PRODUCTION OF LIQUID ORGANIC FERTILIZER (LOF) BASED ON LEAVES, FRUIT PEEL, BAMBOO SHOOTS, AND FREE-RANGE CHICKEN MANURE

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| ABSTRACT

Continuous use of inorganic fertilizers without the addition of organic fertilizers can lead to an imbalance of nutrients in the soil, damage to soil structure, and a decrease in soil microbiology. Self-sufficiency in making Liquid Organic Fertilizer (LOF) from cheap and abundant natural materials is intended to counteract the negative effects of continuous chemical fertilizer use, in order to maintain soil fertility and the ecosystem. Papaya leaves, guava leaves, and teak leaves are rich in N, P, and K as well as essential microelements; banana and pineapple peels serve as sources of potassium and carbohydrates; free-range chicken manure is rich in macro (NPK) and micro nutrients; bamboo shoots are sources of growth hormones and microorganisms. The experimental aims to utilize these solid materials in the production of liquid organic fertilizer. All solid materials are chopped into small pieces and then blended alternately with a molasses solution (1kg of papaya leaves, 1kg of guava leaves, 1kg of teak leaves, 1kg of banana peels, 1kg of pineapple peels, 1kg of bamboo shoots), then mixed with 1 liter of coconut water, 1 liter of rice water decoction, and 250 ml of EM-4 bio activator, as well as 10 liters of pure water in a 40-liter capacity bucket to undergo anaerobic fermentation for approximately 14 days. The result obtained is an organic liquid fertilizer (LOF) with a brown or dark color, a characteristic fermentation aroma, and containing N, P, K, and growth hormones for fertilizing various types of vegetables and plants.

| KEYWORDS
LOF, leaves, fruit peels, bamboo shoots, chicken manure

I. INTRODUCTION

1.1. Background

The Green Revolution aims at significantly increasing agricultural crop production in order to meet the global food demand alongside the rapid growth of the world population. This is marked by the continuous use of chemical or inorganic fertilizers, which impacts soil degradation. Chemical fertilizers such as SP-36, Urea, and KCl can provide essential macronutrients N, P, and K that are crucial for plant growth, but excessive use can lead to soil fertility degradation and environmental pollution. Therefore, a sustainable agriculture approach that combines chemical fertilizers with **liquid organic fertilizer**/compost fertilizers, and bio-activators such as ecoenzyme becomes a potential alternative.

Waste also becomes one of the environmental problems, while from a health (environmental) perspective, the presence of waste can serve as a medium for the growth of disease-causing Waste also becomes one of the environmental problems, while from a health (environmental) perspective, the presence of waste can serve as a medium for the growth of disease-causing germs or as a medium for the widespread transmission of a disease. It certainly also disrupts the scenery and causes various kinds of diseases [1].

Some of the waste commonly discarded in human food consumption includes banana peels, pineapple peels, and free-range chicken droppings. There are also other natural materials that have been underutilized, such as guava

leaves, teak tree leaves, and bamboo shoots, even though these materials have the potential to be used as sources for making liquid organic fertilizer that is very beneficial for plants and soil fertility.

Therefore, efforts are needed to attempt the production of liquid organic fertilizer from materials that are cheap and abundant in nature, and even from waste that has been underutilized or not used at all.

Several studies have been conducted to use the above materials as a source for making liquid organic fertilizer individually and using various methodologies. However, no one has ever tried to mix all these diverse materials together using a specific methodology, namely by blending them with a 2L, 350-watt blender at 1500-2000 rpm before the fermentation process, as we have done.

The research contribution : The Production and Testing of Liquid Organic Fertilizer from Fruit Peel Waste with the Addition of EM4 Bioactivator and Variation in Fermentation Time produced the best liquid organic fertilizer, which is a mixture of banana, mango, and pineapple peels with a fermentation time of 7-14 days and contents of Organic C, total N, K2O, and P2O5 of 17.4, 6.05, 2.50, and 0.15%, respectively. The resulting liquid organic fertilizer already meets the quality standards of Ministry of Agriculture Regulation Number 261 of 2019, except for the P2O5 content [2].

The diverse mixture that is believed to have high nutrient potential is: (Papaya leaves + guava leaves + teak leaves + banana peel + pineapple peel + bamboo shoots + chicken manure) Expected benefits: increase total N (vegetative cereals), provide balanced P & K (roots & grain filling), enhance organic C & microbial activity, and function as both fertilizer and biostimulant.

Scientific Basis for the Preparation :

Main Contribution	***Material Basic***	***Literature***
Chicken manure	High N (1–3%), moderate P	Agronomy & POC research
Banana peel	K dominant (0.1–0.3%)	POC banana peel journal
Papaya leaves	Papain enzyme, organic N	Agroplant journal

I.2. Problem Identification

1.2.1. Continuous use of inorganic fertilizers without adding organic fertilizers can lead to an imbalance of nutrients in the soil, damage soil structure, and reduce soil microbiology, thereby decreasing soil fertility.

