Test Effectiveness of Composting Techniques Rice Stump

by Nana Danapriatna

Submission date: 28-Apr-2023 11:41AM (UTC+0700)
Submission ID: 2077936361
File name: Artikel_13_Dr._Nana.pdf (350.44K)
Word count: 3170
Character count: 16936

Test Effectiveness of Composting Techniques Rice Stump

Nana Danapriatna[1] and Ismarani[1]
[1]*Faculty of Agriculture, Islamic University 45 Bekasi, West Java, Indonesia*

Keywords : Composting techniques, compost, rice straw

Abstract : This study aims to determine the effectiveness of "in situ" composting techniques for rice stump. The research method used experimental method with a randomized block design of three treatments and repeated three times. The treatments for the experiment were: A (Technique of composting rice stump without additional decomposer); B (Technique of composting rice stump by means of rice stump sprayed with decomposer liquid); C (Composting technique by means of rice stumps lay down and then flowed fluid decomposer). The response variables analyzed were content of N, P, K, C, C- N ratio and rice straw compost. The data were analyzed using variance analysis and continued with the least significant difference test at 5% level. The results showed that different composting techniques had a significant effect on organic C content, total N, K and C-N ratio of rice straw stump compost while the P and SiO2 content variables had no significant effect. Composting technique by means of rice stumps laid down and then flowed with decomposer more effectively than the composting technique of rice stump without the addition of decomposer and rice stump composting technique by means of rice stumps sprayed with decomposer liquid.

1 INTRODUCTION

The continuous use of chemical fertilizers causes the soil biological ecosystem to become unbalanced, so that the goal of fertilizing to provide nutrients in the soil is difficult to achieve (Sutanto, 2006). Excessive use of chemical fertilizers in lowland rice fields will cause environmental problems that will cause changes in soil chemical and physical properties. This condition occurs because the fertility rate and soil organic matter has decreased, therefore if it is not immediately addressed then in the not too distant future, these lands are no longer able to produce optimally and sustainably (Parnata, 2004 *in* Pratiwi *et al*., 2013) The solution to overcome this problem is to reduce the use of inorganic fertilizers and implement organic farming systems.

The solution to reduce excessive use of chemical fertilizers is by using organic material in the form of compost. The function of compost is to add nutrients, improve soil structure, increase the ability to retain water and increase plant growth and production (Hardjowigeno, 1995). According to Murbandono (2000) the use of compost can provide benefits, among others, can provide nutrients needed by plants, become an alternative substitute for chemical fertilizers because the price is cheaper, quality and familiar with the environment, is multipurpose because it can be used for basic organic fertilizer , can improve soil structure, heavy soil becomes lighter and light soil will become better structure, can improve soil texture, increase soil porosity, soil aeration and can increase the composition of microorganisms in the soil.

Providing organic fertilizer can improve soil physical, chemical and biological properties and can improve the efficiency and effectiveness of fertilization (Zurhalena *et al*., 2015). The application of around 2-6 tons of straw compost is able to supply the needs of plants to produce around 8 ton rice grain ha^{-1} (Simarmata *et al*., 2010). Application of 400 g ha^{-1} biofertilizer (*Azotobacter* and *Azospirillum*) and straw compost as much as 14 tons ha^{-1} in Ciparay, Bandung with IPAT-BO technology (System of organic based aerobic rice intensification (SOBARI)) can reduce the use of urea by 33% by increasing the yield of rice grain varieties Ciherang is 4% (Danapriatna *et al*., 2012[a]).

The use of rice straw as organic fertilizer with a dose of 5 tons per ha can increase the C-organic content, N, and K on the soil (Widati *et al*., 1998). The results of research by Danapriatna *et al*. (2012[b]) showed that the application of 400 g ha^{-1} biofertilizer (*Azotobacter* and *Azospirillum*) and straw compost as much as 2 tons ha^{-1} can restore soil health as indicated by an increase in organic C to above 2% and an increase in population and activity bacteria and

Danapriatna, N. and Ismarani, .
Effectiveness of Composting Techniques Rice Stump.
DOI: 10.5220/0009935317931798
In *Proceedings of the 1st International Conference on Recent Innovations (ICRI 2018)*, pages 1793-1798
ISBN: 978-989-758-458-9

increased rice production and reduce urea use by 30%.

