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Abstract. The study evaluated the quality of organic fertilizer on the different ratios of cow manure and laying hens manure. The study used a completely randomized design with five treatments, such as T0 (100% cow manure), T1 (75% cow manure and 25% laying hens manure), T2 (50%cow manure and 50% laying hens manure), T3 (25% cow manure and 75% laying hens manure) and T4 (100% laying hens manure). The parameters observed in this study contained nitrogen (N), phosphor (P), potash (K), carbon (C) organic, C/N ratio, and pH. The results showed the ratio of cow manure and laying hens manure had a significant effect ($P<0.05$) on the content of the N, P, K, C organic, and the C/N ratio, but no significant effect ($P>0.05$) on pH. The fertilizer with laying hens manure had the highest ($P<0.05$) contain N (1.57%), P (1.39%) and K (1.31%), but the lowest of the C/N (14.67%).

1. Introduction

Production on animal husbandry contributed to a daily human being not only in a positive benefit to supply the protein needs but also had the negative effect was pollute from excessive manure. Generally, manure was a source of N and P elements that could be increased in organic soil fertility and a source of nutrients for plants. But there are many problems from N and P pollution from manure to water bodies, methane emissions, and odor pollution because of not death properly[1]. Manure was a serious issue, especially in poultry.Manure that dumped become pollutant who impact of the environment wich essentially support lives such as air, water, and soil caused impairing the welfare of the environment, reducing the quality of life, a source of disease, triggering increased of methane gas and also disorder in aesthetics and comforts[2]. Because of that, proper waste treatment needed to reduce the impact of pollution.

Manure could be utilized in a different way of the process as making fertilizer, biogas, and manufacture of bio charcoal materials. The simple way to process the manure was making organic fertilizer [3]. Organic fertilizer could improve texture and structure because it can add macronutrients (nitrogen, phosphorus, potassium, calcium, magnesium, andsulfur) and micro (zinc, copper, cobalt, barium, manganese, and iron) in the soil, besides that it also a source of plant nutrients and could reduce excessive anorganic fertilizer.Organic fertilizer processed by fermentation using Effective Microorganism (EM4)[4]. Manure that processed become organic fertilizer was to minimize the problem arising from animal husbandry and also making income and increased selling price than used industrial fertilizer [5]. So far manure of goats and chickens was limited used for making organic fertilizer unlike cow manure, and with this study was expected to use the laying hen manure become

organic fertilizer and determine the quality of organic fertilizer with a ratio of the of cow manure and laying hens manure.

2. Methodology

The research was done at the Agriculture and Rural Training Centre in Jember Regency for making organic fertilizer. It wasthen analyzed at the Research Center ofCoffeeand Cocoa of Jember.

The materials used for making organic fertilizer were cow manure, laying hens manure, 300 g of dolomite, 300 g of a smooth brand, 100 mL of EM4, 100 mL of molasses, and 2500 mL of water. Those solutions weresprayed on the materials until moderately wet. After all the materials and solutions were mixed properly, they were made it into the mound and covered with gunny sack for 14 days. The everyday temperature was measured. The reversal of materials was done when the temperature was too high more than 50°C. On the 5^{th} to 7^{th} days, reversal was done to all of the treatments. Two days one reversal on the 8^{th} to 14^{th} days for homogenous fermentation to each organic fertilizer.

The method used in this research was a Completely Randomized Design with different ratios of manure used as a treatment. Each treatment was repeated four times. The treatments were T0: 100% cow manure, T1: 75% cow manure + 25% laying hens manure, T2: 50% cow manure + 50% laying hens manure, T3: 25% cow manure + 75% laying hens manure, and T4: 100% laying hens manure

2.1. Parameter of Research

Research parameters consisted of N, P, K, C Organic, C/N Ratio, and pH

2.2. Statistical analysis

The data were analyzed by using variance analysis (ANOVA) when the treatment was significantly different ($P<0.05$) or ($P<0.01$) followed by Duncan Multiple Range Test (DMRT).

