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Study Of Nutrient Potential Waste Of Catfish, Cow Dung, And Ketapang Leaves As Solid Organic Fertilizer (POP)

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ABSTRACT

Aquaculture will produce waste in the form of manure and there are many ketapang trees whose leaves fall that can be used as a material for making green fertilizer. The purpose of this study was to determine the nutrients, i.e. nitrogen, phosphorus, potassium, C-organic, C/N ratio and pH in solid organic fertilizer (POP) from fish waste water, cow dung and ketapang leaf compost. Fish solid waste is taken from the harvest pond that has been stirred and filtered, while for cow dung and ketapang leaves using the addition of a bioactivator (EM4 + molasses), with treatment (dried ketapang leaves: cow dung: bioactivator) P1 (1 kg : 0.25 kg : 250 ml), P2 (0.875 kg : 0.375 kg : 250 ml) P3 (0.75 kg : 0.5 kg : 250 ml), control (1.25 kg : 0 kg : 250 ml). Composting was carried out anaerobically with a composting time of 28 days. Based on the research results only C-organic and pH of all types of fertilizers as well as C/N ratio of cow dung and ketapang leaves, total phosphorus from fish waste that meets the requirements of the Ministry of Agriculture 70 of 2011, concerning POP, it must contain a minimum NPK of 4%, pH 4-9, C-organic at least 15% and a C/N ratio of 15-25%, while according to the compost standard SNI-19-7030-2004, the levels of nitrogen at least 0.4%, phosphorus at least 0.1%, potassium at least 0.2%, C-organic 27-58% and C/N ratio 10-20%.

Keywords*: fertilizer, POP, macro nutrients*

1. INTRODUCTION

Garbage is the discarded residue of a product or item that can no longer be used and utilized, but still has potential economic value if it is recycled. Types of waste are generally divided into two forms, namely non-organic waste and organic waste. Non-organic waste is waste consisting of inorganic materials such as metal, glass, rubber and plastic. The characteristics of this type of waste are difficult to decompose (durable). Meanwhile, organic waste is waste that comes from living things such as animal remains, vegetables, fruits, leaves and animal dung that are easily decomposed (not durable) (Triwuri et al., 2019).

Organic fertilizers have essential macro and micro elements, but the content of macro elements is usually low such as nitrogen (N), phosphorus (P), and potassium (K). Organic fertilizers can be a good place for microbial populations in the soil compared to chemical fertilizers.

Organic fertilizers are able to improve soil structure, increase micro-organisms, enhance water absorption and storage capacity, so that fertility levels also increase (Fitrah and Amir, 2015).

Organic fertilizers are very useful to increase agricultural production, both quality and quantity, reduce environmental pollution, and can improve the quality of land conditions gradually or continuously. The use of organic fertilizers in the long term can increase crop and land productivity and can prevent damage or land degradation. Sources of materials in the manufacture of organic fertilizers are very diverse, with very diverse physical characteristics and chemical/nutrient content, so that the effects of using organic fertilizers on plants and land can vary. Organic matter has a very important role in increasing soil fertility, both for growth and crop yields (Juarsah, 2014).

Organic waste such as leaves and animal manure both on land and water is one of the materials that can be used as compost. Composting is a method for converting organic matter into simpler materials, either using microorganism activity in the form of microbes to accelerate its decomposition, or without using microbial activity (Andriyeni et al., 2017).

