# The Effect of Casgot Property on The Biological Properties of Soil In Which Cucumbers Are Planted

Dwi Ryan Agfandri[1*], Hilwa Walida[2], Novilda Elizabeth Mustamu[3], Badrul Ainy Dalimunthe[4]

[1, 2, 3, 4] Agrotechnology Study Program, Faculty of Science and Technology, Labuhanbatu University, Rantau Prapat, North Sumatra, Indonesia
*Corresponding Author:
Email: Dwiryan718@gmail.com

***Abstract***.

*Soil biological properties are various aspects related to the life of microorganisms and macroorganisms in the soil and biological activities. This study aims to understand how soil organisms and their biological activities contribute to soil fertility and plant health. This study used a purposive sampling method and was analyzed using descriptive analysis. Soil biological properties, including the total number of bacteria and fungi, were observed to assess the effect of Black Soldier Fly larvae (kasgot) fertilizer application. The results showed that treatment variations had a significant effect on the population of fungi and bacteria in the rhizosphere. The highest value of the fungal population was recorded in the M1 treatment without the first treatment, while the lowest value was in the M1 treatment with the first treatment, indicating that the type and frequency of treatment can drastically affect fungal growth. For the bacterial population, the M3 treatment in the first application showed the highest effectiveness, while the M2 treatment in the second application showed the lowest results, highlighting the importance of the dose and application stage in increasing the bacterial population. Overall, this study emphasizes the importance of selecting the right treatment to optimize the soil microbial population in agricultural practices.*

***Keywords:*** *Biological Properties, Kasgot Fertilizer, Purposive Sampling and Cucumber Plants.*

## I. INTRODUCTION

Soil biological properties refer to the presence and activity of living organisms in the soil, including microorganisms such as bacteria, fungi, actinomycetes, and macro-organisms such as earthworms, insects, and plant roots. These organisms play an important role in the decomposition of organic matter, nutrient cycling, and the formation of soil structure. Soil microorganisms, for example, play a role in the mineralization process, where organic matter is converted into nutrients that can be absorbed by plants [1]. Earthworms, on the other hand, help in soil aeration and increase the porosity and water holding capacity of the soil through their burrowing activities. This biological activity as a whole helps maintain soil fertility and supports plant growth [2]. In addition, soil biological properties also include interactions between soil organisms and plants. For example, the symbiotic relationship between mycorrhizal fungi and plant roots can increase the uptake of nutrients, especially phosphorus, by plants. Soil microorganisms can also produce bioactive substances that act as biological controls against plant pathogens, thereby reducing the need for chemical pesticides. Biodiversity in soil reflects the health of the soil ecosystem, which ultimately affects agricultural productivity and environmental sustainability [3].Providing cashgot, or droppings from insect larvae such as *Black Soldier Fly (Hermetia illucens),* in the soil can have a positive impact on the biological properties of the soil. Kasgot is rich in nutrients and organic material which can increase the activity of soil microorganisms. The organic material in cassava functions as a food source for bacteria and fungi, which in turn accelerates the decomposition of organic material and increases the availability of nutrients for plants [4]. Apart from that, cassava can also increase the biodiversity of soil microbes, which play an important role in maintaining the balance of the soil ecosystem and supporting healthy plant growth.

The provision of cassava can also improve soil structure by increasing the activity of soil organisms such as worms [5]. This biological activity helps in the formation of better soil aggregates, increases soil porosity, and increases water holding capacity. Soil that is looser and rich in microorganisms can provide a better environment for roots to grow and absorb nutrients effectively. In addition, cassava can contain bioactive compounds that act as natural biopesticides, helping to protect cucumber plants from attacks by pathogens and soil pests, thereby reducing the need for chemical pesticides [6].Although giving cashgot has many benefits, there are several problems that need to be considered. One of them is the potential for nutritional imbalance if cassava is used in inappropriate amounts. Kasgot is rich in nitrogen, and excessive application can cause an increase in nitrogen levels which can disrupt the balance of soil and plant nutrients, as well as cause nitrogen leaching which has a negative impact on the environment [5]. In addition, cassava can carry certain microorganisms or pathogens that can be a threat to cucumber plants and the soil itself. Therefore, it is important to ensure that the cassava used has gone through a good processing process to reduce the risk of contamination. Regular monitoring of soil and plant health is also needed to detect negative impacts early and take the necessary steps to overcome them. Thus, although cassava can provide many benefits for the biological properties of soil and plant growth, its use must be done carefully and wisely [7]. Based on the explanation above, the author will conduct research on the effect of cassava on the biological properties of soil planted with cucumbers. This research aims to evaluate how cassava application can affect the activity of soil microorganisms.

