

# The Influence of Liquid Organic Fertilizer from Peanut and Banana Peels toward Vegetative Growth of Spinach

Rusdiyana<sup>1,2\*</sup>, Dyah Rini Indriyanti<sup>3</sup>, Putut Marwoto<sup>3</sup>, Retno Sri Iswari<sup>3</sup>, Edy Cahyono<sup>3</sup>

<sup>1</sup> Doctoral Science Education Study Program, Postgraduate Program, Semarang State University, Indonesia

<sup>2</sup> Primary school teacher education study program, Universitas Achmad Yani, Banjarmasin, Indonesia

<sup>3</sup> Postgraduate Program, Semarang State University, Indonesia

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**Abstract:** The liquid organic fertilizer (LOF) formula from peanut and banana peels. This research aims to: (1). Analyze the effect of LOF provision from peanut and banana peels on the vegetative growth of spinach; (2). Analyze the best LOF dose for vegetative growth of spinach, and (3). Analyze the effect differences between NPK fertilizer and LOF from peanut and banana peels toward the vegetative growth of spinach. The researchers promoted this study from November to December 2020 in a greenhouse in Banjarbaru. The researchers applied RAL design by providing fertilizer since the spinaches were 10, 17, and 24 days. The vegetative growth parameters were: Plant height, number of leaves, leaf width, and the leave color. The result proved that: (1). LOF provisions from peanut and banana peels significantly influenced the height and leave numbers of spinach; (2). The best dose for LOF provision is 50ml of peanut peel LOF + 50ml of banana peel LOF to get excellent height and leave numbers of the spinach; (3). The growth of the spinach, in terms of height, numbers of leaves, and leaf width during NPK fertilizer provision, was in line with the provisions of banana and peanut peel LOF.

**Keywords:** *Amarantus SP*; Leaf width; NPK; Liquid organic fertilizer; Spinach height

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## Introduction

Indonesia has the most fertilized soils and is suitable for any vegetative plants. One of them is spinach, *Amaranthus sp*, because it is easy to cultivate. Besides planting spinach, Indonesian people also plant banana trees in plantations, farms, or yards. The local community usually processes bananas into high-value products instead of directly consuming bananas (Nasrun et al., 2016). Borneo has many saba bananas, *Musa paradisiaca forma typical*. The community usually fry the pulps into the fried banana, cook *wadai Amparan tatak*, and make the banana into banana cake or *kolak*. However, they have not used banana peels.

Borneo is an island that cultivates the most saba bananas and peanuts, *Arachis hypogaea*. Many local people sell peanuts in traditional markets. The people usually take the seeds and process the seeds into snacks and seasoning. However, the peels have not been used as organic fertilizer. Peanut peels have many macronutrients, useful for vegetative growth, such as vegetable plants. Using banana or peanut peels as the primary materials to make liquid organic fertilizer, POC, makes the nutrients easier to absorb by plant roots (Paradosi et al., 2014). These fertilizers are also environmentally green (Puspawati, et al., 2016).

Banana peels contain potassium, phosphorus, calcium, manganese, sodium, magnesium, and sulfur (Departemen Pertanian, 2008). Kadir et al, (2016)

\* Corresponding Author: [rdiyana81@students.unnes.ac.id](mailto:rdiyana81@students.unnes.ac.id)

explain that banana peels are wastes that have nutrients, especially potassium, to support microbial growth during the fermentation phase. Banana peels are useful materials to produce liquid organic fertilizer (Nasrun et al., 2016). They have many micronutrients for the vegetative growth of vegetable plants. On the other hand, peanut peels have many potassium and phosphor (Departemen Pertanian, 2008) and many other nutrients, such as N 2,64%, P<sub>2</sub>O<sub>5</sub> 3,56%, K<sub>2</sub>O 1,67%, and C organic 4,93% (Dahlan & Darmansyah, 2011). The formula of liquid organic fertilizer mixtures from saba bananas and peanut peels could complement the macronutrients for the vegetative growth of spinach.

Banana peels have many potassium and phosphor. However, they have low nitrogen. Peanut peels can provide the needed N substance as the macronutrient of the spinach's growth. From the background, this research reviewed: "The Influence of Liquid Organic Fertilizer from Peanut and Banana Peels toward Vegetative Growth of Spinach."

This research aims to: (1) Analyze the effect of liquid organic fertilizer provision from peanut and saba banana peels toward the vegetative growth of spinach, *Amanathus sp*; (2) Analyze the best liquid organic fertilizer dose for vegetative growth of spinach; and (3). Analyze the effect differences between NPK fertilizer and liquid organic fertilizer from peanut and banana peels toward the vegetative growth of spinach.

