Jurnal Pembelajaran Dan Biologi Nukleus p-ISSN: 2442-9481
Vol 9 (1): 23-30, March 2023 e-ISSN: 2685-7332

Effect of Compost Tea and JADAM Microorganism Solution on Growth of Chili Pepper In PT. Cinquer Agro Nusantara

Iffa Afiqa Khairani[1*], Novriadi[1], Septi Putri Wandasari[1], M. Zulhiyadi Nanda[2], and Andi Anshori[2]
[1]Department of Biology, Faculty of Sciences, Institut Teknologi Sumatera
Jl. Terusan Ryacudu, Lampung Selatan 35365, Lampung, Indonesia.
[2]Kebun Nusantara PT. Cinquer Agro Nusantara, Jl. Namang Pahlawan, Bangka Tengah 33681, Bangka Belitung, Indonesia

***Corresponding author**: iffa.khairani@bi.itera.ac.id

Submit January 22th 2023 and Accepted February 16th 2023

Abstract

Chili pepper (Capsicum frustescens) is herbaceous plant from the family solanaceae which is massively cultivated in Indonesia. It also can be used as raw material for food product and pharmacy industries. Organic fertilizer usage has been both a solution to increase productivity and a replacement to chemical fertilizer usage. The aim of this study is to examine the effect of compost tea organic fertilizer and JADAM Microorganism Solution (JMS) on the growth of chili pepper in PT. Cinquer Agro Nusantara, Bangka Belitung. This research used a completely randomized design with 15 unit treatments which were divided into control group, compost tea group, and JMS group. The result showed that the plant group with JMS performed the highest height expansion, increasing the number of leaves significantly compared to control and compost tea group. This study concludes that application of compost tea and JADAM Microorganism Solution (JMS) as organic fertilizer on C. frustescens can increase the plant's growth.

Keywords: *chili pepper, compost tea, JADAM microorganism solution*

https://doi.org/10.36987/jpbn.v9i1.3807

INTRODUCTION

Chili pepper (*Capsicum frustescens*) is a herbaceous plant from the *famili solanaceae* which is massively cultivated as a horticultural commodity in Indonesia. Generally, plants of the *genus Capsicum* contain vitamins C and E, provitamin A, carotenoids, and phenolic compounds (Morales-Soto et al., 2013). The main compound in the extract *C. frutescens* are *luteolin*, *capsaicin,* and *dihydrocapsaicin* which has a benefit as an antibacterial (Rivera et al., 2019). The general utilization of chili pepper are in fresh or processed, as an additive, and as flavoring in food. Chili pepper is also widely used as a raw material for

the food industry, such as sauces, chili powder, and flavoring. It is also starting to be used in the pharmaceutical industry.

Chili pepper has a prospect for domestic consumption and export. In the 2017-2021, the demand for chili pepper increased by 2.65% every year, which includes requests for seed availability, consumption, and industrial raw materials (Sofiarani & Ambarwati, 2020). Several factors, such as the availability of nutrients, resistance to pests and diseases, sufficient land, can influence the success rate of chili pepper farming. Good soil conditions for the growth of chili plants are loose, crumbly soil, containing at least 1.5% organic matter, containing nutrients and water, and also free from weeds (Fikrizal, 2018).

One of effort to increase the success of chili pepper's farming is applying chemical fertilizers. However, long-term use of chemical fertilizers will adversely affect soil quality. In addition, the accumulation of residual fertilizers carried by rain can cause pollution in body of water around agricultural land. Various negative impacts caused by chemical fertilizers make farmers change over to organic fertilizers, which are more environmentally friendly and easy to make. One form of organic fertilizer that has been widely developed is compost tea. Compost tea is an option in developing organic agriculture because it has various benefits, such as providing nutrients and growth hormones in plants, and can be a biocontrol agent for plant diseases (Berek, 2017).

Another method of increasing the yield of organic farming is the provision of inputs JADAM Microorganism Solution (JMS). By applying JMS, soil microorganisms will suppress specific pathogens, moderate soil temperature, and increase the diversity of nutrients for plants. Agricultural techniques using the JADAM method were discovered in Korea and have been extensively researched and implemented in tropical countries such as Hawaii and the Philippines (Cho, 2016). Based on the background above, this study aims to determine the effectiveness of using organic farming techniques, compost tea and JADAM Microorganism Solution on the growth of chili pepper plants in PT. Cinquer Agro Nusantara (CAN), Bangka Belitung.

