Volume 2, No. 4 April 2024
p-ISSN 3032-3037| e-ISSN 3031-5786

ADVANCES IN SOCIAL HUMANITIES RESEARCH

The Effect Of Moles (Local Microorganisms) Of Banana Peel And Fruit Peel On The Growth Of Stems, Leaves, and Roots Of Tomato Plants

Khusnul Choirunisa, Putri Silviana Aringsih, Daniar Eka Nur Fauziah, Herwening Widya Siwi, Siti Nur Khafidhoh, Endang Setyaningsih
University of Muhammadiyah Surakarta, Central Java, Indonesia
Email: Khusnulchirunissa@gmail.com

Abstract
Local microorganisms (MOL) are one of the means in helping the process of plant growth made from organic materials. In this study, MOL was made from banana peels and other fruit skins, and java sugar was added when fermented for two weeks. Its use is carried out with four treatments: control, 1: 2, 2: 1, and 3 days. This study used quantitative data by observing the growth of tomato plants (Solanum lycopersicum) for 21 days, which experienced significant changes in their growth. Banana peel contains macro elements C, N, P, and K. Meanwhile, Javanese sugar in MOL can be used by microorganisms to obtain glucose for food. Local microorganisms have environmentally friendly properties and can help the plant growth process by working in the soil through plant roots. Despite these findings, the study exhibits limitations in experimental control and measurement of other variables influencing tomato plant growth beyond MOL utilization. Additionally, the significance of observed growth changes lacks clarity, warranting further investigation.

Keywords: banana peel, growth fruit peel, leaf, MOL, root, stem

Introduction

The number of people in the world, including in Indonesia, is increasing yearly; with the increase in the number of people, there are many positive and negative impacts. One of them is the increasing consumption of foodstuffs, thus increasing the amount of waste or food waste produced, both organic and inorganic waste (Aisyah et al., 2024). In Indonesia, waste is a big problem that is difficult to solve. Many efforts have been made by the government or the community, but the existence of waste is still a problem (Karjoko et al., 2022). Landfill reached 26,443,235.59 tons in 2021 and unmanaged waste of 40.66 tons/year, with the largest composition of waste being organic waste, amounting to 40.2% of total waste (Rohmadi et al., 2022).

Composting is one of the efforts that can be made against the large amount of organic waste. According to research by (Manullang et al., 2018), the composting process can be accelerated by adding activators in the form of microorganisms that can accelerate the decomposition process of organic waste. This activator can be derived from local microorganisms (MOL). MOL is a fermented liquid that can be easily obtained from local resources. Microorganisms (putrefactive bacteria) can interact to help the weathering process of organic materials such as leaves, grass, straw, very ripe fruits, remnants of twigs and

branches, animal feces, and others. The survival of these microorganisms is supported by wet and humid environmental conditions (Kurniawan, 2018).

According to the results of research by (Wardani et al., 2022) stated that after local microorganisms undergo a fermentation process, they can function as decomposers and liquid fertilizers that can increase soil fertility because they contain nutrients that are high enough and useful for plant growth. According to the results of research (Manullang & Sadikin, 2020), bio activators from banana weevils and fruit waste contain *bacteria Enterobacter* sp. and *Bacillus* sp. Strengthened by the results of research (Magnani et al., 2010), the genus Enterobacter has the ability to produce AIA hormones that can spur plant growth. In addition, according to the results of research (Lopez et al., 2022), Bacillus sp. bacteria can stimulate plant growth through the production of AIA hormones, and it can be a plant disease controller.

Based on the description of the problem above regarding the accumulation of waste and based on previous research, this study was carried out, which aims to overcome the problem of organic waste from households that accumulate by processing the waste into liquid organic fertilizer that utilizes local microorganisms or MOL. Therefore, in this study, the application of banana peel waste, fruit peel waste, and brown java sugar as local microorganisms (MOL) was carried out by fermentation for 14 days so that local microorganisms (MOL) were obtained that could be directly applied to plants. The benefits of applying liquid organic fertilizer here are to support increased nitrogen uptake and the growth and development of tomato plants. So, the use of local microorganisms (MOL) in the manufacture of liquid organic fertilizer is expected to produce good tomato plants.

