International Conference on Biology Education, Natural Science, and Technology
Vol. 1 No. 1 (2023)

Quality Of Kirinyuh Leaf Liquid Organic Fertilizer and Coconut Water Waste With Pineapple Skin Bioactivator

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KEYWORDS:
Bioactivator, kirinyuh leaves, pineapple skin, waste coconut water, liquid organic fertilizer.

ABSTRACT

Liquid organic fertilizer is liquid fertilizer so that plants can absorb it more easily. Liquid organic fertilizer can overcome problems arising from using inorganic fertilizers in the long term. This study aims to determine the quality of liquid organic fertilizer from kirinyuh leaves and coconut water waste by adding pineapple peel as a bioactivator. This study used the experimental method and utterly randomized design consisting of 2 factors with four combinations and three repetitions, namely factor 1 (K): a combination of the essential ingredients of kirinyuh leaves and coconut water waste (K 1: 168 ml: 82 ml & K 2: 82 ml: 168 ml). Factor II (M): Add MOL of pineapple skin (M 1: 100 ml and M 2: 150 ml). The parameters used were sensory tests regarding color, odor, pH and nitrogen, phosphorus, and potassium content. This study uses data analysis: descriptive qualitative, and quantitative. The results showed that liquid organic fertilizer has a greenish-brown color, does not have a solid fermented odor (like tape) and some have an unpleasant odor, and has a pH of 4.00 – 4.67. Based on the POC content test, only three treatments met the quality standards of SNI 19-7030-2004 for nitrogen content, namely K1M1, K1M2, and K2M1.

1. INTRODUCTION

Fertilizer is one of the primary sources of nutrition given to plants or growing media to meet the availability of nutrients that supports plant growth so that it can grow optimally. In addition, fertilizer can also be referred to as an additional material given to the soil, which helps enrich or increase soil fertility chemically, physically, or biologically (Astiti et al., 2022). According to the type, fertilizers can be divided into organic and inorganic fertilizers. However, excessive use of inorganic fertilizers can result in adverse environmental impacts, including a) decreased soil organic matter content, b) soil prone to erosion, c) decreased soil permeability, d) decreased soil microbial populations, e) faster soil drier and finer, f) poor structure, g) low soil organic matter content (Herdiyantoro, 2015). In addition, inorganic fertilizers cannot improve soil quality, unlike organic fertilizers, which can fertilize and enhance soil quality.

Organic fertilizers use ingredients consisting of plant and animal organic matter that has gone through a fermentation process and function to provide nutrients to plants and can improve the soil's physical, chemical, and biological properties (Suwahyono, 2017). Liquid organic fertilizer is a solution of fermentation using organic materials such as plant residues and animal and human wastes, which contain more than one nutrient. In general, liquid organic fertilizers use materials from animal waste such as chicken manure, cow manure, and goat manure. In addition, various debris such as market waste, kitchen waste, fruit peels, corn stalks, straws, banana cobs, tea waste, tofu waste, and others.

Making this liquid organic fertilizer uses a combination of two different ingredients to complement and fulfill the availability of nutrients needed by plants to manufacture liquid organic fertilizer using kirinyuh leaves and coconut water waste. Kirinyuh is a woody weed with ingredients that can be used as a source of organic matter (green manure) (Wiraswati et al., 2021). In addition, the nutrient content of kirinyuh is relatively high, namely 7.76 % nitrogen, 1.10 % phosphorus, and 5.79 % potassium (Napitupulu et al., 2018). Therefore, kirinyuh leaves can be used as liquid organic fertilizer to increase nutrients.

Coconut water is suitable for microbial growth because it contains nitrogen compounds, sugars, minerals, and vitamins (Echdar & Maryadi, 2019). In addition, coconut water contains inorganic ions such as Cl, Cu, Fe, Mg, P, K, Na, and S, amino acids, nitrogen compounds, enzymes, vitamins, and organic acids, which can induce cell division and shoot multiplication (Hidayanti et al., 2022). Furthermore, research (Suryati et al., 2019) regarding using coconut water waste as liquid organic fertilizer states that coconut water contains a lot of potassium, up to 17 %. It also has a sugar content between 1.7 – 2.6 % and 0.07 – 0.55 % protein. In addition, it contains other minerals such as Na, Ca, Mg, Fe, Cu, P, and S.