METHOD

This research was conducted in September - November 2022 at the PT. Cinquer Agro Nusantara (CAN), Namang District, Central Bangka Regency, Bangka Belitung Province. This research method used a completely randomized design (CRD) with fifteen chili pepper (*Capsicum frustescens*) as an experimental units. Type treatment consisted of control, treatment with the administration of compost tea, and treatment with the administration of JADAM Microorganism Solution (JMS); each treatment contained five plants as replicates.

Tools and materials

The tools used to make compost tea include filters, dippers, buckets, digital scales, measuring cups, *gembor*, and aerator, while the materials used to make compost tea, i.e. 1 kg of solid compost, 500 mL boiled water of seaweed *Sargassum* sp., 1 L of pepper soaking water (PT. CAN pepper soaking water with a 10 days of soaking time), 50 g of brown sugar, and 20 L of water. In other hand, tools for making JADAM Microorganism

Solution (JMS) includes buckets, filters, dippers, measuring cups, digital scales, and *gembor*, while the materials used to make JMS are 40 g of potatoes, 20 g of coarse salts, 20 g the soil of bamboo from PT. CAN, and 20 L of water.

The Compost Tea Preparation

50 g of seaweed *Sargassum* sp., and 50 g of brown sugar was boiled and then cooled. All the ingredients are put into a bucket, mixed with 1 L of pepper-soaking water and 1 kg of solid compost, and then give the aeration for two days. Compost tea is applied by diluting it with water (ratio 1: 9), then sprinkled on chili pepper plants as much as 1 L for each plant once a week.

The JADAM Microorganism Solution (JMS) Preparation

40 g of potatoes cut into small pieces and boiled until softened, then mixed with PT. 20 g the soil of bamboo from PT. CAN, and 20 g of coarse salt. All ingredients are put into the cloth and mixed with 20 L of water in a bucket. The bucket was closed and left for two days. After two days, the activity of microorganisms formed an air bubbles and foam, then JMS is ready to be applied. JMS was applied by diluting the JMS solution and water (ratio 1: 9), and sprinkling 1 L of chili pepper for each plant once a week.

RESULTS AND DISCUSSION

Results

The results of data analysis are presented in Table 1. Increasing the height of chili pepper that given by compost tea and JADAM Microorganism Solution (JMS) were higher than control plants. The group of chili pepper which given by JMS showed an increase in plant height with an average of 48.4 cm (SE= 9.28), while the other two groups, which giving a compost tea, showed increase in height with an average of 35.4 cm (SE= 1.81), and the control group showed an increase in height with an average of 31.4 cm (SE= 4.74).

Tabel 1. Increasing of Plant Height and The Number of Leaves

Chili Pepper	**Treatment (*Mean ± Standard Error*)**		
	K	**CT**	**JMS**
Plant height	31.4 ± 4.74 cm	35.4 ± 1.81 cm	48.4 ± 9.28 cm
The number of leaves	25 ± 4.70[a]	33.4 ± 4.95[a]	58 ± 10.02[b]

*The superscript letter [a] and [b] indicated a significant difference (P<0.05). Aplhabet Description: (K) Control; (CT) *Compost Tea;* (JMS) *JADAM Microbial Solution*.

In line with the increase in plant height, the number of leaves of chili pepper plants increased with compost tea and JMS also showed improvement compared to control plants. The results of the statistical analysis and the LSD test in the chili pepper group given by JMS showed an average the number of leaves by 58 leaves (SE= 10.02). This value shows a significantly different increase compared to the group compost tea with an average of 33.4 leaves (SE= 4.95) and the control group with an average of 25 leaves (SE= 4.70). Based on these two parameter data, the chili pepper group with the JMS treatment

showed the best increase in plant height and the number of leaves compared to the other two groups.

Discussion

Organic farming techniques using compost tea and JADAM Microorganism Solution (JMS) has been proven to increase the growth of chili pepper plants in PT. Cinquer Agro Nusantara, that can be seen from the data on the increasing of plant height and the increasing of number of leaves. This research is an early stage in testing the effectiveness of compost tea and JMS on the growth of chili pepper plants. In this study, identification of the types of microbes and measurements of the macro and micronutrients contained in the compost tea and JMS had not been carried out, but based on literature studies, compost tea and JMS has various benefits to help increase plant growth in organic farming techniques.

