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Application of Organic Fertilizer Cow Dung and Biofertilizer in Shallots (*Allium Acalonicum* L.) in Lowland

Aplikasi Pupuk Organik Kotoran Sapi dan Pupuk Hayati pada Bawang Merah (*Allium Acalonicum* L.) *di Tanah Lebak*

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ABSTRAK

Lahan lebak berpotensi untuk dikembangkan menanam bawang merah, mengingat pentingnya bawang merah dalam memenuhi kebutuhan hidup masyarakat Indonesia yang terus bertambah dan didukung dengan pangsa pasar yang tinggi, oleh karena itu untuk meningkatkan produktivitas bawang merah di tanah lebak perlu diberi pupuk organik kotoran sapi dan pupuk hayati. Tujuan penelitian ini adalah untuk menentukan pupuk organik kotoran sapi dan pupuk hayati yang terbaik dalam meningkatkan produktivitas bawang merah di lahan ataupun tanah lebak. Penelitian ini dilakukan di Desa Seri Tanjung Kecamatan Tanjung Batu Kabupaten Ogan Ilir Propinsi Sumatera Selatan. Tata letak percobaan di polybag dengan menggunakan Rancangan Acak Kelompok Faktorial dengan 8 kombinasi perlakuan yang diulang 4 kali. Faktor 1 adalah pupuk organik kotoran sapi yaitu 0, 7,5, 15, 22,5 ton/ha. Faktor 2 adalah pupuk hayati yaitu tanpa dan pupuk hayati. Produksi (berat kering umbi tanaman) tertinggi tercapai pada aplikasi pupuk organik kotoran sapi 15 ton/ha dengan pupuk hayati yaitu sebesar 53,56 g/tanaman.

Kata Kunci: pupuk hayati, lebak, pupuk organik kotoran sapi, bawang merah

ABSTRACT

Lowland has the potential to be developed to plant shallots, given the importance of shallots in meeting the growing needs of the Indonesian people and supported by a high market share, therefore to increase the productivity of shallots in Lowland it is necessary to apply organic cow dung and biofertilizer. The purpose of this study was to determine the best organic cow dung and biofertilizer in increasing the productivity of shallots on land or in lowland. This research was conducted in Seri Tanjung Village, Tanjung Batu District, Ogan Ilir Regency, South Sumatra Province. The layout of the experiment was in polybags using a factorial randomized block design with 8 treatment combinations which were repeated 4 times. Factor 1 is organic cow dung fertilizer, namely 0, 7.5, 15, 22.5 tons/ha. Factor 2 is biofertilizer, namely without and biofertilizer. The highest production (dry weight of plant tubers) was achieved in the application of organic cow dung fertilizer of 15 tons/ha with bio fertilizers, which was 53.56 g/plant.

Keywords: biofertilizer, lowland, organic cow manure, shallots

INTRODUCTION

Every year there was a reduction in fertile agricultural land due to conversion to non-agriculture, thus switching to sub optimal land, among others, through the use of lowland land. Lowland has the potential for the development of shallot plants, considering that human needs for agricultural products continue to increase (Sakti & Sugito, 2018). The planting of shallots could be done in lowland.

The challenge for Lowland lies in the low fertility of the soil, therefore organic cow dung and biofertilizer were one of the solutions to restore soil fertility. One adult cow could produce 30 kg of manure per day (Faturrohman et al., 2015), contains nutrients N, P, K which were needed by plants and could strengthen soil aggregates and water holding capacity (Riyani et al., 2015), and could be proven from the results of research by Marlina et al. (2020), that the application of organic cow dung fertilizer at a dose of 15 tons/ha and the use of rice straw mulch resulted in the highest shallot production of 2.43 kg/plot or the equivalent of 8.52 tons/ha.

