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The effectivity testing bio-organic fertilizer toward the plant's growth and productions of water spinach (*Ipomoea reptans Poir*)

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Abstract. Farmers tend to use chemical fertilizer to boost their water spinach production. Consumers' demand for high quality and the chemical-free product should be considered in using less chemical fertilizer. A possible solution is using a safe and eco-friendly bio-organic fertilizer. In general, this study purposes of supporting food security, which can provide food with the best quality and safe to consume by people and not harm the environment. Moreover, this study aims to acknowledge the effectivity of bio-organic fertilizers (Petrobio, Marolis, and Fertismart) toward the plant's growth and production of water spinach. This study used the factorial plan in RAL, which consists of 2 factors. First, the bio-organic fertilizer that has 3 stages: Petrobio, Marolis, and Fertismar. Second, the use of NPK fertilizer: without NPK, 50% used, and 25% used for each trial should pass three times examination. The result shows that using bio-organic fertilizer can affect the plant's growth and productions, with the evidence of the plant's height, number of leaves, and plant's net-masses. Bio-organic could decrease the application of chemical fertilizer; by contrast, it can't substitute NPK to boost the water spinach production. The best result was from the fertilized plant using Marolis alongside with NPK.

1. Introduction

Fertilizer is an important production factor in agriculture. Less amount of fertilizer than it should have would probably decrease the production result. Furthermore, it would threaten our food security. Daily, to aim a higher amount of production, farmers tend to use non-organic fertilizer in continuity, and sometimes it's overused. It is eventually causing land-degraded, which affects the decrease in plant's productivity. Awoken people in demand for the best quality and chemical-free food can lower chemical fertilizer use.

Action is needed to reduce the use of non-organic fertilizer with help from bio-fertilizer technology, specifically changed the half of chemical fertilizer's inputs to organic materials, natural and bio-fertilizers (useful microorganism) so it can't harm the land's health and fertility [1,2]. Bio-fertilizer is an active biological fertilizer which consists of microorganism that can raise the fertilizing efficiency, land's health, and fertility. Meanwhile, the microorganism/micro-fauna and its constituent ingredients were the formulae of biological fertilizer [3].

The bio-fertilizer that consist of microorganism which can multiply and actively boost the plant's growth could escalate both the plant's quantity and quality [4,5] plays to secure land environment



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through Nitrogen (N)'s fixation on which land is rich of micro and macronutrients, the mineralize Phosphate (P) and Kalium (K), the extraction of plant's growth regulator [6], and also can reduce the use of NPK fertilizer [7-9] reported that bio-fertilizer could give positive impact to various spices and herb such as pepper, clove, ginger, artemisia, coriander, vanilla, fennel which is indicated by an increase in plant's growth parameters (height, number, and area of leaves, roots), as well as secondary metabolite compounds produced.

The bio-fertilizers used in this study are Petro Biofertil, Marolis, and Fertismart, which contain useful microbes for plants like bacterial fastening N named Azospirillum and solvent microbes P named Azotobacter. Those three bio-fertilizers then applied to the water spinach (*Ipomoea reptans Poir*). The reason why water spinach is used in this study because of its high value economically and favored by most people in Gorontalo. To fulfil consumer's need toward high-quality water spinach, it is determined by the use of biofertilizer, which was not only keeping environmental sustainability but also at the agricultural sector.

2. Materials and method

This study was held from July to November 2015 at The Ex-farm of Universitas Negeri Gorontalo. The method is using factorial planning in RAL that consists of two factors. First, the bio-organic fertilizer that has 3 stages: Petrobio, Marolis, and Fertismar. Second, the use of NPK fertilizer: without NPK, 50% used, and 25% used. Data analysis was using BNT 5%.

The seed of water spinach planted in a hole with 3 cm depth at the polybag. NPK fertilizer application is given at the time of planting and application of biological fertilizers given at the time of seven-day plants. Maintenance involves watering, weeding, and pest control when needed. Observations are conducted every two weeks and were carried out during vegetative growth, which is when plants aged 14 and 28 days after planting. Moreover, it was also observing the plant's height, the number of leaves and its area, and plant's net-masses.

3. Results and discussion

3.1. The height of plant

Growth is a process that occurs in the life of plants that resulted in the change of plant size increasingly larger and determine crop yield. The increase in overall crop size is the result of the increase in the size of the plants (organs) resulting from the rise in cell tissues produced by cell growth [10].

Table 1. The water spinach's height (in cm) with Given NPK Phonska Fertilizer compare to Given Biofertilizer on 14 and 28 days after planting's observation.

