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Quality of Liquid Organic Fertilizer Peanut Shells and Tofu Dregs With Banana Stems as Bioactivator

Muhammad Rizal Kahfi, Aminah Asngad*
Biology Education Department, Faculty of Teacher Training and Education, Universitas Muhammadiyah Surakarta.
Jl. A. Yani Tromol Pos I, Pabelan, Kartasura, Surakarta 57162, Jawa Tengah, Indonesia
*Corresponding Author. E-mail address: aa125@ums.ac.id

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ABSTRACT

Liquid organic fertilizer is nutrition given to plants to improve the supply of nutrients so that plants can grow well. The utilization of peanut shells and tofu dregs has the potential as liquid organic fertilizer and banana stems as a bioactivation. This study aimed to determine the quality of liquid organic fertilizer, a combination of peanut shells and tofu dregs, adding moles of banana stems as a bioactivator. This study used experimental methods and a Completely Randomized Design (CRD) consisting of 2 factors and 4 combinations with 3 repetitions. Factor 1 combines peanut shells and tofu waste K1 = 100 ml: 200 ml and K2 = 120 ml: 180 ml. Factor 2 is the local microorganism concentration, namely M1 = 100ml and M2 = 200ml. Data were analyzed using descriptive qualitative and quantitative. The results showed that the fertilizer had a yellowish brown and light brown color, a slightly pungent fermented to not overpowering, and a pH of 4. The highest N was in K1M1 combination of 0,57%, the highest P in K1M1 and K2M1 was 0,05%, and the highest K in K1M1 of 0,08%. It can be concluded that liquid organic fertilizer has good quality complies with SNI 19-7030-2004.

1. INTRODUCTION

Plants need nutrients to support their growth. The addition of ingredients with sufficient nutrients will make the plants grow well. Using fertilizers can improve and add nutrients required for plants to grow. Fertilizers are materials added to growing media or plants to meet the nutrients plants need to grow correctly. In fertilizers, the availability of anions for plant growth, such as nitrate, phosphate, borate, and chloride, as components function to increase nutrients for plant needs is one of the functions of fertilizer use. Fertilizers are divided into inorganic fertilizers (chemical) and organic fertilizers (natural).

Organic fertilizers are materials added to improve the supply of nutrients for plants and consist of organic materials derived from plants or animals that have undergone a fermentation process and are used as a source of plant nutrition. Organic fertilizers are divided into solid and liquid forms. Liquid organic fertilizer is a solution containing one or more soluble carriers of the elements needed by plants, and solid organic fertilizer is organic matter in solid form from plant residues or animal waste. Liquid organic fertilizer has the advantage of being able to provide nutrients according to plant needs more easily and quickly evenly distributed because of its liquid form. According to Roidah (2013), liquid organic fertilizer can use organic materials such as animal manure, animal body parts, and plants. Waste can also be used to make liquid organic fertilizer, namely peanut shell waste, leri water, tofu dregs, and others.

In general, peanuts are only used for seeds for consumption and food purposes, while the skin produces waste and has not been widely used. Peanut shell waste is a waste that is often found in the surrounding environment and is simply thrown away. Peanut skin has an essential substance

for the fulfillment of plant nutrients. According to Sihite (2020), peanut shell waste contains several nutrients: N 2.64%, P2O5 3.56%, K2O 1.67%, and organic C 4.93.

Other materials are needed to manufacture liquid organic fertilizer so that the nutrients required by plants can be fulfilled. One of the ingredients that is easily found around us is tofu dregs. Tofu dregs are solid waste from the tofu processing industry, which is underutilized. Discarded tofu waste can pollute the environment. One effort to overcome this is by utilizing tofu waste as fertilizer. Tofu dregs contain 8.66% protein, 3.79% fat, 51.63% water, and 1.21% ash (Kusumaningtyas et al., 2020). Sunarsih et al. (2018) found that tofu dregs contained nutrients namely N 0.09%, phosphorus 0.062%, and K 1.82%.

