DOI :https://doi.org/10.36378/juatika.v5i1.2464
JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL. 5 NO. 1 January 2023
eissn 2656-1727
pissn 2684-785X
Hal : 232 – 238

Utilizing Compost Soil Conditioner in Beach Sand Soil as a Palm Oil (*Elaeis guineensis* Jacq) in Pre-nursery Media

Sri Suryanti *, Ryan Firman Syah, Ichan Al Hafish
Institut Pertanian STIPER, Jl. Nangka II, Maguwoharjo,
Sleman, Yogyakarta,
*email: ntie@instiperjogja.ac.id

ABSTRACT

The objective of this study was to assess the effect of the type and dose of compost on the growth of oil palm seedlings in pre nursery with coastal sandy soil. The other objective is to know the effect of the type of compost on the growth of oil palm seedlings in pre nursery with coastal sandy soil. Lastly, the study examines the right dose of compost that provides the best growth of oil palm seedlings in pre nursery with coastal sandy soil. The experimental design was set in a factorial completely randomized design (CRD) consisting of two factors from April to June 2020 at the Tridharma Research Station Faculty of Agriculture, INSTIPER. The first factor is the type of compost which consists of 2 levels, Lamtoro compost, and vermicompost. The second factor is the dose of compost consisting of 4 levels: control (without compost), 50 gr compost/polybag, 75 gr compost/polybag, and 100 gr compost/polybag. The research data were analyzed using analysis of variance (α =0,05), and if there was a significant effect, it was continued with the Duncan multiple range test (α = 0,05). Parameters observed included seedling height, total leaf, leaf width, stem diameter, shoot dry weight, root dry weight, root length, and total roots. The results showed that no combination of types and doses of compost significantly affected the growth of oil palm seedlings in pre-nursery. Using vermicompost can significantly increase oil palm seedlings' leaf area and root dry weight. Using compost at a dose of 50 g/polybag increased seedling height, stem diameter, and root dry weight in pre-nursery of oil palm seedlings.

Keywords*: types, doses, vermicompost, growth*

Copyright © 2023. The authors. This is an open access article under the CC BY license (https://creativecommons.org/licenses/by/4.0/)

1. INTRODUCTION

The availability of quality seeds in large quantities is one of the problems in developing oil palm. Good plant nursery media is needed to grow good oil palm seedlings. The availability of fertile soil is increasingly limited, so planting media in nurseries is starting to use marginal soils such as beach sand soil. Using beach sand soil has several obstacles and low productivity of beach sand land. The physical characteristics of beach sand soil, especially soil structure, poor drainage, and low soil fertility, are the limiting factors for oil palm production. In general, beach sand soils have a low cation exchange capacity (CEC), soil pH, and organic matter content (Kome *et al.*, 2020)

Efforts that can be made to overcome the limitations of beach sand soil include using soil amendments such as organic fertilizers such as vermicompost and Lamtoro leaf compost, as well as organic matter. Vermicompost is one of the solid organic fertilizers from the vermicompost process assisted by earthworms (*Lumbricus rubellus*) (Lokha *et al.*, 2021). Laboratory test results showed that vermicompost fertilizer contains many nutrients, namely 1.79% nitrogen, 1.79% potassium, 0.85% phosphate, 30.52% calcium, and 27.13% carbon. Vermicompost is also very effective at improving soil texture and making plants thrive compared to chemical fertilizers (*Direktorat Perlindungan*, 2022). Lamtoro liquid organic fertilizer contains C-Organic 0.584%, N-Total 0.068%, P 0.029%, K 0.158%, Ca 0.023%, Mg 0.018%, pH 4.4 and C/N ratio of 9 (Jeksen dan Mutiara, 2017). The results of research on the south coast of Kulon Progo showed that using organic matter from the Angsana leaves can improve the properties of sandy soil. Angsana leaves are the best source of organic matter in improving soil physical and chemical properties such as water availability, soil unit weight, porosity, and soil C-organic content. (Hasibuan, 2015). The application of vermicompost significantly increased the growth and yield of green bean plants on sandy beaches compared to the control (without organic fertilizer). Using vermicompost fertilizer at 20 tons/ha can increase the growth and production of soybeans on sandy beach land. The effect of the combination of vermicompost and soybean varieties was on the root length and weight of 100 seeds (Soares and Purwaningsih, 2013). Providing organic fertilizers will increase the availability of macro and micro nutrients in the soil to increase the availability of nutrients needed by plants. The results of research on mustard greens showed that the best combination of cow manure and organic fertilizer was using 100 g of cow manure and 10 g of Gaksi organic fertilizer (Hijria *et al.*, 2019). POC Lamtoro significantly increased seedling height, tuber diameter, root wet weight, root dry weight, wet crown weight, and dry crown weight in the main oil palm nursery. The Lamtoro POC concentration of 600 ml/l significantly affects the growth of oil palm seedlings (Setiawan *et al*., 2021). The application of Lamtoro leaf compost also significantly increased the height of the seedlings and the number of leaves of the Cempaka Kuning seedlings but did not significantly affect stem diameter (Sulham, 2019). Lamtoro leaf compost also significantly affected the number of leaves and the height of Brassica juncea plants (Sarmento *et al*., 2019). Lamtoro leaf

