Earthworms (*Lumbricus rubellus*) Performance on Bagassem

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Abstract. The study aimed to determine the effect of bagasse media on cocoon production and the increase in earthworms biomass.There are 5 compositions of maintenance media that were tested as treatment, namely: A. 100% palm sugar + 0% bagasse, B. 75% palm sugar + 25% bagasse, C. 50% palm sugar + 50% bagasse, D. 25 % onggok palm + 75% bagasse, and E. 0% onggok palm + 100% bagasse. The results showed that there was no effect of differences in media treatment on the increase in earthworm biomass. The bagasse media is good for worm growth but is not good for reproduction shown by the increase in the number of worms and cocoon production.

Keywords **:** *Lumbricus rubellus, performance, bagasse and cocoon*

1. Introduction

Earthworms are one of the soil organisms that have many beneficial effects on agriculture and socciety. It is well known that earthworms play an important role in the soil macrofauna biomass. They are extremely important in soil formation, principally by remedifying the contaminated soil, degrading the organic solid wastes and also produce nutritive (protein rich feed materials) for fish, cattle, poultry and organic fertilizers for the farmers to grow safe and chemical-free organic foods for society (Rajiv K. Sinha, *et al*., 2010).

One species of earthworm that has been cultivated is *Lumbricus rubellus*, this worm has been widely developed for livestock needs in various parts of the world. *Lumbricus rubellus* earthworms have a body size that is larger than other worms and multiply very rapidly to produce a huge biomass of worms in a short time. Studies indicate on the optimal condition of moisture, temperature and feeding materials that they double their number at least every 45-60 days.

Baggase is the result of the process of extracting sugar cane stems during the process of making sugar from sugar cane. Baggase has great potential as a basic ingredient of organic fertilizer in the form of compost. Nowadays bagasse can be processed again into paper, electricity generation, compost fertilizer and animal feed. Chemical composition analysis of bagasse showed that up to 96 % and 85 % of hemicellulose and lignin (Camila Alves Rezende, et al. 2011)

The process of making bagasse-based compost can be done with an earthworm assisted. The composting process with the help of earthworms is known as vermicomposting. By utilizing bagasse as a medium for maintenance of earthworms, this study aims to determine the performance of mass growth and reproduction of *lumbricus rubellus*.

2. Materials and Methods

This research was carried out using a complete randomized experimental design. There are 5 kinds of treatment groups, namely A. 100% palm sugar + 0% bagasse, B. 75% palm sugar + 25% bagasse, C. 50% palm sugar + 50% bagasse, D. 25% palm sugar + 75%% of bagasse, and E. 0 % palm sugar + 100% bagasse. The maintenance tanks used are made of plastic with a size of 35 x 30 x 15 cm. The study was carried out by inserting 15 grams of *lumbricus rubellus* as initial weight, in each maintenance tank. Each treatment media was carried out 5 replication.

Research procedures include (1). Preparation of treatment media used. Bagasse used has been weathered for 5 months. The media is ready to be used if the initial test shows that the worm placed on the surface moves into the media. (2). Inserting into each mass media the weight of lumbricus rubellus as much as 15 grams, and (3). Maintenance is carried out for 2 months by maintaining temperature and humidity. Feeding in the form of tofu is done every 2 days as much as 3 percent of the weight of worms.

Data measurement is done based on the data types as follows (1) the mass weight of lumbricus rubellus is measured at the end of the first and second months of maintenance. Measurements use analyte scales. (2). The number of cocoons, the number of worms, the hatchability of cocoons every treatment medium is measured at the end of the first and second months of maintenance, (3) Media temperature, pH and humidity of the media were carried out every 14 days at 11.00 WIB. Data analysis using one-way ANOVA with SPSS version 16. If there is a significant effect, it is continued by Duncan Multiple Range Test (DMRT) mean difference test.

