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Effect of Adding Various Qualities of Litter and Urea on the Growth of Earthworms (Pontoscolex corethrurus) and Soil Microorganism Populations

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ABSTRACT

This study aims to determine the effect of adding a mixture of coffee litter + Gliricid + durian and Urea and its combination on the growth of Pontoscolex streak worms and the population of soil microorganisms, especially bacteria and fungi, and whether worm growth can increase the population of bacteria and fungi. The results of this study indicated that the addition of litter (coffee+Gliricidia+durian) ja increased worm biomass by 29% compared to the addition of Urea (0.28g/head) and increased the diameter of the worms by 12% compared to the addition of Urea(0.25mm/head) . The combination of litter and Urea increased the bacterial population by 16% compared to the addition of Urea alone (32.105cfu/ml), while compared to the addition of only litter (34.105cfu/ml) the bacterial population increased by around 9%.

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1. INTRODUCTION

Earthworms are one of the soil animals that can affect the processes of decomposition of organic matter, distribution of organic matter, nutrient cycles and movement of water in the soil (Lavellee et al., 1998).

Organic matter is a source of carbon and nitrogen for soil microorganisms. Due to the activity of drenic services, BOT is always in a dynamic state (Soemarno, 1993). Decomposition is a process of breaking down complex compounds in organic matter into simpler forms as a result of the activities of interacting biota with environmental factors and material quality (Hairiah et al, 2000)

Pontoscolex corethrurus worms are earth-digging worms known as ecosyste engineers whose role is in mixing organic matter with the soil, improving nutrient cycles and aeration. Pontos colex corethrurus develops and acts with soil microorganisms to release enzymes that are useful in the decomposition of low-quality BO (Fragosoetal, 1997 in Handayanto and Hairiah ; 2007). However, from the results of Letik's research (2008) it is known that the growth of Pontoscolex is not limited by the quality of the BO input but is more limited by the size of the BOT. The finer the BO size is added, the Pontoscolex growth will increase.

This means that in natural conditions, the more litter that enters the soil and is decomposed immediately by microorganisms, the more beneficial it will be for earthworms to form a number of lactic acid, acetic acid, acetaldehyde, diacetyl and formic acid. Handay antodan Hairiah (2007) suggests that bacteria have a role, namely converting energy in BOT into a form that is useful for

other soil organisms in the soil food web and mushrooms also play a role in converting BO which is hard to be crushed into a form that can be used by other organics.

The important BO quality components are the C/N ratio, lignin content, polyphenols, and their capacity to bind proteins (Handayanto, 1999). Thus the different types of BO, the rate of decomposition is also different. Organic matter is categorized as high quality if the C/N ratio is <25, the anlignin content is <15% and the polyphenol is <3%, so it is quickly weathered (Palmand Sanchez, 1991 in Hairiah 2004a). If BO is quickly weathered by microorganisms, then the availability of feed for worms soil also increases and the growth of earthworms will also increase. The addition of low quality BO into agricultural soils will inhibit N-mineralization, but in the long term it will double the availability of N-organic.

Adding a little inorganic N to the soil can reduce the problem of N deficiency in the soil, and accelerate the decomposition of low quality BO. In addition, several studies report that Gliricidia leaves contain toxic compounds that can inhibit the life of worms. In Glirici he has a tannin content of 40. 7 g per kg of dry litter, this content is used to control nematode populations and plant pests (Dragon vallemaetal, 2004) in Fauziah, 2007). and Urea on the growth of earthworms (Pontoscol excore thrush) and populations of soil microorganisms (bacteria and fungi).

2. METHOD

2.1 Types of research

The research method used in this research is a survey method (descriptive) with three repetitions. Samples were obtained as many as 8 (eight) different brands of fermented milk drinks from various places in Malang City randomly. Results Data analysis was carried out by comparing the data obtained from the test results, both microbiological and chemical analysis as well as the relationship between one another and then conclusions were drawn.

2.2 Research Variables

The variables in the study consisted of the number of worms studied and the effect of worm stimulation on microorganisms.

2.3 Research design

The treatment of this experiment has 5 levels arranged according to Completely Randomized Design with 4 replications.

Table 1. Treatment plan

No	Treatment	Code
1	1 No worms + no kgd + no urea	KO
2	2 Worms + No KGD + No Urea	KCC
3	3 Worms + No KGD + Urea	UREA
4	4 Worms + KGD + No Urea	KGD
BNT	mr	42,48

2.4 Sampling location

Samples were obtained from sampling earthworms taken from pots that had been prepared beforehand.

