ROLE OF BACTERIAL SYMBIONT'S OF THE LARVAE *ORYCTES RHINOCEROS L.* WITH ADDITIONAL BIOACTIVATORS AS A DECOMPOSER FOR OIL PALM EMPTY FRUIT BUNCHES IN THE FIELD

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ABSTRACT

This study aims to determine the role of the larvae of Oryctes rhinoceros symbiont bacteria and a more effective bioactivator as a decomposer of oil palm empty bunches (OPEFB) in plantation areas. One solution to overcome the problem of OPEFB waste is to use oil palm empty fruit bunches into compost which has high ecological and economic value. This is supported by the increasing demand for compost as a form of organic intake for plants today. The method use was Design Factorial randomize group (RBD) using two factors, Factor I : the use of bacterial symbionts and the addition of bio-activator (B0: Control, B1: B. stratosphericus + T. harzianum B2: B. stratosphericus +T. harzianum sp + yeast , B3: B. cereus + T. harzianum ,B4: B. cereus + T. harzianum + yeast , B5: B. siamensi + T. harzianum ,B6: B. siamensi + T. harzianum + yeast). Factor II : thicness of the layer of empety oil palm bunches (T1: 2 layers and T2: 3 layers). The parameters observed were temperature, C / N , color. The results showed that the composting time had a significant effect on temperature, the best C / N ratio was in treatment of B3T2 (B. cereus + T.harzianum treatment at a thickness of 3 layers OPEFB) was 11.41% with the color of the compost turning black.

Keywords: bacterial symbionts, Larvae O.rhinoceros, oil palm empty bunches

INTRODUCTION

Oil palm empty marks are a source of organic matter rich in nutrients N, P, K, and Mg. The number of EFB is estimated to be 23% of the amount of fresh fruit processed. Each tonne of OPEFB contains nutrients N 15%, P 0.5%, K 7.3% and Mg 0.9% which can be used as fertilizer substitution for oil palm plantations. The availability of EFB in the field is quite large with an increase in the number and capacity of palm oil mills to absorb the fresh fruit bunches produced [1]

Currently OPEFB may be used as compost, pulp and paper, carbon and growing media. As long as the TKKS is allowed to rot in the oil palm plantations. This disrupts the growth of oil palm which will be planted later because EFB takes a long time to decompose, possibly up to 6 months without the help of decomposers. [6]

The strategy to encourage the process of biodecomposition of organic matter is carried out by utilizing activators. Activator is a microbial decomposer that acts as a catalyst to accelerate the composting process and make the composting results perfect with good quality, because it contains the nutrients needed by plants. [14].

The larvae of the symbiotic bacterium O. rhenoceros used as composting activators can significantly affect the physical and chemical factors of the compost produced [8]. Several Trichoderma species that have been reported as biological agents, such as: T. harzianu, T. viridae, and T. koningii have a broad spectrum in various agricultural crops. In addition, Trichoderma also acts as a biodecomposer that decomposes organic waste into quality compost [3].

MATERIALS AND METHODS

The research was conducted in the PTPN III Oil Palm Plantation area, Tanah Raja Gardens, North Sumatra and the propagation of symbiotic bacteria larvae of Oryctes rhinoceros and Trichoderma harzianum at the Disease Laboratory of the Faculty of Agriculture, North Sumatra from September 2019 – December 2019. The material used was Empty Palm Oil Bunches, B. stratosphericus, B. cereus, B. siamensi, T. harzianum, yeast. Obtained from the collection of the Laboratory of Plant Diseases at the Faculty of Agriculture, University of North Sumatra, Medan.

This study used a 2-factorial Randomized Block Design (RBD) namely:
Factor I : Use of O. rhinoceros larva symbiont bacteria and addition of bioactivator
B0 : Control
B1: B. stratosphericus + T. harzianum
B2: B. stratosphericus + T. harzianum + yeast

B3: B. cereus + T. harzianum
B4: B. cereus + T. harzianum + yeast
B5: B. siamens + T. harzianum
B6: B. siamens + T. harzianum + yeast
Factor II: OPEFB layer thickness
T1: 2 ply,
T2: 3 ply.

So that in 12 treatment combinations and 3 replications, a total of 42 treatments.

The research implementation includes the propagation of symbiont bacteria and bioactivators. Then determine and prepare 1 (one) area of Immature Plants for oil palm plantations and given OPEFB per principal circular around the plant with 2 layers (200kg) of OPEFB applied B. stratosphericus, B. cereus, B. siamensi, T. harzianum as much as 2 liters, yeast as much as 20gr/2 liters. And treatment with 3 layers (300kg) of OPEFB was applied to B. stratosphericus, B. cereus, B. siamensi, T. harzianum as much as 3 liters, yeast as much as 20gr/3 liters.
Parameters observed included: compost temperature, C/N ratio and compost color change.

RESULTS AND DISCUSSION

Temperature
From the results of analysis of variance and further test of Duncan's distance showed that the application of bacteria and the addition of bioactivators had a significant effect on the composting temperature.