Research Methods

The research methods used in this study include experimental methods, descriptive observational, and literature studies. The study aims to test the effectiveness of the utilization of moles or microorganisms from an organic waste of banana peels and fruits for the growth and development of tomato plants (*Lycopersium Esculentum Mill*.). The stages of research include the search for appropriate literature, field studies with the manufacture of materials, and data collection regarding the research that has been carried out.

The object of study is the growth and development of tomato plants (*Lycopersium et al.*) treated with liquid organic fertilizer from banana peel and fruit waste. The research was carried out at the Biology Laboratory of the University of Muhammadiyah Surakarta from June to October 2023. The research hypothesis includes three statements that examine the effect of fermented fertilizer on the growth of tomato plants. The study population was all treated tomato plants, while the sample was 41 randomly selected tomato plants.

Data collection is done through two methods, namely primary data through field studies and secondary data through library studies. The tools used include shovels, stoves, pots, etc., whereas the ingredients used are polybags, tomato seeds, and banana and fruit peel waste. The stages of research implementation consist of preparing, creating, applying, collecting data, and analyzing. Data collection is carried out through literature tests and experiments by observing plant growth and quality.

Data analysis was carried out using univariate analysis to analyze each variable of the research results, using scientific values and standard deviations. The results of the experiment will be compared with the references obtained. Thus, this research method includes various

steps to test the effectiveness of the utilization of moles or microorganisms from the organic waste of banana peels and fruits for the growth and development of tomato plants.

Results and Discussion

The results of the study showed that giving MOL banana peel and fruit skin had a different influence on each treatment. In plant height growth, number of leaves, and root length since the beginning of administration, there are four treatments, namely control, 1: 2, 2: 1, and 3 days using tomato plants carried out for 21 days or three weeks. The main ingredients in MOL solution consist of 3 types of components, including: 1. Carbohydrates: rice washing water, used rice, cassava, potatoes, and wheat. 2. Glucose: brown sugar liquid, granulated sugar liquid, coconut water/sap. 3. Source of bacteria: gold snails, fruits such as tomatoes, papaya, and animal feces (Pawar, Saha, Nandan, & Parambil, 2021).

Plant Height

Based on the results of observations and data on the use of MOL, graphs were obtained for the banana peel and fruit peel, and average plant height data was obtained for four treatments.

Table 1. Average Height of Tomato Plants

*Tomato Plant Height (cm)				
MOL concentration	Watering frequency			Average
	Week 1	Week 2	Week 3	
Control	15,71	16,85	19,77	17.44 cm
1:2	13,41	15,28	19,94	16.21 cm
2:1	15,51	18,3	20,84	18.21 cm
3 Hari	15,42	17,75	19,17	17,44 cm

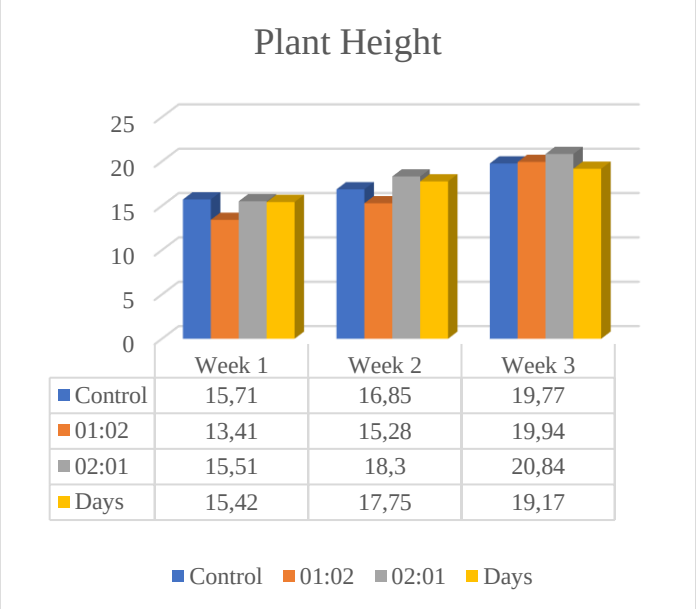

Figure 1.
Graph of Tomato Plant Height

From figures 1.1 and 1.2, significant results were obtained for three weeks, with the final average in the control treatment obtained 17.44 cm, 1:2 treatment obtained 16.21 cm, 2:1

treatment obtained 18.21 cm and three days treatment obtained 17.44 cm, the same as the control. The highest average final result is obtained from the 2 1 treatment, and this can also be caused by the concentration of MOL Banana Peel and Fruit Skin in the treatment at 1:2 treatment only using 100 ml MOL Banana Peel and Fruit Skin so that the concentration in the treatment is higher than 1:2 also the intensity of MOL watering more often treatment 2:1, 1:2 compared to the 3-day treatment.