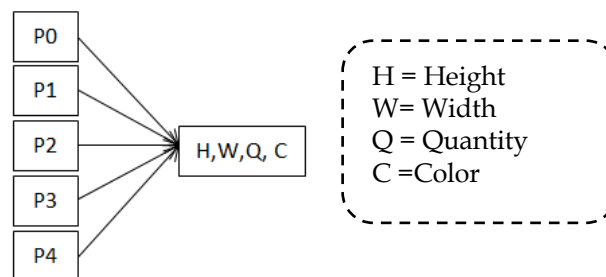
**Method**

The researchers conducted this study from November until December 2020 in a personal greenhouse located in Banjarbaru, 500 m above the sea surface. The applied design was Complete Random Design. It consisted of five treatments. They were P0 = 0 ml POC, P1= 50 ml POC of peanut peel + 50 ml POC of saba banana peel, P2= 75 ml POC peanut peel + 25 ml POC saba banana peel, P3= 25 ml POC peanut peel + 75 ml POC saba banana peel, and P4= manufactured NPK fertilizer, 5 grams. The researchers provided the fertilizers three times. The first administration was during 10-days old of the spinach. The second administration was when the spinach was 17-days old. Then, the third administration was when the spinach was 24 days old. Research treatments can be seen in Figure 1.

The researchers produced banana peel liquid organic fertilizer from saba banana peels (500 gram). The researchers sliced and fermented the peels within 1L water for three days. Then, the researchers filtered the solution diluted with a ratio of 1:3. The result was 3L Liquid Organic Fertilizer to use. The researchers produced peanut peel liquid organic by fermenting the peanut peels, 500gram, within 500ml of water in a

sealed bottle for two weeks. Then, the researchers filtered the soaked water. The result was 500ml liquid organic fertilizer to use.

The researcher seeded the green spinach seeds in a huge pot for ten days. After the seed grew, the researchers sorted the sprouts with the same height, 2 cm. Then, the researchers moved the sprouts in a planting medium. The researchers used soil from yards, 2 kg of soil, and put it in small pots sized 25 cm x 25 cm. The researchers found four 10 days old sprouts to move in the planting medium with a 2 cm distance for each sprout.



**Figure 1.** The Influence of LOF from Peanut and Banana Peels, NPK fertilizer toward height, the leaf width, numbers of leaves, and the leaves color.

The observation parameters of the vegetative growth of spinach were: a). Height of spinach (cm) since the researchers moved the plants from the seedling medium. The researchers measured the height once a week for four weeks; b) The researchers counted the numbers of the spinach once a week for four weeks. The researchers counted the blossoming leaves; c) measured the leaf width once a week for four weeks. The researchers measured the blossoming leaves and d) observed the spinach colors once a week for four weeks. The researchers analyzed the data of the spinach's height, spinach's leaves, and leaf width with an observation table. Then, the researchers examined the influences of the treatments toward the spinach's height, the leaf numbers, and the leaf width with ANOVA statistic test under 1% significance level and 5% for real influence. Then, the researchers continued the examination with the Bonferroni test, assisted by SPSS.

**Result and Discussion**

The administration of Liquid Organic Fertilizer and NPK influence the spinach height (Table 1). The best treatment was P1, 50 ml POC of peanut peels + 50 ml POC of saba banana peels and P4, NPK fertilizer (Table 2). The result shows that liquid organic fertilizers from saba banana and peanut peels have equal effects with the manufactured fertilizer. Phibunwatthanawong & Riddech (2019) also found the

administration of liquid organic fertilizer had an equal effect with chemical fertilizer or manufactured fertilizer toward lettuce's growth (*Green Cos Lettuce*). The organic fertilizer could be combined with NPK. The

combination of organic and NPK fertilizers significantly influences the growth of coconut height (Siallagan et al., 2014).

**Table 1.** Effect of POC, NPK on the growth of spinach stem height, number of leaves and leaf width

Treatment	10 days	17 days	24 days	31 days	38 days	T-tes sig 1%	T-tes Sig 5%
<b>Height</b>							
P0	2.00	2.80	3.25	5.75	8.56		
P1	2.00	3.83	6.28	9.68	17.39	**	*
P2	2.00	3.13	4.85	8.20	12.33	**	*
P3	2.00	3.08	4.43	9.67	12.33	**	*
P4	2.00	3.25	3.88	8.18	15.78	**	*
<b>leaves</b>							
P0	3.00	4.00	4.25	5.75	6.00		
P1	3.00	4.00	5.25	8.25	8.50	**	*
P2	3.00	4.00	5.25	6.00	7.25	ns	ns
P3	3.00	4.00	5.50	6.25	7.25	ns	ns
P4	3.00	4.00	5.25	7.25	7.75	ns	ns
<b>Leaf width</b>							
P0							
P1	1.18	1.25	1.13	2.41	2.72		
P2	1.25	1.63	3.36 2.98	2.84	3.35	ns	ns
P3	1.25	1.68	2.98	2.39	2.69	ns	ns
P4	1.15	1.35	2.13	2.80	2.91	ns	ns
	1.25	1.65		2.10	3.55	ns	ns

