International Journal of Research and Review
Vol. 10; Issue: 2; February 2023
Website: www.ijrrjournal.com
Research Paper E-ISSN: 2349-9788; P-ISSN: 2454-2237

Quality of Cow Manure Compost Using Effective Microorganism (EM4) and Black Soldier Fly (BSF) Fly Larvae (Maggot)

Anggi Roslila Hutapea[1], Dini Julia Sari Siregar[2]

[1,2]Universitas Pembangunan Panca Budi, Medan, Indonesia

Corresponding Author: Anggi Roslila Hutapea

DOI: https://doi.org/10.52403/ijrr.20230234

ABSTRACT

This study aims to determine differences in the quality of cow manure compost using Effective Microorganisms (EM4) and the quality of cow manure compost using Black Soldier Fly (BSF) Larvae (Maggot). The experimental design used in this study was a completely randomized design consisting of 4 treatments and 5 replications. Treatment Po = Cow dung, P1 = Cow dung + EM4, P2 = Cow dung + maggot, P3 = Cow dung + EM4 + maggot. Parameters observed were temperature, color, smell, texture and C-organic compost which showed a very significant difference (p <0.01) to the mean value of fermented cow dung, the lowest total N was found at p1 with a value of 0.69% while the highest value is found in p2 with a value of 1.13%, the lowest C/N ratio is found in p2 with a value of 36.97% while the highest value is found in po with a value of 63.54%, the lowest P2O5 is found in p1 1.42% while the the highest was at 2.45%. The lowest K20 is at p2 with a value of 1.41% while the highest value is at p3 with a value of 2.346%., and the lowest PH is at p2 with a value of 8.214% while the highest value is p1 8.72%.

Keywords: *Microorganism, black soldier fly, fly larvae, quality Compost*

INTRODUCTION

Livestock in Indonesia, including the agricultural sector, requires serious attention from the government to continue to be developed. This is considering the importance of livestock in meeting the needs of meat and livestock products for the community (Andrianto, 2014). Fertilizer processing from cow manure has been carried out a lot, one of which is by using Effective Microorganisms (EM4). In the composting process microbiological processes occur and during aerobic composting the population of microorganisms is constantly changing. One of the effective bioactivators used in the composting process is Effective Microorganisms (EM4) which functions as an inoculant to increase the number of decomposing microorganisms, increase the microbial content in the soil, improve soil quality, and accelerate composting.

Besides Effective Microorganisms (EM4), there is a new alternative technology that can produce compost from the digestion of Black Soldier Fly (BSF) Larvae (Maggot). However, the processing of cow manure using Black Soldier Fly (BSF) larvae is a new form of organic waste processing.

BSF fly larvae or commonly called maggot is a sustainable innovative method for reducing organic waste with an efficiency of 55-80% (Buana and Alfiah, 2021).

BSF larvae are able to decompose various organic wastes, such as fruit waste, vegetable waste, food scraps, animal waste, bones and animal flesh and even those that have become carrion (Zahro et al., 2021). The results of bioconversion of cow dung by BSF larvae can be used as fertilizer, besides that BSF larvae also have economic value (Nirmala and Purwaningrum, 2020). Based on this description, researchers will carry out a comparative analysis of the quality of cow dung compost using Effective Microorganisms (EM4) and those using Black Soldier Fly (BSF) Larvae or a mixture of the two ingredients.

METHOD

Material

The materials used in this study were cow manure, effective microorganisms (EM4), black soldier fly (BSF) maggot larvae. The tools used are: covered bucket, magobox, gloves, tarpaulin, sieve, scales, and stationery.

Methods

The research method used is experimental research. The research method used in this study was a completely randomized design (CRD), which consisted of 4 treatments and 5 repetitions. The following were: Po = Cow dung, P1 = Cow dung + EM4 , P2 = Cow dung + maggot, P3 = dung cow + EM4 + maggot.

Table 1. Results of all quantity data for temperature, color, smell, texture.

