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Macronutrients Level And Total of Bacteria From Combination of Banana Stems And Coconut Fibers With MA-11 As Bioactivator

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Abstract. The purposes of this research were to determine the maximum macronutrients content of C, N, P, K and the total of bacteria from combination of banana (*Musa paradisiaca*) stems, and coconut fibers that is using local microorganism MA-11 as a bioactivator. The combination includes Combination 1 (K1): 250 grams of banana stems and 250 grams of coconut fiber; Combination 2 (K2): 375 grams of banana stems and 125 grams of coconut fiber; Combination 3 (K3): 125 grams of banana stem and 375 grams of coconut fiber. Each combination added 1 liter of coconut water, 125 grams of sugar and 125 ml of MOL MA-11 which was fermented for 7 days. The contents of C, P and K in liquid organic fertilizer were determined by using a spectrophotometer, while N levels were determined using semi micro kjeldahl. The number of bacteria in each combination is calculated using the total count method. The results showed that the highest of total Carbon (C) was found in combination 1 (K1) of liquid organic fertilizer, namely 14.35%. The maximum macronutrients N, P and K are found in the combination 3 (K3), respectively 2.48 % (N), 0.66 % (P) and 2.19 % (K). The highest total count of bacterial was found in combination 3 (K3) was 8.2×10^7 cfu/ml.

1. Introduction

Agriculture is one of the main sectors in Indonesia's development. As a country that has many populations that are increasing every year, This country has serious homework, especially the problem of food security. Agricultural products become one of the foundations of society in meeting their daily needs. But often agricultural land used to grow rice and secondary crops do not produce optimal production, causing production to decline.

Bali as one of the islands in Indonesia which has a decreasing amount of rice production. Data from the Central Bureau of Statistics of the Province of Bali stated that rice production per hectare decreased from 858,315.76 tons in 2011 to 853,899 tons in 2015 or decreased by around 0.5%. This is caused by many things, among others. The phenomenon of land use change triggered by many things, one of which is the rapid development of the tourism sector and the data came from the Central Bureau of Statistics (BPS) of the Province of Bali, which states that the maximum time period for the conversion of paddy fields during 2000-2012. In 2000, the area of rice fields in Bali Province was 85,776 hectares to 81,625 hectares in 2012, which means around 4,151 hectares of paddy fields switch function to non-rice fields [13]. The land condition is currently a lot of concern.



Another problem that currently arises is that agricultural land is starting to be intolerant to be planted due to the continuous use of synthetic chemical fertilizers. Inaccuracy in the use of fertilizers causes hardening of the soil. According to [7], the hardness of soil texture is caused by accumulation of residual or chemical fertilizer residues so that the soil is difficult to decompose. Chemical properties are relatively more difficult to decompose or break down compared to organic matter. The harder the soil, the harder it is to absorb nutrients; use of higher fertilizer concentrations to get the same results as previous harvests; and the process of spreading the roots and aeration (breathing) of the root is disrupted resulting in the root being unable to function optimally and in turn decreasing the production capacity of the plant.

The number of negative factors caused by unhealthy soil due to the use of synthetic chemical fertilizers raises the thinking for some parties about saving agricultural land. In addition to the method of tillage, synthetic chemical fertilizers must be replaced with organic based fertilizers provided by nature. Bananas or *Musa paradisiaca* are known as plants that live in a variety of topographic soils, whether flat or sloping land. The optimum productivity of bananas will be produced on flat land at altitudes below 500 m above sea level (asl) and acidity of the soil at pH 4.5-7.5. Daily temperatures range from 25°C-28°C with rainfall of 2000-3000 mm / year [12]. Bananas are fruiting plants only once and then die so the banana stems will become waste. Fiber and coconut water are part of coconut plants which are widely found and contain nutrients. According to [5], coconut fruit has a composition of coconut fibers 35%, shells 12%, fruit meat 28% and fruit water 25%. One coconut can get an average of 0.4 kg fibers containing 30% fiber.