Biofertilizers have good prospects for developing farming businesses, especially shallots. Biofertilizers were microorganisms that live in the soil and were very helpful in the process of providing nutrients that were not available to be available. Biofertilizers have been widely sold and circulated and their use could significantly increase the production of shallots in tidal soils (Marlina et al., 2018b), rice in lowland and tidal lands (Marlina et al., 2014; 2016: 2018a), soybeans in lowland land (Aminah et al., 2015: Marlina & Gusmiatun, 2020), sweet corn in lowland (Marlina et al., 2019).

These biofertilizers contain microorganisms including Azotobacter, Azospirillum, phosphate solubilizing bacteria that could be useful in donating N, P, K nutrients through the work of nitrogenase and phosphatase enzymes (Suwandi et al., 2017). The presence of Azospirillum bacteria and phosphate solubilizing bacteria turned out to be very effective in contributing NPK nutrients needed by shallot plants in increasing shallot yields (Marlina et al., 2018). The purpose of this study was to determine the best organic cow dung and biofertilizers in increasing the productivity of shallots on land or in lowland soil.

MATERIALS AND METHODS

This research was conducted in Seri Tanjung Village, Tanjung Batu District, Ogan Ilir Regency, South Sumatra Province. The layout of the experiment was in polybags using a factorial randomized block design with 8 treatment combinations which were repeated 4 times. Factor 1 was organic cow dung fertilizer, namely 0, 7.5, 15, 22.5 tons/ha. Factor 2 was biofertilizer, namely without and biofertilizer.

The implementation begins with clearing the soil taken from shallow lowland, then it was sifted until smooth and put into polybags weighing 10 kg. Then given organic chicken manure according to the treatment (7.5 tons/ha= 58.59 g/polybag, 15 tons/ha=117.19 g/polybag, 22.5 tons/ha=175.78 g/polybag) by immersing in the soil for 2 weeks before planting. At the time of planting given biofertilizer as much as 20 g / plant immersed 2 cm in the soil. At the time of planting, the ends of the onion bulbs were cut by 1/3 first and soaked with atonic PGR for 15 minutes and after that the bulbs were planted in the planting medium up to the neck of the bulbs. Inorganic fertilizers were still given of the recommended dose (95 kg urea/ha=0.75 g/polybag, 46 kg SP-36/ha=0.36 g/polybag, 60 kg KCl/ha=0.47 g/polybag) at the time of planting 2/3 parts and 30 DAP 1/3 parts by being immersed in the soil).

Maintenance was always done by watering every morning and evening, controlling weeds manually by removing weeds that grow in polybags. Harvesting was done when the shallot plants were 60

DAP with the characteristics of the leaves having turned yellow or 80% dry and the neck of the tuber has drooped.

RESULTS AND DISCUSSION

The results of analysis of variance showed that the treatment of organic cow dung and biofertilizers had a very significant effect on all observed variables, but the interaction treatment had no significant effect on all observed variables (Table 1).

The increase in growth and production of shallots was found in the treatment of giving organic fertilizers of cow dung 15 tons/ha with biofertilizers when compared to the application of organic fertilizers at 7.5 tons/ha with no biological fertilizers (Table 2, 3 & 4), this was due to biofertilizer given around the roots of this plant contains active and aggressive bacteria infecting the roots so that the roots will be protected from other bacterial infections that were detrimental to plants and could improve soil aeration, and make the soil fertile. Bacteria with this ability were called PGPR (Plant Growth Promoting Rhizobacteria) which will help plant growth and production and gradually restore soil fertility (Kafrawi et al., 2017).

Biofertilizers containing N-fixing bacteria (such as Azospirillum, Azotobacter), phosphate solubilizing bacteria (Bacillus, pseudomonas) were active in helping to decompose organic fertilizer of cow dung 15 tons/ha. The activity of Azospirillum and Azotobacter bacteria was to provide N elements, and some were able to provide P for plants and could produce growth hormones such as indole acetic acid (IAA). Azotobacter and Azospirillum bacteria will tether N from the air and convert it to NH_3 using the nitrogenase enzyme found in the bacterial cell wall, then NH_3 was converted into glutamine or alanine, so that it could be absorbed by plants in the form of NO_3^- and NH_4^+ (Goswami 2015; Sudewi et al. 2020; Sutariati 2020).

