Study of The Utilization of Ruminant Ruments as A Bioactivator For Palm Oil Frond Compost Quality

By Agus Hermawan

ISBN : 978-979-18768-9-6

PROCEEDINGS

The Fourth
International Conference on Green Agro-Industry
Sustainable Agroindustry in The Era of Industrial Revolution 4.0

October 22-23, 2019

Published by:
FACULTY OF AGRICULTURE
UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN"
YOGYAKARTA

International Conference on Green Agro-Industry

Organized by:

Supported by:

Proceedings
The 4th
International Conference on Green Agro-Industry
(ICGAI)

Sustainable Agroindustry in The Era of Industrial Revolution 4.0

Grand Inna Malioboro, Yogyakarta, October 22th-23th 2019

Publisher:
Faculty of Agriculture
Universitas Pembangunan Nasional "Veteran" Yogyakarta

Proceedings

The 4th
International Conference on Green Agro-Industry
(ICGAI)

Sustainable Agroindustry in The Era of Industrial Revolution 4.0

Organizing Committee:

Head of Organizer	: Dr. Ir. Tuti Setyaningrum, M.Si.
Vice Head of Organizer	: Dr. Ir. R.R. Rukmowati Brotodjojo, M.Agr.
Secretary	: Dr. Ir. Sari Virgawati, M.Eng.
	Danar Wicaksono, S.P., M.Sc.
	Ali Hasyim Al Rosyid, S.P., M.Sc.
Treasurer	: Ir. Indah Widowati, M.P.
	Ir. Chimayatus Sholichah, M.P.
Board of Directors	: Dr. Ir. Mofit Eko Poerwanto, M.P.
	Dr. Ir. Djoko Mulyanto, M.P.
	Ir. Ellen Rosyelina Sasmita, M.P.
	Dr. Ir. Budiarto, M.P.
Publication & Proceeding	: Dr. Antik Suprihanti, S.P., M.Si.
	Liana Fatma Leslie Pratiwi, S.P., M.Sc.
Event	: Dr. Dwi Aulia Puspitaningrum, S.P., M.P.
	Dr. Bambang Supriyanta, S.P., M.P.
Fieldtrip	: Endah Wahyurini, S.P., M.P.
	M. Kundarto, S.P., M.P.
Consumption	: Dr. Ir. Nanik Dara Senjawati, M.P.
	Maftuh Kafiya, S.TP., M.Si.
IT & Equipment	: Dr. Ir. Susila Herlambang, M.Si.
	Ir. Darban Haryanto, M.P.
	Agus Santoso, S.P., M.Si.

Steering and Scientific Committee

Dr. Csaba Paktos, Ph.D.
Roland Schafeintner, Ph.D.
Dr. Shinji Fukuda
Dr. Jerome Soriano
Partoyo, S.P., M.P., Ph.D
Dr. Laszlo Lakatoz

Publisher:
Faculty of Agriculture
Universitas Pembangunan Nasional "Veteran" Yogyakarta

Editorial Staff:
Jl. SWK 104 (Lingkar Utara), Condongcatur, Yogyakarta 55283 (Kampus Pusat)
Telp. +62 274 486733
http://agriculture.upnyk.ac.id/
e-mail: email@upnyk.ac.id

PREFACE

The industrial revolution 4.0 brought many changes with all the consequences. The industry will be more compact and efficient, but there are also risks that might arise, such as reduced human resources because it is replaced by machines or robots. With all the potential that exists we must be active actors who get benefit from the big changes.

It is a must for stakeholders in the agricultural sector to be able to prepare themselves and adapt to changes in the era of the industrial revolution 4.0 to answer the challenges of the future, and turn threats into opportunities.

Improvement of the agricultural sector must be done, and farmers must be strong in technological capabilities. Agro-industry is able to produce environmentally friendly products, substitute non-renewable materials and energy, avoid or minimize the use of toxic chemicals, and minimize emissions. Agro-industry development needs to be directed to integrate the upstream and downstream aspects of the system in a sustainable manner for more prosperous farmers and more advanced agro-industries.