The process of making liquid organic fertilizer is carried out utilizing fermentation so that the compounds in the materials used can decompose adequately and are easily absorbed by plants. Speed up the fermentation process, and it requires a bioactivator. The waste that will be used in the manufacture of the bioactivator this time is pineapple skin. Pineapple skin contains vitamins A and C, carotenoids, flavonoids, tannins, sodium, alkaloids, calcium, phosphorus, iron, magnesium, and bromelain enzymes (Salasa, 2019). The bromelain enzyme functions to soften cellulose so that it can be used as EM-organic (Sulistiono, 2017). Local microorganisms on pineapple skin are *Rhizobium* Sp., *Azospirillium* Sp., *Azotobacter* Sp., *Pseudomonas* Sp., *Phosphate bacteria*, *Bacillus* Sp., *Azotobacter* Sp. (Supianor et al., 2018). According to (Palupi, 2015), pineapple skin waste can be used in making MOL.

Based on the description above, the aims of this research is to determine the quality of liquid organic fertilizer from kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator. So that researchers are interested in conducting research with the title "**Quality Of Kirinyuh Leaf Liquid Organic Fertilizer And Coconut Water Waste With Pineapple Skin Bioactivator**".

2. MATERIALS AND METHODS

This research was conducted at the Green House Laboratory of the Teaching and Education Faculty, Muhammadiyah University, Surakarta, to manufacture fertilizers and sensory tests. In addition, N, P, and K content tests were carried out at the Laboratory of Soil and Plant Nutrition, Agrotechnology Study Program, Muhammadiyah University, Yogyakarta. The materials used in the manufacture of this fertilizer are young and old kirinyuh leaves, coconut water waste, pineapple skin, water, brown sugar, molasses, leri water, bran, pH stick, and raffia rope. At the same time, the tools used include a 16L jar, 5L jar, blender, basin, digital scale, analog scale, wooden stirrer, inlet, stove, filter, 250 ml measuring cup, 1000 ml measuring cup, knife, gloves, pH indicator, documentation tools.

The procedure for carrying out this research included: 1) Making pineapple skin bioactivator by grinding the pineapple skin using a blender, adding coconut water which had been dissolved with brown sugar and adding rice washing water, then closing the jar and fermenting for 14 days, 2) Then making the extract kirinyuh leaf by crushing the kirinyuh leaves using a blender, filtering the kirinyuh leaf extract and storing the extract in a bottle, 3) Collection of coconut water waste

from the market, 4) Liquid organic fertilizer is made by mixing kirinyuh leaf extract, coconut water waste, and skin bioactivator pineapple according to the measure. Then it is mixed with molasses, bran, leri water and homogenized. After that, it is fermented for 14 days. Then observe the liquid organic fertilizer according to the sensory test, which includes color, odor, and pH.

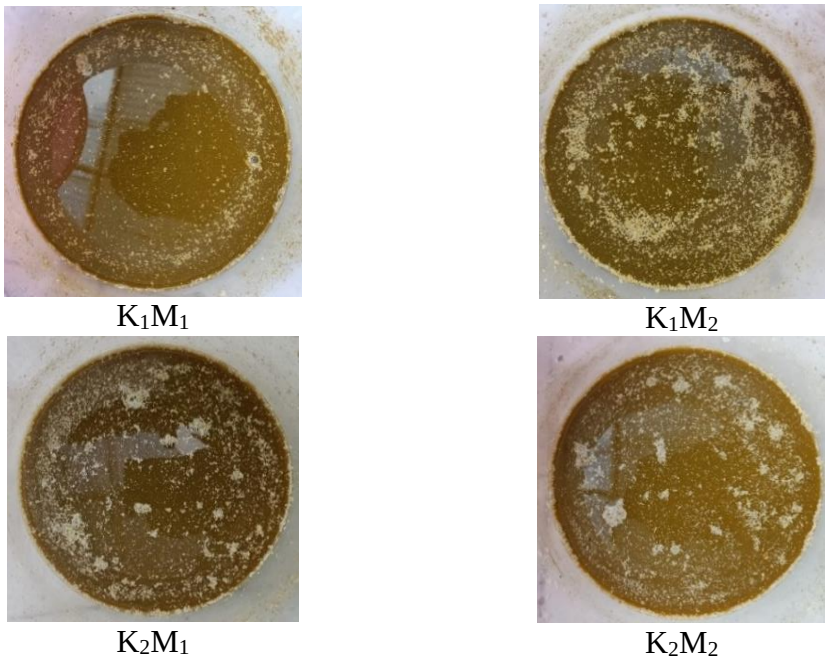
This study used an experimental research type with a completely randomized design (CRD) consisting of 2 factors with four combinations and three repetitions, namely factor 1 (K): a combination of the essential ingredients of kirinyuh leaves and coconut water waste (K 1: 168 ml: 82 ml and K 2: 82 ml: 168 ml). Factor II (M): Add MOL of pineapple skin (M 1: 100 ml and M 2: 150 ml). The data analysis used in this research is descriptive qualitative, and quantitative. This data analysis determines sensory properties (color, odor, pH). In addition, it is used to determine the content of Nitrogen, Phosphorus, and Potassium in statistical form with two-way ANOVA in the manufacture of liquid organic fertilizer by utilizing kirinyuh leaves and coconut water waste and adding skin pineapple as a bioactivator.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Sensory Observation