Table 1. Results of analysis of variance of the effect of organic cow dung and biofertilizers on the observed variable

Observed Variables	Treatment			Coefficient of Diversity (%)
	POKS	PH	Interaction	
Plant Height (cm)	**	**	tn	7.14
Number of Leaves (strands)	**	**	tn	1.64
Number of Roots (strands)	**	**	tn	7.57
Bulb Weight per Clump (g)	**	**	tn	3.73
Bulb Dry Weight per Clump (g)	**	**	tn	4.95

Note: POKS = Cow dung Organic Fertilizer, PH = Biofertilizer

Table 2. Effect of organic cow dung fertilizer on observed variables

Cow Dung (CD) (ton/ha)	Plant Height (cm)	Number of Leaves (sheet)	Number of Roots (sheet)	Weight of Bulbs per Clump (g)	Weight of Bulbs per Clump (g)
0	23.38 a	22.25 a	5.50 a	45.00 a	21.88 a
7.5	29.88 b	27.19 b	7.63 b	71.13 b	43.75 b
15.0	31.00 b	39.25 d	8.88 d	77.00 c	52.03 c
22.5	31.00 b	28.75 c	8.25 c	73.00 b	46.13 c
BNT 0.05 =	2.14	0.46	0.59	2.58	2.11

Note: The notation in each column was the same, the difference was not significant

Table 3. Effect of biofertilizers on observed variables

Biofertilizer	Plant Height (cm)	Number of Leaves (strands)	Number of Roots (strands)	Weight of Bulbs per Clump (g)	Weight of Bulbs per Clump (g)
without	27.81 a	25.25 a	7.13 a	65.25 a	39.50 a
with	29.81 b	28.97 b	8.00 b	67.81 b	42.39 a
BNT 0.05 =	2.14	0.46	0.59	2.58	2.11

The notation in each column was the same, the difference was not significant

Table 4. Effect of combination of organic cow dung and biofertilizers on weight tubers and tuber dry weight per clump

Combination (POKS + PH)	Bulb Weight per Clump (g)	Increase in Control (%)	Dry Weight of Tuber per Clump (g)	Increase In Control (%)
0 ton/ha without PH	43.75	100	20.25	100
0 ton/ha with PH	46.25	105.71	23.50	116.05
7,5 ton/ha without PH	70.50	161.14	42.25	208.64
7,5 ton/ha with PH	71.75	164.00	45.25	223.45
15 ton/ha without PH	74.25	169.71	50.50	249.38
15 ton/ha with PH	79.75	182.29	53.56	264.49
22,5 ton/ha without PH	72.50	165.71	45.00	222.22
22,5 ton/ha with PH	73.50	168.00	47.25	233.33

Phosphate solubilizing bacteria were bacteria that could dissolve P which was absorbed by the surface of iron and aluminum oxides as Fe-P and Al-P compounds (Novatriana 2020; Tuhuteru et a*l.*, 2017), so that P nutrients were released from metal compounds (Fe and Al). and available to plants.

The combination of organic cow dung fertilizer of 15 tons/ha with biofertilizers was able to increase tuber weight per clump as much as 182.29% when compared to the combination of organic cow dung fertilizer of 7.5 tons/ha with no biofertilizers (Table 4), this indicates that The big role of biofertilizers in decomposing cow dung fertilizer and contributing N nutrients and providing P nutrients, added by the research results of Firmansyah et al., 2016, Purba, 2015), that organic fertilizers could increase the yield of shallot bulbs.

The application of organic cow dung fertilizer at 15 tons/ha has increased the number of leaves by 39.25 leaves (Table 2) and was significantly different from without and using organic cow dung fertilizer by 7.5 and 22.50 tons/ha. This means that the nutrient N contributed by organic cow manure and biological fertilizers works well in increasing the number of shallots. The number of leaves that increased significantly also increased the chlorophyll content and According to Cerovic et al. (2012) and Parry et al. (2014), that there was a close relationship between high chlorophyll content with increased photosynthesis and the high yield of seeds or tubers achieved.

