Journal Homepage: -www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI:10.21474/IJAR01/8208
DOI URL: http://dx.doi.org/10.21474/IJAR01/8208
ISSN NO. 2320-5407

RESEARCH ARTICLE

UTILIZATION OF WASTE IN BEEF CATTLE LIVESTOCK IN SUPPORTING THE DEVELOPMENT OF CORN AGROINDUSTRY

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Manuscript Info

Manuscript History

Received: 16 October 2018
Final Accepted: 18 November 2018
Published: December 2018

Keywords:-
Livestock waste, beef cattle, development, agroindustry, corn

Abstract

The availability of fertilizer has always been the issue in Indonesia's agriculture, including in the corn agroindustry. One offer to the solution is integrating the beef cattle livestock to the corn agroindustry where farmers can manage livestock manure as organic fertilizer for their crops and utilize corn waste as animal feed. The purpose of this study is to engineer the traditional/commercial beef cattle composting and provide added value to the industry. We designed the composting using anaerobic system with treatments of T_1, T_2, C_1 and C_2 (4 kg of traditional/commercial beef cattle waste mixed with an EM4 solution with a concentration of 5 ml and 10 ml / l water). Compost material was stirred evenly, put in hollow polybags on a sealed plastic bucket, fermented for 40 days and the pile was turned every 3 days. Ripe compost was sun-dried while being turned until dry (no later than three days). Dry compost was finely ground (40-60 mesh), packaged and analyzed for parameters namely yield, moisture content (oven), pH (Potentiometer), organic C (Gravimetric), total N-level (volumeter), total P_2O_5 (Spectrophotometry), K_2O (AAS), C/N ratio. The data obtained were presented descriptively. The analysis revealed that EM4 10 ml/l performed better than 5 ml/l in accelerating the composting process. The C_2 treatment produced compost with a yield of 21.91%, moisture content 10.07%, pH 8.98, P_2O_5 1.79%, K_2O 1.54%, organic C 37.50%, N total 1.80% and C/N ratio 20.83, which was the most appropriate product regarding SNI quality standard.

INTRODUCTION:-

In integrated agroindustry models, farmers overcame the fertilizers availability problem by utilizing beef cattle waste. Farmers used livestock manure as organic fertilizer for their crops and agricultural waste as feed (Ismail and Djajanegara 2004). Wahyuni's research (2010) evidently revealed valuable data that solid dung and cattle's urine was approximately 25 kg/head/day while the urine contains N ± 10 grams/liter, mostly in the form of urea.

Compost is an environmentally friendly organic fertilizer which is important to improve the physical and chemical structure of the soil so that it can enrich nutrients that can spur plant growth (Handayani, 2009, Priadi and

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Ermayanti, 2014). The purpose of this study is to engineer traditional/commercial beef cattle waste processing into compost in supporting the development of corn agroindustry.

Research Methods:-

Time and Place:-

This research was conducted in the Greenhouse of the Faculty of Agriculture, the Islamic University of North Sumatra from June 1 to September 30, 2018, for the preparation, collecting data and writing report.

Materials and Tools:-

The materials used in this study included EM4 and solid/liquid commercial/traditional beef cattle waste obtained from beef cattle farmers around Deli Serdang Regency.

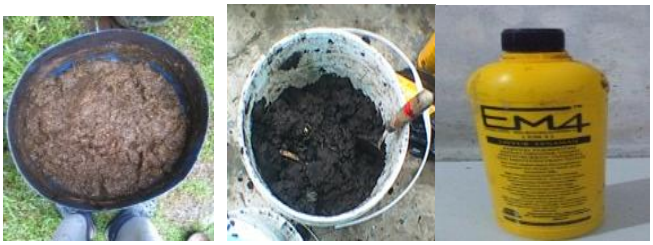

Figure 1:-Compost raw material

The equipment used in this study included 18 kg plastic buckets, polybag, tissue, label paper, plastic packaging, compost cutting machines, greenhouses, scales, ovens, and other analytical tools.

Method

Our research was undergone in an anaerobic composting system. Composting was done following methods:

T_1 = 4 kg of mixed traditional beef cattle waste with an EM4 solution concentration of 5 ml/l of water

T_2 = 4 kg of mixed traditional beef cattle waste with an EM4 solution concentration of 10 ml/l of water

C_1 = 4 kg of mixed commercial beef cattle waste with an EM4 solution concentration of 5 ml/l of water

C_2 = 4 kg of mixed commercial beef cattle waste with an EM4 solution concentration of 10 ml/l of water

The stirred compost material was put into a hollow polybag in a sealed plastic bucket. The soil was checked and was turned every 3 days. It was estimated that after 40 days, the compost was ripe and the decomposition process did not produce foul odor; even the aroma released was similar to the smell of fermentation.

Figure 2:-The process of composting

Next, the compost pile was dried under sunlight and turned regularly (no later than three days). Dry compost was finely ground (40-60 mesh), packaged and tested for several parameters.

Figure 3:-Compost drying and smoothing process

Process
The parameters we tested included yield, moisture content (oven), pH (potentiometer), organic C (Gravimetric), total N-level (Volumeter), total P2O5 (Spectrophotometry), K2O (AAS), C / N ratio (Supatma and Arthagama 2008; Surtinah 2013). Data obtained from the tests were presented descriptively.