Composting or the manufacture of organic fertilizers is a method for converting or converting organic matter into simpler materials using microbial activity. The manufacturing process can be carried out under aerobic and anaerobic conditions. Aerobic composting is the decomposition of organic matter in the presence of oxygen (air), the main products of aerobic biological metabolism are carbon dioxide, water and heat. Anaerobic composting is the decomposition of organic matter without the use of free oxygen; The end products of anaerobic metabolism are methane, carbon dioxide and certain compounds such as organic acids. Basically, the manufacture of solid and liquid organic fertilizers is decomposition by utilizing microbial activity, therefore the speed of decomposition and the quality of compost depend on the state and type of microbes that are active during the composting process. Optimum conditions for microbial activity really need to be considered during the composting process, for example aeration, growth media and food sources for microbes (Nur, Noor and Elma, 2018)

The existence of organic waste problems caused by both fallen leaves and animal waste, both cow and fish waste, then compost can be a solution to reduce the impact of organic waste. Organic fertilizers have the advantage that they do not contain artificial (non-natural) chemicals, so they are safer for humans and the environment, especially for land use in agriculture (Hartatik, Husnain and Widowati, 2015). The purpose of this activity is to determine the content of nutrients, especially nitrogen, phosphorus, potassium, C-organic, C/N ratio and pH of catfish waste, cow dung and dried Ketapang leaves as solid organic fertilizer (POP) in Widarapayung Wetan Village, Cilacap.

2. RESEARCH METHOD

Research sites

This research was conducted at the Cilacap State Polytechnic Campus (PNC). Taking dried Ketapang leaves on Jalan Setiabudi, Kebon Manis Village, Cilacap. Meanwhile, samples of cow dung and catfish waste were taken in the District of Widarapayung Wetan which is located on the coast of Widarapayung, which is approximately 34.2 km from the Cilacap State Polytechnic.

Research Tools and Materials

The main tools and materials used in this activity are closed containers (buckets) of wastewater from catfish farming activities (solids), cow dung, dried Ketapang leaves, bioactivator (EM4 + molasses), universal Ph, thermometer, pounder and chopper. .

Research Stages

Solid waste from harvested catfish farming ponds is stirred so that liquid and solid waste are evenly mixed, taken using a bucket and filtered to separate liquid and solid, then labeled, and observed in the laboratory.

Cow dung obtained from community farms is dried and pulverized, while the dried ketapang leaves are chopped into smaller sizes, in order to facilitate the decomposition process (Wardana et al., 2015). The total weight of the composting material used was 3.875 kg for dry ketapang leaves, 1.125 cow dung and 1 liter of bioactivator consisting of EM4 + molasses. Variations in the comparison of the compost material used were 4 treatments including controls with details, namely dry ketapang leaf waste: addition of organic cow manure, namely:

- Control (1.25 kg : 0 kg : 250 ml),
- Treatment 1 (1 kg : 0.25 kg : 250 ml),
- Treatment 2 (0.875 kg : 0.375 kg : 250 ml),
- Treatment 3 (0.75 kg : 0.5 kg : 250 ml).

Composting was carried out in an aerobic manner with a composting time of 28 days.

