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Effect of adding sawdust and husk ash on N, P, K and C-organic content in making goat manure compost

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ABSTRACT

This research aims to determine the effect of adding sawdust and husk ash on the N, P, K and C-Organic content in making goat manure compost. Materials used in making compost include: sawdust, husk ash, goat manure, EM4, water and palm sugar. This research was conducted using the Completely Randomized Design (CRD) method consisting of 5 treatments and 4 replications. The percentage ratio of goat manure, sawdust, and husk ash used in each treatment is A (100:0), B (75:25), C (75:25), D (75:12.5:12.5) and E (50:25:25). The variables observed were levels of N, P, K, and C-Organic. The data obtained were analyzed using the F test, followed by Duncan's Multiple Range Test (DMRT) with a 95% confident level. The result shows that the addition of sawdust and husk ash to composting goat manure had no significant effect ($p>0.05$) on the N, P and K content, but had a significant effect ($p<0.05$) on organic C. It can be concluded that Compost with the addition of sawdust and husk ash in compost has no significant effect ($p>0.05$) on the N, P, and K content but has a significant effect ($p<0.05$) on the organic C. Based on the results of research that has been carried out regarding the addition of sawdust and husk ash to making goat manure compost, it was found that the chemical parameters of the compost in the form of Nitrogen, Phosphorus, Potassium, and C-organic are by SNI 19-7030-2024.

Key words: Compost, Goat manure, Nitrogen, Organic C, Phosphorus, Potassium.

INTRODUCTION

Compost fertilizer is organic fertilizer obtained from the weathering of plant materials or organic waste such as straw, husks, leaves, organic waste from factory processing, and organic waste resulting from human treatment. Composting is generally done to create a microenvironment suitable for the growth of microorganisms. Composting can also be accelerated with specific treatments to produce good-quality compost quickly. Quality compost has a pH of 6.80-7.49. Physically, mature compost has a blackish-brown color, crumbly texture, and no smell (Trivana et al., 2017).

Sawdust is the raw wood material processed using a wood saw and then converted into small pulp. Sawdust, waste for industrial companies, can be used as a business opportunity as raw material for compost fertilizer. However, so far, waste in the form of sawdust has yet to be utilized optimally. One alternative that can be taken to reduce sawdust waste is to use sawdust waste as compost. Sawdust has excellent potential as a fertilizer because it can optimize the absorption of water and nutrients in plants to improve plant fertility. Sawdust contains chemical components such as cellulose, hemicellulose, lignin, and extractive substances (Tatogo, 2010).

Besides using sawdust, husk ash is also a good material for compost fertilizer, which is easy to obtain at a small cost. It can reduce waste resulting from burning in the rice industry. Because husk ash contains the elements Phosphorus (P), Potassium (k), Calcium (Ca), and Magnesium (Mg), the relatively high potassium content in husk ash plays a crucial role in plant growth; apart from that, it also helps increase the pH and structure of the soil so that better

(Tamtomo et al., 2015) so that husk ash waste can also be helpful as an additional goat manure compost.

Compost fertilizer derived from goat livestock is relatively easy to obtain as the primary source of nutrients in organic cultivation, where goat manure has a water content range of 64%, organic matter 31%, nitrogen 0.70%, P2O5 0.40%, K2O 0, 25%, CaO 0.40% and a C/N ratio of 20-25%, the need for manure is enormous because of its low nutrient content (Eky, 2019). The benefits and results obtained are waste from animal waste (feces), which is helpful as organic fertilizer, which is environmentally friendly and can be used as fertilizer. Organic fertilizer contains macro and micro nutrients for plants and can save costs. Paying close attention will result in air pollution, which can also attract insects and affect environmental sanitation; this is caused by livestock manure, which contains relatively high ammonia levels. Therefore, it is necessary to process livestock manure into something more practical and economically valuable.

MATERIALS AND METHODS

Research materials

The materials used in this research are 30 kg of goat manure obtained from Nagari Bukit-Bual breeders, 5 kg of sawdust from woodworking equipment entrepreneurs, 5 kg of husk ash from rice processing hullers, and one bottle of EM4. The tools used for the research were shovels, hoes, plastic tarpaulins, scales, plastic buckets, spectrophotometers, Walkley Black, Kjeldhal, HNO3, and HCLO4 extracts. Analysis solutions are standard solutions of sulfuric acid (H2SO4), boric acid, Conway indicator, selenium mixture, sodium hydroxide (NaOH), potassium dichromate (K2Cr2O7), standard solutions, distilled water, nitric acid (HNO3) and perchloric acid (HClO4).

Research design

This research was conducted experimentally using a completely randomized design (CRD) consisting of five treatments and four replicates. The treatment was carried out to compare the chemical composition of goat manure compost between those added with sawdust and rice husk ash. The five treatments were: A (100% goat manure as a control), B (75% goat manure : 25% sawdust), C (75% goat manure : 25% rice husk ash), D (75% goat manure : 12.5% sawdust : 12.5% rice husk ash), and E (50% goat manure : 25% sawdust : 25% rice husk ash).