Age of observed plant (hst)	Biofertilizers	NPK Fertilizer		
		Not using	NPK 50 %	NPK 25 %
14	Petro biofertil	19.8	21.2	21.87
	Marolis	20.07	21.5	24.53
	Fertismart	19.3	22.3	22.33
BNT 5%	tn			
28	Petro biofertil	30.63a	35.30c	35.90c
	Marolis	32.97b	35.53c	38.33d
	Fertismart	31.07a	36.10c	33.33b
BNT 5%		1.117		

Notes: Numbers followed with the same alphabet in row and column are showing a not significantly different result at BNT 5% test. hst = (days after planting).

Table 1 shows that the treatment of biological fertilizers and NPK has a noticeable effect on the height of the plant at the end of growth but not evident in the early age of growth. The provision of biological fertilizer and NPK is not real to the plant height at age 14 HST caused because at the beginning of fertilizer, increase is not absorbed perfectly, so the results are not seen. It is supported by Kohar et al., that the roots of the water spinach perform the maximum absorption function when the plant is 14 days after planting [11].

At the age of 28 HST treatment of biological fertilizers and NPK affects the height of the plant. This is due to the mineral nutrients obtained from the plant's environment that will enter into the plant through the root cells then transported to the stem, leaves, and to the entire plant. A plant that is placed in an environment that supports its growth and the presence of appropriate mineral nutrients, the plant will experience growth so that the plant becomes higher.

Best results are shown by a combination of Marolis fertilizer treatment with 25% NPK Phonska fertilizer. Biofertil fertilization with NPK 25% does not differ real with fertilization Biofertil, Marolis, and Fertismart combined with NPK 50%. The provision of biological fertilizers, both Petro Biofertil, Marolis and Fertismart showed no difference when combined with 50% NPK fertilizer. Fertismart fertilization with 25% NPK shows the same results as Marolis' biological fertilizer that is not fertilized NPK. The lowest result is demonstrated by Petro Biofertil's manure treatment without NPK fertilization but does not differ from the real biofertilizer with Fertismart and Marolis that is not given NPK fertilizer.

The provision of bio-organic fertilizer can create texture conditions and soil structures better, supporting the formation of crumb structures and soil aggregate stability. Steady land aggregates will provide proper aeration so that enough oxygen is available for plant respiration. Also it can increase the soil's ability to store water. The provision of organic materials could improve the quality and quantity of crop production. Increased production will be achieved at a combination of fertilization between inorganic fertilizer and organic because organic material can improve soil conditions. The provision of fertilizer type is a real effect on the stability of land aggregates [12], and soil aggregate stability will give high results for agricultural production [13].

3.1.1. *The number of leaves*. Interaction between Biofertilizer and NPK Phonska fertilizer showed a noticeable difference in the number of leaves of the plant at the age of 28 HST and not real at the age of 14 HST. Height of Kangkung plant at age 14 and 28 HST presented in Table 2.

Table 2. The number of leaves with Given NPK Phonska Fertilizer compare to Given Biofertilizer on 14 and 28 days after planting's observation.

Age of observed plant (hst)	Biofertilizers	NPK Fertilizer		
		Not using	NPK 50 %	NPK 25 %
14	Biofertil	5.67	6.67	6.33
	Marolis	6.00	7.00	7.67
	Pupuk fertismart	6.33	6.33	6.33
BNT 5%		tn	2n	tn
28	Petro biofertil	8.33a	10b	9.67ab
	Marolis	8.67ab	10.67b	12.33c
	Fertismart	9.67ab	11bc	10.67b
BNT 5%		0.735		

Notes: Numbers followed with the same alphabet in row and column are showing a not significantly different result at BNT 5% test.

hst = hari setelah tanam (days after planting).

The provision of Biofertilizer and NPK Phonska showed no interaction on the number of leaves of the plant at age 14 HST but showed real interaction at the age of 28 HST. The effect is not noticeable at the beginning of growth caused by the ability of plant roots to absorb fertilizers that have not functioned perfectly, consequently, the fertilizer is not absorbed maximally. Another cause is the nature of bio organic fertilizer that "slow-release" so it takes a long time to see the influence of organic fertilizer. The influence of biological fertilizers gives promising prospects in the long term, safe and environmentally friendly. The continuous provision of biofertilizer can improve soil structure so that the soil will be healthy and can affect the availability of plant nutrients.