extract fertilizer application with different salinity significantly affected growth, plant biomass, and chlorophyll-a of C. Vulgaris. The best specific growth rate was 1.93/day at a salinity of 35 ppt, with a biomass content of 0.403 g/l and chlorophyll-a of 0.018 µg/ml (Aulia, 2021). The Lamtoro liquid organic fertilizer treatment significantly increased the growth and yield of sweet corn plants (Ainiya *et al*., 2019), and liquid organic fertilizer for Lamtoro leaves with a concentration of 30% produced the highest length, diameter and cob weight (Hasan *et al*., 2021).

2. MATERIALS AND METHODS

The research was carried out at the Education and Research Garden of the Faculty of Agriculture, INSTIPER, with an altitude of 118 meters above sea level from April to June 2020. The research used equipment that included hoes, machetes, buckets, water sprinklers, shovels, soil sieve, wood, bamboo, a ruler, stationery, a small black polybag measuring 15 cm x 15 cm, an analytical scale, and an oven. While the material used is beach sand taken from the south coast of Yogyakarta. Oil palm sprouts of the D x P Simalungun variety, compost from Lamtoro leaves and vermicompost. The Simalungun variety has various adaptations and can be planted in various land types.

The research was carried out using a factorial, completely randomized design experiment (CRD) with two factors. The first factor is the type of compost which consists of 2 levels, namely Lamtoro and vermicompost. The second factor is the dose of compost with three levels: control, compost dose of 50 grams/polybag, compost dose of 75 grams/polybag, and compost dose of 100 grams/polybag). Each treatment combination was repeated three times. Data were analyzed using analysis of variance at a significant level of 5%. If there were significant differences between treatment combinations, it was further tested using the DMRT (Duncan Multiple Range Test) at a significant level of 5%. Parameters observed included seedling height, number of leaves, leaf area, stem diameter, shoot dry weight, root dry weight, root length, and number of roots.

3. RESULT AND DISCUSSION

The results showed that the application of vermicompost significantly increased the leaf area of the oil palm seedlings. In contrast, the application of Lamtoro leaf compost and vermicompost did not have a different effect on the parameters of plant height, number of leaves, stem diameter, dry crown weight, root dry weight, root length, and number of roots (Table 1).

Table 1. Various compost types affect several growth parameters

Variable	Lamtoro	Vermicompost
Seedling Height (cm)	19.50 a	21.12 a
Total leaf (strands)	3.91 a	4.08 a
Leaf wide (cm^2)	84.97 b	107.99 a
Stem diameter (cm)	0.59 a	0.55 a
Shoot dry weight (gram)	0.78 a	0.93 a
Root dry weight (gram)	0.40 b	0.52 a
Root length (cm)	21.33 a	23.50 a
Total root	3.41 a	3.41 a

Note: Numbers followed by the same letter in the same row indicate no significant difference based on the DMRT test at the 5% level