Fertilizers with a combination of organic ingredients require bioactivators to shorten their formation time during fermentation. Local microorganisms are chosen because they come from residual organic matter. MA-11 or *Microbacterium alfa-afa* is known as one of the local microorganisms that is popular as innovative decomposers are developed by the mini laboratory of the Agricultural Extension Institute which has been tested in the microbiology laboratory, Gajah Mada University. Based on the foregoing, it is necessary to do research on the test of NPK content of liquid organic fertilizer in combination with banana stems, fibers and coconut water with local microorganisms MA-11 as bioactivators to determine the exact fertilizer content so that it can be applied in accordance with the correct dosage of plants by farmers. In addition, the total number of bacterial colonies in fertilizers is used as a quality standard for organic fertilizers.

2. Methods and Procedures

2.1. The Formula of Liquid Organic Fertilizer

The making of liquid fertilizer combination began with preparing all ingredients. Then based on previous research and based on information from The Research Centre of Tampak siring obtained, among others

- Combination of 1 (K1): 250 grams of banana stem + 250 grams of coconut fiber + 1 liter of coconut water, 125 grams of sugar and 125 ml of MOL MA-11.
- Combination of 2 (K2): 375 grams of banana stem + 125 grams of coconut fiber + 1 liter of coconut water, 125 grams of sugar and 125 ml of MOL MA-11.
- Combination of 3 (K3): 125 grams of banana stem + Coconut fiber 375 grams + 1 liter of coconut water, 125 grams of sugar and 125 ml of MOL MA-11.

Furthermore, the plastic jar that has been washed is prepared then all the ingredients are put into it, stirred until it is homogeneous and evenly mixed then the container is closed tightly. The container is placed in a safe place at room temperature for further fermentation for 7 days. On the 7th day each solution was taken as much as 20 mL and analyzed by N, P and K.

2.2. Test Phase of Content N, P, K

2.2.1. Determination of N-Organic

Weighing 0.25 g of sample into the kjeldahl flask plus 0.25 g of selenium mixture and 3 mL of H_2SO_4 pa, whipped until evenly mixed and left for 2 hours to be fabricated. It is reconstructed to perfection with a gradual temperature of 150°C until finally the maximum temperature is 350°C and a clear liquid is obtained (3 hours). After being cold diluted with a little aquades so as not to crystallize. Quantitatively moved the solution into a destilator boiling pumpkin volume of 250 ML, plus distilled water to half the volume of boiling pumpkin and a little boiling stone. Plus 10 ML of 40% NaOH. Prepare a distillate container which is 10 ML of 1% boric acid in 100 ML erlenmeyer which is added with 3 drops of conway indicator, and is stopped when the fluid in erlenmeyer has reached about 75 ML. Destilat is titrated with 0.05 N H_2SO_4 to the end point (the color of the solution changes from green to pink) This titl is called A ML, then the same thing is done on the determination of the ML blank this titrant is called A1 ML [4].

2.2.2. Determination of P Levels

a) Sample Preparation

Considering 0.5 g of sample is inserted into the Kjeldahl flask, added 5 ml of HNO_3 and 0.5 ml of HClO_4 , whipped and shaken overnight. Heated starting with a temperature of 100°C , after the yellow vapor is exhausted the temperature is raised to 200°C . Destruction ends when white steam has gone out and the liquid in the flask is left about 0.5 ML cooled and diluted with distilled water and the volume is adjusted to 50 ML, whipped until homogeneous and left overnight or filtered with W-41 filter paper to obtain clear extracts (extract A) [4].

b) Making Color Generating Reagents

Concentrated reagents; Weighed 12 g $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24} \cdot 4\text{H}_2\text{O}$ plus 0.275 g potassium antimonitrate added with 140 ML H_2SO_4 pa then diluted with distilled water to 1000 ML. Dilute reaction; 0.53 g of ascorbic acid plus 50 ML of concentrated reagent made 500 ML with ion-free water [4].

c) Preparation of Standard Solution P

Phosphorus standard solution from 50 ppm Phosphorus standard solution was made variation 2; 4; 6; 8 and 10 ppm [4]. A total of 2; 4; 6; 8 and 10 ml standard 50 ppm solution was put in a 50 ML volumetric flask and added to distilled water until the boundary markings [6].