So it can be said that the effect of giving MOL Banana Peel and Fruit Skin is caused by several factors, namely the concentration of MOL solution, watering time, the media used, and also the dose in dredging is very important because it will have a bad effect on growth if it is not in accordance with plant needs. Therefore, giving MOL 24% is a good dose to meet plant nutrient needs (Dhani et al., 2014). Moreover, banana peels contain 15% potassium and 12% phosphorus more than fruit flesh.

The presence of potassium and phosphorus is high enough to be used as a substitute for fertilizer. Banana peels also contain macro elements C, N, P, and K, each of which functions to grow and develop fruit stems. Banana peel waste also contains microelements Ca, Mg, Na, and Zn, which can function to help plant growth grow optimally so that it impacts the maximum amount of production. Banana peel not only contains macro and microelements, but there are organic compounds such as water, carbohydrates, fats, proteins, calcium, phosphorus, iron, Vitamin B, and Vitamin C (Syukriani et al., 2021).

Number of leaves

Table 2. Average number of leaves of tomato plants

***Number of leaves of tomato plants**				
MOL concentration	Watering frequency			Average
	Week 1	Week 2	Week 3	
Control	14,14	25,42	32,71	24,09
1:2	14,42	23,14	30,57	22,71
2:1	15,71	22,71	29	22,47
3 Days	16,87	20,71	23,28	20,28

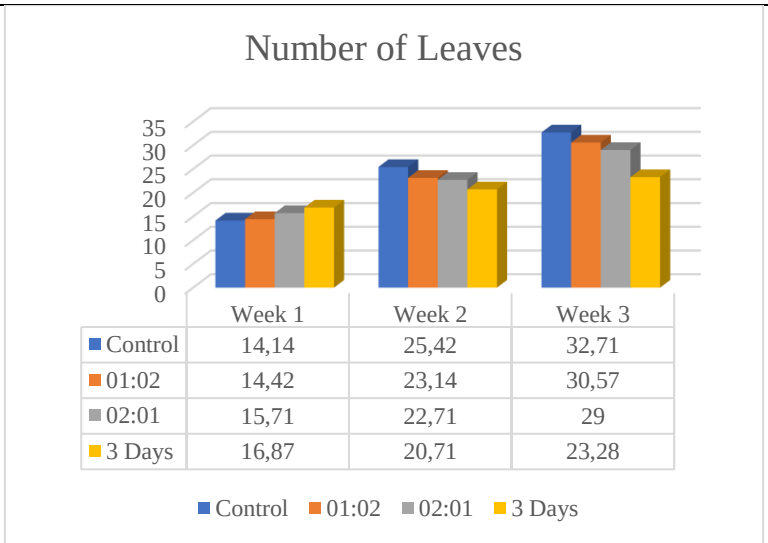

Figure 2.
Graph of the number of leaves of tomato plants

Figures 1.3 and 1.4 show that leaf count increase for all control treatments, 1:2, 2:1, and three days is linear. Observation of the number of leaves is carried out to determine the real difference in the number of leaves in each treatment. The leaves function as producers of photosynthate, which is used for plant growth in the vegetative period and sump formation in the generative period. The results of the observations obtained the average number in the control treatment with a total of 24.09 leaves, 1: 2 treatment with an average number of 22.71 leaves, 2: 1 treatment with an average result of 22.47 leaves, and in the 3-day treatment with an average of 20.28 leaves.

From the results of this observation, the highest average result was obtained in the control treatment because the intensity of watering is often done so that a high number of leaves is obtained. While the treatment every three days has a low average, this can occur because watering uses a dose of 100 ml MOL Banana Peel and Fruit Skin so that the concentration is higher than the control treatment and is only done for three days. This is in accordance with the nature of liquid organic fertilizer, which is suspected that the nutrients contained in the organic fertilizer given have not been able to be absorbed optimally by plants because they have not decomposed properly in the soil so that growth will be slow and the cause of the plants in this study is the soiled textile where the study has a hard texture.