Liquid organic fertilizer production occurs anaerobically or does not require oxygen and is fermented without sunlight. The manufacture of organic fertilizers requires MOL (local microorganisms). Local microorganism is a bioactive component that can break down organic matter. Specifically, bioactive agents are purified microbial isolates that uniquely digest organic materials, including cellulose fibers. Hadi (2019) stated that adding local microorganism to manufacture liquid organic fertilizer can accelerate the fermentation process. Local microorganism can be obtained by utilizing household waste or crop residue, vegetables and fruits, animal waste, etc. Local microorganism that can be used as a decomposer is local microorganism which contains many decomposing microorganisms, such as the local microorganism of banana stems.

Banana stems can be used as an alternative to making organic local microorganism. Banana stems can be used as ingredients for local microorganisms that can increase soil fertility. Local microorganisms can help accelerate the fermentation process. These decomposing bacteria help make compost faster, easier, and of better quality. Yuliansari & Endina (2020) stated that in banana stems, there is the bacterium *Pseudomonas* sp. and *Citrobacter freundii* which can speed up the fermentation process. This shows that banana stem is one of the ingredients that can be used as a local microorganism or activator.

Based on the background above, the problem is: How is the quality of liquid organic fertilizer combined with peanut shells and tofu dregs with adding banana stems as a bio activator? This study aims to determine the quality of liquid organic fertilizer combined with peanut shells and tofu dregs with the addition of banana stem local microorganism as a bio activator in terms of sensory characteristics (color, aroma, and pH) and nitrogen, phosphorus, and potassium content.

The benefits of the results of this study are expected to provide information to 1). Providing information to the general public about using peanut shells, tofu dregs, and banana stems as liquid organic fertilizer. 2). Provide information to fertilizer makers about the quality, content, and content of good plant nutrients. 3). Farmers and materials for consideration for the Government regarding alternatives to making organic fertilizer using peanut shells and tofu dregs with adding banana stem bio activators as a substitute for chemical fertilizers.

2. MATERIALS AND METHODS

This research was conducted at the UMS Biology Laboratory Greenhouse. This study used 16L jars, 5L jars, blenders, basins, digital scales, analog scales, wooden stirrers, basins, stoves, filters, 250ml measuring cups, 1000ml measuring cups, knives, pH indicators, and bottles. At the same time, the materials used in this study included peanut skins, tofu dregs, banana stems, water, brown sugar, molasses, leri water, groundwater, bran, pH stick, raffia, and label paper.

The research procedures include: 1). Making the bioactivation: chopping and grinding 3 kg of banana stems into a jar, adding 3 liters of leri water, coconut water, and 800 grams of brown sugar, stirring until homogeneous, and fermenting for two weeks. 2). Extracting peanut shells: Grind 3 kg of peanut skins with 3 liters of water, filter the crushed material, and extract it. 3). Making tofu dregs flour: 3kg of tofu dregs is heated in a pan on the stove for 45 minutes and pureed with 1 liter of water. 4) Manufacture of fertilizer: the extract and local microorganism of banana stems are put into a jar according to the treatment, 5). add 90 ml of molasses and 90 gr of bran in each jar, then

homogenize, close the jar, ferment for 14 days, and do sensory observations every three days (Nasution and Rizka 2022).

The method used was an experimental method and completely randomized design (CRD) with two factors: the composition of peanut shells with tofu pulp waste and adding a banana stem bioactivation. This study used 4 treatments with 3 repetitions, and the data analysis technique used was descriptive qualitative and quantitative analysis.

