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The Effect of Bioneensis and Liquid Organic Fertilizer (POC) of Liquid Oil Palm Waste On The Growth And Production Of Red Okra (Abelmoschus esculentus L. Moench)

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Abstract

Red okra has a high economic value and can be used as medicine for several chronic diseases, such as irritable bowel, gastric irritation, and diabetes mellitus. Consequently, there is a need to increase the plants' production to meet the increased demand for its products. Bioneensis is a biofertilizer produced by Palm Oil Research Center with several benefits, such as the ability to increase the production of plantation and horticultural crops when combined with POC. This study used a factorial randomized block design, which consists of 2 factors, namely different Bioneensis Fertilizer Concentrations of 0, 100, 200, and 300 g/plot as well as various Palm Oil Waste POC concentrations of 0, 100, 200, and 300 mL/L Water. The results showed that Bioneensis fertilizer had a significant effect on all the parameters observed, while POC had no significant effect. The best combination was 200 g/Plot Bioneensis and 100 mL/L POC, which had positive effects on all parameters except the generative observation aspect.

Keywords: Red Okra; Bioneensis; Combination

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1. Introduction

Okra (Abelmoschus esculentus L. Moench) is a vegetable from the Malvaceae family (cotton), and it originated from Ethiopia and South Asia. The plant is not well known in Indonesia, because its sustainable cultivation has not been implemented on a large scale. However, it has been cultivated commercially in the form of garden plants and plantations in some countries. India is the largest producer of the plant globally with a total production of 1.5 million tons on 350,000 ha of land, and this accounts for 70% of total world production. Okra was cultivated in West Kalimantan, Indonesia in 1877 (Santoso, 2016), and there were 2 varieties namely, red and green okra based on the color of the fruit (Ikrawati and Rokhmanah, 2016). The plant is widely produced by Chinese farmers as vegetables, and it has a high economic value because all its parts can be used. The young fruit can be processed into vegetables, while its mucus content makes it suitable as a soup ingredient (Rustiawan et al., 2015). Several studies have reported the use of okra as a medicine for various chronic diseases, such as diabetes mellitus, as well as colon and gastric irritation (Raditya et al, 2017). In Indonesia, the plant is still not in demand by the public and is only cultivated by farmers because there is still a lack of knowledge about its potential and cultivation methods. Okra is a potential non-oil and gas commodity, which can serve as a business opportunity for farmers to increase their profits. In the cultivation, several factors must be considered to obtain maximum yields. One of the care activities that can support its growth and production is fertilization. Furthermore, fertilization is often carried out to replace the missing nutrients as well as increase the supply of nutrients needed by plants to increase their production and quality (Nyanjang et al, 2003). Based on the physical form, fertilizers can be divided into 2 categories, namely the solid and liquid fertilizers. Solid fertilizers are in the form of rigid materials, such as piles, crumbs, granules, and crystals, while the liquid type is in the form of concentrates or liquids. Based on the constituent compounds, they can also be divided into 2 types, namely, organic and inorganic fertilizers. Organic fertilizers are derived from natural materials, such as plants and animals, while the inorganic type is obtained from inorganic materials containing certain nutrients/minerals, and are also known as chemical fertilizers.

Excessive and continuous use of chemical fertilizers can lead to a decrease in soil and water quality. A continuous increase in their dose every year can also cause soil hardness and the balance of nutrients is disturbed. The application of an organic farming system is the best way to overcome this problem (Pranata, 2010). Therefore, it is important to promote farmers to use organic and biological fertilizers as an alternative to the chemical types. The main ingredients of biological fertilizers (biofertilizers) are obtained from living bodies, especially microorganisms that are used to increase the production of a plant in terms of quality and quantity (Abdurahman, 2008). Simanungkalit (2006) reported that they are inoculants produced from active living organisms and help to bind certain nutrients or facilitate the availability

