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The Growth and Production Improvement of Soybean Plant (*Glycine max* L.) by Applying The Local Microorganisms of Fruit Waste in Palopo

AUTHORS INFO

Rahman Hairuddin
University of Cokroaminoto Palopo
rahmanhairuddin73@gmail.com

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Abstract

This study was aimed to find out the effective local microorganism of fruit wastes concentration on the growth and production of the soybean plants. This study was conducted in the trial land of Campus 2, Faculty of Agriculture, Cokroaminoto University, Palopo from September to December 2019. The method used in this study was the randomized block design with 5 treatments and 4 replications, therefore there were 20 experimental units. Each experimental unit comprised 2 plant units, therefore there were 40 plant samples on the given concentration of P0: Control, P1: 50 mL/L fruit waste local microorganism concentration, P2: 100 mL/L fruit waste local microorganism concentration, P3: 150 mL/L fruit waste local microorganism concentration, and P4: 200 mL/L fruit waste local microorganism concentration. The results showed that the local microorganism application on the soybean plants had no significant effects on the plant height, total of leaves, flowering period, and a total of pods. The local fruit waste microorganism with 100 mL concentration was capable of improving the plant height, total of leaves, flowering period, and a total of pods with the respective average of 31.9 cm, 51.6 leaves, 21,8 days, and 35 soybean pods

Keywords: local microorganisms, fruit waste, soybean

A. Introduction

Soybean is one of the food plant types which has the important means after rice plant and corn. Soybean is also the main plant protein and oil source, therefore consuming the soybean has been assured will increase each year along with the increased total of population or public awareness on the nutrients required from the soybean plant. Based on the dry weight basis, soybean contains approximately 40% proteins, 20% oils, 35% dissolved carbohydrates (sucrose, stachyose, and rafinose, etc.), undissolved carbohydrates (food fibers), and 5% ashes (Liu, 2004).

Although does not contain vitamin B12 and C, soybean is the best vitamin B source compared to the other beans.

The productions and productivities of soybean in South Sulawesi Province from 2014 – 2018 were 54.723 ton/ha, 67.192 ton/ha, 62.054 ton/ha, 16.101 ton/ha, and 35.824 ton/ha. Based on the production data, the data was fluctuative due to lack of soil nutrient fulfillment acquisition in the soybean cultivation system.

The soil nutrient acquisition to support the soybean cultivation system is necessary to achieve more optimal results in terms of improved soybean plant growth and production. One of the supporting nutrients that can often be used is the local microorganisms.

local microorganisms is a group of microorganisms that can be cultivated by providing a food as an energy source serves as a starter in the compost production (Ole, 2013). local microorganisms contains macronutrients, micronutrients, and potential microorganisms as organic matter degrading agent, growth promoter, as well as pest and disease controller, which can be used as decomposer, organic fertilizer, amd organic pesticide. Factors determining the local microorganisms quality are the fermentation media, materials or substrates concentration, shape and behavior of the active microorganisms in the fermentation process, pH, temperature, fermentation period, and C/N ratio of local microorganisms solution (Seni, 2013). One of local microorganisms production materials are fruits as microorganism sources. local microorganisms obtained from fruits has macronutrient and micronutrient contents of 0,1833% N, 54,989 mg/L P, 3,125 mg/L K, 3,7 mg/L Ca, 64,5 mg/L Mg, 1,605 mg/L Fe, 0,274 mg/L Mn, 1,115 mg/L Zn, and 38,78 mg/L NH_4 (Wiswasta *et al*., 2016).

Pratiwi (2018) applied the local microorganisms of banana suckers on the rice plant which resulted shorter flowering period of 66,33 days after planting and harvesting period of 102,33 days after planting. Tambunan (2018) stated that local microorganisms of tomato and coconut water wastes application influenced the growth and productivity improvement of chilli plants. Salamah (2016) reported that the local microorganisms of Indian bael fruit affected the growth and productivity improvement of Tosakan choy sum plant.

This study was aimed to discover the response of local microorganisms in fruit wastes to the growth and production of soybean plant and capable concentration to improve growth and production of soybean.

B. Methodology

1. Study Location and Period

This study was performed in the trial land of Campus 2 , Faculty of Agriculture, Cokroaminoto University, Palopo, Lamaranginang street, Batupasi Village, Wara Utara Subdistrict, Palopo on September – December, 2019.

2. Materials and Equipments

Materials used in this study were the soybean plant seedlings, fruit waste, coconut water, rice water, molase, and water. Equipments used in this study were hoe, shovel, scales, measuring cylinder, tape measure, bucket, hose, and writing utensils.