## II. METHODS

### Place and time of research

This research was carried out in Batu Tunggal Village, NA IX-X District, North Labuhanbatu Regency. The research will be carried out for 3 months, starting from March to June 2024.

### Tools and materials

Research tools and materials include cashgot *(larva Black Soldier Fly)*, cucumber soil, hoe, rake, funnel, sterile spatula for soil sampling, sterile bottles for sample collection, microscope, petri dish, equipment for microbial counting, chemicals for microbial culture.

### Research methods

Sampling using the Proposive Sampling Method: Soil sampling was carried out using the proposive sampling method, where sample points were selected based on consideration of the presence of soil that represents the cucumber cultivation area [8]. Each sample point will be taken randomly in the treatment (with cashgot) and control (without cashgot) areas to ensure a good representation of variations in soil conditions. The treatments used were M0 as a control, M1 was the first treatment, M2 was the second treatment and M3 was the third treatment, with observation without treatment, giving the first treatment and giving the second treatment.

### Data analysis

The data collected in the form of the total number of bacteria and total fungi in certain soil units will be analyzed descriptively by comparing the parameters before and after being treated with cashgot.

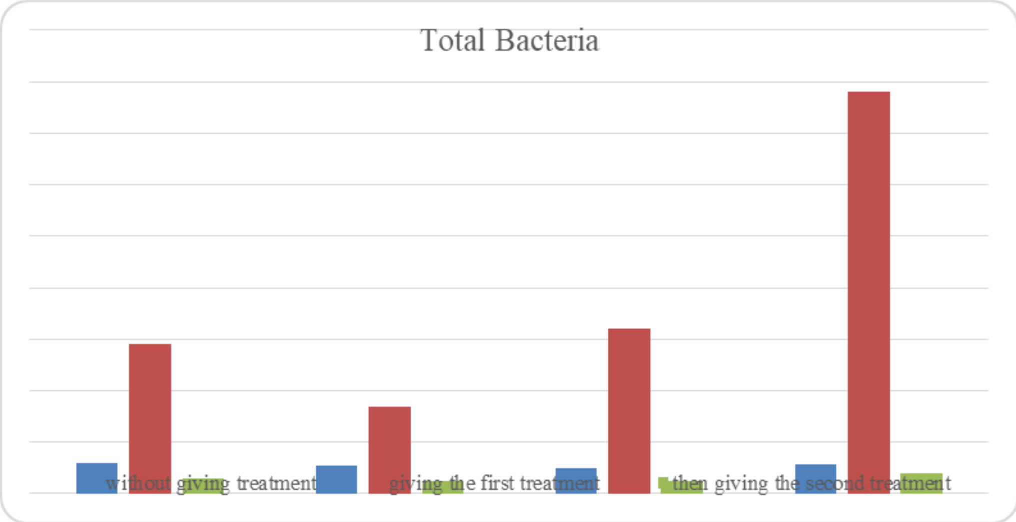
## III. RESULTS AND DISCUSSION

### Total bacteria

The results of laboratory analysis on the total bacterial parameters of the biological properties of soil planted with cucumbers treated with cassava fertilizer are presented in table 1

| treatment | Total Bacteria Observation Parameters (CFU/ml) | | |
|---|---|---|---|
| | without treatment | first gift | second gift |
| M0 | 5.99E+06 | 2,90E+07 | 2,90E+06 |
| M1 | 5,50E+06 | 1,70E+07 | 2.54E+06 |
| M2 | 5,04E+06 | 3,20E+07 | 2,53E+06 |
| M3 | 5,65E+06 | 7.80E+07 | 3.89E+06 |

Based on the laboratory results, the total mushrooms for each treatment are presented in the form of diagram 1.




Based on the results of observations of total fungi (CFU/ml) from the treatments given, significant variations were seen between the different treatments. The highest value was recorded in the M1 treatment without the first treatment, reaching 2.70E+06 CFU/ml. This treatment showed the highest level of fungal growth compared to all other treatments. On the other hand, the lowest value was recorded in treatment M1 with the first treatment, only reaching 6.00E+05 CFU/ml. This shows that giving the first treatment to treatment M1 resulted in a significant reduction in the number of fungi observed compared to the other treatments. These results illustrate that the effect of treatment on fungal growth can vary significantly depending on the type of treatment given. Treatment M1 without giving the first treatment showed the most positive response with a high level of fungal growth, while giving the first treatment in the same treatment resulted in a quite drastic reduction in the number of fungi. Other treatments such as M2 and M3 also showed variations in fungal growth response, but not as strong as that seen in treatment M1. In conclusion, these observations highlight the importance of appropriate treatment selection and application in managing fungal populations in the context of agricultural biology research. This research is in line with [9] the application of organic fertilizer affects the population of soil bacteria and its impact on plant health. This research usually involves comparing soil treated with organic fertilizer and control soil, as well as measuring changes in the number and type of soil bacteria.