3. RESULT AND DISCUSSION

3.1 Result

3.1.1 Sensory Test

After going through fermentation for 14 days, and sensory tests were carried out on ten panelist to test of sensory characteristic, the results of the liquid organic fertilizer combined with peanut shells and tofu dregs and the addition of banana stems as a bio activator can be seen as follows:

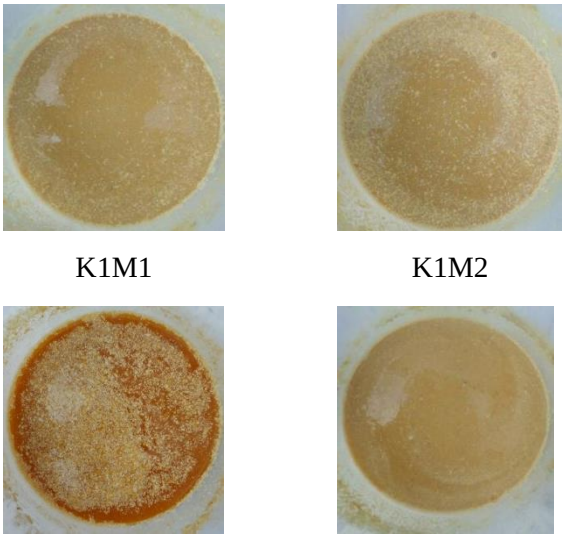


Figure 1. Liquid organic fertilizer result

The results of sensory observations that have been made regarding the color, aroma, and degree of acidity (pH) in the liquid organic fertilizer combination of peanut shells and tofu dregs with the addition of banana stems as a bioactivator can be seen in the following table:

Table 1. Sensory test results of liquid organic fertilizer combination of peanut shells and tofu dregs with the addition of banana stems as a bioactivator

Combination	Sensory Observation Result		
	Color	Aroma	pH
K1M1	Light brown	Fermentation smell not overpowering	4
K1M2	Light brown	Fermentation smell not overpowering	4
K2M1	Yelloowish-brown	Slightly pungent fermented smell	4
K2M2	Light brown	Fermentation smell not overpowering	4

Noted:
K1 M1 = Liquid organic fertilizer with a concentration of 100 ml of peanut shell extract and 200 g of tofu dregs with 100 ml local microorganism of banana stem.
K1 M2 = Liquid organic fertilizer with a concentration of 100 ml of peanut shell extract and 200 g of tofu dregs with 150 ml local microorganism of banana stems.
K1 M2 = Liquid organic fertilizer with a concentration of 120 ml of peanut shell extract and 180 g of tofu dregs with 100 ml local microorganism of banana stems.
K2 M2 = Liquid organic fertilizer with a concentration of 120 ml of peanut shell extract and 180 g of tofu dregs with 150 ml local microorganism of banana stems.

Based on the results of the table analysis above, it can be seen that sensory observations of all samples have a light brown and yellowish brown color with a pH of 4 and a slight difference in aroma.

3.1.2 N, P and K Content

Based on the results of laboratory tests regarding the macro-nutrient content including nitrogen (N), phosphorus (P), and potassium (K) in the liquid organic fertilizer combination of peanut shells and tofu dregs with the addition of banana stems as a bioactivator, it can be seen from the test results for the content in following table:

Table 2. The content of N, P, and K in liquid organic fertilizer a combination of peanut shells and tofu dregs with the addition of psiang stems as a bioactivator

Combination	Analysis Result		
	N (%)	**P (%)**	**K (%)**
K1M1	0,55	0,05**	0,08 **
K1M2	0,57 **	0,04 *	0,07
K2M1	0,52	0,05	0,06 *
K2M2	0,48 *	0,04	0,06

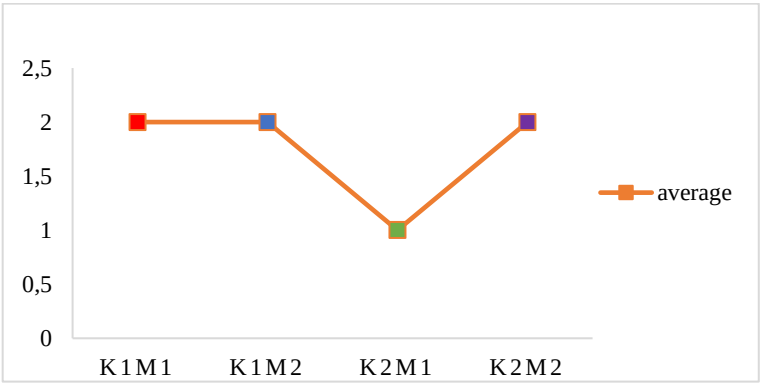
Where: (*) lowest yield
(**) highest yield