Results and Discussion:-

The results showed that the performance of EM4 activator at a concentration of 10 ml / l was better than 5 ml / l since it could accelerate the composting process and produce compost which fulfills the requirements of SNI's (Indonesian National Standard) quality standards for organic fertilizers.

Table 1:-Compost Composition and Treatment Results

Parameter (%)	SNI*		Treatment**			
	Min	Max	T_1	T_2	C_1	C_2
Yield	-	-	16.78	22.86	26.67	21.91
Water content	-	50.00	27.70	15.09	26.69	10.07
pH	6.8	7.49	8.96	9.15	8.92	8.98
P_2O_5	0.10	-	0.77	2.12	0.70	1.79
K_2O	0.20	-	2.48	2.32	1.78	1.54
Organic C	9.80	30.00	46.00	46.23	40.01	37.50
N total	0.40	-	2.20	2.19	2.03	1.80
C/N ratio	10.00	20.00	20.91	22.77	18.27	20.83

Source: * SNI (2004); ** Research Data (2018).

From Table 1, it is clear that in general, the treatments resulted in products of compost which were fulfilling the minimum required value in respect to SNI standard, although there were some parameters in which the analyzed products exhibited greater value from SNI's maximum value, namely pH and organic C.

During the composting process, the brownish color changed to dark brown. At the end of the composting, the color turned into brownish black due to the formation of humic acid. In addition to discoloration, compost released acidic odor/fermentation smell.

The highest yield of compost was C_1. The decomposition process in treatment C_1 relied on the ingredients used, in which cellulose is easier to decompose, compared to lignin. Depreciation of compost material during formulation was due to the decomposition of material by an organic-matters-converting microorganism (into carbon dioxide, water, hummus, and energy) during the composting. Our results were in accordance with Wahyono et al. (2011), explaining that the final depreciation of mature compost is about 50-75% of the initial weight of compost.

The entire product of our experiment met the SNI 19-7030-2004 standard with <50% moisture content. Compost raw materials which were rich in easily-decomposed organic matters yielded low moisture content product. Organic matters are decomposed into carbon dioxide, water and compost (Arumsari et al., 2012).

In contrast, the product of all treatments failed to meet SNI 19-7030-2004 standard about pH, owing to the fact that the commercial beef cattle waste used as the raw material contained high base substances such as concentrates and vitamins.

P_2O_5 content in compost depends on the amount of phosphorus in the raw materials and the number of microorganisms in the composting process (Miftahul 2003). All treatments produced mature and stable composts, and the results fulfilled SNI 19-7030-2004 standard, which is $P_2O_5 > 0.1\%$.

The measurement of K_2O levels of all samples displayed quite a high number, exceeding the minimum requirement of SNI 19-7030-2004 (0.2%). Our analysis on results suggested that the addition of EM4 as an activator on compost influences the levels of K_2O. Potassium is used a catalyst by the microorganisms in the substrate. The presence of bacteria and its activity would significantly affect the decrease in potassium content. This aligned with the statement in Agustina (2004), that potassium is a compound produced by microbial metabolism where microbes use free K^+ ions presented in the raw materials of fertilizer for metabolic purposes.

Analysis of C-organic from all products exceeded the requirement of SNI 19-7030-2004, which should be >30%. The high amount of organic C was because beef cattle waste contained high carbon from corn stover and concentrate as the feeds. This was in line with the explanation of Jannah (2003) that microorganism activity produces C element during the decomposition of organic matter, hence the level of organic C increases.

The total N level of all treatments was relatively high, exceeding the baseline of 0.40% as in SNI 19-7030-2004. Decomposition of organic matter by microorganisms in the composting process will produce a number of nitrogen elements and is one of the key parameters regarding the quality of organic fertilizers. The greater the content of N, P and K in compost, the better the compost is when used on plants as it provides sufficient nutrients for plants and soil (Putro et al., 2016).

According to Sutanto (2002), the essential principle in composting is to reduce the value of C/N ratio of the material as close to C/N ratio of soil, which about 10-12, or less than 20. Analysis of C/N ratio of all samples exceeded the maximum value of SNI 19-7030 -2004, which is 20%. The treatments resulted in a high C/N ratio, owing to the high carbon feed (corn stover and concentrate) of the beef cattle, resulting in high carbon manures as well. Sulaeman's (2011) research also supports this result, in which he stated compost materials such as husks, rice straw, corn stalks, and sawdust have a C/N ratio between 50 and 100.

Conclusions and Recommendations:-

The results of the composting study revealed that the EM4 10 ml/l was better than 5 ml/l in terms of accelerating the composting process of formulations of compost material. C_2 treatment produced compost with a yield of 21.91%, moisture content 10.07%, pH 8.98, P_2O_5 1.79%, K_2O 1.54%, organic C 37.50%, N total 1.80% and C/N ratio 20.83; of all was the most appropriate product regarding the quality standard of SNI.

Suggestions:-

1. It is necessary to conduct a similar study with the addition of beef cattle waste to the formulation of compost material (2:2) and consider the time of fermentation to obtain higher quality compost with a C/N ratio fulfilling the quality standard.
2. To follow up and support the development of integrated corn agroindustry in Deli Serdang Regency, North Sumatra, it is recommended to put the research results into application.

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