Jurnal Lahan Suboptimal : Journal of Suboptimal Lands
ISSN: 2252-6188 (Print), ISSN: 2302-3015 (Online, www.jlsuboptimal.unsri.ac.id)
Vol. 12, No.1: 88-94 April 2023
DOI: 10.36706/JLSO.12.1.2023.595

Description of Changes on C-organic, N also The Growth of Pepper Shrub due to The Application of Vermicompost in a Floating System

Deskripsi Perubahan C-organik, N-total serta Pertumbuhan Lada Perdu Akibat Pemberian Vermikompos pada Sistem Terapung

Nadhira Ghea Salsabila[*)], Siti Masreah Bernas

Department of Soil Science, Faculty of Agriculture, Universitas Sriwijaya, Indralaya, Ogan Ilir 30662, South Sumatera, Indonesia
[*)]Corresponding author: gheasalsabila7@gmail.com

(Received: 21 September 2022, Accepted: 28 March 2023)

Citation: Salsabila, NG, Bernas SM. 2023. Description of changes on C-organic, N also the growth of pepper shrub due to the application of vermicompost in a floating system. *Jurnal Lahan Suboptimal : Journal of Suboptimal Lands*. 12 (1): 88-94. DOI: 10.36706/JLSO.12.1.2023.595.

ABSTRAK

Pengembangan lada perdu memerlukan tambahan pupuk, dikarenakan tanaman lada tergolong rakus hara. Penelitian ini bertujuan untuk mendeskripsikan perubahan vermikompos terhadap C Organik, N serta pertumbuhan lada perdu pada sistem terapung. Penelitian ini menggunakan Rancangan Acak Kelompok Faktorial, dengan 5 taraf perlakuan yaitu V_0 (0 g/tanaman), V_1 (250 g/tanaman), V_2 (500 g/tanaman), V_3 (750 g/tanaman), dan V_4 (1000 g/tanaman). Hasil menunjukkan perlakuan Vermikompos berpengaruh tidak nyata terhadap peningkatan C Organik tanah dan N tanah. Pada perlakuan vermikompos terhadap peningkatan C Organik tanah dan N tanah paling tinggi dihasilkan oleh dosis 1000 g/tanaman. Peningkatan terbaik terhadap N tanaman dihasilkan oleh vermikompos dosis 500 g/tanaman. Nilai rata-rata jumlah daun terbaik dihasilkan oleh perlakuan vermikompos 1000 g/tanaman. Pada beberapa daun menunjukkan gejala penyakit yang disebabkan oleh cendawan *Phytophthora capsici* yang kemudian pada 12 MST terdapat tiga tanaman mati. Hal ini menunjukkan bahwa pemberian vermikompos mampu menyediakan nutrisi bagi tanaman lada perdu terutama pada peningkatan kandungan C-organik, N tanah dan tanaman serta pertumbuhan tanaman.

Kata kunci: serapan unsur hara, *Piper albi* Linn, rawa lebak

ABSTRACT

The development of pepper shrub requires an additional fertilizer, hence the pepper plants were classified as nutrient voracious. This study aimed to describe changes in vermicompost on soil N, C-organic and pepper shrubs growth in a floating system. This study utilize a Randomized Block Design Factorial, with 5 levels of treatment, V_0 (0 g/plant), V_1 (250 g/plant), V_2 (500 g/plant), V_3 (750 g/plant), and V_4 (1000 g/plant). The results indicate that the Vermicompost treatment has no significant effect to increase soil C-organic and soil N nutrient. With the vermicompost treatment, the highest result for soil C-organic and soil N nutrient was produced by 1000 g vermicompost/plant. The best enhancement in plant N nutrient was produced by 500 g vermicompost/plant. The average value of the best number of leaves produced by 1000 g vermicompost/plant. Some leaves

indicate some symptoms of disease caused by the fungus *Phytophthora capsici* which then at 12 WAP there were three unsuccessful plants. As a conclusion, the application of vermicompost was able to provide nutrients for pepper shrubs, especially for increasing C-organic, N nutrient of soil and plants as well as the plant growth.