The analysis of N, P, and K content in Table 2 shows that the highest nitrogen (N) content was found in the K1M2 combination of 0.57%. In contrast, the lowest nitrogen content was found in the K2M2 combination, which was 0.48%. the highest phosphorus content was in the combination K1M1 and K2M1, namely 0.05%, while the lowest phosphorus content was in the combination K2M1 and K2M2, namely 0.04%. The highest potassium (K) content was found in the K1M1 combination, 0.08%, and the lowest in the K2M1 combination, 0.06%.

3.2 Discussion

3.2.1 Color parameters

After sensory observations on liquid organic fertilizer from peanut shells and tofu dregs with the addition of banana stems as a bioactivator, it showed that each treatment sample had the slight different color. Then the data can be presented in the form of a bar chart as follows:



Description: 1 = yellowish brown; 2 = light brown; 3 = dark brown; 4 = blackish brown

Figure 2. Color parameter of liquid organic fertilizer

Color is one of the determining factors for the quality of liquid organic fertilizer and determining the maturity of liquid organic fertilizer. It can be seen from the results of the average color observation of liquid organic fertilizer peanut shells and tofu dregs with the addition of banana stems as a bio activator that there is no significant difference in color. In the treatment combinations K1M1, K1M2, and K2M2, the POC was light brown, while in the K2M1 treatment combination, the color was yellowish brown.

The color change in liquid organic fertilizer can be affected by the color of the ingredients used. The ingredients used in this fertilizer are light brown extracted banana stems, white tofu dregs flour, brownish white banana stem MOL, and other additives such as molasses, rice bran, coconut water, and leri water, which can also affect the color of the fermented product liquid organic fertilizer. The activity of microorganisms from adding banana stem bio-activators accelerated the change of the liquid organic fertilizer color from each treatment. Its relevant research by Situmorang (2018) states that adding a bio activator in the manufacture of liquid organic fertilizer can cause a color change from blackish brown to brown due to the activity of microorganisms during the decomposition process. This also follows research by Siregar (2016) which states that microorganism activity can affect the color change in liquid organic fertilizer during fermentation.

Mixing all these ingredients makes the resulting liquid organic fertilizer a yellowish-brown color at first; after being fermented, it produces a light brown color. It is appropriate Tsaniya's research (2021) that in SNI 19-7030-2004, physical indicators of fertilizer maturity in color are between brown and blackish brown.

3.2.2 Aroma Parameters

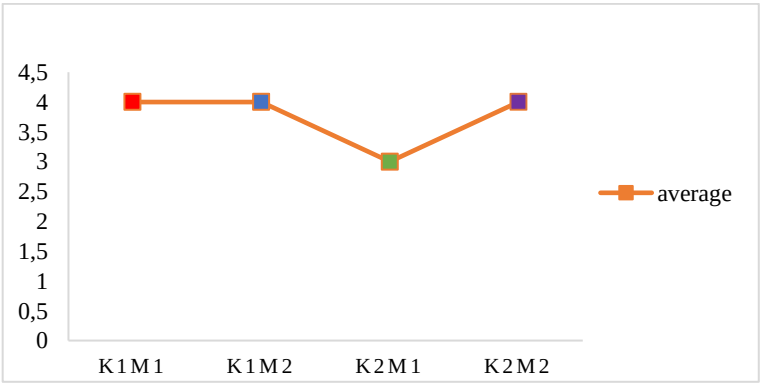


Figure 3. Aroma parameter liquid organic fertilizer

Description: 1 = bad smell; 2 = pungent fermented odor; 3 = slightly pungent fermented smell; 4= fermentation smell not overpowering