Table 1. Effect of application of bacteria and addition of bioactivator on composting temperature 0-6 MSA (0C)

Treatment	Temperature Change						
	0 WAP	1 WAP	2 WAP	3 WAP	4 WAP	5 WAP	6 WAP
B0T1	26,67ab	28,17a	29,33a	30,50a	30,50a	30,00a	27,00a
B0T2	27,50bcde	28,67a	29,83a	30,83a	30,83a	30,17ab	27,33ab
Rataan	27,085	28,67	29,71	30,75	31,04	30,08	27,17
B1T1	26,33a	30,33b	31,50b	33,33b	35,17b	32,17def	28,17cdef
B1T2	27,83de	31,67c	32,50cde	35,17cd	36,00bcde	32,67ef	28,67ef
Rataan	27,08	31,33	32,25	34,71	35,79	32,42	28,42
B2T1	26,83abc	32,00c	33,17def	34,83cd	35,33bc	32,83ef	27,83bcd
B2T2	27,83de	31,17bc	32,67cde	35,17cd	37,17gh	33,17f	28,50def
Rataan	27,33	31,38	32,79	35,08	36,71	33,00	28,17
B3T1	27,67cde	31,33c	32,83cdef	34,67c	36,50efg	31,33bcd	28,00bcde
B3T2	27,83de	31,67c	33,67f	35,67de	37,67h	33,17f	28,33cdef
Rataan	27,75	31,58	33,46	35,42	37,38	32,25	28,17
B4T1	27,67cde	31,17bc	32,83cdef	35,17cd	37,00fgh	31,67cde	28,17cdef
B4T2	28,17e	31,67c	32,83cdef	35,33cde	37,17gh	32,83ef	27,83bcd
Rataan	27,92	31,54	32,83	35,29	37,13	32,25	28,00
B5T1	27,17abcd	31,33c	32,33bcd	35,67de	35,67bcd	31,67cde	27,33ab
B5T2	27,83de	31,67c	33,17def	36,17ef	36,17cdef	32,00def	28,83f
Rataan	27,5	31,58	32,96	36,04	36,04	31,83	28,08
B6T1	27,33bcde	31,33c	32,00bc	35,67de	35,67bcde	31,67cde	27,67abc
B6T2	26,83abc	31,83c	33,33ef	36,67f	37,00fgh	30,67abc	28,17cdef
Rataan	27,08	31,71	33,00	36,42	36,67	31,17	27,92

Description: Numbers followed by the same letter in the same column are not significantly different according to Duncan test level 5%

On the Table. 1 shows that there is a significant difference between B0T1(26,67) and B5T2 (27,83). The highest temperature increase occurred at 4 msa in the B3T2 treatment of 37.67°C. While the lowest temperature at B0T1 is 30.67°C. At 0 WAP the temperature looks low because the microorganisms have not worked, the temperature seems to increase starting at 1 WAP to 4 WAP, at 6 WAP the temperature is close to the initial temperature. According to [10] in his research stated that the increase and decrease in the temperature of the compost occurred during the decomposition process. Heat occurs due to the presence of decomposing microbes. Compost materials that have not been decomposed will be decomposed by microorganisms, after which the compost heap loses heat so that the temperature decreases at the end of the composting process and approaches the ambient temperature. After most of the material decomposes, the temperature will gradually decrease, this is in accordance with research [5] on straw composting which observed the temperature, the composting began to rise on the 4th day and began to fall on the 24th day, on the 48th day. , the compost has reached a stable temperature (<30 C).

The heat in the compost occurs because microbes begin to actively utilize oxygen and begin to reduce organic matter into CO2, water vapor and heat. After all the materials decompose, the temperature will gradually decrease. At this time there is an advanced compost maturation, namely clay humus complex [4].

C/N ratio

From the results of the analysis of the C/N value of compost that has been carried out at PT. Socfin Indonesia, the content of C – Organic and N in compost related to C/N compost can be seen in the following table.

Table 2. Compost C/N tilapia content

Treatment	Compost Content					
	8 WAP			10 WAP		
	C-Organik (%)	N-Total (%)	C/N	C-Organik (%)	N-Total (%)	C/N
B0T1	50,06	0,78	63,79	40,66	1,71	23,82
B0T2	48,26	0,87	55,46	46,2	1,32	35,05
B1T1	47,46	0,84	56,61	41,87	2,31	18,16
B1T2	47,58	0,98	48,32	37,95	2,23	17,03
B2T1	48,82	1,35	36,62	35,91	1,55	23,23
B2T2	47,26	1,39	34,11	39,73	2,65	15,01
B3T1	47,98	1,53	31,28	22,14	1,5	14,8
B3T2	44,48	1,12	39,89	28,12	2,47	11,41
B4T1	48,31	1,06	45,44	37,63	1,86	20,24
B4T2	46,67	1,94	24,17	39,26	2,33	16,88
B5T1	47,31	0,98	48,4	35,91	2,17	16,55
B5T2	46,34	1,74	26,67	46,67	2,03	23,01
B6T1	44,73	1,93	22,59	45,27	1,37	33,05
B6T2	47,62	1,5	31,74	43,57	2,3	18,93

Table 2 shows the C-organic value at 8 WAP composting is higher than the C-organic value at 10 WAP. This happens because in the composting process C molecules will be released and will be lost in the form of CO2. The process of aerobic decomposition of organic matter with the help of microorganism remodel and the nutrient content of N, P, K and K in the material to be composted produces water vapor (H2O), carbon dioxide (CO2), nutrients, humus and energy [8]. There was an increase in nitrogen content from 8 WAP to 10 WAP due to the nitrogen mineralization process, namely the change of inorganic nitrogen into organic nitrogen with the help of enzymes produced by microbes in the biodecomposer. This is in accordance with [13] which states that the increase in nitrogen content in compost occurs due to the decomposition process carried out by microorganisms that produce ammonia and nitrogen.