3. Experiment Methods

This study used a randomized block design containing 5 treatments and 4 replications, therefore there were 20 experimental units. The treatments used in this study were P0: Control, P1: local microorganisms with concentration of 50 mL/L, P2: local microorganisms with concentration of 100 mL/L, P3: local microorganisms with concentration of 150 mL/L, and P4: local microorganisms with concentration of 200 mL/L.

The first step was preparing the equipments and materials of local microorganism production by mixing all materials in the bucket and stirring until all materials were merged and ready for the fermentation process within 2 weeks. The second step was preparing the planting media by forming 20 bed units with the size of 85 cm x 60 cm and planting distance of 30 cm x 30 cm. Before planting, planting holes were made using a sharpened stick with 2 planting holes on each bed with the distance between planting holes was 30 cm. Seedlings were planted on the planting hole with 2 seedlings for each planting hole. The third step was applying the local microorganism on the plants started at 2 days after planting until the generative phase based on the determined

concentration. The last step was observing the plant height (cm), total of leaves (leaves), flowering period (days), and total of pods during the harvest (pods).

C. Result and Discussion

The statistical analysis showed that the fruit waste local microorganism application had no significant effect against the growth and production of soybean plants as presented on the following Figure 1, 2, 3, and 4.

1. Plant Height (cm)

Figure 1 shows the local microorganism of fruit wastes with 100 ml concentration was capable of producing the best plant height with the average of 31,9 cm. The fruit waste local microorganism contains macronutrients that promote the plant growth (Handayani, S. H., A. Susilowati, dan A.Yunus, 2015) reported that local microorganisms of papaya fruit has the highest N element (0,45%), while K, Mg, and Fe content on local microorganisms of cow urine which had the highest value were K (417,76 ppm), Mg (2.460,88 ppm), and Fe (6,66 ppm). Jamilah dan Novita E. (2016) added that the balanced macronutrients and micronutrients can help improve the plant metabolism, thus achieving an optimum growth.

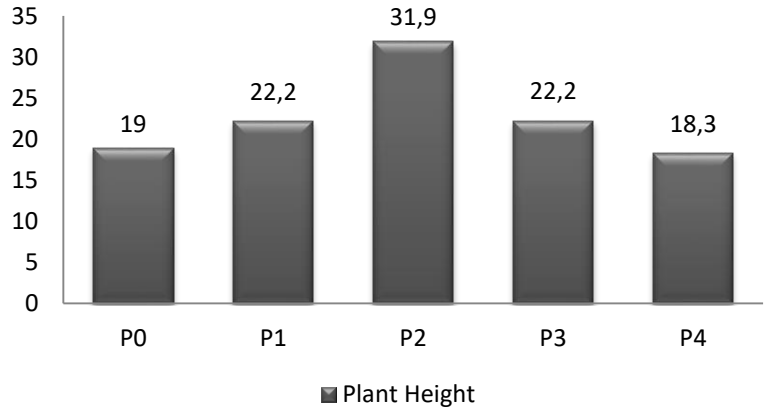

Figure 1. The average of soybean plant height on several concentrations of local microorganisms

2. Total of Leaves (leaves)

Figure 2 showed the best total average of leaves on the local microorganism concentration of 100 ml with 51,6 leaves. The fruit waste local microorganism contains N, P, and K nutrient required for plants as leaf is one of plant organs with the ability of receiving light to perform a photosynthesis; the faster photosynthesis process, the more leaves formed. According to Poerwowidodo (Parman, 2007), nitrogen nutrient acts as a chlorophyll former, therefore inducing the photosynthesis activity. This photosynthesis will produce a photosynthate which supports the leaf meristematic tissue developments.

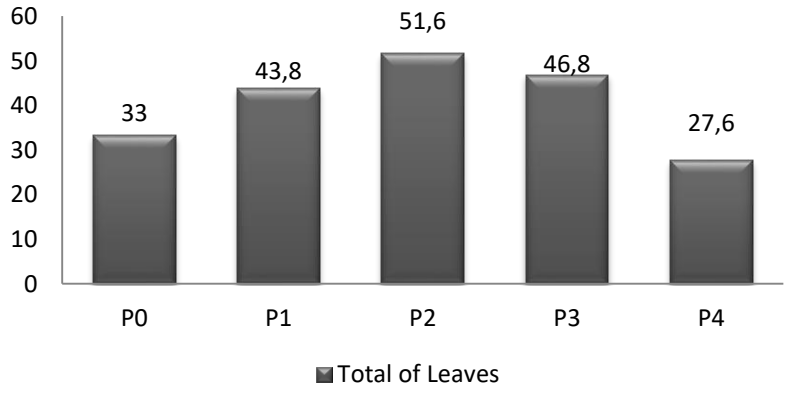

Figure 2. The total average of soybean plant leaves on some concentrations of local microorganisms