3. Results and Discussion

3.1. Effect of media on the weight gain of earthworm mass

Measurement of weight gain of earthworm mass at week 4 and 8 as shown in figure 1 and 2 below :

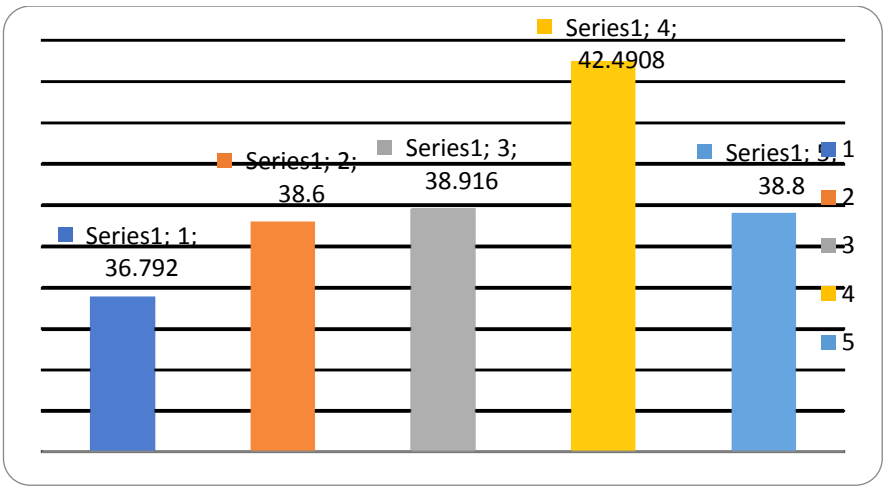

Figure 1. Weight Increase Earthworm Mass (grams) in the fourth week.

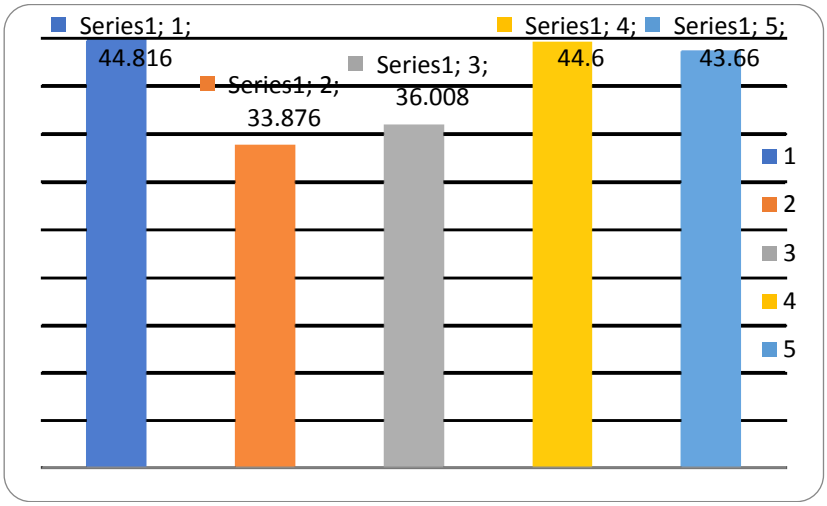

Figure 2. Weight Increase Earthworm Mass (grams) in the eighth week.

The results of measurements of weight gain of earthworm mass showed that 100% bagasse at the beginning of the study showed the lowest mass weighting (figure 1) but thus at the 8th week, it showed a high increase in earthworm mass.

The data were then analyzed by variance analysis to determine whether there were differences in variance in the five treatment media (Tables 1 and 2). The results of one-way variance analysis showed that there was no difference in the effect of the media on mass worm massing.

Table 1. Variety Analysis of the Effects of Media Differences on Weight gain of earthworm mass on the fourth week.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	85.981	4	21.495	1.067	.399
Within Groups	403.094	20	20.155		
Total	489.075	24			

Table 2. Variety Analysis of the Effects of Media Differences on Weight gain of earthworm mass on the eighth week.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	547.183	4	136.796	.779	.552
Within Groups	3513.402	20	175.670		
Total	4060.585	24			

3.2. Effect of media on the number of earthworms

Observation on the number of worms at the end of the study is as shown in Figure 3. The results of the calculation of the number of earthworms (tails) showed that the 4th treatment was 100% onggok palm media which had the highest number of 55 tails, while the smallest number in the 5th treatment medium was 100% bagasse.The data were then analyzed by variance analysis to determine whether there were differences in variance in the five treatment media. The results of the analysis are shown in Table 3. The results of the analysis of variance showed a very significant effect of media differences (treatment) on the number of earthworms during maintenance.