3. Results and Discussion

3.1. N Element

Based on Table 1 showed that Nitrogen content in T0 treatment on organic fertilizer had the lowest result of all treatment with an average content 0.76% of N, compared with the highest with an average content 1.57% of N in T4. Similar to reference [6] poultry manure had higher N content than other livestock. All treatment has met the standard of [7] minimal contained 0.4 % of N organic fertilizer. The results of statistical analysis showed that significantly affect ($P <0.05$) for each ratio fertilizer treatment to N element. The results of Duncan's showed that the N element on T0 treatment was significantly different fromT1, T2, T3, and T4. T2 was significantly different fromT3 and T4. T3 was significantly different fromT4.

Table 1. Results of Analysis of Organic Fertilizer

Parameters	Treatments				
	T0	T1	T2	T3	T4
N (%)	0.76^{a}	0.86^{b}	0.99^{c}	1.40^{d}	1.57^{e}
P (%)	0.93^{a}	1.19^{b}	1.25^{c}	1.38^{d}	1.39^{d}
K (%)	0.88^{a}	0.93^{b}	1.00^{c}	1.10^{d}	1.31^{e}
C Organic (%)	16.34^{a}	19.03^{ab}	21.83^{bc}	24.96^{c}	23.04^{c}
C/N	21.46^{bc}	22.16^{c}	22.06^{c}	17.83^{ab}	14.67^{a}
pH	7.53^{a}	7.40^{a}	7.43^{a}	7.43^{a}	7.73^{a}

^{a,b,c,d,e}Different superscript at the same column indicated significant difference ($P<0.05$).

The differences of N element on organic fertilizer was influenced by food consumed by the livestock. The more protein content in food would impact to the rough protein on manure content. The high protein content would influence the N content which will be broken down in the making process

of organic fertilizer. This was appropriate with research by [8] that rough protein on cow manure which was given corn leaves as the food was 8.9%, lower than laying hens manure which had rough protein 12.69%.

Addition of bran for the making process of organic fertilizer also affected the N element content. The bran was fermented by bacteria contained on EM4. Fermentation to bran would decrease crude fiber, increased rough protein and gross energy content of bran. The decreased of crude fiber was caused by a fermentation process that changeslignocellulose bond so that those compounds of carbohydrates break down into simpler one [9].

3.2. P Element

Based on Table 1 showed that Phosphorus content in P0 treatment of organic fertilizer had the lowest result of all treatment with an average content 0.93% of P, compared with the highest with an average content 1.39% of P in P4 treatment. All treatment has met the standard of [7] minimal contained 0.1 % of P organic fertilizer. The results of statistical analysis showed that significantly affect ($P < 0.05$) to each ratio treatment of organic fertilizer. The results of Duncan showed that T1 was significantly different from T2, then T2 was significantly different from T3, but T3 was not significantly differentfrom T4. These differences were caused by the number of bacteria. EM4 contained mix culture of several microorganismsinclude Lactic acid bacteria: *Lactobacillus plantarum, Lactobacillus casei, Streptococcus lactis*;Photosynthetic bacteria: *Rhodopseudomonas palustrus, Rhodobacter spaeroides*; Yeast: *Saccharomyces cerevisiae, Candidia* utilis; and *Actinomycetes*: *Streptomyces albus*, *Streptomyces griseus*[10]. Phosphates solvent bacteria used N for metabolism and produced phosphatase enzymes then broke phosphatase into phosphor [11] causing P element content also increased along with the increase of amount laying hens manure ratio in each treatment. The more phosphates solvent bacteria and N element,the P element content would increase too. According to [12] used *Saccharomyces cerevisiae* to fermentation the liquid fertilizer from the processing of beef cattle manure. The greater of the nitrogen contentmicroorganism multiplication that change phosphor would increase too, so the phosphor that contenton the liquid fertilizer also increased.

3.3. K Element

Based on Table 1 showed that the K element content in T0 treatment of organic fertilizer had the lowest result of all treatment with an average content 0.88% of P, compared with the highest with an average content 1.31% of P in T4 treatment**.** The statistical analysis had significantly affect ($P < 0.05$) on each ratio treatment of organic fertilizer on the K element. The results of Duncan showed that T0 was significantly different fromT1, T2, T3, and T4. T2 was significantly different fromT3 and T4, T3 was significantly different from T4. According to [4] stated that cow manure contained 0.75% of K, not much different with the result of this study 0.88%. K element was soil nutrient that needed for plants for flowering and fertilization, important in carbohydrates metabolism processed, activator enzymes, set osmotic pressure, efficient use of water, absorption nitrogen and synthesis protein. If Kdeficient crops happened, the supply of sink organs with photosynthates is impaired, and sugars accumulate in source leaves [13]. All treatment hassimilarto the standard of [2] minimal contained 0.2% of the K element fertilizer.