The results showed that the four treatment samples had a non-stinging aroma. At the beginning of the fermentation process, the aroma is like the aroma of peanut butter. This is due to the raw material used, peanut shells, and the addition of bran and molasses as a source of nutrition for microorganisms to decompose organic materials. On the 3rd to 12th day of observation, the fertilizer gave off a change in aroma to fermented tape, which over time, was pungent. However, on the 14th day of observation, the fertilizer did not show a pungent odor.

During 14 days of making fertilizer, there is a fermentation process by microorganisms present in liquid organic fertilizer with the help of a banana stem bioactivator. The decomposition activity of the material by microbes causes the smell of tape. The pungent smell of tape or alcohol indicates microbial activity that is currently active, and a smell that gradually decreases indicates microbial activity that has started to become inactive or that the fertilizer is ripe. It is appropriate with research by Lestari et al. (2019), which states that liquid organic fertilizer fermented for 7-14 days will smell like tape. So the liquid organic fertilizer produced is of good quality.

3.2.3 pH Parameters

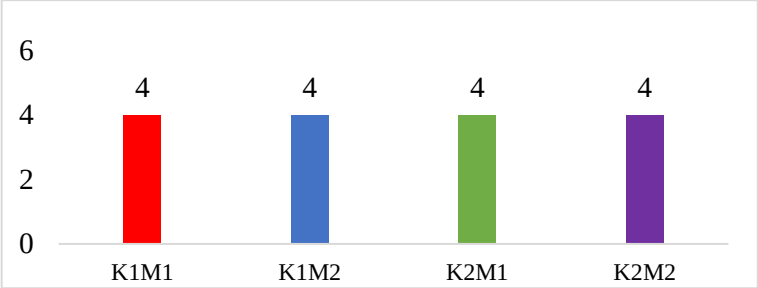


Figure 4. pH parameter of liquid organic fertilizer

After conducting sensory observational research on liquid organic fertilizer, a combination of peanut shells and tofu dregs with the addition of banana stems as a bio activator, it was shown that there was a similarity in pH value in each treatment. The pH of the treatment sample indicated that the pH of the fertilizer was 4. At the beginning of the fermentation process, the pH of the four treatments was acidic, namely, 5. The activity of actively developing bacteria could affect the decrease in acidity. It is according in Kurniawan's research (2017) that the degree of acidity in fertilizers that is experiencing an increase or decrease is caused by bacterial activity.

This shows that the pH of the liquid organic fertilizers in this study was still in the acidic pH category, so they were still suitable for the growth of microbes that decompose organic matter in liquid fertilizers. The advantage of pH, which tends to be acidic, can produce many nitrogen elements and kill the nymphs or eggs of pathogenic organisms (Setyaningsih et al. 2017). Too high a pH increases oxygen consumption and damages the environment. Conversely, if the pH is too low, some microorganisms will die. This pH value follows the requirements for liquid organic fertilizer from the Decree of the Minister of Agriculture of the Republic of Indonesia concerning Minimum Technical Requirements for Organic Fertilizers, Biological Fertilizers, and Soil Improvement, which states that the pH value of Liquid Organic Fertilizer is between 4-9 (Tsaniya et al. 2021).