Comparing soil microbial diversity under different tillage methods, such as the use of compost versus conventional tillage. The main focus is on how processing methods affect soil bacterial populations and their biological activity[10]. This study is different from research [11] showing that heavy metal pollution significantly affects soil microbial communities by changing microbial activity, soil enzyme activity, and microbial community composition. Exposure to heavy metals causes a decrease in soil microbial activity, disrupts important soil biological processes, and causes changes in microbial community structure, which negatively impacts soil quality and function. Microbes have extraordinary potential in degrading complex and dangerous xenobiotic compounds in the environment. Various microorganisms, including genera such as *Alcaligenes, Rhodococcus,* and *Aspergillus*, demonstrated a significant ability to utilize xenobiotic contaminants as a carbon or nitrogen source, as well as carry out effective biodegradation [12]. Fertilizing with liquid organic fertilizer also affects the total population of bacteria in the rhizosphere of mustard plants. The combination of ½ the recommended dose of NPK with 1 recommended dose of liquid organic fertilizer gives the best results for bacterial populations [13]

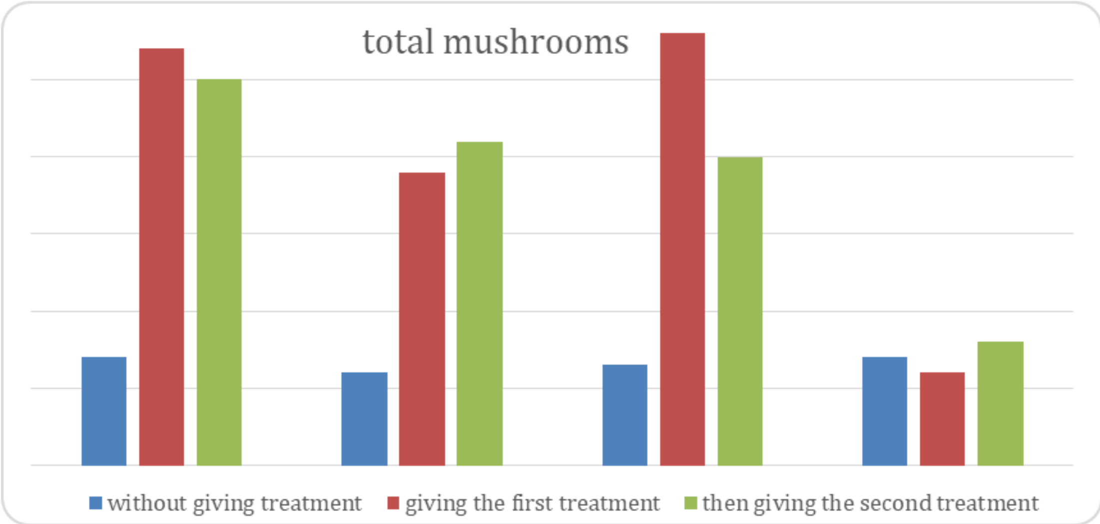
**Total Mushrooms**

The results of laboratory analysis on the total fungal parameters of the biological properties of soil planted with cucumbers treated with cassava fertilizer are presented in table 2.

| treatment | Observation parameters Total Fungi (CFU/ml) | | |
|---|---|---|---|
| | Without treatment | First treatment | Second treatment |
| M0 | 7,00E+05 | 2,70E+06 | 2,50E+06 |
| M1 | 6,00E+05 | 1,90E+06 | 2.10E+06 |

| | | | |
|---|---|---|---|
| M2 | 6,50E+05 | 2.80E+06 | 2,00E+06 |
| M3 | 7,00E+05 | 6,00E+05 | 8,00E+05 |

Based on the laboratory results, the total mushrooms for each treatment are presented in the form of diagram 2.