Observed variables

The observed variables are the N, P, K, and C-organic levels, measured by conducting tests according to the National Standardization Agency Standards and laboratory tests. Meanwhile, making compost begins with preparing the tools and materials. The next step is to mix the main compost ingredients according to the treatment. Each treatment has four repetitions, so there are 20 treatment units. Each treatment unit is given a mixture of EM4 and water as a starter to maintain humidity during the composting process. After evenly mixing the ingredients, they are stored and covered with tarpaulin to create an anaerobic atmosphere. The compost-checking process is carried out on the third day and is turned over. After 21 days, the composting process is considered complete, and testing is carried out on the chemical composition of the compost.

Statistical analysis

Data obtained from the results of the study were analyzed using the F-test with a confidence level of 95%. Furthermore, if the results of the analysis showed a significant difference between treatments, then continued with Duncan's Multiple Range Test (DMRT)

with the same confidence level of 95% and presented in the average ± standard error means (SEM). SPSS program version 25.0 (SPSS Inc., Chicago, IL) was used for data processing.

RESULTS AND DISCUSSION

Nitrogen (N)

The average Nitrogen value of goat manure compost with different levels of sawdust and husk ash addition can be seen in Table 1. The results showed that adding sawdust and husk ash to the compost has no significant effect ($p>0.05$) on the nitrogen value of the compost. The average N value of compost fertilizer in this study ranged between 0.54 - 0.58%, where the compost fertilizer complies with SNI 19-7030-2004 standards with a minimum N content of 0.40%. The nitrogen content value in this study was caused by the ability of the EM4 microorganisms used in the composting process to degrade all compost treatments. The EM4 microorganisms that play a role in the composting process are decomposers, lactobacillus sp, lactic acid bacteria, photosynthetic bacteria, Streptomyces, cellulose-decomposing fungi, and phosphorus-dissolving bacteria, which function as natural decomposers of organic materials (Akmal, 2004). The more nitrogen content, the faster the organic material will decompose because microorganisms that decompose compost material need nitrogen to reproduce (Sriharti and Salim, 2010).

The composting process is influenced by the activity of microorganisms in degrading organic material in compost. This condition aligns with the opinion of Yuli et al. (2008), who stated that the N content in compost comes from organic material degraded by microorganisms, so the degradation process dramatically influences the N content in compost. In decomposing compost material, microorganisms need nitrogen for their development (Sriharti and Salim, 2010).

The average N value in this study was around 0.54 - 0.58%, which is considered good but still low compared to Ayu's (2022) research, where the N value in compost ranged from 0.94 - 2.04%. The high carbon content in organic materials can cause this low N value. According to research by Capah (2006), the low nitrogen content can be caused by the removal of nitrogen substances in the form of nitrogen gas or the form of ammonia gas, which is formed during the composting process, and the high carbon content during packaging before analyzing the nutrient content.

Table. Chemical content of Goat Manure Compost

Treatment	N	P	K	C-organic
	……..……..%.....			
A	0,58±0,17	0,45±0,37	0,20±0,38	15,01±1,31^{a}
B	0,56±0,17	0,44±0,42	0,19±0,10	18,22±1,13^{b}
C	0,56±0,22	0,45±0,21	0,21±0,18	15,75±1,04^{a}
D	0,55±0,60	0,46±0,35	0,23±0,51	21,15±0,73^{c}
E	0,54±0,47	0,44±0,41	0,20±0,56	20,12±0,70^{c}

Notes: A (100% goat manure as a control), B (75% goat manure : 25% sawdust), C (75% goat manure : 25% rice husk ash), D (75% goat manure : 12.5% sawdust : 12.5% rice husk ash), and E (50% goat manure : 25% sawdust : 25% rice husk ash). N: Nitrogent, P: Phoporous, K: Kalium, C/N: Carbon/Nitrogent. Mean values in the same collum with different superscript letters differ significantly ($p<0.05$).

Phosphorus (P)

The average Phosphorus value of goat manure compost showed that the addition of sawdust and husk ash to the compost had no significant effect ($p>0.05$) on the phosphorus value of the compost. The data in Table 1 showed that the results of the average P value in this study ranged between 0.44 - 0.46% based on the results of the data analysis, so the P content in compost fertilizer has met the minimum requirements set by SNI 19-7030-2004 namely 0.10%.

The value of Phosphorus content in this study is due to the P2O5 content in the composting process being in line with the N content in the compost, in line with the opinion of Yuli et al. (2008), which states that the (P2O5) content in compost is related to the N content in the compost. The greater the nitrogen contained, the more the multiplication of microorganisms that break down phosphorus will increase, so the phosphorus content in the compost material also increases (Stofella et al., 2001). Most microorganisms will use the phosphorus content in compost material to build their cells. The breakdown of organic matter and the process of assimilation of phosphorus occurs due to the presence of phosphatase enzymes produced by some microorganisms.

Wahyono et al. (2003) stated that if N is available in sufficient quantities in the composting process, then the P element is also available in sufficient quantities. The higher the total N content, the greater the number of microbes, so with a large number of microbes, the phosphorus that is broken down also increases, and this is one of the determinants of phosphorus levels in compost (Marlina et al., 2010). The presence of the nutrient element phosphorus is caused by the weathering of organic materials used as compost. According to Novizan (2002), phosphorus mostly comes from the weathering of natural mineral rocks; the rest comes from the weathering of organic materials.

