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Potential Of Purebred Chicken Egg Shell Waste As Liquid Organic Fertilizer To Promote The Growth Of Tomato Plants (Lycopersicum esculentum Mill)

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ABSTRACT

Eggshell waste is a type of organic waste produced from egg consumption activities, both in households and the food industry. Liquid Organic Fertilizer from eggshell waste has a real effect on the increase in plant height and many leaves in tomato plants. The formulation of the problem in this study is whether the use of eggshell waste is an alternative to increase the growth of tomato plants and whether there is the most effective concentration on the growth of tomato plants. This study aims to analyze the effectiveness of the use of eggshell waste as liquid organic fertilizer in increasing the growth of tomato plants (Lycopersicum esculentum Mill). The type of research is a true experiment using a Complete Random Design (RAL) with four treatments and five replications. The research sample was 20 tomato plant seedlings sown for 21 days. The data was analyzed using the One Way Anova test with an error rate (α) = 0.05 and continued with Tukey's follow-up test. The results showed that the application of liquid organic fertilizer from eggshell waste for six weeks at the high parameters of plants with concentrations of 0 ml (92.40), 50 ml (96.40), 100 ml (110.20) and 150 ml (119.20) with a value of sig. <0.05 and on the parameters of many leaves with concentrations of 0 ml (264.60), 50 ml (270.80), 100 ml (391.60) and 150 ml (406.60) with sig values. <0.05. The results of Tukey's follow-up test obtained that the most effective concentration was 150 ml (P= >0.05). Liquid organic fertilizer from eggshell waste exerts a significant influence on the growth of tomato plants. It is expected for future researchers to use variable variations.

INTRODUCTION

The increase in population and the development of social and economic activities of the community have resulted in an increase in the volume of waste produced. In addition, the types and characteristics of waste are also increasingly diverse due to the development of industrial and technological activities (Firdani, et.al., 2022). Based on data from the Ministry of Environment and Forestry in 2020, Indonesia with a daily production of waste is 175,000 Tons are equivalent to 64 million tons per year, where the production of waste per person per day is 0.7 kg. This surge in the volume of waste that continues to increase has great potential to reduce the quality of the environment for the community. Garbage has been known to be one of the main causes of global warming or the increase in the earth's surface temperature (Lingga et al., 2024).

The percentage of organic waste such as household waste (vegetables, fruits, food waste), leaves, livestock manure, eggshells, straw and rice husks reached 65.5%. Waste that constantly accumulates without any special handling can cause environmental pollution. Eggshell organic waste has a main composition of CaCO3 which can cause pollution due to microbial activity in the environment. Eggshell waste is a type of organic waste produced from egg consumption activities, both in households and the food industry (Emi, 2019). According to the Directorate General of Livestock and Animal Health, the Indonesian Ministry of Agriculture recorded chicken egg production in 2022 at 6,322.55 thousand tons. Eggshell waste is 10% of chicken egg production, so the amount of eggshell waste in Indonesia is 632,255 thousand tons. The physical

structure of the eggshell is hard, rough, fishy in flavor and has a less attractive color, making eggs undesirable when used as food. The varied chemical composition of eggshells shows its potential as a fertilizer to improve the chemical properties of the soil (Sanuriza et al., 2020).

Organic waste from eggshells can cause environmental pollution in the form of; air pollution (eggshells contain the remains of complex substances from their contents that have an unpleasant odor), water pollution (if it rains and the eggshell is carried by the water, it means that the water is contaminated with the remains of the egg that is still attached to the shell), the eggshell is also a nest of disease and pollution because some bacteria can live inside the eggshell (Mukti, et al., 2024) Eggshells contain 98.2% calcium carbonate, 0.9% magnesium, and 0.9% phosphorus. The eggshell is composed of 95.1% inorganic matter, 3.3% protein and 1.6% water. The chemical composition of the eggshell consists of 1.71% protein, 0.36% fat, 0.93% water, 16.21% crude fiber, 71.34% ash. The high content of this eggshell has the potential to be used as plant fertilizer and neutralize acidic soil (Maryanti et al., 2024).

Liquid organic fertilizer is an extract from the decay of organic materials. These organic materials can come from plant residues, animal and human waste that contain more than one element. By extracting organic waste, it can take all the nutrients contained in the organic waste. In addition to nutrients, it also absorbs microorganisms, bacteria, fungi, protozoa and nematodes at the same time (Ratnasari, 2023).

RESEARCH METHODS

Research Location and Time

The research location was carried out on tomato farming land in Permata Village, Paguyaman District, and the research time was carried out from March to September 2025.

Research Design

This study is a true experimental study to test the effect of liquid organic fertilizer from eggshell waste for the growth of tomato plants (Lycopersicum esculentum Mill.). This study used a Complete Random Design (RAL) approach with a variety of treatments, namely tomato plants that were given NPK fertilizer as a control and given liquid organic fertilizer every 2 times a week. The concentration of liquid organic fertilizer to be given is 50 ml POC, 100 ml POC, and 150 ml POC. Each of them carried out 4 POC treatments and 5 repeats. A total of 20 tomato plant seedlings were observed.