Based on observation data on total bacteria (CFU/ml) in different treatments, the highest value was recorded in treatment M3 with the number of bacteria reaching 7.80E+07 CFU/ml in the first administration. This shows that M3 treatment is very effective in increasing the bacterial population at this stage. In contrast, the lowest value was in treatment M2 with a bacterial count of 2.53E+06 CFU/ml in the second administration. This indicates that at the second administration stage, M2 treatment was less effective in maintaining or increasing the bacterial population compared to other treatments. Overall, the results of the observations showed significant variations in the total number of bacteria between different treatments and at different administration stages. Treatment M3 stood out as the most effective treatment in the first administration, while treatment M2 showed the lowest results in the second administration. This variability can be caused by various factors, including the type and dose of treatment given as well as different soil microbiological conditions at each observation stage. Further analysis is needed to understand how each treatment affects bacterial population dynamics in the context of this study. this study is in line with [14], Long-term fertilization with organic fertilizer significantly affected soil properties, soil fungal alpha diversity, and fungal community composition in the North China Plain. The use of organic fertilizers increased fungal diversity and reduced the abundance of pathogens such as Fusarium, while chemical fertilization had no significant impact on the diversity or composition of fungal communities. According to [15]showed that the return of rice straw increased the abundance and diversity of soil fungal communities, while earthworm inoculation inhibited the expansion of fungal communities caused by straw.

Although straw promoted the growth of fungi with cellulolytic abilities such as Pseudeurotium and Fusarium, inoculation of earthworms and untreated controls (CK) showed the dominance of fungi such as Stachybotrys and Schizothecium. Providing liquid organic fertilizer has a significant effect on the total fungal population in the rhizosphere of mustard greens. The best treatment for fungal populations is a combination of ½ the recommended dose of NPK with 1 recommended dose of liquid organic fertilizer [13]. This study differs from [16], showing that agricultural field soils irrigated with long-term industrial wastewater experience heavy metal accumulation, which influences the profile and diversity of soil fungi. Soil fungal populations, although remaining within normal ranges, showed a decrease in viable numbers with increasing concentrations of heavy metals such as Chromium, Cadmium and copper. Isolated metal-tolerant fungi showed large variations in levels of tolerance to metals, with Aspergillus as the dominant genus having varying minimum inhibitory concentration (MIC) values. [17] showed that simulating extreme drying followed by rewetting affected the composition and diversity of soil fungal communities, with uneven changes. Drying reduced fungal community richness, primarily affecting 25% of fungal OTUs, whereas changes in extreme rewetting only impacted 8% of prokaryotic OTUs. This study identified two specific legacy response groups (LRG) for fungi, where one group experienced a decrease in relative abundance in soils with a history of drought, and the other group increased in soils. providing organic fertilizer and plant spacing on soil fungal populations. Thus, soil fungal populations are not significantly influenced by variations in the dose of organic fertilizer or the planting distance applied [18].

## IV. CONCLUSION

The results showed that variations in treatment had a significant effect on the fungal and bacterial populations in the rhizosphere. The highest value of the fungal population was recorded in treatment M1 without the first treatment, while the lowest value was in treatment M1 with the first treatment, indicating that the type and frequency of treatment can drastically influence fungal growth. For bacterial populations, M3 treatment in the first application showed the highest effectiveness, while M2 treatment in the second application showed the lowest results, highlighting the importance of dose and application stage in increasing the bacterial population. Overall, this study emphasizes the importance of selecting appropriate treatments to optimize soil microbial populations in agricultural practices.

## REFERENCES


[1] F. Hazra And L. Mahir Rachman, "Variability Of Soil Biological Characteristics In Suboptimal Dry Lands**," *J. Land And Resources. Land***, Vol. 7, No. 1, Pp. 135–141, 2020, Doi: 10.21776/Ub.Jtsl.2020.007.1.17.

[2] S. Arispa, Zaitun., And R. Hayati, "Soil Improvement Residues On Biological Properties," ***J. Science. Mhs. Pertan.***, Vol. 7, No. 1, Pp. 47–56, 2022.

[3] Sakiah, A. Firmansyah, And D. Arfianti, "Soil Biological Properties On Application And Without Application Fields Of Empty Oil Palm Bunches At Adolina Pt. Perkebunan Nusantara Iv Soil Biological Characteristics On Land With And Without The Application Of Oil Palm Empty Fruit Bunch At Adolina Pt. Plantation**," *J. Researcher. Pertan. Apply***., Vol. 20, No. 1, Pp. 11–17, 2020.

[4] M. Fauzi, L. M. Hastiani, A. Q. R. Suhada, And N. Hernahadini, "The Effect Of Magotsuka Kasgot (Former Maggot) Fertlizer On Height, Number Of Leaves, Leaf Surface Area, And Wet Weight Of Green Mustard Plants (*Brassica Rapa Var.* Parachinensia)**," *J. Agric. Sci.*,** Vol. 20, No. 1, Pp. 20–30, 2022.