The use of organic fertilizers can streamline the availability of a number of fertilizers provided and help release nutrients that are bound by the soil, also accelerate the process of decomposition of organic matter/plant litter or can be used as a composting bioactivator (Sitosu Agro Cemerlang, 2005). The use of rice straw as fertilizer can be directly immersed or composted first. Some farmers use straw directly or only left without any addition, but this method has several weaknesses. The use of fresh straw will directly complicate tillage (Sawit *et al.*, 1989 *in* Suhartatik *et al.*, 2001) besides the availability of nutrients from straw is long enough for plants.

Rice straw that will be applied must be composted to control the contamination of disease seeds (pathogens) contained in the straw and improve the quality of straw compost. Composting straw by utilizing biodegradable decomposer consortium can improve the quality (nutrient content and beneficial microbial content), produce biodegradable straw compost which plays a role in killing disease seeds or pathogens and induce plant resistance to disease (Simarmata *et al.*, 2010).

The source of the material for making straw compost that is widely available in the rice field area besides the straw left over from the rice threshing is the rice stump that is sucked during harvest. During this time rice straw stubble has not been widely used even most farmers burn it. Therefore, utilization of rice straw stubble is worth considering. The technique of composting rice straw after being harvested in the form of rice stumps in the rice field

area needs to be examined so that composting techniques are effective and can be easily carried out by farmers. Effective composting technique of rice straw stumps in terms of several chemical properties of compost produced according to the standard of the Minister of Agriculture Regulation No. 70 / Permentan / SR.140 / 10/2011. The purpose of this study was to determine the effectiveness of composting techniques for rice straw stumps so that it could be considered by the communi in making straw compost more effectively, so as to reduce the use of inorganic fertilizers.

2 RESEARCH METHOD

The research method used was an experimental method with a randomized design of three treatments and repeated five times. The treatments tested in this study are: A (Composting technique of rice stump without addition of decomposer); B (Technique of composting rice stump by means of rice stump sprayed with decomposer liquid); C (Composting technique by means of rice stumps laid down and then flowed with decomposer).

During the composting process the rice stump is left open without cover. After 4 weeks the process was carried out by taking samples of rice straw st p for each treatment unit and chemical analysis was carried out at the Balitsa Lembang Laboratory. To determine the effectiveness of composting techniques is done by comparing the chemical response variables with organic ilizer standard compost according to the standard Minister of Agriculture Regulation No. 70 ermentan / SR.140 / 10/2011.

Data analysis was performed statistically by analysis of variance (ANOVA) and continued with the Least Significant Difference Test (LSD) using the DAASTAT program version 1.022 (Onofri, 2011). The response variables observed were C-organic, N, P, K content, C-N ratio and Si rice straw compost (Table 1).

The study was conducted in the greenhouse of the Faculty of Agriculture UNISMA Bekasi and the Balitsa Lembang laboratory. The research materials and tools used were rice stumps, decomposers, water, liquid sugar, plastic tubs, buckets, and sample containers. The decomposer used is EM4 which contains *Lactobacillus* sp. (8.7×10^5), lactic acid-producing bacteria, and in a small number of photosynthetic bacteria *Streptomyces* sp. and yeast.

3 RESULT AND DISCUSSION

Treatment of diffe t composting methods significantly affected the organic C content, total N, K and C-N ratio of rice straw stump compost.

3.1 Organic C content, Total N and C-N Ratio Compost of Rice Stumps Straw

Composting technique by means of rice stumps laid down and then flowed with decomposer (Treatment C) experienced a decrease in organic C of 1.67% compared to composting techniques of rice stump without addition of decomposer (Treatment and a decrease of 0.91% organic C composting of rice stump by spraying decomposer (Treatment B) (Table 2). This is because some of the C-organic is used by microbes from decomposers for the composting process. This is consistent with the statement of Atkinson *et al.* (1996) that changes in organic C are caused by the loss of carbon as carbon dioxide.