1.2.2. In our surroundings, there are many cheap and abundant natural materials, and even waste, that contain nutrients that can serve as sources of liquid organic fertilizer for plants.

1.2.3. For the sustainability of soil fertility and to maintain soil microorganisms, it is necessary to promote the self-production of liquid organic fertilizers from various cheap and abundant natural materials, as well as the abundant organic waste around us.

1.3. Research Objectives and Benefits

1.3.1. Objectives

a. To identify natural materials and waste that can be utilized as sources of elements, compounds, and microorganisms needed by plants in the form of liquid organic fertilizer that will be produced.

b. To understand the process of making Liquid Organic Fertilizer from natural materials and surrounding waste independently.

c. To raise public awareness to utilize useful community waste for the sustainability of soil fertility in agriculture and to impact the availability of food materials and food security.

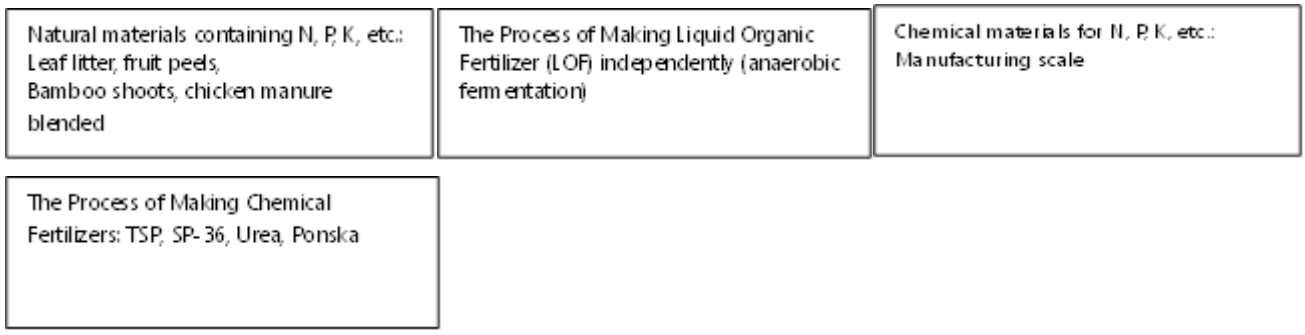
I.3.2. Uses

a. The Liquid Organic Fertilizer (POC) produced serves as a balance for soil nutrients and microorganisms, and is capable of suppressing the presence of plant diseases.

b. The community, especially farmers, has an alternative organic fertilizer that meets the nutrient requirements of plants in times of inorganic fertilizer scarcity.

c. Serves as a basis for further research in developing a sustainable and environmentally friendly agricultural system by incorporating the use of Liquid Organic Fertilizer made from various leaves, fruit peels, bamboo shoots, and various animal wastes.

Framework of Thought



Hypothesis

The source of nutrients needed by plants is found in inexpensive natural materials from various wastes such as leaves, fruit peels, bamboo shoots, and free-range chicken manure. If these ingredients are blended after blending at a speed of 1500-2000 rpm before the anaerobic fermentation process, a better liquid organic fertilizer will be obtained, rich in nutrients, microbes, and microorganisms needed for plant growth and disease resistance.

II. METHODOLOGY

3.1. Time and Place

The experiment on making Liquid Organic Fertilizer was carried out from December 3 to December 17 in Pangulah Selatan Village, Krajan Subdistrict, Karawang Regency, West Java.

3.2. Tools and Materials

The solid materials used in this study were papaya leaves, guava leaves, teak leaves, banana peels, pineapple peels, bamboo shoots, and free-range chicken manure. The liquid materials used were coconut water, rice washing water, molasses (from palm sugar), well water, and EM-4 Bio Activator solution. The tools used were 40-liter plastic buckets, plastic basins, knives, chopping boards, blenders, bamboo stirrers, stationery, plastic bottles, manual scales, and labels.

3.3. EXPERIMENT PROCEDURE

1. The solid materials prepared are 1 kg of papaya leaves, 1 kg of guava leaves, 1 kg of teak leaves, 1 kg of banana peels, 1 kg of pineapple peels, 1 kg of bamboo shoots, and 1 kg of free-range chicken manure. The liquid materials prepared are: 1 liter of molasses, 1 liter of coconut water, 1 liter of rice-washing water, and 250 ml of EM-4.

2. All materials are cleaned from other dirt, except for chicken manure.

3. Papaya leaves, guava leaves, teak leaves, banana peels, pineapple peels, and bamboo shoots are cut and chopped into small pieces of 1-2 cm using a knife and cutting board (as a cutting surface). Separate each type into its own container (plastic basin).