of nutrients in the soil for plants. Bioneensis is a biofertilizer produced through innovation in a PPKS study, and it has many benefits, such as increasing the production of plantation and horticultural crops According to PPKS (2020), its application increased the growth of corn and produced 30-50% more dry maize biomass compared to the use of 100% chemical fertilizers. Palm oil mill effluent (LCPKS) is still underutilized in adding nutrients to the soil. To control environmental pollution, it is necessary to manage palm oil liquid waste biologically, chemically, and physically. LCPKS has a very pungent odor due to its organic and inorganic compounds content, which can and cannot be overhauled by microorganisms (Sahirman, 1994 in Kurniawan, 2019). Prayitno et al (2012) revealed that the use of palm oil mill waste can increase plant growth and production by improving the biological, chemical, and physical properties of the soil.
Therefore, this study aims to determine the effect of biofertilizer bioneensis and liquid organic fertilizers (POC) of palm oil mill liquid waste on the growth and production of Red Okra (Abelmoschus esculentus L. Moench) using the field test.

2. Materials and methods

2.1. Materials

This study used a factorial Randomized Block Design (RAK) method, which consisted of 2 treatment factors, namely:

B0 = Control (Without the application of bio-fertilizer biogenesis)
B1 = Application of bio-fertilizer 100 g/plot
B2 = Application of bio-fertilizer 200 g/plot
B3 = Application of bio-fertilizer 300 g/plot

Liquid organic fertilizer (POC) consists of 4 levels.

P0 = Control (Without the POC of palm oil mill effluent)
P1 = Giving POC of palm oil mill effluent 100 ml/l of water
P2 = Giving POC of palm oil mill effluent 200 ml/l of water
P3 = Giving POC of palm oil mill effluent 300 ml/l water

The data were analyzed with the factorial Randomized Block Design (RAK) using a linear mathematical model. The significant effect was further tested with the Duncan Distance Test (Montgomery, 2009)

2.2. Making Palm Oil Mill Liquid Waste

Production of liquid organic fertilizers (POC) of palm oil mill liquid waste requires several materials, including 500 ml EM4, 500 ml Molasses, 10 liters of water, and 100 liters of palm oil mills waste (LCPKS) taken from the pond of the PTPN IV Bah Jambi Palm Oil Mill (PKS). The mixture of fertilizer consisted of 500 ml EM4, 500 ml molasses, and 10 liters of water. It was stirred and 100 L of palm oil mill liquid waste was added. The mixture was evenly distributed for one hour, agitated, and then blended every day. Subsequently, the level of pH, BOD, and COD were measured.

2.3. Land Preparation

The area used for the experiment was manually sanitized from plant residues and objects that can interfere with plant growth. The soil was prepared using two steps, where the first treatment involves turning the soil as deep as 20-30 cm using a tractor, after which it was left for 7 days. The second treatment was crushing a large top to obtain crumbly soil. A total of 32 plots were used, and each of them has a size of 100 x 160 cm with a spacing of 50cm. The distance between the replications was 100 cm, while the bed height was 30 cm.

2.4. Application of NPK Mutiara & Bioneensis

Fertilizer Pearl NPK fertilizer as a basic fertilizer was applied through sprinkling on the beds at a dose of 50% of the recommendation. Furthermore, it was applied 14 days before planting the seeds to ensure that it blends with the soil and does not poison the plants. Bioeneesis biofertilizer was applied 3 days before planting based on the predetermined treatment dose.

3. Results and discussion

3.1. Plant Height

The high variance results of red okra plants aged 2 to 7 weeks after planting (MST) are presented in Table 1. The application of bioneensis at a dose of 200 grams/plot (B2) showed a very significant difference from treatments B0 and B1 in influencing the height of red okra plants at the age of 4 and 5 weeks. Furthermore, the addition of biofertilizer Bioneensis at a dose of 200 grams/plot (B2) gave the highest height growth of 69cm compared to others at 7 weeks after planting (MST).

The response curve of the relationship between the application of biofertilizers Bioneensis and plant height at the age of 5 WAP is presented in Figure 1.
The coefficient of determination (R2) obtained was 0.7933, which indicated that the application of Bioneensis had a 79.33% effect on plant height. This was caused by the presence of functional microorganisms in the biofertilizer, namely Azotobacter sp, which can fix nitrogen (N). Nitrogen plays a major role in increasing plant height, and similar results were obtained by Mardianto (2014).

3.2 The Number of Leaves (Strands)

The variance results of the number of okra plants leaves from 2 to 7 weeks after planting (MST) are presented. The response curve of the relationship between the application of biofertilizer Bioneensis and the number of leaves at the age of 4 WAP.