Keyword: nutrient absorption, *Piper albi* Linn, swamp

INTRODUCTION

Pepper plants were morphologically classified as plants that have two kinds of (dimorphic) tendrils, namely fruit vines (plagiotropes) and climbing vines (ototropes) (Ningrum et al., 2018). In Indonesia, the cultivation of pepper plants was generally developed from climbing vines (pepper climbing) which requires a stick to grow (Rukmana et al., 2015). However, day by day the availability of durable dead wood enforcers was getting harder and harder to find. Shrub pepper could be an alternative because it does not require an enforcement rod and was easier to maintain (Rajati, 2011). In vegetative propagation of pepper shrubs using cuttings using fruit branches, so that when compared to ordinary pepper the results were better (Ferry & Wardiana, 2012). Pepper shrub plants were classified as nutrient voracious so that in their development they require fertilizer (Baning et al., 2016). Pepper shrub cumulatively absorb macro nutrients N, P, and K from the soil, thus requiring high nutrient availability to grow and produce well (Daras & Sobari, 2012).

The availability of nutrients in the soil could be increased by adding fertilizers, such as organic fertilizers. The use of organic fertilizers could complement the nutritional needs that were important for plants and also improve soil properties, besides that organic fertilizers could reduce the need for chemical fertilizers which in their use leave residues (Anggraeni, 2018). Currently, vermicompost was an organic fertilizer that was popularly used. Vermicompost was more efficient when compared to the use of other organic fertilizers, because the effect given by vermicompost looks faster and the dose was less so that there was savings in the use of inorganic fertilizers (Setiawati et al., 2017). Vermicompost was a simple bioconversion using worm decomposers (Putra et al., 2021). There was a worm breeding itself in a decomposition process. In the process of decomposition of organic matter, earthworms have a very important role (Putra, 2020). Previous research showed that vermicompost treatment with a dose of 1 kg/plant medium was able to increase C-organic and soil N nutrient which affected the dry weight and wet weight of pakcoy plants (Setiawan et al., 2015). Then the vermicompost treatment at a dose of 250 g/plant gave a response to soil moisture content, soil C-organic, N nutrient soil and plant as well as flower cabbage production in floating farming systems (Risa, 2020).

Fulfillment of water needs must also be fulfilled in addition to the nutrients that were already available. One of the efforts to fulfill water needs in nurseries was a floating farming system (Siaga & Lakitan, 2021). The floating farming system could be one way of planting which was quite effective in its application (Irmawati et al., 2021). In a floating farming system, water diffuses from below the media so that no watering was needed, this was one of the advantages of a floating farming system (Bernas et al., 2012).

Pepper shrubs have the potential to be cultivated in a floating farming system, because the trees were short with a productive plant height of about 1 meter (Anggraini et al., 2021). So it was necessary to do research to examine the effect of vermicompost application on the growth of pepper shrubs in a floating farming system in order to describe the changes in vermicompost on C-organic, N nutrient and the growth of pepper shrubs in a floating system. This study aimed to describe changes in vermicompost on soil

N, C-organic and pepper shrubs growth in a floating system.

MATERIALS AND METHODS

Time and Place

This research was conducted from October 2020 to January 2021 at the Floating Pond, Department of Soil Science, Faculty of Agriculture, Universitas Sriwijaya, Indralaya.

Experimental Design

This study used a Factorial Randomized Block Design (Factorial RBD) with 5 treatment levels, which were: V_0 = 0 g/plant (0 ton/ha), V_1 = 250 g/plant (1.25 ton/ha), V_2 = 500 g/plant (2.5 ton/ha), V_3 = 750 g/plant (3.75 ton/ha), V_4 = 1000 g/plant (5 ton/ha), each treatment was repeated 3 times.