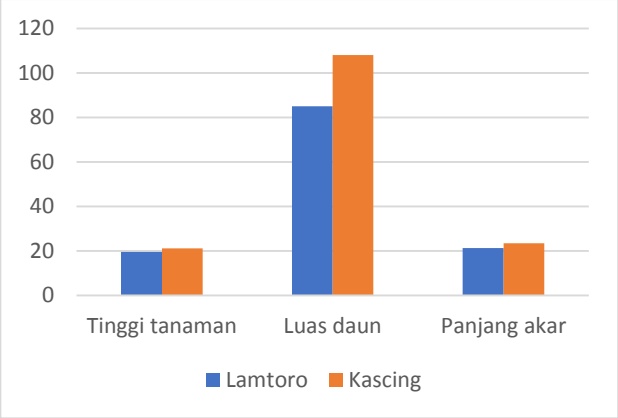

Figure 1. Effect of Lamtoro compost and vermicompost on seedling height, leaf area, and root length

Lamtoro compost and vermicompost did not show a different effect on plant height, number of leaves, stem diameter, shoot dry weight, root length, and number of roots. Meanwhile, using vermicompost significantly increased leaf area and root dry weight of oil palm seedlings compared to using Lamtoro compost (Table 1, Figure 1). The increase in leaf area on fertilized seedlings with vermicompost improved the plant's ability to carry out photosynthesis. Hence, the root and stem growth was higher. Lamtoro compost is expected to increase the availability of nitrogen nutrients because the nitrogen content of Lamtoro leaves is very high.

Lamtoro leaf compost has a nutrient content of N 2.14% (very high), P 0.35% (high), 0.71% (high), and a C/N ratio of 12.80 (high) (Zuliyanti, 2013). Meanwhile, vermicompost contains 1.79% nitrogen, 1.79% potassium, 0.85% phosphate, 30.52% calcium, and 27.13% carbon. Even though the vermicompost nitrogen content is lower than Lamtoro compost, the first contains hormones needed for plant growth. Vermicompost fertilizer contains the hormones gibberellin, cytokinins, and auxins. Vermicompost fertilizer, which is organic matter produced by worm manure, can improve the physical, chemical, and biological properties of soil, especially on marginal land (Simanjutak, 2009) such as beach sand,

Table 2. Effect of organic fertilizer dosage on several growth parameters

Variable	Control	50 gram /polybag	75 gram /polybag	100 gram /polybag
Seedling Height (cm)	17.51 b	20.65 a	21.78 a	21.31 a
Total leaf (strands)	3.83 a	3.83 a	4.16 a	4.16 a
Leaf wide (cm^2)	0.48 b	0.58 a	0.63 a	0.60 a
Stem diameter (cm)	73.85 b	97.61 ab	107.49 a	106.97 a
Shoot dry weight (gram)	0.69 b	0.86 ab	1.00 a	0.87 ab
Root dry weight (gram)	0.34 b	0.49 a	0.54 a	0.49 a
Root length (cm)	22.91 a	21.00 a	22.66 a	23.08 a
Total root	3.50 a	3.16 a	3.33 a	3.66 a

Note: Numbers followed by the same letter in the same row indicate no significant difference based on the DMRT test at the 5% level

The gibberellin content in vermicompost can increase the growth of leaf area and the cytokinin content, stimulating root growth. Vermicompost benefits plants, among others, by increasing the availability of nutrients and improving soil structure so that it is good for plant growth media, increasing the growth of roots, stems, and leaves. Therefore the application of vermicompost can significantly increase leaf area and root dry weight.

The analysis showed that fertilizing with an organic fertilizer at a dose of 50

grams/polybag significantly increased plant height, leaf area, and root dry weight in the early oil palm nursery. In comparison, stem diameter and crown dry weight significantly increased when fertilized with an organic fertilizer dose of 75 grams/ polybag. Fertilization with various doses of organic fertilizer had no significant effect on the number of leaves, number of roots, and root length (Table 2.). This shows that doses of 50 grams/polybag and 75 grams/polybag can meet the needs for the growth parameters of plant height, stem diameter, leaf area, dry canopy weight, and root dry weight. Provision of organic matter at the appropriate dosage will increase the soil microbes' activity, improving the soil's physical properties Improvements in soil properties will further enhance the growth and development of plant roots and increase the absorption of water and nutrients in the soil. These results differ from previous studies, which showed that giving vermicompost at a dose of 50 grams/polybag significantly increased the dry weight of shoots. Furthermore, a vermicompost dose of 75 grams/polybag could increase the diameter of the oil palm seedling humps (Khoiri M. Amrul, 2013). The application of vermicompost fertilizer in the main oil palm nursery is useful for reducing 50-75% of inorganic fertilizer doses and providing a fairly good growth response for oil palm seedlings (Ariyanti *et al*., 2021).