The soil used does not get organic matter, so nutrients in the soil are not fulfilled. Environmental factors such as air, temperature, light, and humidity do not support it. According to (Laepo, Antara, & Muis, 2022), organic matter gives a slow response to plants because the soil in the study has low C-organic.

Length of roots

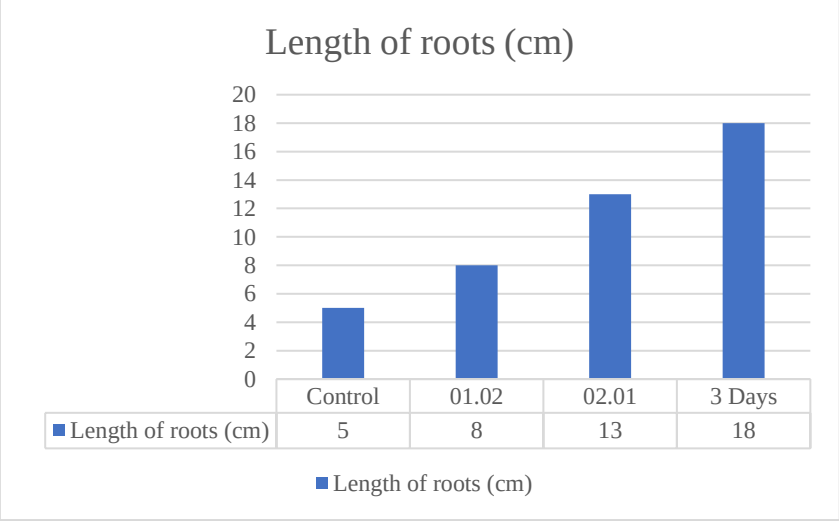

Figure 3.
Root Length Graphics

From the picture, significant results rose using four treatments for three weeks. In the control, the root length is 5 cm; in the 1 2 treatment, the root length is 8 cm; in the 2 1 treatment, the root length is 13 cm; and the longest in the 3-day treatment is 18 cm. This root extension is caused by many factors, namely elements that exist in the content of banana peels and fruit skins to help the growth of root stems and leaves. One of the essential nutrients, nitrogen, contained in banana peel, is the main nutrient for plant growth; N is needed for the formation or growth of vegetative parts of plants such as leaves, stems, and roots (Machrodania &

Ratnasari, 2015). The growth of stems, roots, and leaves also has many factors that influence it, both internal factors that come from within the plant body, such as hormones and genetics. External factors can affect the environment and affect growth, including light, nutrients, water, humidity, and temperature (Ahmed et al., 2020).

Conclusion

In conclusion, the study demonstrates the potential of banana peel and fruit peel waste as a source of local microorganisms (MOL) for the growth and development of tomato plants. The results show that the application of MOL banana peel and fruit skin had a different influence on each treatment, with the 2:1 treatment exhibiting the highest average final result in terms of plant height and the number of leaves. The root length also increased significantly in the 2:1 treatment. The study highlights the importance of the concentration of MOL solution, watering time, and the media used in the growth of tomato plants. The findings suggest that banana peels contain abundant nutrients such as C, N, P, and K, which help in the process of growth and development of stems, leaves, and roots. The study also emphasizes the role of microorganisms in the soil through plant roots, which can help the plant growth process by working in the soil. Despite the limitations of the study, the results indicate the potential of using banana peel and fruit peel waste as a source of MOL for the growth and development of tomato plants, which can contribute to the reduction of organic waste and the promotion of sustainable agriculture practices. Based on observations made with four treatments, namely control, 1:2, 2:1, and three days. Banana peel contains abundant nutrients such as C, N, P, and K, which help in the process of growth and development of stems, leaves, and roots that are added to Java sugar in the fermentation process so that plants also get glucose as food microorganisms in the soil. The best treatment is 2:1, which is very effective for being caught by plants.

References

Ahmed, Hesham A., Yu-Xin, Tong, & Qi-Chang, Yang. (2020). Optimal control of environmental conditions affecting lettuce plant growth in a controlled environment with artificial lighting: A review. *South African Journal of Botany*, *130*, 75–89.