3. Flowering Period (days)

The best flowering period presented on the following Figure 3 showed that P2 as 100 ml fruit waste local microorganism concentration had the fastest flowering period with 21,8 days. The application of fruit waste local microorganism could induce faster flower occurence on the soybean plants was suspectively due to the mixture of local microorganism production contained coconut and rice water required for plants to enhance the flowering process, as stated by Syaifuddin (2013), that coconut water contains cytokinin as the growth substance source and coconut contains proteins, less lipids, minerals, carbohydrates, and various vitamins. The utilization of rice water on each local microorganisms production gave double contents on the five mixtures of local microorganisms production application because of containing phosphorus, as one of the functions could enhance flower and fruit formation.

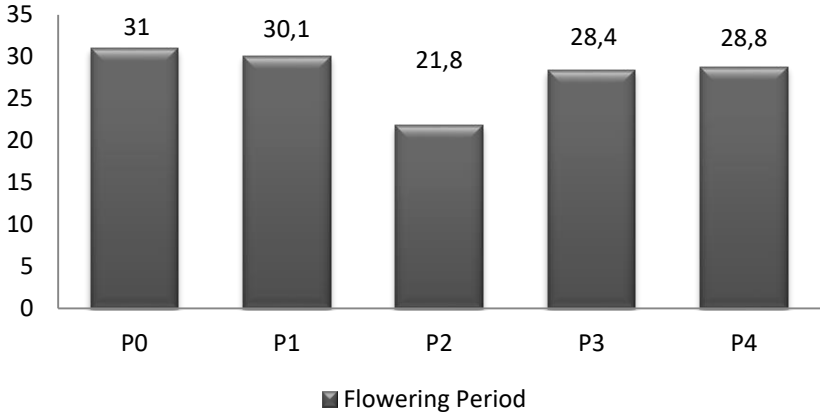

Figure 3. The average of flowering period on some concentrations of local microorganisms

4. Total of Pods (pods)

Figure 4 showed that the application of 100 ml fruit waste local microorganism concentration produced the best total of pods with 35 pods. The application of local microorganism could improve the total of pods on the soybean plants. It can be due to the local microorganism contains P nutrient required for plants during the generative phase. Fitri (2010) stated that the soyben plant pod formation requires nutrients, especially phosphorus, as plants which receives phosphorus will grow higher along with more pods formed. Jumin (1992) added that phosphorus in plants play roles in the cell division, albumin formation, fruit formation and maturation, root development, disease resistance.

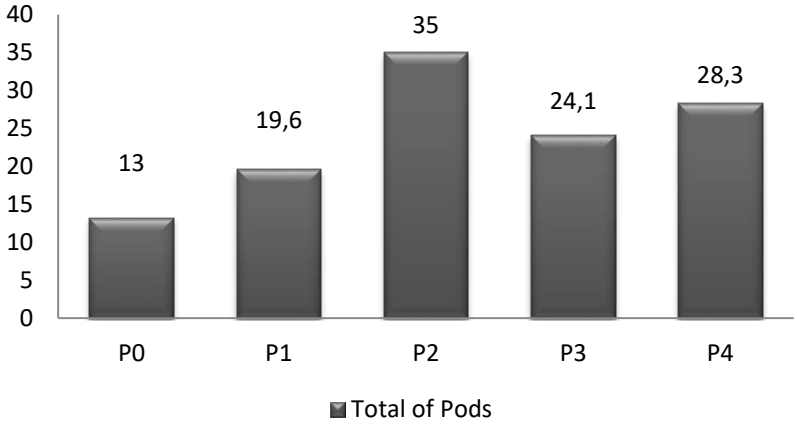

Figure 4. The total average of soybean plant pods on several concentrations of local microorganisms

D. Conclusion

The application of local microorganism on the soybean plants had no significant effect on the plant height, total of leaves, flowering period, and total of pods parameters. The fruit waste local microorganism with the concentration of 100 ml could improve the plant height, total of leaves, flowering period, and total of pods with the respective average of 31,9 cm, 51,6 leaves, 21,8 days, and 35 soybean pods. The fruit waste local microorganism contains the nutrients of N, P, K, and cytokinin hormones in large quantities, therefore capable of improving the growth and production of soybean plants.

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