3.3 Number of Fruit Per Sample (Fruit)

The addition of Bioneensis biofertilizer at various treatment levels had significantly different effects on the number of fruits per sample plant in the second and total harvests, while it had no effect on the first and third harvests.

Table 1. Summary of the high variation results of Red Okra (Abelmoschus esculentus L. Moench) plants against the application of biological fertilizers bioneensis and liquid organic fertilizer (POC) of palm oil mill waste.

Source	F of Plant Age						F.Tabel	
	2 wpp	3 wpp	4 wpp	5 wpp	6 wpp	7 wpp	F .05	F .01
Group	0,23 tn	0,08 tn	0,65 tn	0,04 tn	0,10 tn	0,04 tn	4,54	8,68
B	1,85 tn	2,31 tn	7,26 **	3,42 *	3,23 tn	2,66 tn	3,29	5,42
P	0,32 tn	0,38 tn	2,54 tn	0,23 tn	0,18 tn	0,10 tn	3,29	5,42
B x P	0,62 tn	0,96 tn	1,63 tn	0,83 tn	0,67 tn	0,61 tn	2,59	3,89

Keterangan : tn=not significant; *= significant; **= very significant

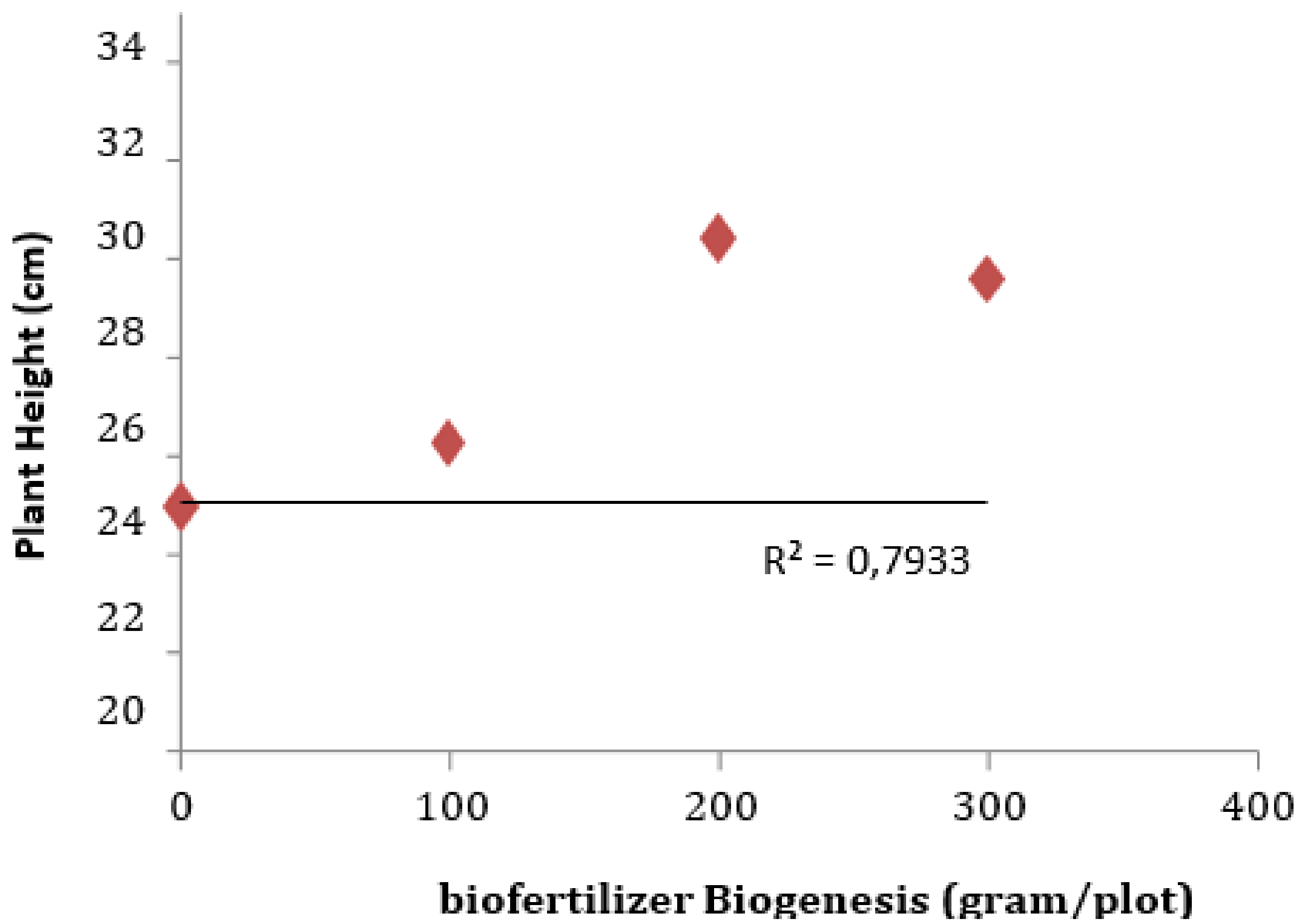

Figure 1. Response to Biofertilizer application on plant height

Table 2. The variation in the Number of Fruits Per Sample for Red Okra (Abelmoschus esculentus L. Moench) after the Application of Biofertilizer Bioneensis and Liquid Organic Fertilizer (POC) of Palm Oil Mill Liquid Waste.

Source	F			F. Table		F	F Table	
	Harvest I	Harvest II	Harvest III	F 0.5	F 0.1		F 0.5	F 0.1
Group	0.01 tn	8.22*	0.62 tn	4.54	8.68	101.92**	3.32	5.39
B	1.03 tn	4.63*	0.71 tn	3.29	5.42	9.12**	2.92	4.51
P	0.94 tn	0.66 tn	0.18 tn	3.29	5.42	2.24 tn	2.92	4.51
B x P	1.17 tn	1.00 tn	0.50 tn	2.59	3.89	3.05 *	2.21	3.07

Furthermore, the application of liquid organic fertilizer from palm oil mill effluent at various levels did not significantly affect the number of fruits per sample plant from the first harvest until the third. The application of Bioneensis at a concentration of 300 grams/plot (B3) gave the highest number of fruits per sample plant in the total harvest compared to other treatment levels, namely 11.41 pieces. Meanwhile, the addition of liquid organic fertilizer from palm oil mill effluent did not have a significant effect. The combination of the two additives gave a significantly different effect on the number of fruit per plant sample in the total harvest, where a dose of 300 grams/plot Bioneesis and 200 ml/l water POC (B3P2) showed the highest of 13.38 pieces compared to other treatment combinations. Lingga and