3.2.4 N, P dan K Content

Based on the results of laboratory tests regarding the macro-nutrient content, including nitrogen (N), phosphorus (P), and potassium (K) in the liquid organic fertilizer combination of peanut shells

and tofu dregs with the addition of banana stems as a bioactivator, it can be seen from the test results for the content in following diagrams:

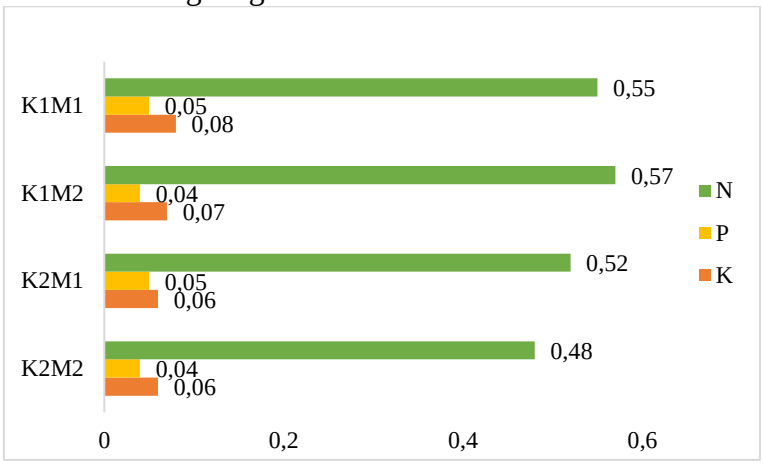


Figure 5. NPK content

3.2.4.1 Nitrogen Levels (N)

The test results for the N, P, and K content in Figure 5 shows that the nitrogen content has a higher percentage content than the P and K content. The highest average nitrogen content found in the K1M2 combination of 0.57%, while the average content is the lowest nitrogen average found in the K2M2 combination, namely 0.48%. It follows the results of statistical tests (means) that the highest average nitrogen content is in the K1M2 combination, and the lowest is in K2M2.

The statistical analysis by two way anova showed significant results with a significance level of less than 0.05, namely 0.011, which meant significant differences between the four liquid organic fertilizer treatment combinations. The fermentation process can influence the difference in nitrogen levels. Following research by Mulyadi et al. (2013), the nitrogen content of each treatment combination was different because the speed of the microbes in decomposing the fermented material was different. According to Meriatna et al. (2019), the nitrogen content decreased after the 16th day of fermentation. The decreasing nitrogen level was also caused by the reaction of N with water, which produced NO3- and H+ (Trivana et al. 2017).

The quality of Nitrogen can decrease quite drastically. It is presumably because the element nitrogen can evaporate together with the evaporation of water. The quality of liquid organic fertilizer can decrease during storage; even though it has been appropriately stored, nutrients can still evaporate and become unavailable, so the longer it is stored, the lower the fertilizer quality can be (Nurlaila et al. 2017). The nitrogen (N) content in liquid organic fertilizer combined with peanut shells and tofu dregs with adding banana stems as a bio activator has met the Indonesian National Standard regarding BSN (Badan Standarisasi Nasional) 2004 standard liquid organic fertilizer. Good fertilizers have a total N parameter that is at a percentage of more than 0.40%.

3.2.4.2 Phosphorus Levels (P)

The observations showed that the highest average phosphorus content was in the combination of K1M1 and K2M1, namely 0.05%, while the lowest average phosphorus content was in the combination of K1M2 and K2M2, 0.04%. The four treatment combinations did not show a significant difference. It follows the results of statistical tests (means) that the highest average phosphorus content is in the combination of K1M1 and K2M1, and the lowest phosphorus content is K2M1 and K2M2. The two way anova statistical analysis did not show a significant difference between the four treatments. This also follows the significance test, which shows a sig value (1) >

0.05, so there is no significant difference between the four liquid organic fertilizer treatment combinations.

The phosphorus content in liquid organic fertilizer combined with peanut shells and tofu dregs with adding banana stems as a bio activator does not meet the minimum standard because phosphorus is less than 0,10%. This can be caused by a need for phosphorus nutrient content in the essential ingredients of liquid organic fertilizer. Nur et al. (2016) in their experiments reported that each waste or waste has a different level of phosphorus and can affect the speed of the fermentation process. Phosphorus-decomposing microorganisms also affect the phosphorus content, whereas in the banana stem, bio activator, there is a phosphorus-decomposing bacteria, namely Citrobacter freundii, which will increase phosphorus levels. The minimum nutrient content in the fertilizer is due to the activity of microorganisms which, apart from breaking down phosphorus, also use it for living activities. This is also because the decomposing microorganisms have reached the death phase before the fermentation process ends.