After fermenting for 14 days, we get the results of liquid organic fertilizer from kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator to get the following results:



K_1M_1 K_1M_2

K_2M_1 K_2M_2

Figure 1. Results of liquid organic fertilizer after fermentation for 14 days

Based on sensory observations, including color, odor, and pH in the liquid organic fertilizer combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator, the sensory test results were as follows:

Table 1. Average sensory test results of liquid organic fertilizer combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator

Combination	Observation result		
	Color	Odor	pH
K_1M_1	Greenish brown	The smell of fermentation is not overpowering	4,33
K_1M_2	Greenish brown	The smell of fermentation is not overpowering	4,00
K_2M_1	Dark greenish brown	Bad smell	4,67
K_2M_2	Greenish brown	The smell of fermentation is not overpowering	4,67

Information :
K1M1: Liquid organic fertilizer with 168 ml of kirinyuh leaf extract and 82 ml of coconut water waste with the addition of 100 ml of pineapple skin bioactivator.
K2M1: Liquid organic fertilizer with 82 ml of kirinyuh leaf extract and 168 ml of coconut water waste with the addition of 100 ml of pineapple skin bioactivator.
K1M2: Liquid organic fertilizer with 168 ml of kirinyuh leaf extract and 82 ml of coconut water waste with the addition of 150 ml of pineapple skin bioactivator.
K2M2: Liquid organic fertilizer with 82 ml of kirinyuh leaf extract and 168 ml of coconut water waste with the addition of 150 ml of pineapple skin bioactivator.

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3.1.2. Content Of Nitrogen, Phosphorus, Potassium

Based on the test results for the content of nitrogen, phosphorus, and potassium in liquid organic fertilizer combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator, the average results are as follows:

Table 2 The intermediate results of the N, P, K content test of liquid organic fertilizer combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator

Sample	N total	P total		K total	
	N %	ppm P	% P	ppm	K tot %
K_1M_1	0.71	674.35**	0.07**	812.14	0.08
K_1M_2	0.76	649.26	0.06	772.54*	0.08*
K_2M_1	0.82**	388.39*	0.04*	812.14	0.08
K_2M_2	0.38*	418.49	0.04	1049.74**	0.10**

Description: (*) lowest content, (**) highest content.

3.2. Discussion

3.2.1. Color Parameters

Based on the results of the color parameter research as shown in Table 1 above, it can be seen that the average color sensory test results on liquid organic fertilizer combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator show that the sample has a greenish-brown and dark greenish-brown color. Initially, liquid organic fertilizer has a light brown color. After being fermented, it produces a greenish-brown color. This liquid organic fertilizer has a greenish-brown color, which can be caused by the essential ingredients used. These, namely kirinyuh leaves, can affect the color of the liquid organic fertilizer to greenish-brown. According to Putri (2022) research, the maturity indicator for organic fertilizer according to SNI

19-7030-2004 is brown-black. According to Siregar (2017), the color change to brown or black is caused by the activity of microorganisms that work during fermentation and depends on the materials used in making liquid fertilizer.