Treatment	Parameter			
	Temperature	Color	Smell	Texture
P_0	$\pm 35^0$C	Dark brown	earthy smell	Halus
P_OU_1	37^OC	Dark brown	earthy smell	Halus
P_OU_2	38^OC	Dark brown	earthy smell	Fine
P_OU_3	37^OC	brown	earthy smell	Rather rough

Note: data on the entire sample and treatment.

The quantity of cow manure that likes to be air-dried for 2 weeks. Cattle manure uses the provision and addition of materials for making compost/fertilizer which are adjusted to the research treatment each using 1kg of fresh cow manure, em4 fertilizer, molasses, well water. in table 1 explains the overall explanation of composting with the above ingredients in table 1 The observed results from the compost maker observed were temperature, color, smell, texture.

STATISTICAL ANALYSIS

The research method used in this study was a completely randomized design (CRD).

RESULTS AND DISCUSSION

Compost temperature measurements are shown in Table 1. Temperature measurements are carried out every day using a thermometer starting 24 hours after the composting process is carried out. The above temperature measurements are carried out every day at 17.00 WIB. The results of the temperature quantities above or in table 1 were observed throughout each treatment and it was taken that was closest to the dominant compost temperature.

The dominant compost temperature in table 1 is 37oC. The use of compost heap temperature to evaluate the composting process is largely determined by other factors such as the type of material being composted, the composting procedure, the season and other variables. After the composting process has been running for approximately 2 weeks until the 45th day, there is a decrease in the daily average temperature and it is maintained at a temperature between 29-32oC until the composting process is terminated. This period is the optimum condition for the compost maturation process to take place. In the early stages of composting, the temperature is increased.

Observation of the color of the compost

Observation of the color of the compost is done by the sense of sight. There are 2 categories of color determination, namely brown and blackish brown according to Indonesian national standards. Color observations were made in table 1 above, which was more dominant, namely blackish brown which was better than just brown. it can be seen that the compost has shown sufficient maturity level where the color of the material is brown-black, smells of rotted leaves, except for straw bokashi where straw structure is still found (± 10% by weight) although the texture feels fine and crumbly like earth. This situation is in accordance with the criteria set out in the Indonesian National Standard (SNI, 2004; Asngad and Supardi, 2005).

Observation of the smell of compost

In observing the smell of compost is done by using the sense of smell. There are 2 categories that are used in odor observations, namely strong odors and earthy odors. Observation of the smell of compost in table 1 which is more dominant is the smell of soil. According to the results of the research above, the smell of soil in compost is better. However, there are other parameters that say the pungent odor is also good.

Compost texture observation

Observation of texture is done by using the sense of touch by using the hands. There are 2 categories used for texture observation, namely smooth and slightly coarse. Observations on the texture of the compost in table 1 which is more dominant is fine texture. Significant effect (<0.005) is the texture of the compost. It can be concluded that the addition of compost is listed in the table of parameter values for observing the physical quality of the compost of beef cattle faeces and cow dung. Based on the texture observation parameters, all compost is included in the rather fine category, Murbanono (2005)

Table 2: - Results of Recapitulation of All Treatments

No	Sample code	Type of Analysis					
		C-organik (%)	N-total (%)	C/N (%)	P2O5 (%)	K2O (%)	pH
1	PO1	42,07	0,74	56,85	1,32	1,52	8,75
2	PO2	42,47	0,67	63,38	1,39	1,36	8,60,
3	PO3	43,64	0,61	71,54	1,97	1,64	8,82
4	P11	42,56	0,66	64,48	1,31	1,40	8,53
5	P12	43,54	0,67	64,98	1,39	1,30	8,41
6	P13	42,19	0,76	55,51	1,58	1,55	8,69
7	P21	39,74	1,28	31,04	2,53	2,29	8,27
8	P22	41,40	1,14	36,31	2,55	2,33	8,22
9	P23	41,98	0,94	44,65	2,19	1,84	8,14
10	P31	41,55	1,04	39,95	2,53	2,32	8,31
11	P32	41,17	1,13	36,43	2,63	2,42	8,25
12	P33	41,40	1,04	39,80	2,15	2,29	8,24