Compost tea is a source of dissolved nutrients that can increase and improve plant nutrient deficiency conditions. Nutrients available in compost tea are faster and easily absorbed by plant roots and leaves. Compost tea can increase the population and diversity of soil microorganisms, thereby improving soil structure, water retention, root depth, and plant growth. Compost tea can also be a biocontrol agent for plant diseases by filling the leaf surface and secreting secondary metabolites on the plant surface to limit the growth of disease-causing pathogens (Hatam et al., 2015; Berek, 2017) .

This study's results align with other studies that have proven that giving compost tea can increase the productivity of plants from the *genus Capsicum*. The research of González-Hernández et al. (2021) suggest that giving-compost tea to peppers (*Capsicum annuum* L.) showed a positive response by inducing growth and protecting chilli plants from the disease *Rhizoctonia solani* and *Phytophthora capsici*.

Several studies related to the microbiological analysis of compost tea made from composting green waste show groups of aerobic bacteria, nitrogen-fixing bacteria, actinobacteria, fungi, and *Trichoderma* spp., are microorganisms that are commonly found in compost tea. Another type of bacteria in compost tea is *Pseudomonas* spp. and spore-forming bacteria such as *Bacillus*, known as Plant Growth Promoting Rhizobacteria (PGPR). Compost tea also contains macro and micronutrients beneficial to plants, such as potassium, calcium, magnesium, and manganese. On the other hand, the content of NO^{3-} and K_2O, which is relatively high in compost tea known to play a synergistic role with microorganisms in increasing growth and suppressing disease in plants (Zaccardelli et al., 2018; de Corato, 2020; González-Hernández et al., 2021).

The usage of compost tea on pepper plant leaves (*Capsicum annuum* L.) for two years has been proven to increase the number of fruits per plant and improve the physiological and nutritional status of pepper plants grown in greenhouse organic farming systems (Zaccardelli et al., 2018). Other research shows-compost tea, which was given a mixture of dry yeast, significantly increased the vegetative growth and physical quality of sweet pepper (length, diameter and fresh weight), total yield, leaf mineral content (N, P, and K) and fruit nutritional value content (calcium and vitamin C) (Abd-Alrahman & Aboud, 2021).

In an organic horticultural farming system, compost tea as a liquid organic formula derived from compost extract not only increases the productivity of the genus *Capsicum*, but it is also known to significantly increase the growth and development of tomato, melon, and potato plants as seen from various plant growth parameters, such as root length, stem diameter, number of leaves, and fresh biomass. Giving compost tea to potato plants also reduces susceptibility to disease infections *Rhizoctonia solani* (Villecco et al., 2020; González-Hernández et al., 2022). Tomato plant that given by compost tea once a week showed a suppressive effect against pathogenic fungal attacks *Rhizoctonia solani* and *Fusarium oxysporum*, as well as increasing the dry weight of tomato plants by threefold (Morales-Corts et al., 2018). Application aerated and non-aerated compost tea in rice plants showed a significant increase in plant height, number of productive tillers, chlorophyll content, plant biomass, and grain yield. Besides that, compost tea can significantly induce antioxidant enzymes such as peroxidase and superoxide dismutase, which play a role in managing diseases in rice (Vanishri & Anil, 2019). Compost tea's formula has also been seen to increase the yields of some vegetables, such as lettuce and kohlrabi, by 24% and 32%. In addition, the physiological and nutritional status of lettuce and kohlrabi plants also increase, as seen from the value of leaf chlorophyll content measured during the plant cycle (Pane et al., 2014).

The usage of compost tea very potential to be developed in sustainable agricultural techniques. Compost tea positively impacts food crops, various types of vegetables, and fruit crops. Compost tea given to mini watermelon plants showed increased fruit hardness and quality index fruit value. It affected the quantitative profile of fruit sugar by affecting the ratio between fructose, glucose, and sucrose in mini watermelons (Liguori et al., 2015). Compost tea combined with the filtrate cyanobacteria and sprayed on the leaves of cantaloupe (*Cucumis melo* L.) as many as three times on the 20th day, the 35th day, and the 50th day after planting can maximize the vegetative growth and yield of cantaloupe (Farrag et al., 2017). Giving 10% compost tea by spraying pomegranate trees is proven to increase tree productivity, fruit weight, and percentage of pulp pomegranates, as well as reduce the percentage of cracks in pomegranates (Kassem, 2021).