Field Activities

Rawa lebak soil with a depth of 0-15 cm taken at the Experimental Field of the Faculty of Agriculture, Universitas Sriwijaya was used as a planting medium in this study. The soil was then put into a polybag of 7.5 kg with a polybag size of 30 cm x 45 cm. Vermicompost treatment was given once by mixing the soil according to a predetermined treatment dose.

The polybags were arranged on a raft that has been placed in a floating pond. Pepper shrub seed were transferred into polybags filled with soil and mixed with vermicompost treatment. The planting of pepper shrub was carried out with the provisions of one plant seed for one polybag. Pepper shrubs that have been planted were allowed to grow and develop with regular maintenance such as cleaning weeds in the planting area, cleaning the ponds, and keeping the water balance.

Variable Observation

The calculation of the number of leaves was done once a week by manual calculation method. C-organic analysis was carried out once at the end for all samples using the Walkley and Black method. While the analysis N nutrient of soil and plant was carried out once at the end for all samples using the *Kjedahl method* (Saridevi et al., 2013). Analysis of C-organic, and N nutrient (Soil and Plants) was carried out at the Laboratory of Chemistry, Biology, and Soil Fertility, Department of Soil Science, Faculty of Agriculture, Universitas Sriwijaya.

Data Analysis

The obtained data were statistically processed with factorial randomized variance. If the results of the variance show a significant and very significant effect, it will be continued with the Least Significant Difference (LSD) test to see the difference between the treatment levels.

RESULTS

Initial Soil and Vermicompost Analysis

The soil that used in the analysis was rawa lebak soil with a depth of 0-15 cm before treatment and the vermicompost used comes from cow dung and plant litter produced in 2019. The results of the soil analysis showed that the soil C-organic content and organic matter were high while the N-total was low, and then the results of the analysis show that the C-organic content of vermicompost was 9.75 % and organic matter was 16.81 % while the N-total content was 0.64 % (Table 1).

C-organic Soil, N Soil and Plant Analysis

The results of the LSD test at the 5 % level (Table 2) showed that the vermicompost treatment had no significant effect on increasing soil C-organic in pepper shrubs, the vermicompost treatment had no significant effect on the N-total of the soil in pepper shrubs, and then the vermicompost treatment has no significant effect on the N-total of the pepper plants.

Number of Leaves

The calculation of the number of leaves in pepper shrub was done every once a

week at the age of 1 week after planting until the age of 12 weeks after planting. Calculation of the number of leaves was done by counting all the number of leaves in pepper shrub. The number of leaves on the plant was a parameter measured to determine the growth of the pepper plant. The results of the calculation of the number of leaves in pepper shrub at the average value of three repetitions of the vermicompost treatment for 12 weeks (Table 3) show an increase in each week compared to the initial number of leaves in pepper shrub.

Table 1. Initial soil and vermicompost analysis

Parameter	Unit	Soil		Vermicompost
		Analysis Results*	Criteria**	Analysis Results*
C-organic	%	4.88	High	9.75
Organic Matter	%	8.41	High	16.81
N-total	%	0.11	Low	0.64
C/N	%	44.36	High	15.23

Note: *) The results of the analys was at the Laboratory of Chemistry, Biology and Soil Fertility, Department of Soil, Faculty of Agriculture, Universitas Sriwijaya. Inderalaya. 2021, **) Criteria for assessing the results of soil analysis (Supriatin et al., 2017)

Table 2. Effect of vermicompost on C-organic soil, N Soil and Plant (%) in pepper shrubs

Treatment Vermicompost dosage (g/plant)	C Organic Soil	N Soil	N Plant
0	7.80	0.13	0.92
250	8.26	0.14	1.04
500	10.73	0.16	1.31
750	6.83	0.17	1.43
1000	12.81	0.18	1.29
Average	9.28	0.16	1.20

Table 3. The average value of the increase in the number of leaves of wild pepper plants

Average Increase in the Number of Leaves of Pepper Shrub Plants (sheet)												
Treatment	Week After Planting (MST)											
Vermicompost dosage (g/plant)	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	2	1	2	3	4	4	4	4	7
250	0	1	1	1	3	6	7	8	8	8	8	7
500	0	1	1	1	3	4	5	7	8	10	10	12
750	0	2	2	3	4	4	7	8	9	9	10	14
1000	0	0	0	1	2	4	6	8	9	9	9	15