Compost Carbon Content

Data analysis on the parameter carbon content of compost after statistical analysis is presented in Appendix 1 showing that the use of maggot as livestock fertilizer/compost is very significantly different (p <0.01) to the carbon content of compost. After proceeding with the honest significant difference test (BNJ), it can be seen that the carbon content with the highest average was obtained in the P1 treatment, namely 3, which was 42.792%. With cow manure + EM4 treatment. This is because the administration of Effective Microorganism 4 (EM4) bioactivator affects the degradation process of organic matter, where the addition of EM4 can reduce the C/N ratio. This decrease indicates that EM4 contains nitrogen, so when added, the nitrogen content will increase and the C/T ratio will decrease. Where the more volume of EM4 is added, the number of microbes as decomposition agents for organic matter will also increase, and the decomposition of organic matter will also increase (Kurniawan, 2013)

Compost Nitrogen Content

The results of the proximate analysis of the parameters of compost nitrogen content after statistical analysis are presented in table 1 above showing that the use of maggot as animal feed is very significantly different (p <0.01) to the nitrogen content of compost. After proceeding with the honest significant difference test (BNJ), it can be seen that the nitrogen content of the compost is present in the P2 treatment with an average of 0.69%. That is, by treating cow manure + EM4, this is because the use of EM4 tends to increase N levels. This is in accordance with the opinion of Simamora (2006), that during the mineralization process nitrogen will decrease according to the composting time. So it is suggested that the longer the composting time, the EM4 concentration needs to be increased. The lowest N-total is at p1 with a value of 0.69% while the highest value is at p2 with a value of 1.13%, the lowest C/N ratio is at p2 with a value of 36.97% while the highest value is at po with a value of 63, 54%, the lowest P2O5 is found at p1 1.42% while the highest value is found at 2.45%. The lowest K20 is at p2 with a value of 1.41% while the highest value is at p3 with a value of 2.346%., and the lowest PH is at p2 with a value of 8.214% while the highest value is p1 8.72%.

Content of C/N Ratio in Compost

The results of the proximate analysis of the parameter C/N ratio in compost after statistical analysis are presented in Appendix 1 above showing that the use of maggot as animal feed is very significantly different ($p < 0.01$) to the nitrogen content of compost. After proceeding with the honest significant difference test (BNJ), it can be seen that the nitrogen content of the compost is found in the P0 treatment, which is equal to 63.54%, namely the control of fire manure, This is because the administration of Effective Microorganism 4 (EM4) bioactivator affects the degradation process of organic matter, where the addition of EM4 can reduce the C/N ratio. This decrease indicates that EM4 contains nitrogen. Where the more volume of EM4 is added, the number of microbes as decomposition agents for organic matter will also increase, and the decomposition of organic matter will also increase (Kurniawan, 2013).

Compost phosphorus content

The results of the analysis of phosphorus levels showed that the treatment of fermented cow dung with several ingredients such as using maggot, molasses, em4. As compost is significantly different (p <o.01), there is a compost phosphorus content. The treatment of cow dung has an effect on each block of repetition, where the average value from po to p3 is the highest value obtained by p3. With an average of 2.45% cow manure + EM4 + maggot. This is due to the weathering process that occurs in cow compost which causes high levels of phosphorus. Where at the compost maturation stage, the microbes will die and the phosphorus content in the microbes will be mixed with the compost material, so that it will directly increase the phosphorus levels in the compost (Supadma and Arthagama, 2008)

Potassium content of compost

The results of the proximate analysis of potassium levels in compost fermented for several weeks using cow manure. got very significantly different results ($p < 0.01$) there were potassium levels then continued with an honest significant difference test (BNJ). The po treatment was very significantly different from p1, p2, p3 where each treatment was very significantly different by carrying out the BNJ follow-up test. The average potassium level based on the results of the proximate analysis of each treatment with repetitions can be seen in table 13. Where the highest potassium content was found in the p3 treatment with an average of 2.346 with the cow manure + EM4 + maggot treatment, this is because microorganisms also need potassium for their growth. Microbes can grow more but the need for potassium to support their growth also increases. So that most of the potassium produced is taken up by microorganisms for its growth and the remaining potassium as analyzed potassium becomes smaller (Pelzjar, 2006).