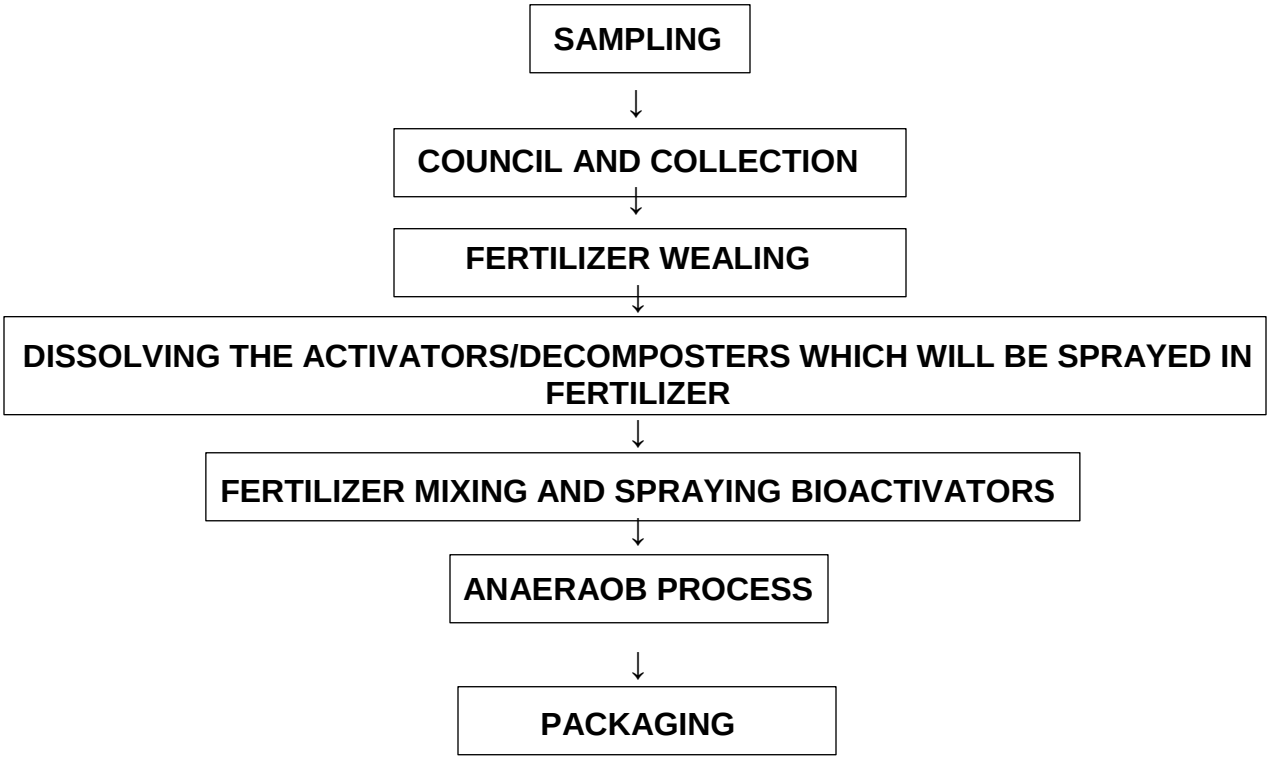

Figure 1. Process flow of organic fertilizer

Effective Microorganisms (EM4)

Many experts argue that effective microorganisms (EM4) are not classified as fertilizers. EM4 is an ingredient that helps speed up the process of making organic fertilizers and improves their quality. In addition, EM4 is also useful for improving soil structure and texture as well

as supplying nutrients needed by plants. Thus the use of EM4 will make plants more fertile, healthy and relatively resistant to pests and diseases (Putra and Ratnawati, 2019).

Here are some of the benefits of EM4 for plants and soil:

1. Inhibit the growth of pests and plant diseases in the soil
2. Help increase the photosynthetic capacity of plants
3. Improve the quality of organic matter as fertilizer
4. Improve the quality of vegetative and generative growth of plants.

The microorganisms contained in it are genetically original, not engineered. Generally EM4 can be made yourself using materials that are easily available. For can speed up the composting process, generally can be done under aerobic conditions because it does not cause odor. However, to speed up the composting process, you can add effective microorganisms (EM4) that takes place anaerobically (actually semi-anaerobic because there is still little air and light). With this method, the resulting odor can actually be lost, if the process goes well. The number of microorganisms/fermenting microbes in EM4 is very large, around 80 genera. Of the many microorganisms, there are 5 main groups, namely photosynthetic bacteria, Lactobacillus sp., Streptomyces sp., yeast (yeast), and Actinomycetes. In the process of fermenting organic materials, microorganisms will work well if the conditions are suitable. The fermentation process will take place under semi-anaerobic conditions, low pH (3-4), high salt and sugar content, moderate water content of 30-40%, presence of fermenting microorganisms, and temperatures around 40-50oC (Surya et al., 2021). Microorganisms contained in EM4 have a good influence on the quality of organic fertilizers, while the availability of nutrients in organic fertilizers is strongly influenced by the length of time required for bacteria to degrade waste (Widyabudiningsih et al., 2021).