DISCUSSION

Preliminary analysis of the soil used indicates a relatively low N-total nutrient. The low number of N-total in marsh soil at depth of 0-15 cm before treatment caused by nitrogen in the soil often lost due to leaching, so there was just a tiny portion of it remains (Tando, 2018). The vermicompost used in this study was made from cow dung and plant litter (Diansyah, 2019). Vermicompost contains compounds needed to increase soil fertility or for plant growth such as *Azotobacter* sp. which can bind non-symbiotic N_2 enriching N in said vermicompost (Simamora et al., 2014). Based on Table 2, the results showed that the vermicompost treatment can increase soil C-organic content compared to the results of C-organic analysis of the soil before treatment, which is 4.88 %. In vermicompost treatment with a dose of 1000 g/plant, the highest C-organic value was 12.81 %. What causing it was vermicompost fertilizer used contains C-organic of 9.75 % so there was an increase in the soil C-organic content. The soil C-organic value after whole treatment classified into very high category based on the scoring criteria for soil analysis results. The availability of C-organic was closely related to availability of soil N-total. If C-organic available was more than N-total in soil, it will hindered the development of microorganisms (Sukaryorini et al., 2016).

Based on Table 2, the results showed that there was an increase in the soil N-total after vermicompost treatment compared to the N-total content before treatment, which was 0.11 %. Although it had no significant effect, the vermicompost treatment with a dose of 1000 g/plant resulted in the best N-total average value of 0.24 %. Vermicompost contains nitrogen nutrients that worked in the most important part of amino acids, nucleic acids, and chlorophyll, increasing plant protein levels and accelerating vegetative growth (Suparno et al., 2013). Overall, N-total content in the soil after treatment was classified into the medium category based on the scoring criteria for soil analysis results.

Based on Table 2, it showed that vermicompost treatment had no significant effect on increasing the N-total of pepper shrubs. This is because nutrient content produced by adding vermicompost at this dose was not sufficient enough for optimal nutrients needed by pepper shrubs. The more number of nutrients that plants can absorbed, the more it can grow and develop optimally according to the growth phase (Marlingga et al., 2021). Optimal value of N nutrient uptake of pepper plants is 1.65-2.79 %, P 0.11-0.26 %, K 1.78-2.84 %. If nutrient content is lower than the critical (limit) value, then the nutrient status will affect plant growth and development, as well as production (Daras & Sobari, 2012).

Based on Table 3, it showed that the average value of the highest number of leaves was produced by vermicompost treatment with a dose of 1000 g/plant, which was 15 leaves. The addition of vermicompost helps in increasing vegetative growth of plants, the number of leaves precisely (Putri et al., 2012). Vermicompost contains microbes and contains plant-stimulating hormones (Ruliyanti & Majid, 2020). In addition, the number of leaves and leaf size can be influenced by genotype and environmental factors (Sitanggang et al., 2015). Some leaves showed symptoms of disease caused by the fungus *Phytophthora capsici* which at 12 MST there were three dead plants, $V_{2.}1$, $V_{3.}1$, $V_{4.}1$ plants. Root Rot Disease (RRD) was difficult to detect early in its development (Ginting & Maryono, 2012). The symptoms like spots on the leaves that continue to grow to the edges of the leaves, even though the leaves have fallen. Hurting leaves will continue to fall until sixth days after inoculation (Bande et al., 2015).

CONCLUSION

Based on the results of the research and discussion that have been described, it can be concluded as follows: Vermicompost

treatment showed no significant effect on C-organic along with N-total of soil and plants. Vermicompost treatment for the highest increase in soil C-organic and soil N nutrient was produced by a plant with a dose of 1000 g/plant. The best increase in plant N nutrient was produced by vermicompost at a plant with a dose of 500 g/plant.