PH level

It can be seen from the pH data for each cow dung treatment that it has a very significant effect on each block of repetition, where the highest average value is obtained by po, namely by using cow dung. Compost Temperature is a determinant of decomposition activity. Observations can be used as a benchmark for decomposition performance, besides that it is also used to find out how the decomposition process works.

Temperature also greatly influences the decomposition process related to the activity of microorganisms that play a role during the decomposition process (According to Heny (2015), the composting process will run in four phases, namely the mesophilic, thermophilic, cooling and ripening phases. But in simple terms it can be divided into two stages, namely the active stage and the maturation stage. At the beginning of the decomposition process, oxygen and compounds that are easily degraded will be used by mesophilic microbes so that the temperature of the compost pile will increase rapidly.

CONCLUSION

The conclusions from the results of the research that has been done or the conclusions obtained are as follows:

1. The results of the research parameters observed in the study were temperature, pH, physical form (color, smell, texture) and nutrients (n, p, k, c). The color that is more dominant in composting is brown, almost 95% of the research results. while the smell of compost in the study was almost 100% the smell of earth, the texture in the compost which was more dominant was fine textured which contained 85%.
2. The lowest C-organic is found at p2 with a value of 40.994% while the highest value is p1 with a value of 42.792%
3. The lowest N-total is at p1 with a value of 0.69% while the highest value is at p2 with a value of 1.13%.
4. The lowest C/N ratio is found at p2 with a value of 36.97% while the highest value is found at po with a value of 63.54%.
5. The lowest P2O5 is found at p1 1.42% while the highest value is found at 2.45%.
6. The lowest K20 is in p2 with a value of 1.41% while the highest value is in p3 with a value of 2.346%.
7. The lowest PH is found at p2 value 8.214% while the highest p1 value is 8.72%.

Declaration by Authors

Acknowledgement: None

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Sugiharto, S., Yudiarti, T., Isroli, I., Widiastuti, E., dan Putra, F. D. 2017. Effects of feeding cassava pulp fermented with Acremonium charticola on growth performance, nutrient digestibility and meat quality of broiler chicks. S Afr J Anim Sci. 47(2): 130-138.
2. Andrianto, T.T. 2014. Pengantar Ilmu Pertanian; Agraris, Agrobisnis, Agroindustri, dan Agroteknologi. Yogyakarta: Global Pustaka Utama.
3. Arikunto, S. 2010. Manajemen Penelitian. Jakarta: Rineka Cipta, 2010.
4. Barros-Cordeiro KB., Nair Báo S. dan Pujol-Luz JR. 2014. Intrapuparial development of the black soldier fly, Hermetia illucens. J Insect Sci. 14:1- 10.
5. Buana, M.S. and Alfiah, T., 2021, October. Biokonversi Kotoran Ternak Sapi menggunakan Larva Black Soldier Fly (Hermetia illucens). Seminar Nasional Sains dan Teknologi Terapan IX 2021 Institut Teknologi Adhi Tama Surabaya (Vol. 9, No. 1, pp. 406-412).
6. Djuarnani, N., dkk. 2005. Cara Cepat Membuat Kompos. Cetakan Pertama. Jakarta: AgroMedia Pustaka.
7. Gobbi P., Martínez-Sánchez A. dan Rojo S. 2013. The Effects Of Larval Diet On Adult Life-History Traits Of The Black Soldier Fly, Hermetia Illucens (Diptera: Stratiomyidae). Eur J Entomol. 110:461-468.
8. Indriani, Y.H. 2003. Membuat Kompos Secara Kilat. Jakarta: Penebar Swadaya.