Following the successes of the 1st, 2nd and 3rd International Conference on Green Agro-Industry (ICGAI) were held on 2013, 2015 and 2017 at Yogyakarta, Faculty of Agriculture, Universitas Pembangunan Nasional “Veteran” Yogyakarta, Indonesia in conjunction with its global partner is proudly to announce the 4th ICGAI. The conference will be held on October 22 - 23, 2019, at Yogyakarta, Indonesia. The conference will address problems of primary importance for food security, discussing and proposing a more constructive and progressive approach to ensure future societal sustainability. The meeting will provide a common forum for a wide range of researchers and practitioners specializing in a range of subjects related to the conference themes.

Yogyakarta, March 2020

Editor

DAFTAR ISI

KEYNOTE SPEAKER

PRESENTER SPEAKER

ECONOMICS, SOCIAL AND BUSINESS

AGRICULTURAL ENGINEERING

ANY OTHER TOPICS

CROP AND CROP MANAGEMENT

ENVIRONMENT

SOIL AND WATER MANAGEMENT

Proceeding International Conference on Green Agro-Industry
Volume 4, 2020 | Pages : 388-394

Study of The Utilization of Ruminant Ruments as A Bioactivator For Palm Oil Frond Compost Quality

Adiapati Napoleon[1], Agus Hermawan[1], Dwi Probowati Sulistyani[1], Muhammad Lilo Legowo[2], Dimas Hidayatullah[2]

[1] Lecture at Soil Science Department, Facukty of Agric.Sriwijaya University

[2] Student at Soil Science Departement, Faculty of Agric. Sriwijaya University

Jl. Palembang-Prabumulih Km. 32 Indralaya Ogan Ilir Sounth Sumatera

*Corresponding author: a_napoleon214@yahoo.com

Abstract.

The aims of this study were to determine the physical and chemical quality of oil palm frond compost with the addition of ruminant liquid bio-activator cattles (cattle, goats and buffalo). The material used in this research was palm fronds and ruminant animal rumen fluid obtained from Gandus Slaughterhouse in South Sumatra. This study used a Completely Randomized Design with 5 treatments with 3 replications consisting of P0 (compost of oil palm fronds without addition of bio-activator), P1 (Compost of oil palm frond with bio-activator EM4), P2 (Compost of oil palm frond with bio-activator goat rumen liquid), P3 (Compost of oil palm fronds with bovine rumen liquid bio-activator), and P4 (Compost of oil palm fronds with buffalo rumen liquid bio-activator). The parameters measured in the study are physical quality (odor, texture, pH, temperature and color) and chemical quality (nitrogen, water content, phosphorus, calcium and C-organic). The data obtained were analyzed by ANOVA, if there any significant differences were followed by Duncan's test. The best ruminant rumen bio-activator in the composting process is cow bio-activator, with produced temperature of 33.66 ºC, moisture content of 61.47%, particle size of 74.0%, compost color is dark, compost has soil smelt, pH 7.30, N-Total 0.50%, P-Available 0.0061%, K-Total 0.24, C-Organic 6.58 and C/N 13%.

Keywords: bio-activator, compost, ruminant rumens

1. Introduction

Palm fronds are one of the most wasteful uses of oil palm plantations. The production of the midrib can reach 22 kg / tree / year, where the weight of the midrib meat is around 2.2 kg and the palm frond biomass reaches 6.3 tons / hectare / year. The content of the chemical compounds making up the oil palm fronds consists of cellulose, hemicellulose, and lignin, respectively 31.7%, 33.9%, and 17.4% [1]. Oil palm midrib, including material with high cellulose content and has a density more than wood, that is equal to 1.16 g / cm3, where it is an organic material that can be composted with nitrogen content per dry weight reaching between 2.2- 2.5% and the C / N ratio is 20 (Rokhman, 2004).