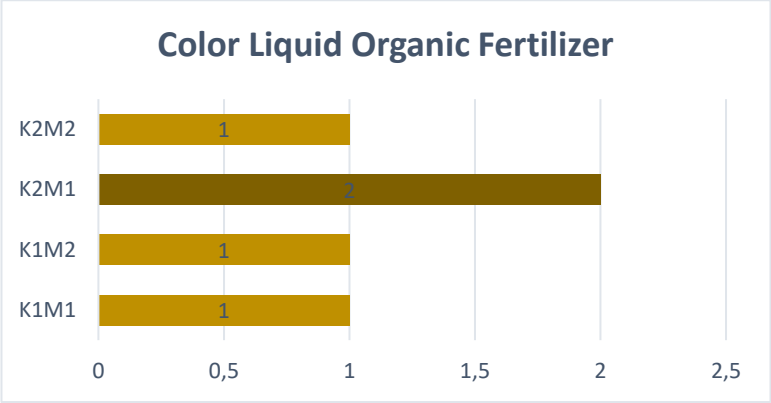

Figure 2. Parameter diagram for the average color of liquid organic fertilizer a combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator

3.2.2. Odor Parameters

Based on the results of the research on odor parameters, as shown in Table 1 above, it can be seen that the average results of the sensory odor test on liquid organic fertilizer, a combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator show that there are samples that have a non-stinging fermented odor (such as tape) and one sample have an unpleasant odor, namely K2M1. According to Sucipto & Hendariyono (2018), if liquid organic fertilizer has a tape-like odor, the liquid organic fertilizer is successful. In contrast, if the liquid organic fertilizer smells rotten, it has not succeeded (failed). The failure to make liquid organic fertilizer can be caused by various factors, such as when the jar is not closed tightly, is not stored according to the temperature, and may be too hot or cold (Selviana, 2019).

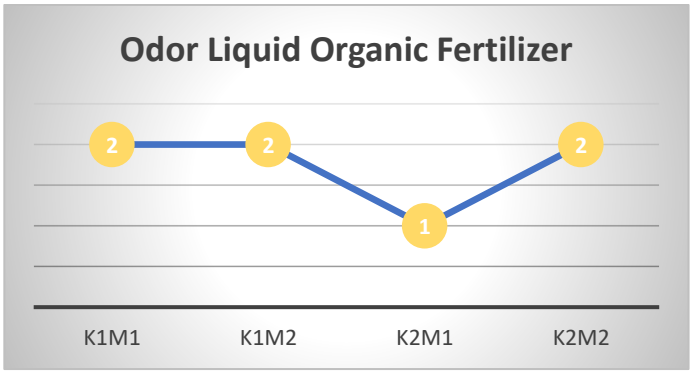

Figure 3. Parameter diagram of the average odor of liquid organic fertilizer a combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator

3.2.3. pH Parameters

Based on the results of the research on pH parameters, as shown in Table 1 above, it can be seen that the average results of the sensory pH test on liquid organic fertilizer combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator show

that all samples have a different pH of 4 .00 to 4.67. Initially, all models had a pH of 5; on day 3, several samples experienced a decrease in pH to 4. The activity of microorganisms in decomposing organic matter was marked by an increase or decrease in pH (Firdaus, 2011). The rise in pH is caused by organic materials that are broken down by certain microorganisms to produce simple organic acids so that an acidic atmosphere is created, after which other types of microorganisms will eat these organic acids, which causes the pH level to rise again (Sulfianti et al., 2021). While the decrease in pH because POC becomes acidic, is due to the activity of phosphate-solubilizing bacteria and lactic acid bacteria, which cause the formation of phosphatase enzymes and organic acids, causing the environment to become acidic (Vianti et al., 2022). This liquid organic fertilizer has a different pH, namely 4 – 4,67 . It is under the requirements of the 2011 Decree of the Minister of Agriculture of the Republic of Indonesia concerning the Minimum Technical Requirements for a liquid organic fertilizer pH of 4 – 9 (Ekawandani & Halimah, 2021).