2.5 Time and Place of Research.

The research was conducted from February to May 2009, at the Laboratory of Soil Biology, Department of Soils, Faculty of Agriculture, Brawijaya University. Analysis of physical, chemical and biological properties was carried out at the Physics, Chemistry and Biology Laboratory, Department of Soil, Faculty of Agriculture, University of Brawijaya, Malang.

2.6 Tools and materials

The tools used in this study included hoes, shovels, bamboo besek (equipment for sampling soil and earthworms), laboratory analysis equipment (oven, distillation, Erlen Meyer tube, burette, pH meter, petridish, autoclave, laminar flow), vermiculture experiments. (pots, paralone, plywood, red and white cork, cloth and rubber), grinding machines, trays, sieves, scales, rulers, tweezers, thread, calipers and tape measure.

Materials The materials used in this study included Andisol type soil taken from a depth of 0-20 cm in the upper bamboo forest land, Sumber Agung Village, Ngantang District (research by Wahyudi, 2008). Endogeic earthworms, namely Pontos colexcoret hrurus immature (which does not yet have a clitellum). The organic materials used are litter from coffee plants, Glirici dia and durian taken, derived from tree clippings from coffee agro-forestry land and Urea fertilizer (contains about 46 %N). (adjusted to the recommended dosage of organic fertilizers for groforestry plants,

namely coffee, Gliricidia and durian). PDA and NA media for growing micro-bodies of other chemicals needed in chemical analysis of organic matter quality and soil conditions. Water to maintain soil moisture in pots.

2.7 Research procedure

The research began by preparing materials for research, namely the Pontos colexcore thrurus earthworm taken in Sumber Agung Village. The main characteristics of the Pontos colex corethrurus are that the body is not pigmented and if the worm is placed on the palm of the hand it looks calm and doesn't move. bigger so that it is more clearly visible, there is a thorn-like thorn like a pineapple skin called quinchunk

2.8 Data analysis.

Prior to the experiment, several basic soil analyzes were carried out including: total N (Kjehdal method), total C-organic (Walkey and Black method), C/N ratio, pH (electrode method), water content (gravimetric method), and texture (hydrometer method), then after experiments total lN (Kjeldahl method), total C-organic (Walkey and Black method), C/N ratio, and pH (electrode method). Black), total N (Kjeldahl method), lignin content (Goering and van Soest method) and polyphenol content (Anderson and Ingram method).

3. RESULTS AND DISCUSSION

3.1 Research result

3.1.1 The Effect of Various Qualities of Litter and Urea on the Growth of Earthworms (Pontoscolex corethrurus).

The growth of Pontosco olexcore thrurus worms was measured by density (K), growth in body size of worms bio mass (B), length (P), diameter (D) and vermicompost production during the 84 day experiment (12 weeks). Based on the results of analysis of variance, it is known that the application of a mixture of litter (coffee + Gliricidia + durian) and Urea between various observation times had a significant effect ($p < 0.05$) on biomass, length, B/K ratio, worm diameter and vermicompost production produced. That is, the addition of litter and urea gave different effects on the growth of earthworms at different times. The results of the analysis of variance showed that the administration of litter and urea between different observation times had no significant effect ($p > 0.05$) on the density of earthworm numbers during the 12 week experiment.

The addition of a mixture of litter and Urea and the combination of the two gave different responses to the bio mass of the worms at different times. The results of the analysis of variance showed that the administration of litter and Urea between observations had a significant effect ($P < 0.05$) on the body mass of earthworms.

The results of the Saragam analysis showed that the treatment (litter and Urea) and the difference in observation time had a significant effect ($p<0.05$) on the B/K ratio of earthworms, and the administration of litter and Urea between various observation times had no significant effect (P>0, 05) to the B/K ratio of earthworms.

The average B/K ratio of earthworms before the experiment was 0.04g/cm2. The average B/K ratio of worms for 12 MSP was 0.07g/cm2 of worms. The results of the analysis of variance (ANOVA) showed that the administration of litter and Urea between various observation times had a significant effect ($P<0.05$) on the earthworm's body length during the experiment (Appendix 5). Worm length for all treatments at the start of the experiment was around 3,244,20 cm/head. The length of earthworms continues to increase with time, the average length increase of 1 worm per 1 week is 0.40 cm/head.