On the other hand, using JMS (JADAM *Microorganism Solution*) also showed a positive effect on the growth of chili pepper plants. JMS is a low-cost organic farming method introduced by Cho (2016). Cho explained that JMS is a liquid biological fertilizer made by an anaerobic fermentation process, with more nutrient content than compost. JMS contains microbes originating from the soil as a starter, potatoes as a source of microbial food, and coarse salt as a source of minerals for microbial life. Soil microorganisms such as fungi and bacteria play an essential role in decomposing nutrients. Microbial activity is significant in restoring soil fertility so that soil becomes an optimal growing medium for plants. JMS is expected to benefit farmers and can return land contaminated with chemical farming to organic farming land. JMS applied to annual crops (annual) can reduce soil salinity, initiate root formation, and protect plants from disease attacks caused by nematodes and plant wilt (Cho, 2016).

Research using JMS has yet to be widely published, so the benefits of applying JMS to many plants still need to be studied further. Other studies use microorganism solutions carried out by Yusron et al., (2022), application Local Microorganism solution

(LoM) has been shown to increase soil respiration and microbial activity significantly. In addition, giving LoM can increase growth and increase corn yields by 37.92%.

CONCLUSION

Organic farming techniques using compost tea and JMS have been proven to increase the height and number of leaves of chili pepper plants in PT. Cinquer Agro Nusantara. The treatment with JMS showed the best increase in plant height and the number of leaves compared to the treatment compost tea and control group.

ACKNOWLEDGEMENT

The authors thank to PT. Cinquer Agro Nusantara as a partner in industrial internship activities carried out by students of the Biology Department, Faculty of Science, Institut Teknologi Sumatera through the Program Kompetisi Kampus Merdeka (PKKM) - 2022 from Kemendikbudristek.

REFERENCES

Abd-Alrahman, H. A., & Aboud, F. S. (2021). Response of sweet pepper plants to foliar application of compost tea and dry yeast under soilless conditions. *Bulletin of the National Research Centre*, *45*(1). https://doi.org/10.1186/s42269-021-00578-y

Berek, A. K. (2017). Teh Kompos dan Pemanfaatannya sebagai Sumber Hara dan Agen Ketahanan Tanaman. Dalam *Jurnal Pertanian Konservasi Lahan Kering International Standard of Serial Number* (Vol. 2, Nomor 4). www.recycledorganics.com

Cho, Y.-S. (2016). *The way to ultra low cost agriculture: declaration of ultra low cost agriculture setting agricultural technology free from commercialism*.

de Corato, U. (2020). Agricultural waste recycling in horticultural intensive farming systems by on-farm composting and compost-based tea application improves soil quality and plant health: A review under the perspective of a circular economy. Dalam *Science of the Total Environment* (Vol. 738). Elsevier B.V. https://doi.org/10.1016/j.scitotenv.2020.139840

Farrag, D., Mehesen, A., Kasem, M., & El-Dein, O. (2017). Impact of Cyanobacteria Filtrate, Compost Tea and Different Rates of Nitrogen Fertilizer on Growth, Fruit Yield and Quality of Cantaloupe Plants. *Microbiology Research Journal International*, *18*(1), 1–10. https://doi.org/10.9734/MRJI/2017/29944

Fikrizal, A. (2018). EVALUASI KESESUAIAN LAHAN TANAMAN CABAI PIPER RETROFRACTERUM di KECAMATAN KAMANG MAGEK KABUPATEN AGAM. *Jurnal Buana*, *2*(2), 546–556.

González-Hernández, A. I., Pérez-Sánchez, R., Plaza, J., & Morales-Corts, M. R. (2022). Compost tea as a sustainable alternative to promote plant growth and resistance against

Rhizoctonia solani in potato plants. *Scientia Horticulturae*, *300*, 111090. https://doi.org/10.1016/J.SCIENTA.2022.111090

González-Hernández, A. I., Suárez-Fernández, M. B., Pérez-Sánchez, R., Gómez-Sánchez, M. Á., & Morales-Corts, M. R. (2021a). Compost tea induces growth and resistance against rhizoctonia solani and phytophthora capsici in pepper. *Agronomy*, *11*(4). https://doi.org/10.3390/AGRONOMY11040781

González-Hernández, A. I., Suárez-Fernández, M. B., Pérez-Sánchez, R., Gómez-Sánchez, M. Á., & Morales-Corts, M. R. (2021b). Compost tea induces growth and resistance against rhizoctonia solani and phytophthora capsici in pepper. *Agronomy*, *11*(4). https://doi.org/10.3390/AGRONOMY11040781