3.4. C Organic

Based on Table 1 showed that C Organic content in T3 was the highest result with average content were 24.96%. T3 was the highest value of C organic because of T3 arranged with two kinds of material such as 75% laying hens manure and 25% cow manure, where laying hens manure is known contained more C organic than cow manure.The results of the statistical analysis of variance showed that there was a significant difference ($P<0.05$) to the content of C organicfertilizer. The result of Duncan showed that T0 was significantly different fromT2, T3, and T4, then T1 was significantly different from T3 and T4.

According to [14] about organic fertilizer, biological fertilizer, and soil cleaners, the value of C organicin all treatments was above the minimum limit of the predetermined parameters that are at least 15%. The content of C organic elements also affects the organic fertilizer. It was used by microbes as an energy source for the fermentation process, which converts organic compounds into simpler forms. If the number of Carbon source high, the result of a linear increased C organic in the fermentation, but decreased pH value and N, P, K elements [15].

3.5. C/N Ratio

Based on Table 1 showed that C/N Ratio value content in T1 treatment of organic fertilizer had the highest result with an average content of 22.16%, compared with the lowest with an average content 14.67% of the C/N ratio in T4. This value has similar to the standards of organic fertilizer according to [14] indicated the allowable value was 15 to 25%. The T0, T1, T2, and T3 have similar to the standard, except the T4 which is slightly below the standard of 14.67%. The results of the statistical analysis of variance showed that there was a significant difference ($P< 0.05$) to the content of the C/N ratio in the organic fertilizer. The result of Duncan showed that T0 was significantly different from T4 then T1 was significantly different from T3 and T4, and T2 was significantly different from T3 and T4.

3.6. The C/N value was the level of quality indicator or the level of maturity of the material used as fertilizer. Carbon in the degradation process was needed for energy and growth needs, N was used to meet proteins as building blocks of metabolic cells. In the process of making microbial fertilizer using C to obtain energy and N to synthesize protein. According to [16] stated that if the C/N ratio value was too low because of the raw material was rich in nitrogen, carbon would be a limiting nutrient or nutrient absorption activity would be limited by carbon content. On the other side, if the C was too low and the N was high, it would produce ammonia gas (NH3) which was characterized by a pungent odor. The low C/N ratio is also affected by temperature. In accordance with the research of [17] stated that the optimal temperature which could reduce the fastest of C/N ratio was 55° C. That was suitable with the value of the C/N ratio on the treatment of T3 and T4 where the initial temperature of fertilizer making reaches more than 50°C and gradually decreased until the 14th day, and had high C value which produced a lower the C/N ratio value than the T0, T1 and T2. The influence of time and the amount of concentration of microorganisms used also affected the value of the C/N ratio. If more concentration of EM4 used, the number of bacteria that decomposed the material, so the material decomposes faster by these bacteria and the length of the processing time made the C/N ratio decreased [4].

3.7. pH

Based on Table 1 showed that the pH value content in P4 treatment of organic fertilizer had the highest result with an average were 7.73%, compared with the lowest with an average of 7.40% in T1**.**The results of the statistical analysis of variance showed that there was no significant difference ($P< 0.05$) to the content of pH value in each organic fertilizer treatment. From the first day of making the lowest pH was 6.75 in theT0 and the highest was 7.28 in the T3.

From the start of measurements on the first day to the 14th day, the pH value did not change much. That was due to the effect of adding dolomite on the drying processed of manure before it was refined. According to [18] the effect of dolomite fertilizer was the increase of soil pH that made a suitable environment for the development of soil microbes in this case the decomposition processed could run well so that nutrients such as Nitrogen and C organic were available. Acidic soils could be improved by adding dolomite which served to increase soil pH. According to [14] the pH value at the end of the fertilizer manufacturer has fulfilled the requirements, which was between 4 to 9, so the pH value of all organic fertilizer treatments has normal limits.

4. Conclutions

Organic fertilizer used 100% of laying hens manure contained the highest of N, P, and K element; the C/N value of almost all treatments has met the maturity rate of organic fertilizer, and pH value t of organic fertilizer has in normal limits.

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