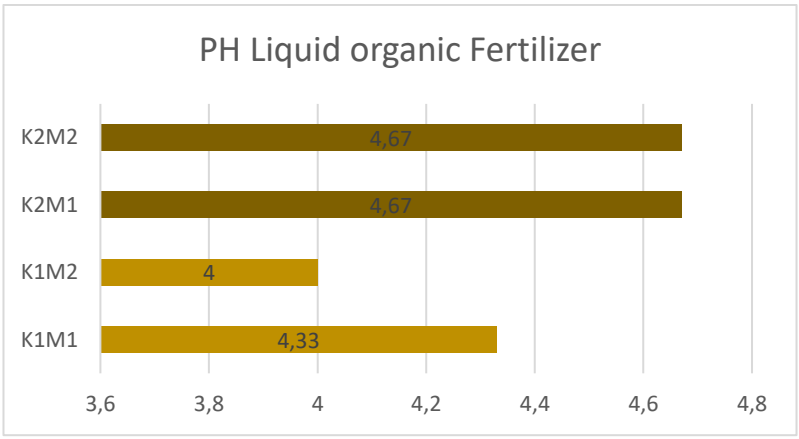

Figure 4. Parameter diagram for the average pH of liquid organic fertilizer combined with kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator

3.2.4. Nitrogen Content

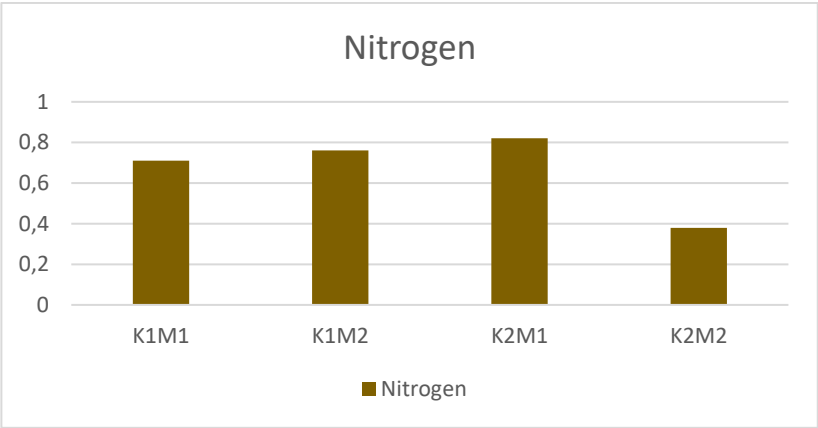

Figure 5. Diagram of the average nitrogen content of liquid organic fertilizer combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator

Based on table 2 above shows that each treatment has differences in nitrogen content. The highest average nitrogen content in the K2M1 combination treatment was 0.82 %. Meanwhile, the lowest moderate content was found in the K2M2 combination treatment, which was 0.38%. It is because the speed of the microbes for each treatment in decomposing the fermented material is different, causing the nitrogen content to vary. According to Wijaksono et al. (2016), the more bacteria present in the fermentation process, the more nitrogen content will increase. According to the test results for the nitrogen content, the lowest content was found in treatment M2, which means it had a bioactivator concentration of 150 ml. In contrast, the highest nitrogen content was found in treatment M1, which meant it had a concentration of 100 ml. In line with Prasetio & Widyastuti's research (2020), the higher the activator contained in organic fertilizer, the lower the nitrogen content. Based on SNI 19-7030-2004, liquid organic fertilizer contains at least 0.40 % nitrogen. In this liquid organic fertilizer, one treatment does not meet the quality of SNI 19-7030-2004, namely the K2M2 combination, which has an average nitrogen content of 0.38 %. It can be caused of the content of macronutrients is very dependent on the mixture of organic materials used in making fertilizer (Kasmawan, 2018).

Tests of Between-Subjects Effects

Dependent Variable: Kandungan_Nitrogen

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.349[a]	3	.116	1162.750	.000
Intercept	5.347	1	5.347	53466.750	.000
factor_1	.055	1	.055	546.750	.000
factor_2	.114	1	.114	1140.750	.000
factor_1 * factor_2	.180	1	.180	1800.750	.000
Error	.001	8	1.000E-004		
Total	5.696	12			
Corrected Total	.350	11			

a. R Squared = ,998 (Adjusted R Squared = ,997)

Based on data analysis using the two-way ANOVA test, the results show that the probability (sig.) is 0.000 <0.05, then H0 is rejected, which means that there is a significant (significant) difference in the average nitrogen content based on factor 1, namely the addition of kirinyuh leaf extract and coconut water waste, as well as factor 2, namely the addition of pineapple skin bioactivator. The probability value (sig.) = 0.000 is obtained from the Test of Between-Subject Effects table.