Many farmers have known very well with inorganic fertilizers which nutrients are very high but the rate of economic input has greatly increased, this has an impact on increasing yield including the price of inorganic fertilizers. Problems like this can be overcome by making compost organic fertilizer, namely by using palm fronds as organic material which is assisted with ruminant rumen fluid as a bio-activator.

Bio-activator is a bioactive material that is able to decompost organic materials in general. The use of bio-activator derives from ruminant animal rumen fluid is a simple step to obtain good quality compost and composting time which is considered faster in the composting process. The function of this bio-activator is to speed up the decomposition process and improve the quality of nutrients. In the rumen fluid there are microorganisms that can help in decomposition, namely bacteria, fungi, and protozoa. The survey results indicate that the availability of ruminant rumen fluid is very large, if every day slaughtering ruminant animals by 5 animals, rumen fluid is obtained as much as 155 liter (Saidi et al., 2008).

Compost is the result of incomplete decomposition of a mixture of organic materials that can be artificially accelerated by populations of various microbes in warm, humid, and aerobic or anaerobic conditions. Compost can increase soil fertility and stimulate healthy roots, improve soil structure by increasing soil organic matter content and will increase the ability of soil to maintain soil water content.

The purpose of this research is to get the best ruminant rumen bio-activator (goat, cow and buffalo) in the composting process and to compare the results of decomposition of ruminant bio-activator and Effective Microorganism 4 (EM4) on the quality of compost of palm oil fronds.

2. Research Methodology

This research was carried out for 5 months at the Center for Organic Fertilizer Research at the Department of Soil and the Laboratory of Chemistry, Biology and Soil Fertility, Faculty of Agriculture, Sriwijaya University.

This study used a Randomized Design of the Bio-activator Treatment Group:

1. B0 = Compost of oil palm fronds without addition of bio-activator
2. B1 = Compost of oil palm fronds with EM4 bio-activator
3. B2 = Compost of oil palm fronds with goat rumen liquid bio-activator
4. B3 = Compost of oil palm fronds with buffalo rumen liquid bio-activator
5. B4 = Palm frond compost with a cow rumen fluid bio-activator

Starter Agent Treatment

1. S1 = Chicken manure
2. S2 = NPK fertilizer

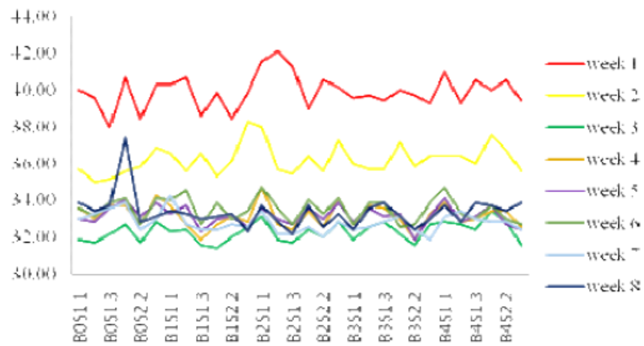
All treatments are replicated 3 times so there are 30 experimental pots

3. Results And Discussion

3.1 Compost Temperature

In the composting process, observation of compost temperature needs to be done to determine the level of compost maturity and to know the decomposition process is still on going. Following are observations of average compost temperature every week (Figure 1).

Figure 1: Graph of the average temperature of compost on every week for Composting



Source: the Center for Organic Fertilizer Research at the Department of Soil and the Laboratory of Chemistry, Biology and Soil Fertility, Faculty of Agriculture, Sriwijaya University

According to Indriani, (2007), an important indicator in the composting process is the temperature of the composting, because the temperature at the time of composting can show the process of microorganisms in decomposing organic matter.