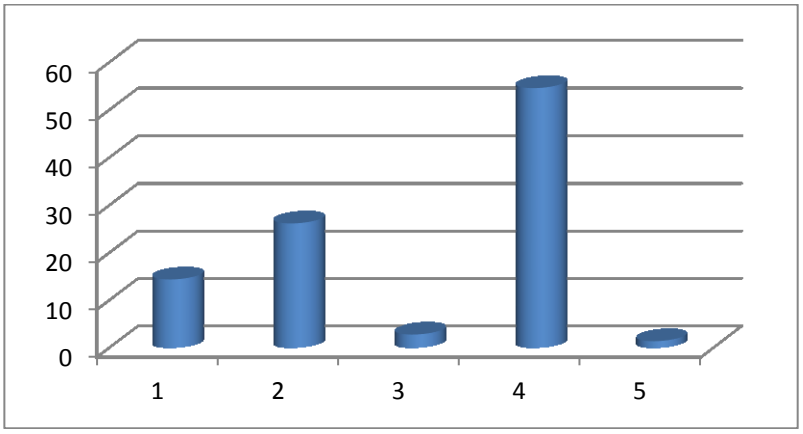

Figure 3. Number of Earthworms at the End of Research on the eighth week.

Table 3. Variety Analysis of the Effect of Media Differences on the Number of Earthworms.

	Sum of Squares	df	Mean Square	F	Sig.
Treatments	9543.440	4	2385.860	24.036**	.000
Dev.Std.	1985.200	20	99.260		
Total	11528.640	24			

3.3. Effect of media on the number of earthworm cocoons

Observations on the number of earthworm cocoons at the end of the study are as shown in Figure 4.

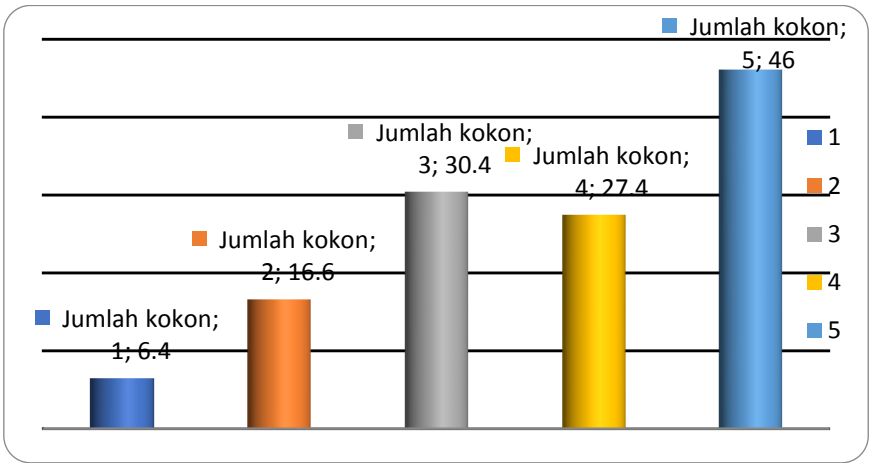

Figure 4. Number of Earthworm Cocoons In the eighth week.

The results of the calculation of the number of earthworm cocoons (grains) showed that the 4th treatment, 100% palm sugar onggok media had the highest number of cocoons, that is 46 cocoons. The data were then analyzed by variance analysis to determine whether there were differences in variance in the five treatment media. The results of the analysis are shown in Table 4.

The results of the analysis of variance showed a very significant effect of media differences (treatment) on the number of earthworm cocoons during the maintenance period.

Table 4. Variety Analysis of the Effect of Media Differences on the Number of Earthworm Cocoons

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4458.960	4	1114.740	5.603	.003
Within Groups	3978.800	20	198.940		
Total	8437.760	24			

Observations on the hatchability of earthworm cocoons at the end of the study are as shown in Figure 5.