9. Isroi dan Nurheti. 2009. Kompos Cara Mudah dan Cepat Menghasilkan Kompos. Yogyakarta, Andi.
10. Kurniawan D., Sri K., dan Nimas MS, 2013. Efek Penambahan Volume Efektif Microorganism 4 (EM4) 1% Dan Lama Fermentasi Terhadap Kualitas Pupuk Bokashi Dari Kotoran Kelinci Dan Limbah Nangka. Jurnal Industri, Vol 2.1: 57 – 66.
11. Mulyadi dan Yovina. 2013. Studi Penambahan Air Kelapa pada Air Kelapa pada Pembuatan Pupuk Cair Limbah Ikan terhadap Kandungan Hara Makro C, N, P, dan K. UNDIP. Semarang.
12. Murbandono, H.S.L., 2007. Membuat Kompos. Jakarta
13. Makkar. HPS, Tran G., Heuze V. dan Ankreas P. 2014. State of the art on use of insects as animal feed. Anim Feed Sci Technol. 197:1-33.
14. Nirmala W. dan Purwaningrum, P. 2020. Pengaruh Komposisi Sampah Pasar Terhadap Kualitas Kompos Organik Dengan Metode Larva Black Soldier Fly (BSF). p. 5.
15. Pelzjar.J. & Chan E.C.S, 1986, "Dasar-dasar Mikrobiologi", UI Press, Jakarta.
16. Rachmawati, dkk. 2010. Perkembangan Dan Kandungan Nutrisi Larva Hermetia Illucens (Linnaeus) (Diptera: Startiomyidae) Pada Bungkil Kelapa Sawit. J Entomol Indones. 7:2841.
17. Sheppard, D. C., J. K. Tomberlin, J. A. Joyce, B. C. Kiser, & S. M. Sumner. 2002. Rearing Methods For The Black Soldier Fly (Diptera: Stratiomyidae). J Med Entomol. 39(4):695-698.
18. Simamora, Suhut., dan Salundik. (2006). Meningkatkan Kualitas Kompos. AgroMedia Pustaka. Jakarta.
19. Supadma, A.A.N dan Arthagama, D.N (2008). Uji FormulasiKualitas pupuk kompos yang bersumber dari sampah Organik dengan penambahan limbah ternak ayam, sapi, babi dan tanaman pahitan. Jurnal Bumi Lestari, 8 (2), 113-121.
20. Tomberlin, J.K., P.H. Adler, and H.M. Myers. 2009. Development of the black soldier fly (diptera: stratiomyidae) in relation to temperature. Environ. Entomol. 38 (3):930-934.
21. Winarsunu, T. 2002. Statistik dalam Penelitian Psikologi dan Pendidikan. Malang: UMM Press.
22. Widarti B.N., W.K.Wardhini dan E.Sarwono, 2015. Pengaruh rasio C/N bahan baku pada pembuatan kompos dari kubis dan kulit pisang. Jurnal Integrasi Proses 5(2): 75-80.
23. Yuniwati, M, dkk. 2012. Optimasi Kondisi Proses Pembuatan Kompos Dari Sampah Organik Dengan Cara Fermentasi Menggunakan EM4. Jurnal Teknologi, No. 5, h. 172-181.
24. Yuwono, D. 2005. Kompos. Jakarta: Penebar Swadaya.
25. Zahro, Eurika, and Prafitasari. 2021. Konsumsi Pakan Dan Indeks Pengurangan Sampah Buah Dan Sayur Menggunakan Larva Black Soldier Fly. Bioma J. Biol Dan Pembelajaran Biol., Vol. 6, No. 1, Pp. 88–101.

How to cite this article: Anggi Roslila Hutapea, Dini Julia Sari Siregar. Quality of cow manure compost using effective microorganism (EM4) and black soldier fly (BSF) fly larvae (maggot). *International Journal of Research and Review*. 2023; 10(2): 271-276.
DOI: *https://doi.org/10.52403/ijrr.20230234*

******