Of the thirty trials conducted temperatures experienced an increase in the first week and for subsequent weeks decreased but still above 30ºC. According to Indriani (2007) the optimal temperature in the composting process is 30 -50 ºC. Based on SNI 19-7030-2004 the temperature of compost that has been ready is the maximum temperature of ground water temperature.

3.2 Compost Water Content

The important role of humidity becomes very important for oxygen supply and microbial metabolism.

Table 1: Compost water content

No	Treatment	Water content (%)
1.	B_0S_1	55.90
2.	B_0S_2	62.04
3.	B_1S_1	60.15
4.	B_1S_2	63.64
5.	B_2S_1	59.47
6.	B_2S_2	63.11
7.	B_3S_1	59.28
8.	B_3S_2	62.18
9.	B_4S_1	59.39
10.	B_4S_2	61.47

Source: the Center for Organic Fertilizer Research at the Department of Soil and the Laboratory of Chemistry, Biology and Soil Fertility, Faculty of Agriculture, Sriwijaya University

According to Kusumawati's research (2011), water content affects the rate of compost decomposition and temperature parameters except for pH and nitrogen levels. Water content affects the rate of compost decomposition and temperature caused by microorganisms need optimal water content to decompose organic material. Based on 30 experiments, there are some treatments whose water content exceeds 60% and there are also below 50%.

Moisture compost affects the activity of microorganisms involved in composting (Yenie, 2008), and the optimum humidity for aerobic composting is 50-60%.

3.3 Compost Color

The color of compost that has been matured is black. The color change from 10YR 4/6 (brown) at the beginning of composting to black is on a mature fertilizer due to the decomposition of organic matter by the activities of various microorganisms. The aerobic decomposition process is shown by the change of color to black (Sutanto, 2002).

At the first week after decomposting and mixing it with other ingredients, the color has become dark brown and at the last week or 8th week the color starts to get darker or blackish, in accordance with SNI 19-7030-2004, the color of ripe compost that is black.

3.4 Compost Smell

Mature compost is characterized by a soil-like odor. Aeration can be increased by reversing the compost collision. This is because the material used is not the same as organic material in general, because the material used is difficult to decompose (Djuarnani et.al 2006).

From the observation of compost odor, all treatments have experienced odor changes from the beginning of the composting process until the end of the composting process. Matured compost in this study smells like soil, this is in accordance with SNI 19-7030-2004 the smell of ripe compost smells like soil.

3.5 Compost Particle Size

The smaller the piece of raw material, the faster the decay time. The size of the material about 5-10 cm suitable for compost in terms of aspects of air circulation that may occur. To speed up the weathering process, manually chopped leaves, twigs and other organic material by hand or machine.

Table 2: Compost particle size

No	Treatment	Particle size (%) 5 mm
1.	B_0S_1	57.3
2.	B_0S_2	40.7
3.	B_1S_1	62.3
4.	B_1S_2	49.7
5.	B_2S_1	58.7
6.	B_2S_2	50.3
7.	B_3S_1	56.7
8.	B_3S_2	52.7
9.	B_4S_1	58.3
10.	B_4S_2	74.0

Source: the Center for Organic Fertilizer Research at the Department of Soil and the Laboratory of Chemistry, Biology and Soil Fertility, Faculty of Agriculture, Sriwijaya University

In this research, the counting of oil palm leaf fronds uses a chopping machine so that the initial particle size of the material is around 3-5 cm. according to SNI 19-7030-2004 the particle size for mature compost ranges from 0.55-25 mm. Referring to compost SNI which has a maximum particle size of 25 mm, all treatments are in accordance with SNI.

3.6 N, P, K, C / N ratio and C-Organic Compost (%)

The nutrient content in each compost is different. The difference in content can be seen in Table 3 below.

Table 3: Compost analysis data.