Marsono (2007) in Wahyuningratri (2017) reported that phosphorus and potassium play an active role in optimizing the generative growth phase in plants.

3.4 Fresh Weight of Fruit Per Sample Plant

The variance results showed that the combination of bioneensis and liquid organic fertilizer from palm oil mill effluent had no significant or relatively the same effect on fresh fruit weight per plot from the first to the third harvest. Auxin hormones and growth regulators produced by microorganisms in bioneensis greatly affected this parameter. Furthermore, Mc.Mahon, et al (2011) revealed that fruit development is strongly influenced by the formation of auxin in developing seeds and other parts of the fruit, which serve as food reserves. The combination of the additives gave a significantly different effect on the fresh weight of fruit per plant sample for the total harvest, and the highest weight of 2527.05 grams was obtained from a dosage of 300 grams/plot bioneensis and 200 ml/l water POC (B3P2). Their combination had a significant effect on the fresh weight of fruit per plot, and this was caused by the positive interaction.

4. Conclusions

The addition of bioneensis gave significantly different effects on the vegetative and generative observation parameters, and the best dose was 200 grams/plot (B2). Furthermore, the use of liquid organic fertilizer (POC) of palm oil mill effluent did not have a significantly different effect on all the parameters of red okra plants, except the fruit weight per plot. The combination of Bioneensis biofertilizer

and liquid organic fertilizer (POC) of palm oil mill wastewater did not have a significantly different effect on all the vegetative observation parameter, but different effects were observed on the generative aspects. Red. Based on the results obtained in this study, the best treatment combination was B3P2

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