ACKNOWLEDGEMENTS

The author would like to thank all parties who have contributed, provided suggestions and input in writing this article to completion.

REFERENCES

Anggraeni I. 2018. Provision of liquid organic fertilizer and solid organic fertilizer to the growth of mustard plant *(Branssica juncea)* [Thesis]. Lampung: Universitas Islam Negeri Raden Intan.

Anggraini N, Evizal R, Septiana LM. 2021. Growth characteristics of piper colubrinum and grafting of piper nigrum/piper colubrinum *J. Agrotropika*. 20 (2): 129–138. DOI: 10.23960/ja.v20i2.5322.

Bande LOS, Hadisutrisno B, Somowiyarjo S, Sunarminto BH. 2015. Foot rot disease epidemic on black pepper in variety of environmental conditions. *Jurnal Hama dan Penyakit Tumbuhan Tropika*. 15 (1): 95. DOI:10.23960/j.hptt.11595-103.

Baning C, Rahmatan H, Supriatno. 2016. The effect of red rice washing water on vegetative growth pepper plant (*Piper nigrum* Linn). *J.Ilmiah Mahasiswa Pendidikan Biologi*. 1 (1): 1–9.

Bernas SM, Pohan A, Fitri SNA, Kurniawan E. 2012. Bamboo floated-cultivation model for uplnad kangkong (*Ipomoea reptans* Poir) in tidal lowland area. *Jurnal Lahan Suboptimal : Journal of Suboptimal Lands.* 1 (2): 177–185. DOI: 10.33230/JLSO.1.2.2012.24.

Daras U, Sobari I. 2012. Formulation of balanced fertilizers on black pepper grown in Bangka Belitung. *J. Tanaman Industri dan Penyegar*. 3 (2): 185–192. DOI: 10.21082/jtidp.v3n2.2012.p185-192.

Diansyah R. 2019. Production of vermikompost using cow manure, litter plants and eartworms (*Lumbricus rubellus*) as decomposers [Field Practice]. Palembang: Universitas Sriwijaya.

Ferry Y, Wardiana E. 2012. Effect of plant spacing and intercrops on the growth of pepper and yield pf intercrops. *Buletin RISTRI 3*. 3 (2): 151–156.

Ginting C, Maryono T. 2012. Decrease of disease severity of foot rot of black pepper due to application of organic matter and *Trichoderma harzianum*. *J. Hama dan Penyakit Tumbuhan Tropika.* 12 (2). DOI: 10.23960/j.hptt.212162-168.

Irmawati, Susilawati, Sukarmi S, Ammar M, Achadi T, Amri A. 2021. Application of liquid organic fertilizer on shallot planted on cow manure mixture media in floating system. *In: Proceedings Seminar Nasional Lahan Suboptimal*. Palembang, Indonesia p. 713–720.

Marlingga PG, Hasbi H, Tripama B. 2021. Response of growth and production of brocolli plant (*Brassica oleraceae Var. Botrytis* L.) to fertilizer composition goat water and azolla liquid organic fertilizer (LOF) concentration [Thesis]. Jember: Universitas Muhammadiyah.

Ningrum FS, Hanum C, Purba E. 2018. Morphological characteristics of pepper (*Piper nigtum* L.) varieties of Natar 1 and Natar 2 tolerant of shade stress . *J. Agroekoteknologi*. 6 (4): 708–714.

Putra ARD. 2020. The effect of methods and dosage of vermicompost applications in kangkung plant (*Ipomoea reptans* Poir) hydroganically [Thesis]. 21 (1): 1–9.

Putra DP, Widyowanti RA, Renjani RA, Krisdiarto AW. 2021. Decomposition of palm oil waste using vermicompost method. *J. Biosistem dan Teknik*

Pertanian. 9 (1): 106–112. DOI: 10.24843/JBETA.2021.v09.i01.p11.

Putri M, Sipayung R, Sinuraya M. 2012. The growth and yield of shallot (*Allium ascalonicum* L.) according to application of vermicompost and sheep urine. *J. Online Agroekoteknologi*. 1 (1): 124–138.