d) Determination of maximum wavelength

As much as 1 ML of standard 8 ppm phosphorus solution is put into a 10 ML volumetric flask then added 9 ML of reagent solution until the boundary mark is then allowed to stand for 15 minutes. The solution was put into the UV-Vis cuvette and the absorbance was measured at wavelengths between 650-750 nm.

e) Making a calibration curve

Prepare 7 pieces of 25 ML volumetric flask for pumpkin number 1 filled with blanks while pumpkin 2 to 7 filled with phosphorus 2 standard solution; 4; 6; 8; and 10 ppm each of 1 ml then added 9 ml of reagent after it was left for 15 minutes. The solution is inserted into the cuvette and the absorbance is measured at the maximum wavelength.

f) Determination of P levels in the sample

Take 1 ML of extract A put into a 25 ML volumetric flask then add distilled water until the boundary mark is then shaken until homogeneous (extract B). Pipette 1 ML of extract B into a volume flask of 25 ML, as well as each standard series P plus 9 ML of color generator reagent into each sample and standard series, shaken until homogeneous. Left for 15 minutes, then measured with UV-Vis at a wavelength of 713 nm.

2.2.3. Determination of K levels

1) Preparation of K Standard Solution

Standard K solution from standard 20 ppm potassium solution was made with standard solution 2; 4; 6; 8; 10 ppm [4], by taking as much as 1; 2; 3; 4 and 5 ml of standard solution were then put into a 10 ml volumetric flask plus distilled water to the boundary mark [6].

2) Making Calibration Curves

The solution that has been made is measured by absorbance using SSA then plotted into the graph to obtain a potassium calibration curve.

3) Determination of K levels in the sample

Weighing 0.5 g of sample into a Kjeldahl flask, plus 5 ml of HNO_3 pa and 0.5 ml of HClO_4 pa, whipped and shaken overnight and then heated to a temperature of 100°C , after yellow steam is exhausted the temperature is increased by 200°C . Destruction ends when white steam has gone out and the liquid in the flask is left 0.5 ml then cooled and diluted with H_2O and the volume is adjusted to 50 ml, shaken until homogeneous and left overnight or filtered with W-41 filter paper to obtain clear extract (extract A) Piping 1 ml of extract A is put into a 25 ml volumetric flask plus distilled water to the boundary markings, then shaken until homogeneous (extract B). Measure K using SSA with a standard series as a comparison.

2.3. Calculation Phase of Bacterial Colonies

Calculation of the number of bacterial colonies starts from the dilution process. Each combination of Liquid Organic Fertilizer will be diluted to 10^{-8} . As for the stages of dilution as follows. Sterile reaction tubes were prepared as many as 9 pieces containing 9 ml sterile aquades. Liquid Organic Fertilizer with its combination is inserted into the first tube as much as 1 ml. Then 1 ml of the solution was taken from the tube with a 10^{-1} dilution and mixed into the second test tube which was filled with 9 ml of distilled water. The second tube is a 10^{-2} dilution tube. This is done up to 10^{-8} dilutions.

After the dilution stage is complete then proceed with the planting process. A total of 10 ml of sterilized NA media was poured into a petri dish and allowed to stand for a while but not solid. As much as 1 ml of diluted liquid organic fertilizer was taken with millipipet and dripped on NA and then shaken to form an eight figure then the petri dish was closed and allowed to become solid. Then the petri dish was placed in the incubator for 1-2 x 24 hours and the number of colonies was calculated [2].

2.4. Data analysis

Data obtained from this study will be analyzed with a qualitative approach. The data will be presented systematically in the form of tables, graphs and images. The data obtained include the content of N, P, and K from each liquid organic fertilizer combined. As well as data on the number of bacterial colonies obtained in each combination

3. Result and Discussion

The level of macronutrient in each combination are showed different results. The data of the macronutrient levels can be seen in Tabel 1.