Hatam, S., Bahman, F.-N., Hasan, A., Gholam, A., & Sadegh, S. (2015). An Overview of the Benefits of Compost tea on Plant and Soil Structure. *Adv. Biores*, *6*(1), 154–158. https://doi.org/10.15515/abr.0976-4585.6.1.154158

Kassem, M. S. M. (2021). Effect of Compost Tea or some Botanical Extracts on the Fruit Quality of Pomegranate Trees at Upper Egypt. *Alexandria Science Exchange Journal*, *42*(2), 435–444. https://doi.org/10.21608/asejaiqjsae.2021.174337

Liguori, L., Pane, C., Albanese, D., Celano, G., Zaccardelli, M., & Matteo, M. di. (2015). Compost and Compost Tea Management of Mini Watermelon Cultivations Affects the Chemical, Physical and Sensory Assessment of the Fruits. *Agricultural Sciences*, *06*(01), 117–125. https://doi.org/10.4236/as.2015.61009

Morales-Corts, M. R., Pérez-Sánchez, R., & Gómez-Sánchez, M. Á. (2018). Efficiency of garden waste compost teas on tomato growth and its suppressiveness against soilborne pathogens. *Scientia Agricola*, *75*(5), 400–409. https://doi.org/10.1590/1678-992x-2016-0439

Morales-Soto, A., Gómez-Caravaca, A. M., García-Salas, P., Segura-Carretero, A., & Fernández-Gutiérrez, A. (2013). High-performance liquid chromatography coupled to diode array and electrospray time-of-flight mass spectrometry detectors for a comprehensive characterization of phenolic and other polar compounds in three pepper (Capsicum annuum L.) samples. *Food Research International*, *51*(2), 977–984. https://doi.org/10.1016/J.FOODRES.2013.02.022

Pane, C., Palese, A. M., Celano, G., & Zaccardelli, M. (2014). Effects of compost tea treatments on productivity of lettuce and kohlrabi systems under organic cropping management. *Italian Journal of Agronomy*, *9*(3), 153–156. https://doi.org/10.4081/ija.2014.596

Rivera, M. L. C., Hassimotto, N. M. A., Bueris, V., Sircili, M. P., de Almeida, F. A., & Pinto, U. M. (2019). Effect of Capsicum Frutescens Extract, Capsaicin, and Luteolin on Quorum Sensing Regulated Phenotypes. *Journal of Food Science*, *84*(6), 1477–1486. https://doi.org/10.1111/1750-3841.14648

Sofiarani, F. N., & Ambarwati, E. (2020). Pertumbuhan dan Hasil Cabai Rawit (Capsicum frutescens L.) pada Berbagai Komposisi Media Tanam dalam Skala Pot. *Vegetalika*, *9*(1), 292. https://doi.org/10.22146/veg.44996

Vanishri, B. R., & Anil, V. S. (2019). Compost Tea Improves Biomass, Yield and Induces a Defense Response in Rice (Oryza sativa L.) under Aerobic Cultivation. *Indian Journal of Pure & Applied Biosciences*, *7*(6), 425–438. https://doi.org/10.18782/2582-2845.7777

Villecco, D., Pane, C., Ronga, D., & Zaccardelli, M. (2020). Enhancing sustainability of tomato, pepper and melon nursery production systems by using compost tea spray applications. *Agronomy*, *10*(9). https://doi.org/10.3390/agronomy10091336

Yusron, M., Mutmainah, H., & Susilawati, P. N. (2022). Application of local microorganism solution and lime to improve soil fertility and maize yield. *IOP Conference Series: Earth and Environmental Science*, *1107*(1), 012003. https://doi.org/10.1088/1755-1315/1107/1/012003

Zaccardelli, M., Pane, C., Villecco, D., Maria Palese, A., & Celano, G. (2018). Compost tea spraying increases yield performance of pepper (Capsicum annuum L.) grown in greenhouse under organic farming system. *Italian Journal of Agronomy*, *13*(3), 229–234. https://doi.org/10.4081/ija.2018.991

How To Cite This Article, with *APA style* :

Khairani, I.A., Novriadi., Septi P.W., M. Zulhiyadi N., & Andi. A. (2023). Effect Of Compost Tea and JADAM Microorganism Solution On Growth of Chili Pepper In PT Cinquer Agro Nusantara. *Jurnal Pembelajaran dan Biologi Nukleus*, 9(1), 23-30. https://doi.org/10.36987/jpbn.v9i2.3807