The real interaction between biological fertilizer and Phonska NPK against the number of leaves of plants obtained at the age of 28 HST. The highest result is shown by a combination of Marolis fertilizer treatment with a 25% NPK Phonska fertilizer followed by the treatment of Fertismart with fertilization NPK 50% but not really compared with other treatments except in Petro fertilizer treatment Without fertilizing NPK. Petro Biofertil's fertilizer treatment shows the lowest result without the fertilization of NPK but not unlike the real biological fertilizers of Petro Biofertil and Marolis, who are not given NPK fertilizer and Petro Biofertil fertilizer combined with 50% NPK fertilizer. In general, the results of the provision of organic fertilizer combined with inorganic fertilizer NPK has a number of leaves more than the treatment without combination fertilization.

The growth of the optimal water spinach is determined by the number of leaves. The leaves are very important for plants because the photosynthesis process takes place on the leaves. This indicates that the availability of sufficient nutrients supported by soil conditions that are suitable for plant growth can optimize the yield of land crops. Photosynthesis availability will spur the vegetative growth of crops, increasing the number and size of plant organs as well as the source of energy for plants.

3.1.2. *The area of leaf.* Variety analysis shows that the provision of biofertilizer and NPK Phonska fertilizer showed a real interaction to the leaves of the plant area in both age 14 and 28 HST. The area of leaf plants in the age of 14 and 28 HST presented in Table 3.

Table 3. The area of water spinach's leaf (in cm²) with Given NPK Phonska Fertilizer compare to Given Biofertilizer on 14 and 28 days after planting's observation.

Age of observed plant (hst)	Biofertilizers	NPK Fertilizer		
		Not using	NPK 50 %	NPK 25 %
14	Petro biofertil	10.53b	12.43c	12.93c
	Marolis	9.17ab	13.10c	14.03c
	Fertismart	8.50a	13.37c	10.73b
	BNT 5%		0.973	2
28	Petro biofertil	28.97a	39.42c	35.9b
	Marolis	32.97b	40.40c	42.62c
	Fertismart	29.07a	40.39c	33.28b
	BNT 5%	1.988		

Notes: Numbers followed with the same alphabet in row and column are showing a not significantly different result at BNT 5% test.

hst = hari setelah tanam (days after planting).

The provision of Biofertilizer and NPK Phonska showed the presence of real interaction on the leaves of the plant in the age of 14 HST and age 28 HST. This indicates that the dose of organic fertilizer has been able to increase the effectiveness of inorganic fertilizer so that it can fulfill the needs of plant nutrients and produce high-quality crops.

At the observation 14 HST the highest result is demonstrated by the combination of treatment of Marolis fertilizer with NPK Phonska 25% fertilizer compared with without fertilization but not really different with Petro Biofertil, Marolis and Fertismart biological fertilizers that are fertilized With fertilizer NPK 50%. The lowest result is shown by Petro Biofertil's fertilizer treatment without the fertilization of NPK but not unlike real with Marolis biological fertilizer that is not given NPK fertilizer.

The delivery of Marolis and NPK fertilizer 25% on observation 28 HST showed the highest results but not different real compared to the treatment of all biological fertilization combined with fertilization NPK 50%. The Petro Biofertil danFertismart bio-fertilization is not offset by the fertilization of the NPK to show low results.

The area of the plant leaves is a factor that determines the amount of solar energy that can be absorbed by the leaves and will determine the amount of photosynthesis produced [14]. Nutrients contained in inorganic fertilizer and organic fertilizer, especially microelements, are absorbed by plants that are then used in the metabolic process of plants, in particular, improve the process of photosynthesis so that the photosynthesis produced partly is transliterated for the increase of leaf area.

3.2. The plant's net-masses

A variety analysis shows that there is a real interaction between the provision of Biofertilizer NPK Phonska fertilizer to the fresh weight of plants in the land. The fresh weights of kale plants at the time of harvest are presented in Table 4.

Table 4. The plant's net-masses (in gram = g) on Given NPK Phonska when harvesting.

Age of observed plant (hst)	Biofertilizers	NPK Fertilizer		
		Not using	NPK 50 %	NPK 25 %
28	Petro biofertil	11.29ab	13.19bc	12.28b
	Marolis	11.57ab	14.67cd	16.51d
	Fertismart	9.60a	14.76cd	10.95ab
BNT 5%		1.374		

Notes: Numbers followed with the same alphabet in row and column are showing a not significantly different result at BNT 5% test.

A combination of Biofertilizer treatment and NPK show real interaction against the fresh weight of plant plants at the time of harvest. The provision of Marolis fertilizer combined with the NPK 25% fertilizer showed a noticeable difference compared to the treatment of Biofertilizer Petro Biofertil, Marolis and Fertismart without NPK or combination of Petro Biofertil fertilizer treatment with NPK 25% and Fertismart fertilizer with NPK 25%, but does not differ with the treatment of Biofertilizer Marolis and Fertismart fertilization with the administration of NPK 50%.