The use of biofertilizers has been able to increase the growth of plant height, number of leaves, number of roots, tuber weight and dry weight of tubers per clump when compared with no application of biofertilizers. According to Hammad et al., (2018), the use of biofertilizers has produced clear tangible results in terms of reducing the level of nitrogen and phosphate fertilization as well as increasing crop productivity as an indirect result of changes in soil conditions and plant physiology and Kalay et al. (2020) the provision of nutrients needed by plants could be carried out by bacteria in biological fertilizers which have the ability to fix N from the air and phosphoric microbes which could increase P in the soil to become available P for plant growth, thereby affecting growth and yield components.

According to Hidayatullah (2014), biological fertilizers could increase fertilization efficiency, soil fertility and health. Bacteria in the rhizosphere environment play an important role in increasing available nutrients and could maintain the cycle of macro-N nutrients. Inoculation of biological fertilizers consisting of nitrogen fixing bacteria could be one of the solutions to increase the population of nitrogen fixing bacteria in the rhizosphere environment which in turn was expected to increase nutrient the soil increases the readiness of nutrients and facilitates their absorption. increases the availability of nutrients and facilitates their absorption. Microorganisms secrete stimulants for growth (Plant Growth Promoting Rhizobacteria (PGPR (Costa et al. (2014)), improving physical, chemical and biological properties, as they increase soil fertility by increasing the number of microorganisms in the soil, and added by Huseein (2021), explaining that the addition of biofertilizers in all its forms causes an increase in growth indicators, biofertilizers cause an increase in the final yield, in quantity and quality, of 10-20% of cereal crops, and also provides most of the essential nutrients for plants (25% air nitrogen + 50% dissolved phosphate) and it was proven in this study using biofertilizers to increase dry tuber production per clump by 264.49%.

The contribution of NPK nutrients from organic cow dung and biofertilizers has their respective roles in shallots. According to Sudin et al. (2021), NPK macro nutrients were needed by shallot plants in sufficient and balanced quantities to further increase productivity and quality of yields or tubers. The nitrogen element available in shallots was recognized to have a significant effect on tuber production and quality. Nitrogen was often used as a building block for nucleic acids, proteins, bioenzymes, and chlorophyll. Phosphorus was considered a builder of nucleic acids, phosphorlipids, bioenzymes, proteins, and metabolic compounds as part of the important ATP in energy transfer. In addition, the element Phosphorus was recognized as very important in the process of root development, but its availability tends to be limited. Potassium was used as a regulator of the ion balance of cells which plays an important role in regulating various metabolic mechanisms such as photosynthesis. Potassium This element also functions to maintain plant water status and cell turgor pressure, regulate stomata and regulate the accumulation and translocation of newly formed carbohydrates. K provided in shallots had a significant effect on yield growth and tuber quality.

While the lowest growth and production was found in the treatment without organic cow dung fertilizer with no biofertilizer, this was because the shallot plant only utilized the nutrients in the media, so that the shallot plant experienced a shortage of N, P and K nutrients as well as other nutrients. other micronutrients and result in lower yields obtained. According to Sopha et al. (2020), insufficient nitrogen supply keeps onions growing, but continues to reduce bulb size and marketable tuber yields. P deficiency in shallots will reduce root and leaf growth, tuber size and yield, but will further support optimal aging.

CONCLUSION

The highest production (dry weight of plant tubers) was achieved in the application of organic cow dung fertilizer of 15 tons/ha with biological fertilizers, which was 53.56 g/plant.

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REFERENCES

Aminah IS, Marlina N, Rahman A. 2015. Application of biofertilizers on several varieties of soybean (*Glycine max* L. Merril) in Lowland. *In: Proceedings of the National Seminar on Suboptimal Land 2015*. Palembang, Indonesia p. 1-8.