3.2.5. Phosphorus Content

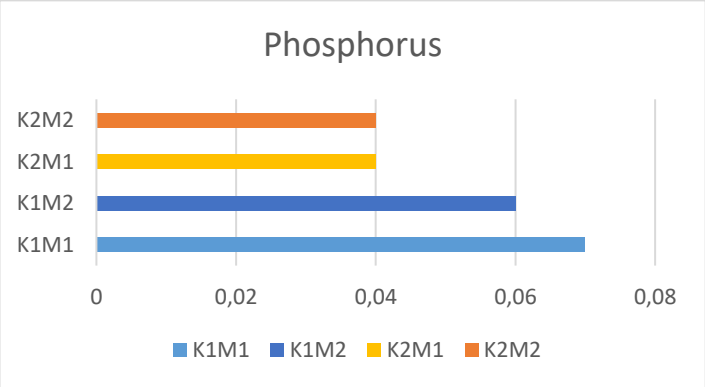

Figure 6. Diagram of the average phosphorus content of liquid organic fertilizer a combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator

Based on table 2 above shows that each treatment has a different phosphorus content. The highest average phosphorus content is found in K1M1, which is 674.35 ppm (0.07 %). In comparison, the lowest moderate phosphorus content is in K2M1, equal to 388.39 ppm (0.04 %). Based on SNI 19-7030-2004, liquid organic fertilizer has a minimum phosphorus content of 0.10 %, so all samples of this liquid organic fertilizer do not meet the quality standards of SNI 19-7030-2004 because the phosphorus content has an average of 0.04 – 0.07 %. According to Sari & Alfianita (2019), there is an increase in phosphorus levels because the EM4 activator contains phosphate-solubilizing bacteria, which play a role in helping dissolve phosphate in organic matter resulting in high levels of phosphorus. Meanwhile, there was a decrease in phosphorus levels, presumably because the phosphate bacteria had finished reacting, causing the levels obtained to decrease. According to Sulfianti et al. (2021), the solution's acidity will affect the phosphorus content; the acidity of this solution will increase with the passage of fermentation time to a certain extent. In addition, the low phosphorus content can be caused by the aerobic fermentation process, in which composting by microorganisms is slow because these microorganisms prefer conditions without air so; that microorganisms have yet to develop optimally because the process of decomposition of organic matter runs slowly and produces low phosphorus content. Optimal development of microorganisms for the number of microorganism cells produced, the phosphorus content obtained is greater (Fahlevi et al., 2021).

Tests of Between-Subjects Effects

Dependent Variable: Kandungan_Pospor

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.002[a]	3	.001	6.750	.014
Intercept	.033	1	.033	330.750	.000
factor_1	.002	1	.002	18.750	.003
factor_2	7.500E-005	1	7.500E-005	.750	.412
factor_1 * factor_2	7.500E-005	1	7.500E-005	.750	.412
Error	.001	8	.000		
Total	.036	12			
Corrected Total	.003	11			

a. R Squared = ,717 (Adjusted R Squared = ,611)

Based on data analysis using the two-way ANOVA test, it was found that the probability (sig.) was 0.003 <0.05, then H0 was rejected, which means that there is a significant difference in the average phosphorus content based on factor 1, namely the addition of kirinyuh leaf extract and coconut water waste From the Test of Between-Subject Effects table, the probability value (sig.) = 0.003 is obtained. While factor 2, namely the addition of pineapple skin bioactivator, obtained a probability value (sig.) of 0.412 > 0.05, then H0 was accepted, meaning there was no significant difference in the average phosphorus content. But based on the results table for the average value of the phosphorus content above, there is a real difference.