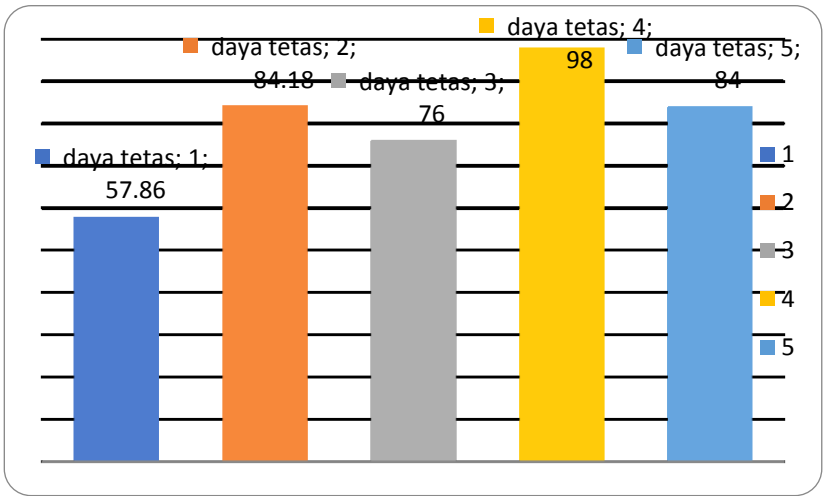

Figure 5. Hatchability of Earthworm Cocoon In the eighth week.

The results of the observation showed that the average hatchability was the highest with the highest in the 4th treatment group (98%). Lowest in the first treatment group. The results of variance analysis showed that there was no significant difference in the average hatching power in the comparison between treatment groups.

3.4. pH of the media

Observation of the pH of the media during the research maintenance period is as shown in Figure 6.

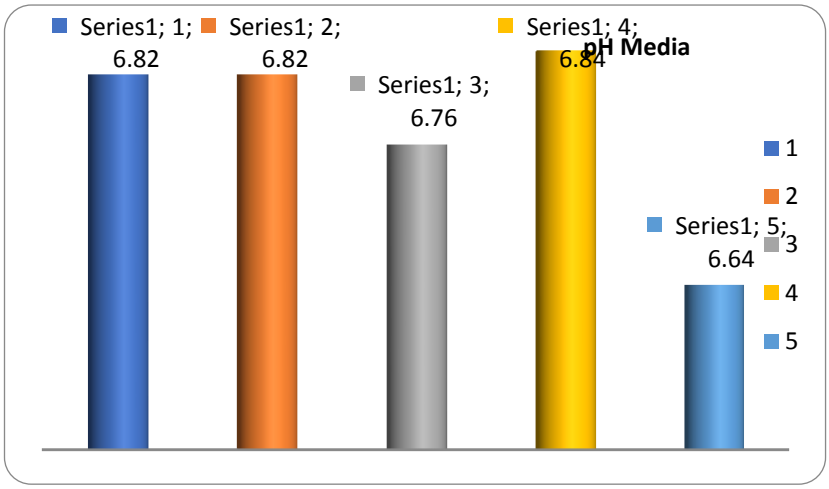

Figure 6. pH of Media During Research

The results of media pH measurements showed a tendency for bagasse to have a lower pH compared to palm sugar (increasingly acidic). In the 4th treatment, the palm sugar onggok media had the highest pH of 6.84, while in the 5th treatment medium the bagasse had the lowest pH of 6.64. The data were then analyzed by variance analysis to determine whether there were differences in variance in the five treatment media. The results of the analysis are shown in Table 5.

Table 5. Analysis of Variety for Media pH During Research

	Sum of Squares	df	Mean Square	F	Sig.
Treatments	.134	4	.033	4.395*	.010
Dev.Std	.152	20	.008		
Total	.286	24			

The results of the analysis of variance showed a significant difference in pH between the maintenance medium of the earthworm used. The life of earthworms is strongly influenced by the mediating conditions of his life. These conditions include available nutrients, pH, water content and temperature. Media can have a direct effect on the growth and reproduction of earthworms. Media consisting of palm sugar and manila muddy compost with various combinations in fact cause differences.

It is known that earthworms can live only on neutral soil pH conditions, which is between 6-7. The pH of the media which is based on grass tends to be more acidic compared to onggok palm. It could be that this difference contributes to differences in the appearance of cocoon growth and production.

Similarly, the ability of the media in binding water. Media with a lot of bagasse tends not to be able to properly bind water compared to the onggok palm media. Media humidity is very influential on worm life, because worms require relatively wet media conditions (containing enough water).

In this study cocoon growth and production are strongly affected by media differences. Palm sugar onggok media is best seen from the increase in the number of worms and cocoon production, but when viewed from the size of the worm, bagasse is good for worm maintenance media.

4. Conclusion

There is no real effect of the combination of palm sugar and bagasse media on the growth of earthworms (*Lumbricus rubellus),* but affects the number of worms and cocoon production.

5. Suggestions

The use of bagasse for maintanance of *Lumbricus rubellus* is very good for mass growth but not for reproduction.

References

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