Table 1: Analisys Of Variable Response Of Rice Straw Compost

Treatment	Methods
C-organic (%)	Walkey & Black
N-total (%)	Kjeldahl
C/N	
P_2O_5 (%)	$HClO_4 + HNO_3$
K_2O (%)	$HClO_4 + HNO_3$
SIO_2 (%)	Dry ignation

Table 2: Effect Of Differences In Pegomposan Rice Stump Straw Technique On Organic C Content, Total N And C-N Ratio Compost

Treatment	C organic (%)	N (%)	K (%)	C-N Ratio
Composting technique of rice stump without decomposer addition (A)	23.16 b	0.71 a	0.45 a	39.9 c
Technique of composting rice stump by means of rice stump sprayed with decomposer liquid (B)	22.40 b	0.79 a	0.55 b	28.3 b
Composting technique by means of rice stumps laid down and then flowed with decomposer (C)	21.49 a	0.91 b	0.65 c	23.9 c
LSD 0,05	0.3	0.09	0.09	.92

Description: The number followed by the same lowercase letter in the column shows that it is not significantly different based on the LSD test

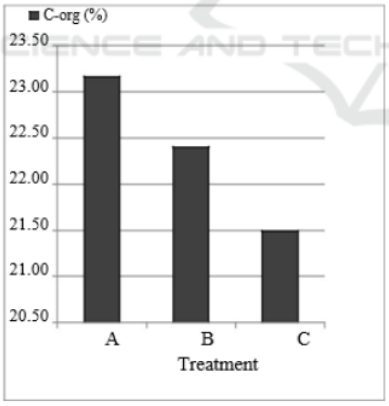

Figure 1. Influence of Different Composting Techniques of Rice Stump Straw to Compost C-Organic Content

Decreasing the C-organic content used by decomposer microorganisms during the composting process significantly increases the total N content of compost. The results of laboratory analysis showed the treatment of Composting technique by means of rice stumps laid down and then flowed with decomposer (C) having a total N content of compost increased by 0.91% greater than the results of composting techniques with treatment of composting techniques without adding decomposer (A) and treatment of rice stump composting techniques by means of rice stump sprayed with decomposer liquid (B) (Figure 2). The total N increase in the treatment given decomposer indicates that microbes derived from decomposers are active in the process of decomposition of rice straw.

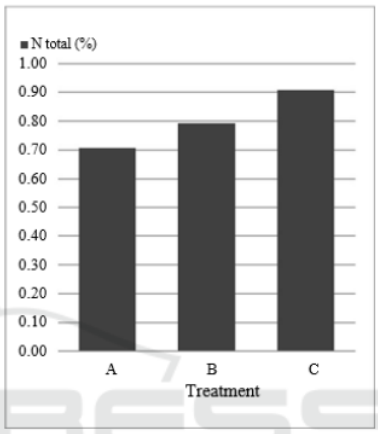

Figure 2. Effect of Difference in Composting Technique of RiceStump Straw on N Total Content of Compost

The difference in the composting technique of rice straw stump significantly affected the K content (Table 3 and Figure 3). The application of composting technique by means of rice stumps laid down and then flowed with decomposer (C) increased 0.20% and 0.10% K content respectively compared to composting techniques without rice decomposer addition (A) and stump composting techniques by means of rice stump sprayed with decomposer liquid (B).

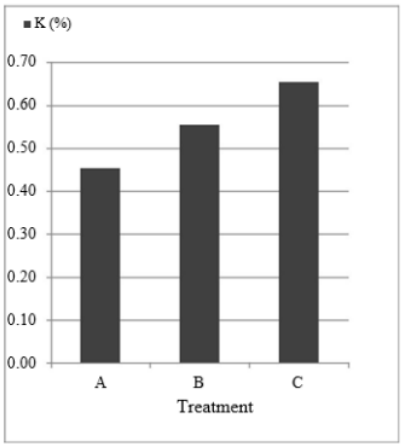

Figure 3. Effect of Difference in Composting Technique of Rice Stump Straw Stems on K Content of Compost