3.2.6. Potassium Content

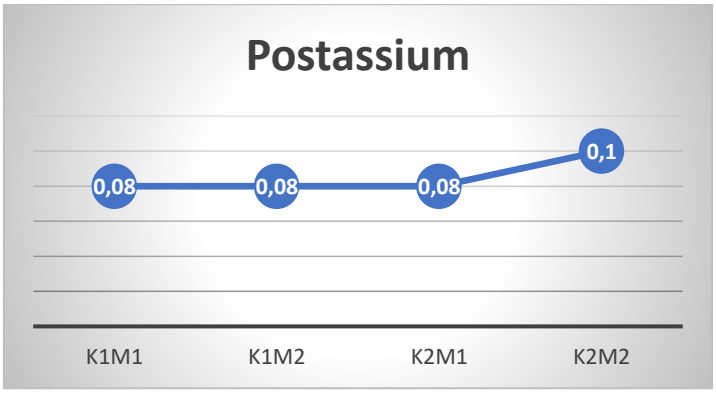

Figure 7. Diagram of the average potassium content of liquid organic fertilizer a combination of kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator

Table 2 shows that each treatment has a different potassium content. The highest average potassium content in the K2M2 treatment was 1049.74 ppm (0.10 %). In comparison, the lowest moderate potassium content is in K1M2, equal to 772.54 ppm (0.08 %). The role of potassium is as a catalyst for microorganisms that function to accelerate fermentation. If the fermentation goes fast, more and more materials are broken down, and the potassium contained can increase (Afifah, I., & Sopiany, 2017). It can be seen that the M2 treatment with 150 ml bioactivator has a higher potassium content than the content obtained from the M1 treatment with 100 ml bioactivator. In line with the research of Fahlevi et al. (2021), the greater the amount of EM4 used, the value of potassium obtained also increases. Based on SNI 19-7030-2004, the potassium content of liquid organic fertilizer is at least 0.20 %, so all samples of this liquid organic fertilizer do not meet the quality standards of SNI 19-7030-2004 because the potassium content has an average of 0.08 – 0, 10%. The reason why the potassium content differed from one sample to another was due to the large amount of EM4 added so that the number of microorganisms also increased during the decomposition process, which resulted in the breaking of carbon chains and the formation of simple carbon chains, increasing the element potassium (Fahlevi et al., 2021).

Tests of Between-Subjects Effects

Dependent Variable: Kandungan_Kalium

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.001[a]	3	.000	3.000	.095
Intercept	.087	1	.087	867.000	.000
factor_1	.000	1	.000	3.000	.122
factor_2	.000	1	.000	3.000	.122
factor_1 * factor_2	.000	1	.000	3.000	.122
Error	.001	8	1.000E-004		
Total	.088	12			
Corrected Total	.002	11			

a. R Squared = ,529 (Adjusted R Squared = ,353)

Based on data analysis using the two-way ANOVA test, it was found that the probability (sig.) was 0.122 > 0.05, then H0 was accepted, which means that there was no significant (not significant) difference in the average potassium content based on factor 1, namely the addition of

leaf extract. kirinyuh and coconut water waste. Whereas factor 2, namely the addition of pineapple skin bioactivator, obtained a probability value (sig.) of 0.122 > 0.05, then H0 was accepted, meaning there was no significant difference in the average phosphorus content. The probability value (sig.) = 0.122 is obtained from the Test of Between-Subject Effects table. But based on the results table for the average potassium content value above, there is little real difference.

4. CONCLUSIONS

Based on the results of the study, it was shown that liquid organic fertilizer from kirinyuh leaves and coconut water waste with the addition of pineapple peels as a bioactivator in sensory tests, which included color, odor, and pH had good quality average results according to SNI 19-7030-2004 and the requirements from the Decree of the Minister of Agriculture of the Republic of Indonesia in 2011 concerning Minimum Technical Requirements for organic fertilizers. But some samples do not meet the quality because they have an unpleasant odor, namely K2M1. Meanwhile, based on the liquid organic fertilizer content test, only three treatments met the quality standards of SNI 19-7030-2004 on nitrogen content, namely K1M1, K1M2, and K2M1. In contrast, the phosphorus, potassium, and nitrogen content in the K2M2 treatment did not meet the quality standards of SNI 19-7030-2004.

After reviewing the results and conclusions of this study, the suggestions that can be given are recommended for further research using higher concentrations of ingredients and it is expected to be able to carry out further research on the application of liquid organic fertilizer from kirinyuh leaves and coconut water waste with the addition of pineapple peel as a bioactivator to plant.

5. ACKNOWLEDGMENTS

Thank you to those who have played a role and supported this research so that this research can run smoothly.

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