[5] I. S. Muhadat, "Kasgot As An Alternative To Solid Organic Fertilizer For Oil Palm Plants (Brassica Juncea L) Using The Verticulur Method," *Ind. High. Educ.*, Vol. 3, No. 1, Pp. 1689–1699, 2021.

[6] H. Agustin, W. Warid, And I. M. Musadik, "Nutritional Content Of Black Soldier Fly (Hermetia Illucensi) Casguot As Organic Fertilizer**," *J. Pertan Sciences. Indonesia***., Vol. 25, No. 1, Pp. 12–18, 2023.

[7] M.- Fauzi, L. H. M, Q. A. Suhada R, And N. Hernahadini, "The Effect Of Magotsuka Kasgot Fertilizer On The Height, Number Of Leaves, Leaf Surface Area And Wet Weight Of Green Mustard Plants (Brassica Rapa Var. Parachinensis)**," *Agritrop J. Pertan Sciences. (Journal Agric. Sci.***, Vol. 20, No. 1, Pp. 20–30, 2022.

[8] I. Lenaini, "Purposive Sampling Techniques And Snowball Sampling**," *Hist. J. Study, Researcher. Compiler Educator. Sej.*,** Vol. 6, No. 1, Pp. 33–39, 2021.

[9] L. Li *Et Al.*, "Bacterial Communities In Cropland Soils: Taxonomy And Functions," *Plant Soil*, Vol. 497, No. 1, Pp. 297–315, 2024, Doi: 10.1007/S11104-023-06396-7.

[10] M. Hartmann, B. Frey, J. Mayer, P. Mäder, And F. Widmer, "Distinct Soil Microbial Diversity Under Long-Term Organic And Conventional Farming," ***Isme J.*,** Vol. 9, No. 5, Pp. 1177–1194, 2015.

[11] D. Zhu, Z. Hui Zhang, And Z. Hui Wang, "Effects Of Heavy Metals On Soil Microbial Community Of Different Land Use Types**," *J. Mt. Sci.*,** Vol. 20, No. 12, Pp. 3582–3595, 2023, Doi: 10.1007/S11629-023-7904-1.

[12] S. Mishra, Z. Lin, S. Pang, W. Zhang, P. Bhatt, And S. Chen, "Recent Advanced Technologies For The Characterization Of Xenobiotic-Degrading Microorganisms And Microbial Communities,"*Front.Bioeng. Biotechnol.*, Vol. 9, No. February, 2021, Doi: 10.3389/Fbioe.2021.632059.

[13] M. R. S. Dirga Sapta Sara, Reginawanti Hindersah, "The Effect Of The Combination Of Npk Fertilizer With Liquid Organic Fertilizer Supplements On The Total Number Of Bacteria And Fungi In The Rhizosphere And The Yield Of White Mustard Plants (Brassica Pekinensis L.)In Lembang Andisols,"Vol.18,No.2,Pp.19–25, 2020.

[14] Y. C. Wen *Et Al.*, "Long-Term Fertilization Alters Soil Properties And Fungal Community Composition In Fluvo-Aquic Soil Of The North China Plain," *Sci. Rep.*, Vol. 10, No. 1, Pp. 1–11, 2020, Doi: 10.1038/S41598-020-64227-6.

[15] K. Song *Et Al.*, “The Effects Of Earthworms On Fungal Diversity And Community Structure In Farmland Soil With Returned Straw,” *Front. Microbiol.*, Vol. 11, No. December, Pp. 1–12, 2020, Doi: 10.3389/Fmicb.2020.594265.

[16] M. Imran *Et Al.*, “Heavy Metal Tolerance Among Free-Living Fungi Isolated From Soil Receiving Long Term Application Of Wastewater,**”** ***J. Pure Appl. Microbiol.*,** Vol. 14, No. 1, Pp. 157–170, 2020, Doi: 10.22207/Jpam.14.1.17.

[17] A. Meisner, S. Jacquiod, B. L. Snoek, F. C. Ten Hooven, And W. H. Van Der Putten, “Drought Legacy Effects On The Composition Of Soil Fungal And Prokaryote Communities,” *Front. Microbiol.*, Vol. 9, No. Mar, Pp. 1–12, 2018, Doi: 10.3389/Fmicb.2018.00294.

[18] I. Adviany And D. D. Maulana, "The Effect Of Organic Fertilizer And Planting Distance On C-Organics, Soil Fungal Population And Dry Root Weight And Rice Yield On Inceptisols Jatinangor, Sumedang," ***Agrotechnology Res. J***., Vol. 3, No. 1, Pp. 28–35, 2019, Doi: 10.20961/Agrotechresj.V3i1.30382.