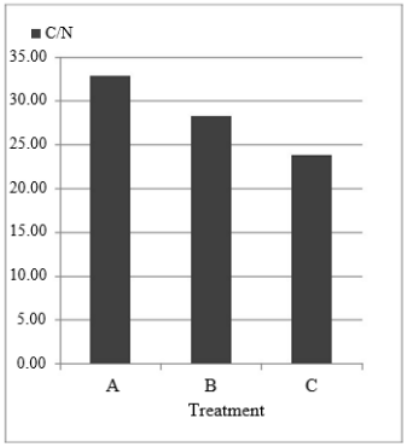

Figure 4. Effect of Differences in Composting Technique of Rice Stumps on C-N Ratio Compost

The addition of decomposers in the form of bacteria or fungi that are capable of producing cellulase enzymes (Meryandini *et al*., 2009) so that the process decomposition of straw can be accelerated. Minimum technical requirements for solid organic fertilizers based on Minister of Agriculture Regulation No. 70/ Permentan / SR.140/10/2011 for C-N ratio of 15% - 25%. Thus, the technique of composting straw rice stumps on the composting treatment by means of rice stumps laid down and then flowed with decomposer (C) has met the standards. Although this compost has not reached the C-N value that is ideal for the maturity level of organic matter (Kausar *et al*. 2010), mature organic fertilizer has a C-N value of less than or equal to 20 (Goyal *et al*. 2005.

The difference in composting techniques of rice straw stumps significantly affected the C-N ratio of compost (Table 3 and Figure 4). Composting technique by means of rice stumps laid down and then flowed with decomposer (C) produces the smallest C-N ratio compared to the other two techniques, namely 23.9%. This is in accordance with the research of Husein and Irawan (2008) that the addition of decomposers in the composting process can help accelerate the process of destabilizing unstable organic materials (high C-N) to stabilize (low C-N) which takes place in a controlled manner, characterized by heat release and CO_2 gas.

3.2 The Content of P and Coarse Silicates (SiO_2) Compost of Rice Stump Straw

The content of P and SiO_2 straw compost in rice stumps was not significantly different in the three composting techniques of rice stumps (Table 3, Figure 5 and Figure 6). This occurs because the same source organic materials, that is straw from rice stump from the same planting area. During the decomposition process, some nutrients will be released through the process of mineralization. According to Allison (1973) the composition of organic matter, environmental conditions, the nature of microflora and fauna will determine the nutrient content in organic matter. Straw is a significant amount of organic material available to rice farmers. About 40% N, 30-35% P, 80-85% K, and 40-50% S remain in the vegetative part of the plant.

Composting techniques by utilizing organic sources such as rice straw stumps are a solution for important sources of micro nutrients such as zinc (Zn) and silicon (Si). Composting by means of rice stumps laid down and then flowed with decomposer (C) and then the compost is incorporated into the fields is an effort to restore much of the nutrients that have been absorbed by the plants and help conserve soil nutrient reserves in the long term in accordance with the opinion of the Dobermann and Fairhurst (2002).

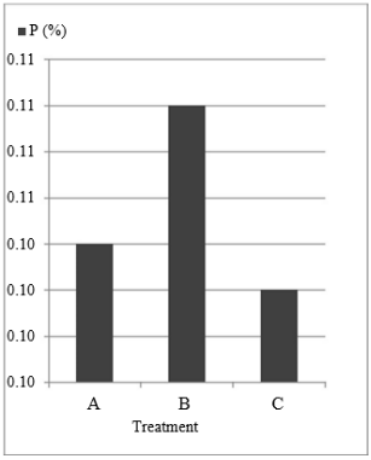

Figure 5. Effect of Difference in Composting Technique of Rice Stump Straw Compost