The average P value in this study ranged between 0.44 - 0.46% based on the results of the data analysis, so the P content in compost fertilizer has met the minimum requirements set by SNI 19-7030-2004, namely 0.10%. The average P value in this study is the same as research by Trivana et al. (2017) on the effect of adding goat manure on the results of composting dry leaves, namely a P-Total value of 0.45%.

Potassium (K)

The addition of sawdust and husk ash to the compost has no significant effect ($p>0.05$) on the potassium value of the compost. The average K value in this study ranged between 0.19 - 0.23% based on the results of the data analysis, so the K content in compost fertilizer met the minimum requirements set by SNI 19-7030-2004, namely 0.20%. The low K content in this study was caused by the organic material of the compost being dense and dry and containing wood lignin, which can inhibit the decomposition process by the opinion of Yulipriyanto (2009) that the higher the lignin, the slower the decomposition.

The potassium content value in this study was caused by the EM4 microorganisms used in the composting process, which were able to work in all compost treatments. However, the K content results in this study were considered low because the activity of the microorganisms in decomposing organic matter was slow. This condition is in line with the opinion of Mulyani (2013) that variations in potassium content values are caused, among other things, by differences in the speed of microorganisms in carrying out the decomposition process of organic material during fermentation. The speed of microorganisms in the decomposition process of organic material is also influenced by the material that is decomposed by the microorganism. According to Luo et al. (2007), if the compost water content is too high or too low, it will affect the composting process.

The results of K levels in this research are classified as low because they only range from the SNI minimum value and are compared with research by Barus (2011) regarding testing the effectiveness of straw compost and NPK fertilizer on rice yields using PROMI activator, producing potassium levels of 0.69% which is considered good.

C-organic

The addition of sawdust and husk ash to the compost had a significant effect ($p<0.05$) on the C value of the compost. The lowest average C value was in treatment A, 15.01%, while the highest average C was in treatment D, 21.15%. The average C-organic value of compost significantly differed with the addition of sawdust and husk ash in making goat manure compost. Treatment A was significantly different ($p<0.05$) from treatments B, D, and E but not significantly different ($p>0.05$) from treatment C. Treatment B was significantly different ($p<0.05$) from treatment A, C, D, and E. Treatments D and E were significantly different ($p<0.05$) from treatments A, B, and C.

Nilai C-organik untuk masing-masing rata-rata berkisar antara 15,01%, 18,23%, 15,75%, 21,15%, dan 20,12%. Nilai kandungan C-organik terendah terdapat pada perlakuan A dan C. Kondisi ini mengindikasikan adanya penurunan kandungan C-organik bahan organik pada perlakuan A dan C yang dapat diuraikan secara optimal oleh mikroorganisme EM4 selama proses pengomposan. Hal ini sesuai dengan pernyataan Badan Penelitian dan Pengembangan Pertanian (2011) bahwa mikroorganisme akan menguraikan C organik pada bahan kompos, digunakan sebagai sumber energi, dan diubah menjadi CO2 untuk pertumbuhan dan perkembangannya. Menurut penelitian Novitasari dan Caroline (2021) yang meneliti tentang efektivitas pupuk dari kotoran sapi, kambing, dan ayam, yang dilakukan dengan metode anaerobik, kandungan C-organik kotoran ayam sebesar 13,38%, hal ini terjadi pada saat pengomposan terjadi penguraian bahan organik. tempat hidup yang ideal bagi mikroorganisme adalah pada kondisi yang lembab dan anaerobik sehingga bahan organik diubah menjadi senyawa organik yang terurai menjadi zat-zat yang siap untuk diserap oleh tanaman (Boga dkk., 2014).

The highest C-organic content value was found in treatment D, namely 21.15%. The highest value in this treatment indicates that the decomposition of organic material in the composting process has yet to proceed optimally. The leading cause of the non-optimal decomposition of organic C is microorganisms that do not grow and develop optimally due to several factors. In treatment D, the high lignin and complex texture of organic materials in the form of sawdust and goat dung granules can be factors causing the non-optimal decomposition process of C-organics in compost, thereby inhibiting the growth and development of microorganisms.

The average C-organic value of compost fertilizer in this study ranged from 15.01 - 21.15%, which is lower than the results of Ayu's (2019) research on the effect of various livestock manure on composting and the quality of compost from coconut fiber with the C-organic value compost ranges from 22.10 - 44.07%. Based on this data analysis, compost meets SNI 19-7030-2004 standards with a minimum C-organic content of 9.80 -32%.

CONCLUSION

Compost with the addition of sawdust and husk ash in compost has no significant effect ($p>0.05$) on the N, P, and K content but has a significant effect ($p<0.05$) on the organic C. Based on the results of research that has been carried out regarding the addition of sawdust and husk ash to making goat manure compost, it was found that the chemical parameters of the compost in the form of Nitrogen, Phosphorus, Potassium, and C-organic are by SNI 19-7030-2024.

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