The above shows that economically the provision of organic fertilizer Marolis with fertilizing NPK 25% more efficient than other treatment that shows the same results when fertilized with NPK 50%. This treatment reduces the use of inorganic fertilizer so that in terms of economic benefit and relatively safe for the environment. The effectiveness of these biological fertilizers because of the role of organic bio-fertilizer that can improve soil chemical properties in particular increase cation capacity (KTK) soil. Sudaryono [15] suggests that the land with high KTK can absorb and provide nutrients better than the soil with low KTK.

4. Conclusion

Biological organic fertilizer affects the growth and yield of land crops shown by the height of the plant, the number of leaves, the area of leaves, and the fresh weight of plants. Biological fertilizer can reduce the use of inorganic fertilizers but can not substitute NPK inorganic fertilizer in the increase

production of land kangkung crop. The best results are obtained at Marolis fertilization with fertilizer NPK 25%.

References

- [1] Zafari A and Kianmehr M H 2012 Management and reduction of chemical nitrogen consumption in agriculture *Am. J. Plant Sci.* **3** 1827
- [2] Halimah N, Baktir A and Purkan P 2019 Exploration of Cellulolytic Microorganism as A Biocatalyst Candidate for Liquid Fertilizer Production *IOP Conf. Ser. Earth Environ. Sci.* **217** 12021
- [3] Permentan 2009 *Permentan No. 28 th. 2009: Pupuk Organik, Pupuk Hayati Dan Pembenh Tanah. Bab I. Ketentuan Umum, Pasal 1 Ayat 2 Dan 5*
- [4] Singh J S, Pandey V C and Singh D P 2011 Efficient soil microorganisms: a new dimension for sustainable agriculture and environmental development *Agric. Ecosyst. Environ.* **140** 339–53
- [5] Nurhidayati T, Muslihatin W, Firdausi N, Setyaningsih E P, Nurhayati A P D and Kuncoro E P 2018 Effect of carrier media for biofertilizer of phosphat solublizing bacteria bacillus sp to peanut (*arachis hypogea*) growth *Biosci. Res.* **15** 1975–81
- [6] Sinha R K, Valani D, Chauhan K and Agarwal S 2010 Embarking on a second green revolution for sustainable agriculture by vermiculture biotechnology using earthworms: reviving the dreams of Sir Charles Darwin *J. Agric. Biotechnol. Sustain. Dev.* **2** 113–28
- [7] Rosliani R, Hidayat A and Asandi A A 2004 Respons Pertumbuhan Cabai dan Selada terhadap Pemberian Pukan Kuda dan Pupuk Hayati Rosliani, R., A. Hidayat, dan AA Asandhi *J. Hortik.* **14** 258–68
- [8] Widawati S, Suliasih S and Muharam A 2013 Pengaruh kompos yang diperkaya bakteri penambat nitrogen dan pelarut fosfat terhadap pertumbuhan tanaman kapri dan aktivitas enzim fosfatase dalam tanah *J. Hortik.* **20**
- [9] Suwandi S, Sopha G A and Yufdy M P 2016 Efektivitas Pengelolaan Pupuk Organik, NPK, dan Pupuk Hayati terhadap Pertumbuhan dan Hasil Bawang Merah *J. Hortik.* **25** 208–21
- [10] Sitompul S M 2016 *Analisis Pertumbuhan Tanaman* (Malang: UB Press)
- [11] Kohar I, Hardjo P H and Lika I I 2010 Studi Kandungan logam Pb dalam tanaman kangkung umur 3 dan 6 minggu yang ditanam di media yang mengandung Pb *Makara J. Sci.*
- [12] Utomo B S, Nuraini Y and Widiyanto W 2017 Kajian kemantapan agregat tanah pada pemberian beberapa jenis bahan organik di perkebunan kopi robusta *J. Tanah dan Sumberd. Lahan* **2** 111–7
- [13] Kohnke H 2005 *Soil Physic. Tata Mc Graw- Hill Publishing* (Bombay)
- [14] Salisbury F. and Ross C W 2004 *4th.Ed. Plant Physiology* (London: Wadsworth)
- [15] Sudaryono S 2011 Tingkat kesuburan tanah ultisol pada lahan pertambangan batubara sangatta, kalimantan timur *J. Teknol. Lingkungan.* **10**

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