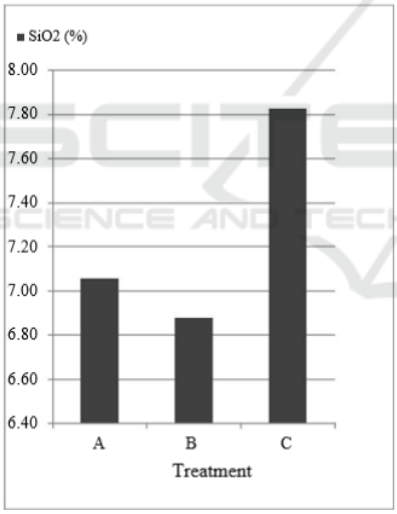

Figure 6. Effect of Differences in Composting Technique of Rice Stump Straw on Silicate (SiO_2) compost

Table 3: Effect Of Differences In Composting Technique Of Rice Stump Straw On P And Silicate (Sio_2) Compost

Treatment	P (%)	rough silicate ($Si0_2$) (%)
Composting technique of rice stump without decomposer addition (A)	0.10 a	7.06 a
Technique of composting rice stump by means of rice stump sprayed with decomposer liquid (B)	0.11 a	6.88 a
Composting by means of rice stumps laid down and then flowed with decomposer (C)	0.10 a	7.83 a
LSD 0.05		

Description: The number follow 3 by the same lowercase letter in the column shows that it is not significantly different based on the LSD test

4 CONCLUSION

Different composting techniques have a significant effect on organic C content, total N, K and C- N ratio of rice straw stump compost, while the P and SiO_2 content variables have no significant effect. Composting technique by means of rice stumps laid down and then flowed with decomposer more effectively than the composting technique of rice stump without the addition of decomposer and rice stump composting technique by means of rice stumps sprayed with decomposer liquid.

Research needs to be done to test the effectiveness of compost fertilizer as a result of the three techniques of composting "in situ" straw of rice stumps on the yield of paddy rice and an economic feasibility and technical analysis of the use of rice straw stump compost.

ACKNOWLEDGEMENTS

Acknowledgments submitted to LPPM UNISMA Bekasi on research grants.

REFERENCES

Allison, F.E., 1973. Soil Organic Matter and its Role in Crop Production. Developments in Soil Science, 3. Elsevier, Amsterdam, 637 pp.

Atkinson CF, Jones DD, Gauthier JJ. 1996. Biodegradability and Microbial Activities During Composting of Poultry Litter. J Poult Sci 75 : 608-617.

Danapriatna N, Simarmata T, Nursinah IZ.. 2012[a] Restoration of Soil Rice fields Health through Application of N-Fastening Fertilizer and Rice Straw Compost. CEFARS 3 (2) : 1 – 8.

Danapriatna N, Simarmata T, Nursinah IZ.. 2012[b]. Recovery of Health and Soil Fertility through the Application of N-Fertilizer and Straw Compost Biofertilizer in an effort to Increase Fertilizer Efficiency and Productivity of Rice Paddy. (Competitive Grant Research Research Report Kemendiknas 2012 with the Number Research Grant Agreement : 0289/K4/KL/2012). Islamic University 45 Bekasi.

Dobermann A and Fairhurst TH. 2002. Rice Straw Management. Better Crops International (16) special supplement.

Goyal SS, Dhull K, Kapoor KK. 2005. Chemical and Biologicl Changes during Composting of Different Organic Wastes and Assement of Compost Maturity. J Biores Tech (6) : 1584-1591.

Hardjowigeno, S. 1995. Soil science. Akademika Presindo. Jakarta.

Husein E and Irawan. Compost Straw (Composting and Compost Characteristics). 2008. Soil Research Institute, Center for Agricultural Land

Resources Research and Development, Agricultural Research and Development Agency. Agriculture Department.

Kausar H, Sariah M, Sauh HM, Alam MZ, Ismail MR. 2010. Development of Compatible Lignocellulotytic Fungal Consortium for Rapid Composting of Rice Straw. J International Biodeterioration & Biogradation (64) : 594-600.

Murbandono, LS. 2000. Make Compost Revised Edition. Penebar Swadaya.Depok.

Meryandini A, Widosari W, Maranatha B, Sunarti TC, Rachmania N, Satria H. 2009. Isolation of Cellulotic Bacteria and Characterization of Enzymes. J Makara Sains (13): 33-38.