In this study, the application of organic fertilizers can increase leaf area. The increase in leaf area will increase the photosynthesis process to increase the shoot's dry weight, stem diameter, and plant height. Stem diameter is an important parameter because well-developed stems can support the growth of oil palm seedlings, and stem growth is related to the availability of nitrogen, phosphorus, and potassium nutrients. The results of the correlation analysis between leaf area and dry weight of the canopy showed a correlation coefficient (r) of 0.91. This shows a close relationship between leaf area and shoots dry weight, where an increase in leaf area will increase plant growth, as indicated by an increase in shoot dry weight. At the same time, the correlation coefficient (r) between leaf area and stem diameter is 0.98. This also shows a close relationship between leaf area and stem diameter, where an increase in leaf area will increase the diameter of the oil palm seedlings. The correlation coefficient (r) between leaf area and plant height is 0.99. This means that an increase in leaf area will increase plant height.

4. CONCLUSION

The application of the type and dosage of compost did not affect the growth of the oil palm seedlings. Vermicompost's application increased the leaf area's growth and root dry weight of oil palm seedlings. A dosage of 50 g/polybag compost and 75 kg with beach sand soil media is enough to meet the nutrient needs for the growth of the early oil palm nursery.

ACKNOWLEDGMENTS

The author would like to thank the Institute for Research and Community Service (LPPM) and the Rector of the STIPER Agricultural Institute Yogyakarta for conducting research until this publication.

REFERENCE

A.S.Z. Hasibuan (2015) 'Pemanfaatan Bahan Organik dalam Perbaikan Beberapa Sifat Tanah Pasir Pantai Selatan Kulon Progo', *Planta Tropika: Journal of Agro Science*, 3(1), pp. 31–40. doi: 10.18196/pt.2015.037.31-40.

Ainiya, M., Fadil, M. and Despita, R. (2019) 'Peningkatan Pertumbuhan dan Hasil Jagung Manis dengan Pemanfaatan Trichokompos dan POC Daun Lamtoro', *Agrotechnology Research Journal*, 3(2), pp. 69–74. doi: 10.20961/agrotechresj.v3i2.31910.

Ariyanti, M., Suherman, C. and Rosniawaty, S. (2021) 'Respons Pertumbuhan Bibit Tanaman Kelapa Sawit (Elaeis guineensis Jacq.) Akibat Pemberian Pupuk Vermicompost dan Pupuk NPK Berbeda Dosis', *Agrosintesa Jurnal Ilmu Budidaya Pertanian*, 3(2), p. 53. doi: 10.33603/jas.v3i2.4512.

Aulia, A. E. (2021) 'Penggunaan Ekstrak Daun Lamtoro (Leucaena Leucocephala) Sebagai Pupuk Dengan Salinitas Yang Berbeda Terhadap Laju Pertumbuhan, Biomassa Dan Klorofil-A Pada Mikroalga Chlorella Vulgaris', *JFMR-Journal of Fisheries and Marine Research*, 5(1), pp. 47–55. doi: 10.21776/ub.jfmr.2021.005.01.8.

Simanjuntak (2009) *Manfaat Pupuk Organik Vermicompost Dan Cendawan Mikoriza Arbuskula (Cma) Pada Tanah Dan Tanaman*. Available at: https://123dok.com/document/nq76xdry-manfaat-pupuk-organik-vermicompost-cendawan-mikoriza-arbuskula-tanaman.html (Accessed: 8 June 2022).

Direktorat Perlindungan (2022). Available at: http://ditlin.hortikultura.pertanian.go.id/index.php/artikel/detail/PupukVermicompost (Accessed: 25 May 2022).

