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The Effect of Composting Liquid Organic Fertilizer Processing Residues on Compost Quality

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ABSTRACT: The Quality of compost can be described with a content of total N, P_2O5 and K_2O. Liquid organic fertilizer processing residues still contain organic material that can be decomposed by microbes into inorganic materials needed by plants. C/N ratio affects the activity of the bacteria decompose organic matter. This study aims to determine the content of N, P, and K compost from integrated processing beef cattle waste with a various C/N. The experiment using completely randomized design with 3 treatments of C/N ratio: T_1 (C/N 20), T_2 (25), T_3 (30). The composting process is carried out for 35 days. Mixture used rice straw as a carbon source. Statistics analysis with ANOVA and difference of influence between treatments studied to use Tukey's test. The results showed that: (1) total N content in each treatment were significantly different, with a total N content of each treatment of 2.31% (T_1), 2.80% (T_2), and 2.48% (T_3). (2) P_2O_5 content between treatments did not show significant differences, with P_2O_5 content of each successive treatment of 1.31% (T_1), 1.14% (T_2), and 1.13% (T_3). (3) the content of K_2O show significant differences between treatments, with K2O content of each successive treatment 11,1% (T_1), 11,8% (T_2), and 11,29% (T_3).

Keywords: compost, organic, fertilizer, C/N ratio, N, P_2O_5, K_2O

INTRODUCTION

Currently it has developed a livestock waste treatment methods in an integrated manner, so that the various outcomes such as liquid organic fertilizer, solid organic fertilizer, biogas, and probiotics can be produced in a series that begins with the initial decomposition process. Decomposition early (pre-decomposition) aims to remodel the organic material into simpler compounds, breed microorganisms decomposing biomass as a raw material liquid organic fertilizer, and reduce pathogenic microorganisms (Hutchison, *et al.,* 2005; Mupondi, 2011; Singh *et al.,* 2011). Decomposing microorganisms will grow quickly within 24-72 hours and the substrate temperature reaches 49-60 ^oC (Cooperband, 2000). Upon entering the phase of fermentation mesophilik dismissed, then dried to 15 % moisture content. The result of pre-decomposition namely 'decomposan'.

Liquid organic fertilizer is made through a process of extraction 'decomposan' dried so that would be obtained filtrate which is the raw material for liquid organic fertilizer, and residue in the form of residual solids extraction. POC residue contain of organic material not decomposed yet, so that the composting process can be continued. There are several requirements that the composting process is going well, including C/N ratio. The composting process is well on the C/N 20-40 (CSIRO, 1979; Singh *et al*., 2011) Residue Composting POC has C/N 13.43 (Marlina,

2014), therefore the necessary additional material as a carbon source in order C/N ratio is ideal, one of which is rice straw. Rice straw is an agricultural waste which have C/N ratio of 44.5 (Marlina *et al*., 2014).

The content of nitrogen (N), phosphorus (P), and potassium (K) as the primary macro nutrients in the compost is an indicator of the quality of compost. Compost quality standards in Indonesia, which contains elements of N minimum of 0.40 percent, 0.10 percent minimum P, and K minimum 0.20 (National Standardization Agency, 2004). This research studied the effect of C/N ratio of the content of N, P, and K on the compost residue liquid organic fertilizer.

MATERIALS AND METHODS

Composting preparation. Residues of liquid organic fertilizer mixed with rice straw to produce the C/N ratio of 20: 1; 25: 1; and 30: 1 in accordance with the treatment. The content of C and N were analyzed at the Laboratory of Research and Services Padjadjaran University Chemistry Department. Water content is 50% for ideal composting. Compost temperature measurement is done every day. Composting is carried out for 30 days.

Statistical Analysis. To campare the difference in N, P, K content of different treatments, the data were analized by analysis of variance with a test criterion (F statistic). The Tukey multiple-comparison procedure of the Statistical Analysis System (2001); SPSS was used.

Analyzing factors on Parameters. N content was analyzed by Kjeldahl method, analysis of P by measuring phosphate (P_2O_5) using a spectrophotometer, and K analysis using AAS (Atomic Absoption Spectrophotometer).