Table 1. The NPK Level (mg/L) from Each Combination of Liquid Organik Fertilizer

Combinations	Replications	Levels (mg/L)			
		C	N	P	K
K1	1	143,770	10,930	4,780.519	13,666.667
	2	143,224	11,490	4,819.481	13,820.513
Average of K1		143,497	11,210	4,800	13,743.592
K2	1	132,295	19,050	5,780.519	18,230.769

	2	132,842	19,330	5,845.455	18,384.615
Average of K2		132,569	19,190	5,812.987	18,307.692
K3	1	124,098	24,650	6,533.766	21,974.359
	2	124,918	24,930	6,585.714	21,717.949
Average of K3		124,508	24,790	6,559.740	21,846.156

From the table above (table 1) it can be seen that the average of the largest macronutrient content produced by liquid organic fertilizer is found in element C in all combinations used in this study, respectively K1, K2 and K3 are 143,497 mg/L, 132,569 mg/L and 124,508 mg /L. While Phosphorus is the smallest element produced in liquid organic fertilizer.

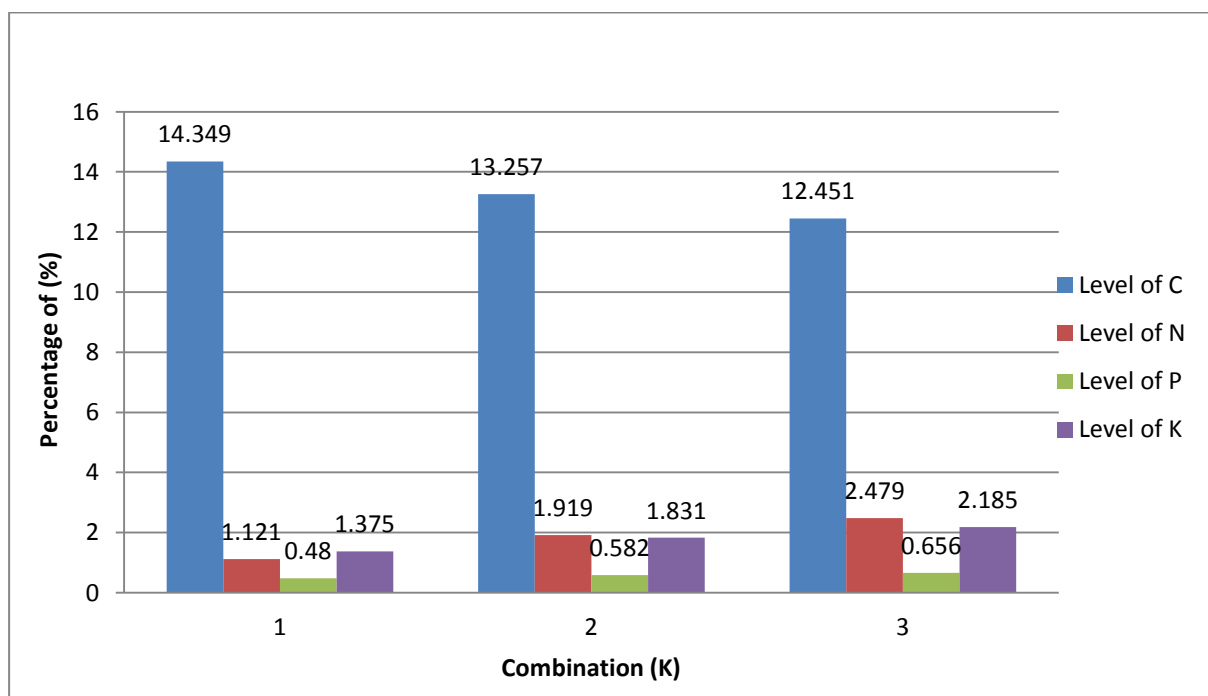


Figure 1. The Percentase (%) from Combination of Liquid Organik Fertilizer. Combination of 1 (K1): 250 grams of banana stem + 250 grams of coconut fiber + 1 liter of coconut water, 125 grams of sugar and 125 ml of MOL MA-11; Combination of 2 (K2): 375 grams of banana stem + 125 grams of coconut fiber + 1 liter of coconut water, 125 grams of sugar and 125 ml of MOL MA-11; and Combination of 3 (K3): 125 grams of banana stem + Coconut fiber 375 grams + 1 liter of coconut water, 125 grams of sugar and 125 ml of MOL MA-11