4. Then, the chopped papaya leaves are placed into a blender along with the molasses solution (which was previously diluted with well water in a small bucket) and blended until smooth and even, then the result is transferred to a 40-liter bucket.

5. Continue the same process for guava leaves, teak leaves, banana peels, pineapple peels, and bamboo shoots.

6. After that, also add chicken manure into the 40-liter bucket.

7. Pour the remaining molasses into the bucket, followed by 1 liter of coconut water, 1 liter of rice washing water, and 250 ml of EM-4.

8. Add well water until the total volume reaches 15 liters in the 40-liter bucket.

9. Stir all solid and liquid ingredients until evenly mixed.

10. Seal the bucket tightly with a lid lined with thick plastic. Place it in a spot that is not exposed to sunlight and is dry, so that the aerobic fermentation process occurs properly.

11. Periodically, every 1-2 days, open it to release the generated gas while stirring the mixture thoroughly.

12. After 7-14 days, the organic liquid fertilizer (POC) is ready to be harvested, with the harvest period corresponding to an aerobic fermentation period of 7 days, 14 days, 21 days, 1 month, and 2 months.

III. RESULTS AND DISCUSSION

3.1. Observation of Experiment Results

3.1.1. Characteristics of Liquid Organic Fertilizer (LOF)

The experiment yielded: Liquid Organic Fertilizer (LOF) with a dark brown color, characteristic LOF odor: fresh acidic smell, alcohol aroma, pH 4.5-6

Photo 1: Results on the 7th day seen in the 50lt Buchet

Photo 2: Results on day 7 in the bottle

Photo 3: Results on day 14 in the bottle

Photo 4: Results on day 21 in the bottle

Photo 5: Results on day 28 in the bottle

Photo 6: Results on day 60 in the bottle

3.2. Analysis of Experimental Results

Comparison of C/N, % content of N, P, K

The minimum technical requirements for POC as regulated in the Minister of Agriculture Decree No. 261/KPTS/SR.310/M/4/2019 are a minimum organic C content of 10% (w/v), macro nutrients N + P2O5 + K2O 2-6% (w/v), minimum organic N 0.5% (w/v), micro nutrients Fe total 90-900 ppm, Mn total 25-500 ppm, Cu total 25-500 ppm, Zn total 25-500 ppm, B total 12-250 ppm, Mo total 2-10 ppm, pH 4-9, maximum heavy metal content As 5.0 ppm, Hg 0.2 ppm, Pb 5.0 ppm, Cd 1.0 ppm, Cr 40 ppm, and Ni 10 ppm. These technical requirements serve as a reference for the POC manufacturing industry.

Nutrient Content of This Mixed POC (Based on Literature)

Parameter	Content Value
Total N	1.2 – 2.5 %
P_2O_5	0.5 – 1.2 %

K_2O	1.5 – 3.0 %
Organic C	4 – 7 %
C/N ratio	12 – 20

Note: These values are realistic and consistent with research journal findings

3.3. Test Results and Utilization of LOF on Plants

Research results show that liquid organic fertilizer made from ***banana peels a***ffects the number of productive branches, while the application of chicken manure affects the number of productive branches but does not affect the fruit weight per sample and the fruit weight per plot. The most optimal dose for banana peel liquid organic fertilizer is P2 (40 ml/plant) and the most optimal dose for chicken manure is A3 (6 kg/plot) [3].

Meanwhile, the application of ***papaya leaf***-based LOF had a significant impact on chili plants (C. frutescens) and showed very good results compared to the use of chemical fertilizers (NPK), thus it was continued in the Duncan test experiment. The results of the Duncan test experiment on chili plant height showed that POC treatment had a significant effect on plant height, as well as the number of leaves and productive branches compared to the negative control (without fertilization) and the positive control, k+; with NPK fertilizer, k- [4].

The NPK content test on LOF based on ***bamboo shoots*** showed a total nitrogen content of 0.72%, P2O5 content of 0.04%, and K2O content of 0.12%. The study on the use of liquid organic fertilizer from bamboo shoots on water spinach plants showed that the application of liquid organic fertilizer increased plant height and the number of leaves. The most effective and best treatment was found in treatment P4 (200 ml Liquid Organic Fertilizer) with an average water spinach plant height of 27.67 cm, around 36 leaves, and leaf color of 5.00 [5].

IV. CONCLUSION

1. Natural materials such as papaya leaves, guava leaves, teak tree leaves, bamboo shoots, and waste materials like banana peels, pineapple peels, and free-range chicken droppings can produce liquid organic fertilizer after undergoing an anaerobic fermentation process.
2. The method of crushing solid materials using a blender facilitates and speeds up the anaerobic fermentation process.
3. The results of this liquid organic fertilizer (LOF) experiment produced LOF characteristics that are dark brown in color with a distinctive LOF aroma: fresh sour smell, pH around 4.5 – 6, and a pleasant alcoholic scent, indicating the successful anaerobic fermentation process.

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