Note: P0 = 0 ml POC, P1 = 50 ml POC peanut shells + 50 ml POC banana skins kepok, P2 = 75 ml POC peanut shells + 25 ml POC banana peels kepok, P3 = 25 ml POC peanut shells + 75 ml POC of kepok banana peel, and P4 = 5 grams of NPK fertilizer, \* = significant at 5% level ANOVA test, \*\* = significant at 1% level ANOVA test, ns = not significant.

**Table 2.** The results of the Bonferroni follow-up test on the height of spinach aged 38 days

Treatments	Average sh	P-value	Sig 1% uji-t	P-value	Sig 5% uji-t
P0	8.56				
P1	17.39	0.000	**	0.000	*
P2	12.33	0.002	**	0.002	*
P3	12.33	0.002	**	0.002	*
P4	15.78	0.000	**	0.000	*

Note: P0 = 0 ml POC, P1 = 50 ml POC peanut shells + 50 ml POC banana skins kepok, P2 = 75 ml POC peanut shells + 25 ml POC banana peels kepok, P3 = 25 ml POC peanut shells + 75 ml POC of kepok banana peel, and P4 = 5 grams of NPK fertilizer, sh = stem height,

\* = significant at 5% level, \*\* = significant at 1% level.

The administration of organic fertilizer could restore the soil's nature (Eugene, et al., 2010). The nutrient from organic fertilizers could be absorbed by plants (Ermadani & Muzar, 2011). Thus, organic fertilizer administration with correct doses is important for the plant's growth. This research combined liquid organic fertilizers from peanut peels and saba banana peels. The treatment of P1 (50 ml POC peanut peel + 50 ml saba banana peels) is the best dose to support the growth of spinach's height. Peanut peels contain nitrogen, phosphor, and potassium. Utilization of peanut shells as organic fertilizer has provided the best average plant height. Khomami (2015) also used peanut peels as organic fertilizers to improve the growth of *marigold* and *Viola tricolor*. The administration of peanut peels as organic fertilizer improved the fertility of the

soils by restoring the chemical natures of the soils and the microbial activities. This organic fertilizer could also decrease the electrical conductivity of saline soils. Thus, the experiment could prove the increased growth of *S. Senegal*, *V. seyal*, and *P. juliflora* (Fall, et al., 2018).

The organic fertilizer from banana peels contains 15% potassium and 2% phosphor. These contents are higher than the original peels of the fruits. Potassium has the main factor as a co-factor to synthesize protein and phosphor. These substances are the components to create some co-enzymes; nucleate acid, phospholipid, and ATP Banana peels are the source of potential potassium for fertilizers (Tuapattinaya & Tutopoly, 2014). The macronutrients, such as potassium within the banana peels, could strengthen the plant tissues and disease resistance. The researchers proved that the

spinach with banana and peanut peel liquid organic fertilizers had significantly different heights than the control group. Nabilah & Pratiwi (2019) also found that saba banana liquid organic fertilizer significantly influenced the vegetative growth of spinach. Husein, et al (2019) also found that banana peel extract, as an organic liquid, could improve the sprout growth of tomatoes. Yernelis, et al (2018) applied the same thing on the sweet crown and found the best effect on the plant's vegetative growth.

Table 1 shows that all plants in P0, P1, P2, P3, and P4 pots have increased numbers of leaf growth. The ANOVA test shows that P1 is significantly different from the control group. It indicates that P1 with 50 ml of saba banana peel liquid organic fertilizer + 50 ml peanut peel liquid organic fertilizer has the best effect of leaf numbers on the spinach. The best combination was in the P1 treatment because the banana peels had potassium and phosphor to support the nitrogen of peanut peels. Without liquid organic fertilizer, the control group had the lowest leaf growth numbers due to a lack of nitrogen, potassium, and phosphor (NPK) needed by the growth of spinach's leaves. Rambitan & Sari (2013) proved that liquid organic fertilizer from saba banana peels significantly influenced peanuts' growth (*Arachis hypogaea L.*), including the leaf numbers and plant height.