In Figure 1, it can be seen that the percentage of macronutrient content shows different results in each combination. The highest carbon content (C) is found in combination Combination of 1 (K1): 250 grams of banana stem + 250 grams of coconut fiber + 1 liter of coconut water, 125 grams of sugar and 125 ml of MOL MA-11. Whereas the content of NPK elements is found in the combination of Combination of 3 (K3): 125 grams of banana stem + Coconut fiber 375 grams + 1 liter of coconut water, 125 grams of sugar and 125 ml of MOL MA-11 respectively 2.479%, 0.656%, and 2.185%.

Table 2. The Total Count of Bacteria (CFU/ml) from Each Combination of Liquid Organik Fertilizer

Combinations	Total count of bacteria (CFU/ml)	Dilution
K1	0.70×10^7	10^7
K2	0.03×10^7	10^7
K3	8.20×10^7	10^7

In calculating the total number of bacterial colonies in each combination of liquid organic fertilizer used in the study (Table 2), Combination 3 (K3) shows the highest number of 8.20×10^7 CFU / ml. While K2 shows the least amount.

Liquid organic fertilizer using organic materials in nature produces different macro nutrient content. In addition to the content of these natural ingredients, the type of bioactivator used also greatly affects the macro nutrient content in fertilizers. In this study macro nutrients produced were influenced by the content of banana, water and coconut fibers which could be utilized by the bacterial bioactivator MA-11.

The results of this research, the most elements produced from the three combinations are carbon (C). In table 1 it can be seen that these elements are K1, K2, and K3, respectively 143,497 mg / L, 132,569 mg /L and 124,508 mg / L. The combination of 1 which is 250 grams of banana stem, 250 grams of coconut fiber, and 1 liter of coconut water shows the highest carbon element content from other combinations used in this study. This is clarified in Figure 1. where the highest percentage of carbon in K1 reached 14.35%. Banana stems contain carbohydrates in the form of cellulose which can be broken down by MA-11 microorganisms into monosaccharides containing carbon elements. [10] states that banana stems contain 4.6% carbohydrates so they can be used as compost fertilizer and food enhancer in livestock. Similarly, coconut fibers contain cellulose, lignin, pyroligneous acid, gas, charcoal, tannins and potassium. [8] in their research coconut coir contains elements of carbon (C) so that it can be used as an active carbon material. MA-11 microorganisms are indicated as cellulosic bacteria that can remodel organic substances, especially cellulose. [1] states that Microbacter Alfaafa (MA-11) is a microbial super decomposer that is capable of rapidly overhauling organic chains and restoring health and soil elasticity composed of Rhizobium sp. which is combined with various bacteria taken from cattle rumen, namely cellulolytic bacteria, proteolytic bacteria, and amylolytic bacteria.

The highest percentage of N, P, K content was in combination 3 (K3), namely a mixture of 125 grams of banana stem and coconut fiber 375 grams plus 1 liter of coconut water, 125 grams of sugar and 125 ml of MOL MA-11, respectively 2,479% (N), 0,656% (P) and 2,185% (K). In [9], the highest macronutrient content of nitrogen (N) was found in 70 ml of banana stems, 130 ml of coconut fiber and 100 ml of chicken manure at 0.15%. The use of bioactivator of MA-11 microorganisms produces a higher N level of 94% compared to using chicken manure. Coconut fibers contain 30% fiber which is rich in potassium and 2% phosphorus [10]. So the number of coconut fibers in the composition affects the levels of N, P, and K produced. According to research by [14] regarding the effect of the use of waste fish washing water and coconut fiber on the nutrient content of liquid organic fertilizer showed the best treatment was found in the addition of 100 ml coconut fiber and fermentation time for 2 weeks with the macro nutrient content produced namely organic Carbon, Nitrogen, Phosphor and Kalium/Potassium were 11.690%, 2.251%, 0.710% and 0.029% respectively. This shows that the addition of bioactivator plays a role in decomposing compounds into macro nutrients of liquid organic fertilizer. Although the levels of fertilizer have not been in accordance with SNI but have shown better results compared to previous studies [3]. This is also evidenced by the highest number of bacterial colonies found in combination 3 liquid organic fertilizers, namely 8.20×10^7 CFU/ml (according to

Indonesia National Standard). The more content of compounds that can be utilized by MA-11 microorganisms into simple elements, the more bacterial growth.