No	Treatment	pH	N-Total	P-available	K-Total	C-Organik	C/N
1.	B_0S_1	7.17	0,62	0,0062	0,20	8.19	20
2.	B_0S_2	6.80	0,45	0,0062	0,20	7,31	16
3.	B_1S_1	7.29	0,51	0,0060	0,22	8,99	18
4.	B_1S_2	7.02	0,49	0,0059	0,23	8,35	17
5.	B_2S_1	6.98	0,52	0,0061	0,23	7,79	15
6.	B_2S_2	6.98	0,58	0,0060	0,22	10,95	19
7.	B_3S_1	7.12	0,41	0,0062	0,26	5,74	14
8.	B_3S_2	6.89	0,40	0,0062	0,20	7,25	18
9.	B_4S_1	7.04	0,51	0,0065	0,22	9,25	18
10.	B_4S_2	7.30	0,50	0,0061	0,24	6.58	13

Source: the Center for Organic Fertilizer Research at the Department of Soil and the Laboratory of Chemistry, Biology and Soil Fertility, Faculty of Agriculture, Sriwijaya University

It can be seen in the data in Table 3 above that the pH, N, P, K, C / N and C-Organic content of all treatments varies greatly. Based on the above results, it can be compared with SNI 19-7030-2004. All pH, N, P, K, C / N and C-Organic contents are in accordance with the standards. In this research, the initial content of C / N ratio of composted material is 62.67%. Compost is determined by low C / N levels. The lower the C / N level the more mature the compost. According to the standard compost requirements, the C / N ratio must be <20, if> 20 then compost has not been said to be matured.

4. Conclusion

The best ruminant rumen bioactivator in the composting process is buffalo bioactivator with NPK fertilizer starter agent, producing a temperature of 33.66 ºC, moisture content of 61.47%, particle size of 74.0%, compost color is dark, compost has smelly soil, pH 7, 30, N-Total 0.50%, P-Available 0.0061%, K-Total 0.24, C-Organic 6.58 and C / N 13%.

Acknowledgment

Thanks you to Anggaran DIPA BLU UNSRI Tahun Anggaran 2019, No. SP DIPA-042.01.2.400953/2019 for the research funding provided

References

Azmi I, Delianis P, Ali R. 2015. Perbedaan produk bioaktivator dari laut (Reuse) dan/atau EM4 terhadap kandungan unsur hara dalam pupuk organik cair rumput laut *Sargassum sp.*, *Journal of Marine Research,* vol. 2(4), pp. 78-86.

Dewi, Y, S. Dan Tresowati. 2012. Pengolahan Sampah Rumah Tangga Menggunakan Metode Komposting, *Jurnal Ilmiah Fakultas Teknik LIMIT'S*, vol. 8(2), pp. 35-48.

[Ditjenbun] Direktorat Jenderal Perkebunan. 2013. Statistik Perkebunan Indonesia 2011-2012 : Kelapa Sawit. Jakarta (ID). Direktorat Jenderal Perkebunan.

Djuarnani, N, Kristian Setiawan, B.S. 2006. *Cara Cepat Membuat Kompos*, Agromedia Pustaka: Jakarta.

Gaur, D.C., 1980. *Present Status Of Composting And Agricultural Aspect, In : Hesse, P.R (ed). Improving Soil Fertility Through Recycling, Compost Technology,* New Delhi: FAO Of United Nation.

Heriyadi, S. Nurachma dan Padang. 2004. Kondisi ekosistem rumen domba lokal yang diberi cairan rumen kambing secara In-Vivo, *Jurnal Ilmu-Ilmu Pertanian Agroland*, vol. 11(4).

Hernawati, T., M. Lamid, H.A. Hermadi, S.H. Warsito. 2010. Bakteri selululoltik untuk meningkatkan kualitas pakan komplit berbasis limbah pertanian, *Veterinaria Medika*, vol.3(3), pp. 43-53.

Kala, D.R., A.B. Rosenani, C.I. Fauziah, L.A. Thohirah. 2009. Composting oil palm wastes and sewage sludge for use in potting media of ornamental plants, *Malaysian Journal of Soil Science*, vol.13, pp. 77-91.