The leaf widths on each spinach plant in P1, P2, P3, and P4 were not significantly different from P0 (see Table 1). It means fertilizer administration does not influence the width of spinach leaves. The widths of the

spinach plant were varied due to the growth period based on the growing leaves. In this research, the widths of the leaves in P1 and P4 were the best. P1 with 50ml POC of saba banana peels + 50ml POC of peanut peels provided the best effect on the widths of spinach leaves. The same finding occurred in P4 by using manufactured NPK fertilizer. This fertilizer provided the best effect on the width growth of the spinach. Organic fertilizers could increase the spinach leave numbers (Akanni, et al., 2011). Today, many farmers use manufactured commercial fertilizers because these fertilizers are rich in nitrogen, phosphor, and potassium. These substances improve the NPK nutrient in farms (Campbell & Reece, 2008).

The NPK elements in liquid organic fertilizer improve the spinach's resistance to diseases; and improve the leaves, flowers, and fruits. The potassium and phosphor of the fertilizer are important for the vegetative growth of the plant (Kamara, et al., 2011). Liquid organic fertilizer was effective in replacing the chemical fertilizer (Mooy, et al., 2019). Leksono & Yanuwadi (2014) also proved the influence of liquid organic fertilizer could improve the weights of apples. Jamilah, et al., (2015) also found the influence of liquid organic fertilizer and potassium influences on the nutrient absorbency and paddy yields in tropical highlands. The authors found that liquid organic fertilizer without potassium administration could increase the absorbency of nitrogen, potassium, and phosphor.

**Table 3.** Color of spinach

Treatment	Spinach 10 days	Spinach 17 days	Spinach 24 days	Spinach 31 days	Spinach 38 days
P0	Bg	Lg	Lg	Lg	Lg
P1	Bg	Bg	Bg	Bg	Bg
P2	Bg	Bg	Bg	Bg	Bg
P3	Bg	Bg	Bg	Bg	Bg
P4	Bg	Bg	Bg	Bg	Bg

Note: P0 = 0 ml POC, P1 = 50 ml POC peanut shells + 50 ml POC banana skins kepok, P2 = 75 ml POC peanut shells + 25 ml POC banana peels kepok, P3 = 25 ml POC peanut shells + 75 ml POC of kepok banana peel, and P4 = 5 grams of NPK fertilizer, Bg = Bright green, Lg = Light green

The colors of the leaves without fertilizer showed brighter colors than spinach with fertilizer (Table 3). Plants that do not receive adequate nitrogen have some features. They are yellowish, short, small, and up-right leaves (Dinas Pangan, Pertanian dan Perikanan, 2018). The treatments of P1, P2, and P3 showed brighter colors. It indicated the plants received nitrogen from the combination of saba banana peel liquid organic fertilizer + peanut peel liquid organic fertilizer. P4 also had brighter green color. It indicated the plant received adequate nitrogen from manufactured NPK fertilizer. Nitrogen is the primary component for leaves to produce chlorophyll (Sari, et al., 2015) and stimulate the

plants' growth, especially the trunks, branches, and leaves (Dinas Pangan, Pertanian dan Perikanan, 2018).

The reserve resources of nitrogen, potassium, and phosphor are at safe levels for the future. However, providing the plants' nutrients will increase and require appropriate management from agricultural industries. It is important because the resources are not renewable (Fixen & Johnston, 2012). The price of plant nutrients, such as nitrogen, potassium, and phosphor, gets higher. However, there are some alternatives, such as liquid organic fertilizers from saba banana and peanut peels. Liquid organic fertilizers have high economic values. Fahrurozi, et al., (2016) showed the concentrations of

liquid organic fertilizers did not influence all observed parameters. The administration of liquid organic fertilizers toward sweet corn variety had an actual effect on the height and width of the leaves, the weight of the fresh roots, the weight of the peeled cobs, and the weight of cob grains. However, the administration did not significantly influence the diameter of the cobs and the weight of fresh shoots.

## Conclusion

Based on the discussion above can be concluded as follow. First, liquid organic fertilizer provisions from peanut and banana peels significantly influence the height and leave numbers of spinach. Second, the best dose for liquid organic fertilizer provision is 50 ml of peanut peel liquid organic fertilizer + 50 ml of banana peel liquid organic fertilizer to get excellent height and leave numbers of the spinach. Finally, the growth of the spinach, in terms of height, numbers of leaves, and leaf width during NPK fertilizer provision, is in line with the provisions of banana and peanut peel liquid organic fertilizers. From the results, this research recommendation was that the administration of saba banana peels and peanut peels as the materials to produce liquid organic fertilizer was as an alternative to manufactured NPK.

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