Rajati T. 2011. Pepper shrub as alternative in forestry land utilization and improvement of enviromental quality. *J. Geografi Gea*. 11 (1): 77–85. DOI: 10.17509/gea.v11i1.1644.

Risa EO. 2020. The effect of vermicompost and compost on soil water content, soil C-organic, N nutrient soil and plant also production of cauliflower (*Brassica oleraceae* Var. Botrytis L.) on floating agricultural systems [Skripsi]. Palembang: Universitas Sriwijaya.

Rukmana D, Wahyudi A, Nurhayati H. 2015. Seedling and cultivation of pepper shrub. In Sirkuler Informasi Teknologi Tanaman Rempah dan Obat. Bogor: *Balai Penelitian Tanaman Rempah dan Obat*. 1–18.

Ruliyanti W, Majid A. 2020. The effect of vermicompost on planting media on the effectiveness pf *Gliocladium* sp. in controlling Fusarium wilt disease (*Fusarium oxysporum*) in Watermelon (*Citrulus vulgaris* Schard). *J. Pengendalian Hayati*. 3 (1): 14. DOI: 10.19184/jph.v3i1.17147.

Saridevi G, Atmaja I, Mega I. 2013. Differences in the nature of soil biology in several types of land use land andisol, inceptisol, and vertisol. *J. Tropical Agroecotechnology*.

Setiawan IGP, Niswati A, Hendarto K, Yusnaini S. 2015. Effect of vermicompost dose in the growth of pakcoy (*Brassica rapa* L.) and changes of some chemical properties of soil ultisol soil Bogo Garden. *J. Agrotek Tropika*. 3 (1): 170–173. DOI: 10.23960/jat.v3i1.2009.

Setiawati MR, Sofyan ET, Nurbaity A, Suryatmana P, Marihot GP. 2017. Application of biofertilizer, vermicompost and N,P,K fertilizer on N content, population of *Azotobacter* sp. and the yield edamame soybean (*Glycine max* (L.) merill) at inceptisols Jatinangor. *J.Agrologia*. 6 (1): 1–10. DOI: 10.30598/a.v6i1.174.

Siaga E, Lakitan B. 2021.Rice breeding and green palm cultivation floating system as an alternative to cultivation of plant during the flood period in swamp rawa lebak, Pulutang, South Sumatera. *J.Abdimas Unwahas*. 6 (1): 1–6. DOI: 10.31942/abd.v6i1.4424.

Simamora ALB, Simanungkalit T, Ginting J. 2014. Response in growth and yield of shallot (*Allium ascalonicum* L.) on giving vermicompost and rabbit urine. *J. Agroekoteknologi*. 2 (2): 533–546. DOI: 10.1007/springerreference_68017.

Sitanggang A, Islan, Saputra SI. 2015. Effect giving chicken manure and plant growth regulator of giberelin on the growth of coffee arabica seeds (*Coffea arabica* L.). *J. Mahasiswa Faperta*. 2 (1): 1–12.

Sukaryorini P, Fuad AM, Santoso S. 2016. Effect of organic matter on availability ammonium (NH4), C-Organic and population in soil microorganism entisol. *J.Plumula*. 5 (2): 99–106.

Suparno, Talkah A, Prasetya B, Soemarno. 2013. Effect of vermicompost from organic wastes on growth and yield of sweet potato (*Ipomoea batatas* L.). *J. Indonesian Green Technology*. 2 (1): 37–44.

Supriatin, Sarno, Lumbanraja J, Dermiyati. 2017. Etermination of standard soil samples to ensure quality (quality control) of soil sample analysis results at the laboratory of soil science, Universitas Lampung. *In Research Report*. 1–23.

Tando E. 2018. Efficiency and improvement of nitrogen availability in soil and nitrogen upport in paddy (*Oryza sativa* L.). *J. Buana Sains*. 18 (2): 171–180. DOI: 10.33366/bs.v18i2.1190.