Onofri, A. 2011. DAASTAT a new EXCEL® VBA macro to perform basic statistical analyses of field trials. https://www.scribd.com/document/204810422/D SAASTAT-By-Andrea-Onofri. http://www.csdassn.org/softlist.cfm [26/03/2018].

Pratiwi, IG.A.P., IW.D.Atmaja, , N.N. Soniari 2013. The Analysis of Compost Quality of Paddy Field Waste with Local Microorganism as a Decomposer**.** J. Tropical Agroecotechnology 2 (4) : 195-203.

Roechan, S and S. Partohardjono. 1994. Nitrogen Nutrient Status of Paddy in Relation to Efficiency of Fertilizer. J. Food Crops Research 14 (1) : 8-13.

Simarmata T, Natalie BF, Hersanty, Turmuktini T. 2010. Inoculation of Biological Agent Decomposer Consortium on Straw in the Land and Provision of Bio Fertilizer to Substitute Inorganic Fertilizers and Increase Rice Production with IPAT-BO Technology. Competitive Grant Repor number: 005/SP2H/PP/DP2M/III/2010.

Sitosu Agro Cemerlang,. 2005. Bio Organic Soil Treatment. PT Sitosu Agro Cemerlang. Jakarta.

Suhartatik E dan Roechan S. 2001. Rice Crop Response The Direct Seed Planting System for Giving Straw and Potassium. J. Food Crops Research 20 (2) : 33-38.

Sutanto R. 2006. Application of Organic Agriculture (Corrections and Development). Kanisius publisher. Yogyakarta.

Widati SE, Santosa, Kabar P. 1998. The Influence of the Use of Microbes and Rice Straws on Several Soil Chemical Properties, Growth and Rice Field Results. Soil research Proceeding No. Soil Research and Agro-climate Center. Bogor.

Zurhalena, Junedi H, Farni Y. 2015. Ibm Rice Farmers Group in the District Sakernan Kab. Muaro Jambi in an effort to Toward Environmentally Friendly Organic Farming. J. Community service 30 (1)

Test Effectiveness of Composting Techniques Rice Stump

ORIGINALITY REPORT

12%	9%	8%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	repository.uin-malang.ac.id Internet Source	2%
2	krishi.icar.gov.in Internet Source	1%
3	Nichols, P.. "Selected physiological responses of Salvinia minima to different chromium concentrations", Aquatic Botany, 200012 Publication	1%
4	www.growingscience.com Internet Source	1%
5	simdos.unud.ac.id Internet Source	1%
6	garuda.ristekbrin.go.id Internet Source	1%
7	docplayer.net Internet Source	1%
8	Sukallaya Kasem, Gopal B. Thapa. "Sustainable development policies and achievements in the context of the agriculture	1%

	sector in Thailand", Sustainable Development, 2012 Publication	
9	Slameto, Meidaliyantisyah, A Irawati, W Wibawa. "Study on production of several soybean varieties with corn intercropping system on dry land in East Lampung, Lampung Province", IOP Conference Series: Earth and Environmental Science, 2021 Publication	<1 %
10	download.atlantis-press.com Internet Source	<1 %
11	Dasih Rahmawati, Sri Nuryani Hidayah Utami, Cahyo Wulandari. "Chapter 5 Effectiveness of Manure Addition and Mycorrhiza on Phosphorus Uptake and Yield of Maize in Kalitirto Inceptisol", Springer Science and Business Media LLC, 2017 Publication	<1 %
12	www.kiran.nic.in Internet Source	<1 %
13	ia802807.us.archive.org Internet Source	<1 %
14	www.athens2014.biowaste.gr Internet Source	<1 %
15	ojs.unm.ac.id Internet Source	<1 %

16	www.unud.ac.id Internet Source	<1%
17	Asih Indah Utami, Sri Nuryani Hidayah Utami, Siwi Indarti. "Chapter 3 Influence of Cow and Chicken Manure on Soil Fauna Abundance and N Uptake by Rice in Conversion from Conventional to Organic Farming System", Springer Science and Business Media LLC, 2017 Publication	<1%

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	On		