The fermentation time also affects the final yield of phosphorus content in liquid organic fertilizer. Kusumadewi et al (2019) explained that the longer the fermentation time, the more nutrients will be used for the activities of microorganisms, and over time, the availability of nutrients will be exhausted, and the activity of microorganisms in breaking down organic compounds will decrease. The resulting phosphorus content will be less. The high N content in liquid organic fertilizer can cause a high P content. This is according to research by Situmorang (2018) that the high content of phosphorus is influenced by the high content of nitrogen, where the higher the nitrogen content, the activity of microorganisms that break down phosphorus will increase, causing the phosphorus content in liquid organic fertilizer to increase.

3.2.4.3 Potassium Levels (K)

Based on observations of the results, the highest average potassium level was in the K1M1 combination, which was 0.08%, and the lowest was in the K2M1 and K2M2 combination, which was 0.06%. From the research results, the potassium content in liquid organic fertilizer combined with peanut shells and tofu dregs with the addition of banana stems as a bio activator in the four combinations showed that the results did not meet SNI 2004 because the K content had a percentage of less than 0.20%.

The results of statistical analysis by two way anova showed a significance value of 0,644 > 0,05. These statistical results indicate no significant difference between the four treatment combinations because the significance results are more than 0,05. The K content is affected by the nutrient content in the raw materials for peanut shells and tofu dregs used to manufacture liquid organic fertilizer. The nutrient content of potassium contained in peanut shells can be seen from research by Sihite et al. (2020) which is equal to 1.67%, while the potassium content in tofu dregs is seen from research by Sunarsih et al (2018) at 1.82%. Microorganisms use potassium as a catalyst, and the activity of microorganisms dramatically influences the increase in potassium levels. The higher the activity of microorganisms, the higher the potassium level. The low potassium content in liquid organic fertilizer is also because the microorganisms in it have yet to develop optimally. The organic matter in liquid organic fertilizer has not entirely decomposed, and the microorganisms are still in adaptation (Sulfianti et al. 2021).

The low potassium content in liquid organic fertilizer is also because the microorganisms in it have yet to develop optimally. The organic matter in liquid organic fertilizer has not been wholly decomposed, and the microorganisms are still in the adaptation phase (Sulfianti et al. 2021).. From the K content in the peanut shell, it can be concluded that the greater the material used, the more potassium nutrient content is obtained. The content of nutrient elements contained in organic fertilizers is usually relatively small for N, P, and K. However, the amount available for each element can be quite a lot, of the concentration of materials in organic fertilizers is higher (Mustamu 2020).

4. CONCLUTIONS

Based on the research results, peanut shells and tofu waste, adding banana stems as activators can be used as liquid organic fertilizer. It can be seen from the observations of sensory characteristics, namely the color of yellowish brown and light brown, slightly pungent to not overpowering fermented aroma and a pH of 4. So liquid organic fertilizer from peanut shells and tofu dregs with local microorganism banana stems as a bioactivation has good quality. Furthermore, meet the sensory requirements of SNI 19-7030-2004. The percentage of nitrogen (N), phosphorus (P), and potassium (K) content of liquid organic fertilizer combined with peanut shells and tofu dregs with the addition of local microorganism of the banana stem as a bio activator with N content complies with SNI 19-7030-2004 and shows a significant difference in treatment. At the same time, P and K did not meet or show a significant difference in treatment. Suggestions that the author can convey are it is necessary to test the content of each ingredient before making liquid organic fertilizer, and further tests regarding applying liquid organic fertilizer, a combination of peanut shells and tofu dregs waste with banana stems as a bioactivator.

5. ACKNOWLEDGMENTS

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