Data analysis

The variables analyzed were total nitrogen, total phosphorus, total potassium, C/N ratio and organic C and Ph which refers to APHA (1989).

3. RESULTS AND DISCUSSION

Table 1. Macronutrient test results

Parameter	Catfish Waste	Cow dung	Leaf
C-Organik (%)	21,67	19,42	60,32
N-Total (%)	1,99	0,90	0,55
P Total (%)	4,10	0,31	0,14
K Total (%)	2,31	0,16	0,20
Rasio C/N	6,71	21,50	80,93
pH	7,05	6,91	6,01

One of the determinants of success in a plant cultivation business is the use of seeds from superior varieties (Sujitno, Kurnia and Fahmi, 2014). However, if it is not equipped with the addition or input of other technologies, the results will not be optimal, one of which is the technology of using organic fertilizers (Napsiah and Ningsih, 2013). Based on table 1 on the results of the macro element test above, the total nitrogen and total potassium levels from catfish waste, cow dung and dried Ketapang leaves, as well as phosphorus from cow dung and dried Ketapang leaves and the C/N ratio from catfish waste did not meet the requirements. solid organic fertilizer according to the regulation of the Minister of Agriculture (Ministry of Agriculture, 2011), while C-organic, and the pH of all types of fertilizers, the C/N ratio of cow

dung and dry Ketapang leaves as well as the total phosphorus content and fish waste have met the requirements according to the regulation of the Minister of Agriculture (Ministry of Agriculture, 2011), and according to the compost standard SNI-19-7030-2004 (National Standardization Agency, 2004) only total potassium, organic C from cow dung, C-organic catfish waste and C/N ratio of catfish waste did not meet condition. According to the provisions of the regulation of the Minister of Agriculture, the requirements for solid organic fertilizers must contain a minimum total NPK of 4%, Ph 4-9, at least 15% C-organic and a C/N ratio of 15-25% (Ministry of Agriculture, 2011), while according to BSN, the minimum nitrogen content is 0.4%, phosphorus at least 0.1%, potassium at least 0.2%, C-organic 27-58% and C/N ratio 10-20% (National Standardization Agency, 2004).

Soil organic matter is the main source of soil nitrogen and plays a significant role in the process of improving soil physical, chemical and biological properties. Organic material in the form of plant residues added to the soil will undergo several phases of overhaul by organisms to become humus or organic matter land. All these biochemical activities are highly dependent or related to the presence of enzymes. Because the organic materials used as energy sources by micro-organisms are so complex and of various types, in the soil there are various types of enzymes and each soil has specific enzymes with special patterns. As is known to the population and types of microorganisms, enzymatic activity is unstable, depending on biotic and non-biotic conditions in the soil. Major changes will occur in the type and amount of enzymes in the soil if there is a transfer of function or land use (Sari, Sudradjat and Sugiyanta, 2015).

Several factors that can affect the process of making organic fertilizers are the C/N value of the material, the size of the material, the mixture of ingredients, working microorganisms, humidity and aeration, temperature and acidity (pH). Things that need to be considered so that the process of making organic fertilizers can take place more quickly include the following, (Syam, Saida and Wicaksono, 2020):

a. Material C/N Value

Organic materials cannot be directly used or utilized by plants because the C/N ratio in these materials is relatively high or not the same as the soil C/N. The C/N value is the result of a comparison between carbon and nitrogen. The C/N value of the soil is around 10-12. If the organic matter has a C/N content close to or equal to the soil C/N, then the material can be used or absorbed by plants. However, generally fresh organic matter has a high C/N, such as rice straw 50-70; leaves > 50 (depending on the type); 15-60 plant branches (depending on the type); old wood can reach 400. The lower the C/N value of the material, the faster it takes to make organic fertilizer. Microbes break down compound C as a source energy and use N for protein synthesis

b. Material Size

The smaller the material, the faster the composting process because the wider the material that is in contact with bacteria. For that, organic matter needs to be chopped into small pieces. The hard material should be chopped to a size of 0.5-1 cm, while the non-hard material should be chopped into a rather large size of about 5 cm. The chopping of materials that are not hard should not be too small because materials that are too crushed (a lot of water) are not good (the humidity will be high).