Hasan, F., Nur, M. J. and Nayo, F. (2021) 'Aplikasi pupuk organik cair daun Lamtoro (Leucaena leucophala (Lam. de Wit) on growth and yield of sweet corn (Zea mays saccharata sturt L.)', *Jurnal Agercolere*, 3(2), pp. 38–45. doi: 10.37195/jac.v3i2.129.

Hijria, H. *et al.* (2019) 'Rekayasa Mutu Tanah Pasir Pantai melalui Aplikasi Bahan Organik terhadap Pertumbuhan dan produksi Tanaman Sawi (Brassica juncea L.)', *Journal Tabaro Agriculture Science*, 3(2), p. 346. doi: 10.35914/tabaro.v3i2.295.

Jeksen, J and Mutiara, C. (2017) *View of Analisis Kualitas Pupuk Organik Cair dari Beberapa Jenis Tanaman Leguminosa*, *Jurnal Pendidikan MIPA*. Available at: https://www.ejournal.tsb.ac.id/index.php/jpm/article/view/9/8 (Accessed: 27 December 2022).

Khoiri M. Amrul, S. S. I. R. P. (2013) 'Respon Bibit Kelapa Sawit (Elaeis guinensis Jacq) pada Berbagai Dosis Pupuk Urea dan Vermicompost di Main Nurserys ', in Supriyanto, M. P. (ed.) *Seminar Nasional dan rapat Tahunan Dekan Bidang Ilmu-Ilmu Pertanian BKS - PTN Wilayah Baratn*. Pontianak: TOP Indonesia, pp. 15–24. Available at: https://faperta.unri.ac.id/wp-content/uploads/2020/09/Prosiding-Respon-Bibit-Sawit-Berbagai-Dosisi-Pupuk-urea-dan-Vermicompost.pdf (Accessed: 9 June 2022).

Kome, G. K. *et al.* (2020) 'Land Suitability Evaluation for Oil Palm (<i>Elaeis guineensis</i> Jacq.) in Coastal Plains of Southwest Cameroon', *Open Journal of Soil Science*, 10(07), pp. 257–273. doi: 10.4236/ojss.2020.107014.

Lokha, J. *et al.* (2021) 'Journal of

Agriculture and Human Resource Development Studies', *AgriHumanis*, 2(1), pp. 47–54. doi: 10.46575/agrihumanis.v2i1.80.

Sarmento, P. d. costa., Gomes, D. C. B. B. and Nabais, C. N. (2019) 'Effect of Types and Dosage of Lamtoro Leaf, Gamal Leaf and Kandang Ayam Leaf Fertilizer on Growth and Result o Caisim Green Palm Plant (Brassica juncea L.)', *International Journal of Development Research*, 09(01), pp. 25246–25252.

Setiawan, R., Novia, P. and Badal, B. (2021) *Pengaruh Konsentrasi Pupuk Organik Cair Lamtoro terhadap Pertumbuhan Bibit Kelapa Sawit (Elaeis guineensis Jacq) pada Main Nursery*. Available at: https://faperta.ekasakti.org/index.php/UJMP/article/view/119/114 (Accessed: 25 May 2022).

Soares, A. and Purwaningsih, O. (2013) 'Pengaruh Pemberian Pupuk Vermicompost terhadap Pertumbuhan dan Hasil Tiga Varietas Kedelai (Glycine max (L.) Merrill) di Lahan Pasir Pantai.', *Pengaruh Pemberian Puouk Vermicompost terhadap Pertumbuhan dan Hasil Tiga Varietas Kedelai (Glycine max (L.) Merrill) di Lahan Pasir Pantai.*, I(1), pp. 7–13.

Sulham, W. R. (2019) 'Pengaruh Kompos Daun Lamtoro (Leucaena leucocephala) terhadap Pertumbuhan Semai Cempaka Kuning (Michelia champaca L)', *Warta Rimba*, 7(September), pp. 107–112.

Zuliyanti N. R. (2013) 'Pengaruh Penambahan Daun Lamtoro terhadap Kualitas Kompos Kertas-Lamtoro dan Pemanfaatannya terhadap Pertumbuhan Tanaman Bayam Merah', *LenteraBio: Berkala Ilmiah Biologi*, 2(1), pp. 149–154.