The results of the analysis of the highest C/N compost at week 8 were obtained in treatment B0T1 which was 63.79 and the lowest was at B6T1 at 22.59, while at week 10 the highest was B0T2, which was 35.05 and the lowest was B3T2, which was 11 ,41 . With increasing age of compost where the decomposition process runs optimally, where the availability of carbon and nitrogen produced is used by microorganisms to the maximum and helps microorganisms to remodel organic compounds in compost [2]. The value of the C/N ratio determines the quality of the compost, because it affects the availability of nutrients in the compost [12].

The results of table 2 observations of the C/N ratio in B6T1 the C/N ratio is very varied. Supposedly, the longer the decomposition period, the ratio of C and N will decrease over time, because the longer the decomposition time, the more material will decompose. This decomposed material causes the C and N ratio to decrease. According to [7] this is presumably due to non-uniform sampling. So, there are some parts that are easily decomposed, for example the outside of the EFB but there are also parts that are still hard, such as the middle of the EFB.

Compost color

Compost color measurements were carried out 2 times using Munsell Soil Color Charts, namely at the beginning and end of composting where the results can be seen in table 3.

Table 3. Compost color measurement

Treatment	Discoloration	
	Early	End
B0T1	7,5 YR 4/2 (Brown)	(7,5 YR 3/3 Dark Brown)
B0T2	7,5 YR 4/2 (Brown)	(7,5 YR 3/2 Dark Brown)
B1T1	7,5 YR 4/1 (Brown)	(7,5 YR 2,5/3 Very Dark Brown)
B1T2	7,5 YR 4/2 (Brown)	(7,5 YR 2,5/3 Very Dark Brown)
B2T1	7,5 YR 4/4 (Brown)	(7,5 YR 3/3 Dark Brown)
B2T2	7,5 YR 4/2 (Brown)	(7,5 YR 3/3 Dark Brown)
B3T1	7,5 YR 4/2 (Brown)	(7,5 YR 2,5/3 Very Dark Brown)
B3T2	7,5 YR 4/4 (Brown)	(7,5 YR 2,5/3 Very Dark Brown)
B4T1	7,5 YR 4/2 (Brown)	(7,5 YR 3/3 Dark Brown)
B4T2	7,5 YR 4/2 (Brown)	(7,5 YR 3/3 Dark Brown)
B5T1	7,5 YR 4/2 (Brown)	(7,5 YR 2,5/1 Black)
B5T2	7,5 YR 4/1 (Brown)	(7,5 YR 2,5/3 Very Dark Brown)
B6T1	7,5 YR 4/2 (Brown)	(7,5 YR 3/3 Dark Brown)
B6T2	7,5 YR 4/2 (Brown)	(7,5 YR 3/2 Dark Brown)

Table 3 shows the color of OPEFB compost from the beginning to the end of the study showing a darker color change from the starting material. At the beginning of composting the overall color is brown. At the end of the observation, the OPEFB compost in treatments B0T1, B0T2, B2T1, B2T1, B4T1, B4T2, B6T1, B6T2 was dark brown, treatments B1T1, B1T2, B3T1, B3T2, B5T2 were darker brown, and B5T1 was black. This is due to differences in the provision of symbiont bacteria and bioactivators. Mature fertilizer has the characteristics of dark brown to black, crumbly, has room temperature and is odorless. According to [9] mature compost is compost that has a blackish color. This means that the OPEFB compost that has been applied to the O.rhenoceros larva symbiont bacteria and bioactivator has matured and the compost can be used as fertilizer in the field.

CONCLUSION

OPEFB contains a lot of organic materials that are difficult to decompose, the constituent content is 50.4% cellulose, 21.9% hemicellulose, and 10% lignin and 17.7% other components, therefore efforts are needed to shorten the time of composting and treatment specialized in composting such as the addition of bioactivators.The application of O.rhinoceros larval symbiont bacteria and the addition of a bioactivator can be used as an effective OPEFB decomposer and can shorten the OPEFB composting time to be faster, from the results of this study it was found that the best compost as fertilizer was B3T2 (treatment B.cereus + T.harzianum at a thickness of 3 layers of EFB) with a C/N ratio of 11.41. Composting time has a significant effect on temperature, the treatment with the most concentrated color is B5T1 (B.siamensi + T.harzianum with a thickness of 2 layers of EFB) 7.5 YR 2.5/1 Black

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