c. Material Composition

The composition of ingredients from several kinds of organic materials will be better and faster. There are also those who add food and growth substances needed by microorganisms so that apart from organic materials, microorganisms also get these materials from outside.

d. Number of Microorganisms

Usually in this process work bacteria, fungi, Actinomycetes and protozoa. Microorganisms are often added to organic material that will be used as fertilizer. With the increase in the number of microorganisms, it is expected that the process of making organic fertilizer will be faster.

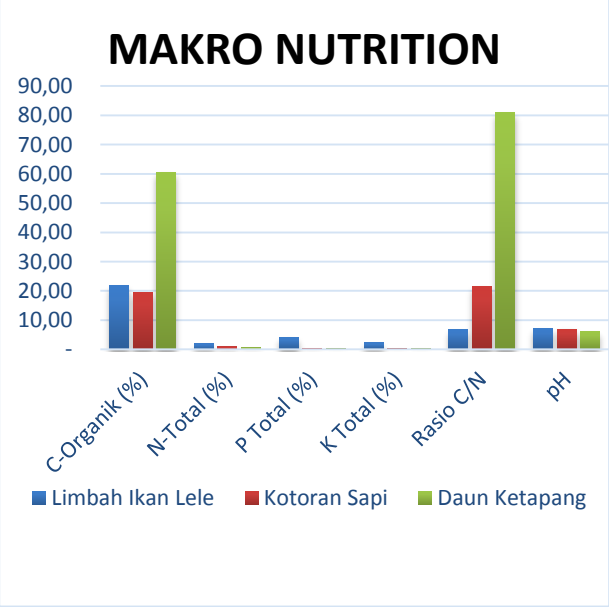

Figure 2. Graph of macro nutrients

Catfish waste water and cow dung come from leftover feed that is not digested properly and is highly dependent on the type of feed given, the stocking density of cultivation, the amount of feed to be given, the length of the cultivation process and the cleanliness of the habitat the organism lives in (Handayani et al. ., 2020). Meanwhile, dry ketapang leaf litter is the result of plant remains that die and fall.

Macro nutrients such as NPK are needed in the growth process by plants which are included in macroprimary elements. Based on Figure 2 on the graph of macronutrients, dried ketapang leaves have a significant C-organic value and C/N ratio from catfish waste and cow dung, while other elements are not so significant. The high content of these nutrients cannot be separated from the high content of organic matter from the taste of dry Ketapang leaves. Wastewater from catfish cultivation activities, cow dung and dry Ketapang leaves can generally be added to plants as nutrients in the growth process (Yulianto et al., 2017).

Several factors that can influence the dynamics of aggregates and organic matter status are changes in land use, tillage and soil and plant management. Soil and plant management accelerate the oxidation of organic matter due to the breakdown of soil aggregates, thereby expanding the colloid surface which can be attacked by microbes and ultimately can affect the increase in the redox value of the soil. The speed of changes in soil organic matter levels due to soil and plant management is strongly influenced by initial organic matter levels (Febrianna, Prijono and Kusumarini, 2018).

4. CONCLUSION

The conclusions obtained from this activity are that only organic C and pH from fish waste, cow dung, ketapang leaves, C/N ratio of cow dung and ketapang leaves, and total phosphorus from fish waste meet the requirements of Ministry of Agriculture number 70 of 2011, while according to the compost standard SNI-19-7030-2004, only total potassium, C-organic from cow dung, C-organic of catfish waste and C/N ratio of catfish waste did not meet the requirements.

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