4. Conclusion and Future Works

The conclusions of this research were (1) The highest of total Carbon (C) was found in combination 1 (K1) of liquid organic fertilizer, namely 14.35%. The maximum macronutrients of Nitrogen (N), Phosphorus (P) and Potassium (K) were found in the combination 3 (K3), respectively 2.479% (N), 0.656% (P) and 2.185% (K). (2) The highest total count of bacterial was found in combination 3 (K3) that was incubation during 2 x 24 hours, namely 8.20×10^7 cfu / ml.

It would be better to continue this research, Trying each of the combinations as a liquid fertilizer in the glasshouse.

References

- [1] Artarizqi, A.T. 2012. *MA-11, Super Microbial Collaboration*. Available at: April 22, 2018. Address: http://homeschoolingkaksetosemarang.com/article/99275/ma-11_collaboration-mikroba-super.html.
- [2] Cappucino, J.G. dan N. Sherman. 2013. *Manual Laboratorium Mikrobiologi* Ed. 8. Jakarta: EGC Medical Book Publishers.
- [3] Dwidjoseputro, D. 1990. *Basics of Microbiology*. Jakarta: Djambatan.
- [4] Eviati and Sulaeman. 2009. *Analysis of Soil, Plant, Water and Fertilizer Chemistry*. Bogor: Agricultural Research and Development Agency Ministry of Agriculture.
- [5] Haryanto, T. and D. Suheryanto. 2004. *Separation of coconut fiber into coconut fiber with processing equipment (defibring machine) for small businesses*. Proceedings of the national seminar on chemical engineering and processes. ISSN: 1411-4216, p. 1-9.
- [6] Miz, M. 2012. *Phosphorus Production from Red Snapper Fish (Lutjanus sp.) For Increasing the Phosphorus Level of Tempe Factory Liquid Organic Fertilizer*.
- [7] Notohadiprawiro, T., S. Soeprapto, and E. Susilowati. 2006. *Soil Fertility Management and Fertilization Efficiency Improvement*. Soil Science UGM, Yogyakarta.
- [8] Pertiwi, D and Herumukti, W. 2009. *Study of Utilization of Coconut Fiber as Activated Carbon to Reduce Phenol Concentration*. Final Project Journal. Departement of Environment Engineering FTSP-ITS.
- [9] Purwati, A.D. 2017. *Test of N and P Content of Liquid Organic Fertilizer Combination of Banana Stems and Coconut Fiber with Addition to Chicken Manure as Bioactivator*. Essay. Biology Education Study Program. Faculty of Teacher Training and Education. Muhamadiyah University Surakarta.
- [10] Rahmadhani, S. 2011. *Effect of Addition of Coconut Fiber to Sand Sliding Strength Parameters*. SMARTEK Journal vol.2.
- [11] Rismunandar. 2001. *Planting Banana*. Sinar Baru Algensindo. Bandung.
- [12] Rukmana, H. R. 1999. *Earthworm Cultivation*. Kanisius; Yogyakarta
- [13] The Central Bureau of Statistics of the Province of Bali. 2017. *Harvest Land Data, Rice Production and Productivity in 2011 to 2015*. Available at <https://bali.bps.go.id/linkTableDinamis/view/id/56> ,Open at December 5, 2017.
- [14] Waryanti, Anik, Sudarno, and Endro Sutrisno. 2013. *Study of the Effect of Addition of Coconut Fiber to the Making of Liquid Fertilizer from the Waste of Fish Washing Water on the Quality of Macro Nutrients (CPNK)*. Now: Environmental Engineering Study Program of FT UNDIP.