Lamid, M., Chuzaemi, S., Puspaningsih, N., Kusmantono. 2006. Inokulasi Bakteri Xilanolitik Asal Rumen Sebagai Upaya Peningkatan Nilai Nutrisi Jerami Padi, *Jurnal Protein*, vol.14(2), pp. 122-128.

Padang. 2003. Pengaruh transfer cairan rumen kambing terhadap kondisi ekosistem rumen domba lokal secara in-vitro, *Jurnal Tadulako (Forsimapas)*, vol. 5 (1), September – Desember 2003.

Pandya, p. R. , k. M. Singh, s. Parnerkar, a. K. Tripathi, H. H. Mehta, d. N. Rank, r. K. Kothari and c. G. Joshi. 2010. Bacterial diversity in the rumen of Indian Surti buffalo (Bubalus bubalis), assessed by 16S rDNA analysis. *J. Appl. Genet*, vol.51, pp. 395-402.

Pope, J.P., 1999. *Activaed Carbon and some Application for Remediation of soil and Ground Water Pollution*, USA: Civil Engineering Dept. Virginia Tech.

Preston and Leng. 1987. *Matching Ruminant Production Systems With Available Resource in the Tropic and Sub Tropic*, New South Wales, Australia: Books Armidale.

Rokhman. 2004. Pelepah Kelapa Sawit sebagai Pakan Dasar Sapi. *Prosiding Temu TeknisNasional Tenaga Fungsional Pertanian Tahun 2004,* Pusat Penelitian dan Pengembangan Peternakan 133, Badan Litbang Pertanian.

Saidi N, Chérif M, Jedidi N, Mahrouk M, Fumio M, Boudabous A & Hassen A. 2008. Evolution of biochemical parameters during composting of various wastes compost, *American Journal of Environmental Sciences,* vol. 4(4), pp. 332-341.

Simanungkalit, R. D. M., Didi, A. S., Rasti, S., Diah, S., & Wiwik, H. 2006. *Pupuk Organik dan Pupuk Hayati,* Jawa Barat: Balai Besar Penelitian dan Pengembangan Sumberdaya Lahan Pertanian.

Sinaga, H. 2011. *Penggunaan Rumen Sapi Sebagai Aktivator Pada Pembuatan Kompos Daun Lamtoro*. Medan: Skripsi USU.

Standar Nasional Indonesia. 2004. *Spesifikasi Kompos dari Sampah Organik Domestik. SNI 19-7030-2004*, Jakarta: Badan Standar Nasional Indonesia:.

Suryahadi, w. G. Piliang, l. Djuwita and y. Widiastuti. 1996. DNA recombinant technique for producing transgenic rumen microbes in order to improve fiber utilization. Indonesia. *J. Trop. Agric.,* vol. 7, pp. 5-9.

Yang, S.S. 1996. Preparation and characterization of compost. *Proceedings of International Training Workshop on Microbial Fertilizers and Composting. October 15-22, 1996 Taiwan Agricultural Research Institute Taichung*, Taiwan, Republic of China. FFTC and TARI.

Yenie E. 2008. Kelembaban Bahan dan Suhu Kompos Sebagai Parameter yang Mempengaruhi Proses Pengomposan Pada Unit Pengomposan Rumbai. *Jurnal Sains dan Teknologi*, vol. 7(2), pp. 58-61

Study of The Utilization of Ruminant Ruments as A Bioactivator For Palm Oil Frond Compost Quality

ORIGINALITY REPORT

13%

SIMILARITY INDEX

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

★www.agriculture.upnyk.ac.id Internet	7%

EXCLUDE QUOTES	ON	EXCLUDE SOURCES	< 1%
EXCLUDE BIBLIOGRAPHY	ON	EXCLUDE MATCHES	< 15 WORDS