Cerovic ZG, Masdoumier G, Ghozlen NB, Latouche G. 2012. A new optical leaf-clip meter for simultaneous non-destructive assessment of leaf chlorophyll and epidermal flavonoids. *Physiologia Plantarum*. 146 (3): 251–260. DOI: 10.1111/j.1399-3054.2012.01639.x.

Costa PB, Granada CE, Ambrosini A, Moreira F, Souza R ,Passos JFM, Arruda L, Passaglia LM. 2014. A model to explain plant growth promotion traits: Amultivariate analysis of 2,211bacterial isolates. *Plos One*. 9 (12): 1-25. DOI: 10.1371/ journal.pone.0116020.g008.

Faturrohman A, Aniar M, Zulkhriyah A, Adam MA. 2015. Perceptions of cattle breeders in using cow manure to become biogas in Sekarmojo Village, Purwosari, Pasuruan. *Jurnal Ilmu-ilmu Peternakan*. 25 (2): 36-42. DOI: 10.21776/ub.jiip.2015.025.02.05.

Firmansyah I, Lukman L, Khaririyatun N, Yufdy MP. 2016. The growth and yield of shallots with organic fertilizers and biofertilizers application in alluvial soil. *J. Hort*. 25 (2): 133-141 DOI:10.21082/jhort.v25n2.2015.p133-141.

Goswami D. 2015. Simultaneous detection and quantification of indole-3- acetic acid (IAA) and indole-3-butyric acid (IBA) produced by rhizobacteria from l-tryptophan (Trp) using HPTLC. *J Microbiol Methods*. 110: 7-14. DOI: 10.1016/j.mimet.2015.01.001.

Hammad SA, Saleem MM, Al-Shazli MM. 2018. Environment and organic agriculture in the Arab World. Modern Library, First Edition, p. 108-125.

Hidayatullah, Aditya. 2014. Effect of combination of liquid biofertilizer with NPK fertilizer on azotobacter sp. population, phosphate solubilizing bacteria and yields of caisim (*Brassica juncea*, L.) in Inceptisols. Faculty of Agriculture, Padjadjaran University, Jatinangor.

Huseein HA. 2021. Biological fertilizer and their role in plant growth. *International Research Journal od Advanced Science*. 2 (1): 17-20. DOI: 0000-0003-0101-9574.

Kafrawi, Nildayanti KZ, Baharuddin. 2017. Comparison of IAA production by shallot rhizosphere isolated bacteria in solid and liquid media and their effect on shallot plant growth. *J Microbial Biochem Technol*. DOI: 10.4172/1948-5948.1000375.

Marlina N, Gofar N, Subakti AHPK, Rahim AM. 2014. Improvement of rice growth and productovity through balance application of inorganic fertilizer and biofertilizer in inceptisol soil of lowland swamp area. *Journal Agrivita*. 36 (1): 48-56.
DOI: 10.17503/agrivita.v36i1.300.

Marlina N, Asmawati, Zairani FY, Midranisiah, Aryani I, Kalasari R. 2016. Biofertilizer utilization in increasing inorganic fertilizer efficiency and rice yield at C-type flooding land of Tanjung Lago Tidal Lowland. *International Journal of Engineering Research and Science & Technology*. 5 (4): 74- 83.

Marlina N, Meidelima D, Asmawati A, Aminah IS. 2018a. Utilization of different fertilizer onthe yield of two varieties of oryza sativa in tidal lowland area. *Biosaintifika Journal of Biology & Biology Education*. 10 (3): 581-587. DOI: 10.15294/biosaintifika.v10i3.16253.

Marlina N, Amir N, Palmasari B. 2018b. Utilization of various types of biofertilizer on the production of shallots (*Allium ascalonicum* L.) in overflow type C tidal soilsfrom Banyuurip. *Jurnal Lahan Suboptimal : Journal of Suboptial Lands.* 7 (1): 74-49. DOI: 10.33230/JLSO.7.1.2018.345.