RESULT AND DISCUSSION

N total Content

Total nitrogen is an essensial nutrien for plants and animals. Total nitrogen is the sum of total kjeldahl nitrogen (ammonia, organic and reduced nitrogen) and nitrate-nitrite. Total Nitrogen in compost from liquid fertilizer residues varied between treatments. Achieved the highest N content in C/N 25 is 2.80% and the lowest N content in the C/N 20 is 2.31% (Table 1). Composts typically have low N content, ranging from 0.8 to 2.0% (Stoffella and Kahn, 2001). Consequently, additional N must be supplied from other sources, which may include legume cover crops (Millner *et al.*, 2009).

Tabel 1. The content of total N, P_2O_5 and K_2O on composting residual liquid fertilizer production

Treatment	Content (%)		
	N	P_2O_5	K_2O
T1	2.31±0.27[a]	1.31±0.49[a]	11.10±0.56[a]
T2	2.80±0.32[b]	1.14±0.27[a]	11.80±0.73[a]
T3	2.48±0.37[a]	1.13±0.35[a]	11.29±0.68[a]

*) T1 = C/N 20; T2 = C/N 25; T3 = C/N 30;

The higher the C/N ratio greater carbon content and the smaller N content in the substrate. C/N ratio is ideal for the composting process 25-40 (Millner *et al*., 2009), but the C/N is optimal for rapid composting process is 25: 1 with water content of 45-60% (Cooperband, 2000).
The supply of carbon relative to nitrogen (C/N ratio) determines whether net mineralization or

immobilization of nitrogen will occur. Mineralization is conversion of organic nitrogen to mineral forms (ie, ammonium and nitrate). Immobilization is incorporation of nitrogen into microbial biomass (Cooperband, 2000). In the high C/N ratio, microbes will immobillize nitrogen into their biomass, while the C/N ratio is low nitrogen can be lost to the atmesphere as ammonia gas (Gaskell and Smith, 2007). Because the residual processing liquid fertilizer already passed the initial decomposition process, then partially degraded organic material by microorganisms. Therefore, the process of composting for 30 days, the compost has reached a good maturity that is reflected by the high N content in the C / N 25. In general, the benefit of fertilizer is to provide nutrients for plants. Therefore there are requirements that must be met as fertilizer quality standards contained in the Indonesian National Standard (BSN, 2004).

P_2O_5 Content

Phosphorus (P) and potassium (K) are plant macronutrients. These results provide an indication of the nutrient value of the compost sample. The content of phosphate (P_2O_5) in each treatment did not differ significantly ($P>0.05$).

The content of phosphorus in fertilizers described with the number of total phosphate (P_2O_5). C/N ratio in the substrate will affect microbial activity. The ideal ratio would lead to the reform process to be efficient organic material. However, the amount of Phosphorous content is not related to the amount of N content in composting. Degradation of organic material on the substrate and or phosphorus mineralization processes occur because the role of phosphatase enzymes produced by microorganisms (Poincelot; Stofella and Kahn, 2001). In the process of composting, P element will be largely used by microorganisms to build cell. Availability of C and N are the ideal bacteria and fungi can remodel lecithin and nucleic acids and liberate phosphorus as phosphate (Sutedjo, 1996).

K_2O Content

The content of potassium (K_2O) on the C/N ratio of 20:1 to 30:1 each treatment did not differ significantly ($P>0.05$). In general, C/N ratio below 35:1 resulted in the composting process is better when it contains nitrogen stable (Darlington, 2013). Compost quality is determined by the substrate material. Compost derived from livestock waste will contain elements of Phosphorous (P) and Potassium (K) is high, while the compost derived from the forage contains high potassium. Research materials derived from animal waste with a mixture of forage that potassium content reaches 11.80 % in treatment C/N 25.

Potassium in the finished compost is much more available for plant uptake than nitrogen because potassium is not incorporated into organic matter. However, some of the potassium can be leached from the compost it is water soluble. Therefore, the study was designed to use a rice sack bag placed in a sheltered spot out of the stream of rain, and the pores in the sack of rice makes the aeration is maintained.

CONCLUSION

Liquid fertilizer residue still contains organic material that can be converted by microorganisms into inorganic material through the composting process. The content of N, P, and K in compost is still qualified as organic fertilizer. Although the nutrient compost is low compared to synthetic fertilizer products, compost is usually applied as greater rates and therefore nutrient contribution can be significant.

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