Whereas after 12 weeks of treatment it varied between 4.8-5.3 cm/head. Worm diameter for all treatments at the start of the experiment was an average of 0.170.22 mm/head. The results of the analysis of variance showed that the administration of litter and Urea between various observation times had a significant effect ($P<0.05$) on the body diameter of earthworms during the experiment (Growth The body diameter of earthworms continued to increase over time (Figure 8), the average length gain of 1 worm per 1 week was 0.03 mm/head. Meanwhile, after 12 weeks of treatment it varied between 0.28-0.40 mm/head.

3.1.2 Relationship of Soil Organic Matter with Growth of Pontoscolex corethrurus Worm and Population of Soil Microorganisms.

Soil organic matter affects the growth of earthworms and the total population of soil bacteria and fungi. The BOT content can be expressed by the C-Organic content of the soil because carbon

is a constituent of organic matter. These earthworm field microorganisms interact with their need for organic matter, because organic matter provides energy for growth and organic matter provides carbon as an energy source.

Earthworms have a very close relationship with soil microorganisms in the BO decomposition process. Earthworms function to redistribute organic substances in the soil by consuming, breaking them down, and removing them again. Most of the material ingested by earthworms cannot be broken down, and most of it is excreted without being digested.

The part of the food that the worms cannot digest will be excreted through the intestines to the anus as worm excrement which contains lots of nitrogen. Some microorganisms from the worm's digestive tract come out with worm manure to increase the decomposition process in the soil. Furthermore, the microbes will change the dirt of earthworms into humus which is rich in nutrients that can be absorbed by plant roots. Soil bacteria and soil microorganisms play a role in digesting worm food, and benefit from worm manure (Kartini, 2003).

3.2 Discussion

The growth of earthworms can be measured based on the density, biomass, length, diameter, and weight of the worms. The results of the analysis of variance showed that the administration of litter and Urea between observations had a different effect on the growth of earthworms. The results of measuring the growth of each observation variable showed varied results. Pontoscolexcore thrurus gave the best response to administration of medium quality litter, namely coffee litter + Gliricidia + durian. Does not get nutrients or food supplies as contained in N-organic fertilizers. The use of Urea, which undergoes rapid hydrolysis, causes Urea to quickly disappear from the soil by washing (Madiganetal, 2000). The hydrolysis reaction of Urea with the help of the soil enzyme urease (Hardjowigeno, 2003) is as follows:

$$CO(NH2)2 + 2H2O\ (NH4)2\ CO3$$

Therefore earthworms are generally more responsive to organic fertilizers (organic matter) than inorganic fertilizers (Whalen, Parmele, and Edwards, 1998) so that the growth of earthworms by giving BO is much better than by giving Urea. This is also suspected because the use of urea can cause acidification of the soil so that the population and growth of earthworms will drop drastically. But indirectly, the provision of Urea will increase the activity of soil microorganisms in breaking down BO for energy for microorganisms so that the results of this reform produce N-organic which can increase nitrogen levels in the soil.

The growth of microorganisms was best in the KGDU treatment, this was because in the combined treatment, the litter mixture was used as a source of food ingredients for heterotrophic bacteria, while the addition of urea was used as a food source for autotrophic bacteria through the process of photosynthesis. This was in line with Desniar's research. (2004), that increasing the concentration of molasses to 15% at concentrations of Urea 0.25 and 0.50 g/l can increase the dry biomass weight of bacteria. This increase is due to the large enough substrate converted by bacteria into biomass.

4. CONCLUSION

The addition of litter (coffee+Gliricidia+durian) alone increased the biomass of worms by 29% compared to the addition of Urea (0.28g/head) and increased the diameter of the worms by 12% compared to the addition of Urea (0.25 mm/head) and the combination of litter and Urea increased the bacterial population by 16% compared to the addition of Urea alone (32.105cfu/ml), whereas compared to the addition of only litter (34.105cfu/ml) the bacterial population increased by around 9%.

The addition of litter and Urea also increased the mushroom population by about 50% compared to the addition of Urea alone (6.105c fu/ml) and compared with the addition of just litter (8.105 cfu/ml) it increased the mushroom population by about 13%. 3. Soil bacterial populations were positively correlated with earthworm population densities (r=0.37**) and vermicompost production (r=0.54**), and fungal populations were positively correlated with earthworm population densities (r = 0.39**).

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It is necessary to carry out further research regarding the identification of the types of bacteria and fungi present in vermicompost which play a role in decomposing organic matter as a food source for earthworms.

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