Marlina N, Aminah IS, Amir N, Rosmiah. 2019. Application of organic fertilizer types to NPK nutrients levels and soybeans production (*Glycine max* (L.) Merril) at different planting spaces in tidal land. *Jurnal Lahan Suboptimal : Journal of Suboptial Lands*. 8 (2): 148-158. DOI: 10.33230/JLSO.8.2.2019.428.

Marlina N, RIS Aminah, RD Puspa. 2020. Increasing the productivity of shallots (*Allium ascalonicum* L.) by giving cow manure compost and types of mulch. *Jurnal Klorofil*: *Jurnal Ilmu-Ilmu Pertanian*. 15 (1): 23-29. DOI: 10.32502/jk.v15i1.3722.

Marlina N, Gusmiatun. 2020. Test effectiveness of various biofertilizer to increase soybean productivity in lowland area. *Jurnal Agrosaintek*. 4 (2): 129-136. DOI: 10.33019/agrosainstek.v4i2.133.

Novatriana C. 2020. Application of plant growth promoting rhizobacteria (PGPR) and effect on growth and yield of shallot (*Allium ascalonicum* L.). *Plantropica J Agric Sci*. 5 (1): 1-8 DOI: 10.21776/ub.jpt.2020.005.1.1.

Parry C, Blonquist JM, Bugbee B. 2014. In situ measurement of leaf chlorophyll :concentration: analysis of the optical/absolute relationship. *Plant, Cell & Environment*. 37 (11): 2508–2520. DOI: 10.1111/pce.12324.

Purba R. 2015. Study of the use of ameliorants on dry land in increasing the yield and profits of soybean farming. *In: Proceedings of the National Seminar on Indonesian Biodiversity Society 2015*. 1483–14865 (1), Indonesia p.1-8.

Riyani N, Islami T, Sumarni T. 2015. Effect animal manure and *Crotalaria juncea* L. on growth and yield of soybean (*Glycine max* L.). *Jurnal Produksi Tanaman*. 3 (7): 556-563 DOI: 10.21176/protan.v3i7.235.

Sakti IT, Sugito Y. 2018. Effect of cattle manure dosage and planting spacing on the growth and yield of shallots (*Allium ascalonicum* L.). *Plantropica: Journal of Agricultural Science*. 3 (2): 124-132. DOI: 10.21176/6/ub.jpt.

Sopha G, Effendi AM, Aprianto F, Firmansyah A. 2020. The incorporation of lime and NPK Fertilizer on Shallot Production in peat soil. *IOP Conf. Series:Erath and Environmental Science*. 653 (2021): 012057. IOP Publishing. DOI: 10.1088/1755-1315/653/1/012057.

Sudin AF, Maintang, Asri M, Wahditya AA, Rauf AW, Syam A. 2021. The growth response and shallot production on some dosage of npk nirate compound fertilizer 16-16-16. *IOP Conf.Series: Earth and Enviromental Science*. 911 (2021): 012-048. DOI: 10.1088/1755/1315/911/1/012048.

Sudewi S, Ala A, Baharuddin, Farid M. 2020. The isolation, characterization endophytic bacteria on indole-3-acetic acidproducing and phosphate solubilizing from roots of local rice plant Kamba in Bada Valley, Central Sulawesi. *Biodiversitas*. 21 (4): 1614-1624. DOI: 10.13057/biodiv/d210442.

Sutariati G. 2020. Characterization of endophytic-rhizobacteria from areca nut rhizosphere to dissolve phosphates, nitrogen fixation of IAA hormone synthesis. *Pak J Biol Sci*. 23 (3): 240-247. DOI: 10.3923/pjbs.2020.240.247.

Suwandi, GA Sopha, L Lukman dan MP Yufdy. 2017. The effectiveness of the national leading biofertilizer on the growth and yield of shallots. *J. Hort*. 27 (1): 23-34.

Tuhuteru S, Sulistyaningsih E, Wibowo A. 2017. Effects of plant growth promoting rhizobacteria (PGPR) on growth and yield of shallot in sandy coastal land. *Ilmu Pertanian* (*Agric Sci*). 1 (3): 105-110. DOI: 10.22146/ipas.16349.