems. A study by [18] showed that an increased ash levels in fermented rice straw using a consortium (mixture) of Phanerochaete chrysosporium and Aspergillus niger. The results of further tests it is known that the interaction between dose and length of fermentation is very real ($P<0.01$) against ash levels.

4. Conclusion

Based on the results of the study it is known that the dose of Eco enzymes use of 5% of the weight of banana stems during 7 days of fermentation can increase crude protein and decrease the content of crude fiber.

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