Aisyah, Siti, Suarmanayasa, I. Nengah, Efendi, Efendi, Widiastuti, Bayu Retno, & Harsono, Iwan. (2024). The Impact Of Fiscal Policy On Economic Growth: A Case Study Of Indonesia. *Management Studies and Entrepreneurship Journal (MSEJ)*, *5*(2), 3773–3782.

Dhani, Herry, Wardati, Wardati, & Rosmimi, Rosmimi. (2014). *Pengaruh pupuk vermikompos pada tanah inceptisol terhadap pertumbuhan dan hasil sawi hijau (Brassica juncea L)*. Riau University.

Karjoko, Lego, Handayani, IGAKR, Jaelani, Abdul Kadir, & Hayat, Muhammad Jihadul. (2022). Indonesia's Sustainable Development Goals Resolving Waste Problem: Informal to Formal Policy. *International Journal of Sustainable Development & Planning*, *17*(2).

Kurniawan, Andri. (2018). Produksi mol (mikroorganisme lokal) dengan pemanfaatan bahan-bahan organik yang ada di sekitar. *Jurnal Hexagro*, *2*(2).

Laepo, Nursyanti Dj, Antara, Made, & Muis, Abdul. (2022). Pengaruh Sosial Ekonomi Penyuluh Terhadap Kinerja Penyuluh Pertanian Di Kabupaten Donggala. *Agroland: Jurnal Ilmu-Ilmu Pertanian*, *29*(3), 290–301.

Lopez, Ana Maria Queijeiro, Silva, Amanda Lys Dos Santos, Maranhão, Fernanda Cristina De

Albuquerque, & Ferreira, Luiz Fernando Romanholo. (2022). Plant growth promoting bacteria: aspects in metal bioremediation and phytopathogen management. In *Microbial Biocontrol: Sustainable Agriculture and Phytopathogen Management: Volume 1* (pp. 51–78). Springer.

Machrodania, Yuliani, & Ratnasari, Evie. (2015). Pemanfaatan pupuk organik cair berbahan baku kulit pisang, kulit telur dan Gracillaria gigas terhadap pertumbuhan tanaman kedelai var Anjasmoro. *Jurnal Lentera Bio. ISSN*, *4*(3), 168–173.

Magnani, G. S., Didonet, C. M., Cruz, L. M., Picheth, C. F., Pedrosa, F. O., & Souza, E. M. (2010). Diversity of endophytic bacteria in Brazilian sugarcane. *Genet Mol Res*, *9*(1), 250–258.

Manullang, Riama Rita, Rusmini, Rusmini, & Daryono, Daryono. (2018). Kombinasi mikroorganisme lokal sebagai bioaktivator kompos combination of local microorganism as compose bioactivators. *Jurnal Hutan Tropis*, *5*(3), 259–266.

Manullang, Riama Rita, & Sadikin, Ali. (2020). Peningkatan Kualitas Bioaktivator Keong Mas Dengan Penambahan Berbagai Bahan Terhadap Jenis Mikroorganisme. *Prosiding Seminar Nasional Terapan Riset Inovatif (SENTRINOV)*, *6*(1), 1209–1215.

Pawar, Nitin, Saha, Anindita, Nandan, Neelesh, & Parambil, Jose V. (2021). Solution cocrystallization: A scalable approach for cocrystal production. *Crystals*, *11*(3), 303.

Rohmadi, Mukhlis, Septiana, Nurul, & Astuti, Pertiwi Adi Puji. (2022). Pembuatan pupuk organik cair dan kompos dari limbah organik rumah tangga. *Jurnal Ilmu Lingkungan*, *20*(4), 880–886.

Syukriani, L., Febjislami, S., Lubis, D. S., Hidayati, R., Asben, A., Suliansyah, I., & Jamsari, J. (2021). Physicochemical characterization of peel, flesh and banana fruit cv. raja [Musa paradisiaca]. *IOP Conference Series: Earth and Environmental Science*, *741*(1), 12006. IOP Publishing.

Wardani, Oktaviani Kusuma, Broto, R. T. D. Wisnu, & Arifan, Fahmi. (2022). Pembuatan mikroorganisme lokal berbasis limbah organik sebagai aktivator kompos di desa Sikunang, kecamatan Kejajar, Kabupaten Wonosobo. *Inisiatif: Jurnal Pengabdian Kepada Masyarakat*, *1*(1), 63–66.