Population and Sample

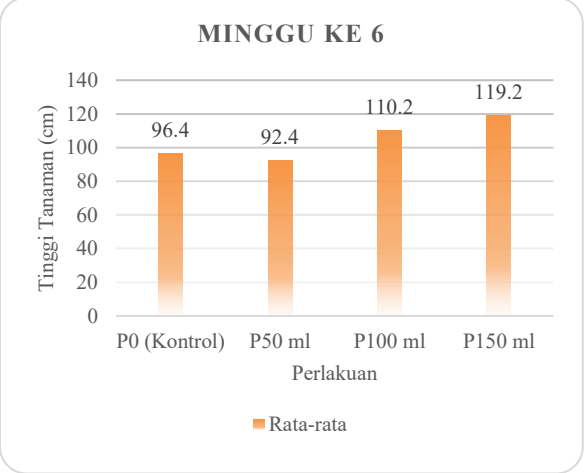
The population in this study was tomato plant seeds that were sown for 21 days and the study sample was 20 tomato plant seedlings.

RESULTS

This study was conducted to determine the effect of liquid organic fertilizer from eggshell waste on the high growth of tomato plants and the large number of leaves in tomato plants that were given treatment 0 (control), 50 ml POC treatment, 100 ml POC treatment, and 150 ml POC treatment every 1 week 2 times POC and observed once every 1 week for 6 weeks.

Plant height increase (cm)

The height of the tomato plant is measured from the base of the plant stem to the highest branch using a ruler (cm). The average of the highest increase in the height of the tomato plant is at the concentration of POC 150 ml and the lowest amount of increase that occurs in the control treatment can be seen in the figure below:



The results of the increase in height of tomato plants were entered for the Normality and Homogeneity test. Normality in the plant height parameter results in a p-value >0.05, this can be said that the data obtained is normal. Meanwhile, the homogeneity of the plant height parameter shows a p-value of >0.05, meaning that the data obtained is homogeneous. Because the prerequisites have been met, the ANOVA test can be performed.

Table 1 Recapitulation of ANOVA test results of plant height parameters

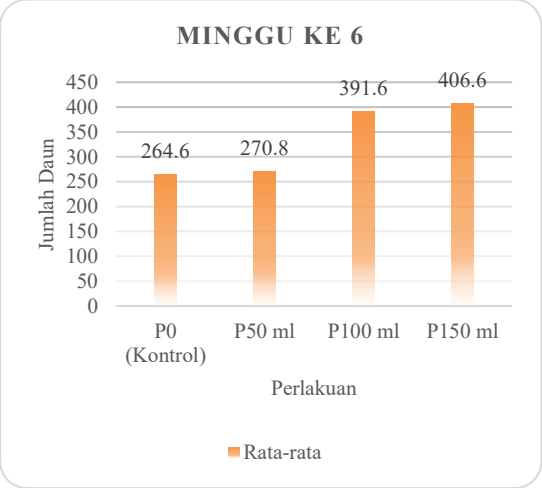
Variable	F	Sig.
Plant Height Increase	6.154	0.006

Source : Primary Data, 2025

Based on the results of the ANOVA test, liquid organic fertilizer from eggshell waste has a real effect on the increase in height of tomato plants that receive different concentration treatments. This difference can be seen in the height increase parameter which shows a p-value of <0.05, this proves that the treatment given is real growth.

Lots of leaves (Strands)

Leaf counting is carried out once a week, data collection is carried out 6 times from the first week to the sixth week and counted per strand. The average increase in the highest number of leaves is at the POC concentration of 150 ml and the lowest amount of increase in the control treatment can be seen in the figure below.



The results of the number of leaves of the tomato plant were entered for the Normality and Homogeneity test. The normality in the parameter of many leaves results in a p-value of >0.05, this can be said that the data obtained is normal. Meanwhile, the homogeneity of the leaf count parameter shows a p-value of >0.05, meaning that the data obtained is homogeneous. Because the requirements have been met, the ANOVA test can be performed.

Table 2 Recapitulation of ANOVA test results of multi-leaf parameters

Variable	F	Sig.
ots of leaves	29.240	0.000

Source: Primary Data, 2025

Based on the results of the ANOVA test, liquid organic fertilizer from eggshell waste has a real effect on the number of leaves in tomato plants that receive different concentration treatments. This difference can be seen in the parameters of many leaves which show a p-value of <0.05, this proves that the treatment given has a real effect on leaf growth.

Optimization of liquid organic fertilizer application of egg shell waste

The optimization of the concentration of liquid organic fertilizer from eggshell waste is most effective against the tall growth of plants and many leaves of tomato plants can be seen in the following table:

Table 3 Recapitulation of Tukey's follow-up test results

Variable	Treatment	Average	Sig.
rease in plant height	0 ml	92.40	0.095
	50 ml	96.40	0.095
	100 ml	110.20	0.095
	150 ml	119.20	0.591
s of leaves	0 ml	264.60	0.989
	50 ml	270.80	0.989
	100 ml	391.60	0.874
	150 ml	406.60	0.874

Source : Primary Data, 2025

Based on the results of Tukey's follow-up test presented in table 4.3, the administration of POC from purebred chicken eggshell waste has a real effect on plant height and number of leaves in tomato plants. Plant height with concentrations of 0 ml (92.40), 50 ml (96.40), and 100 ml (110.20) with sig values. 0.095 p-value >0.05 and at concentrations of 100 ml (110.20) and 150 ml (119.20) with a sig. value of 0.591 p-value >0.05. Meanwhile, in many leaves the concentration is 0 ml (264.60), 50 ml (270.80) with a value of sig. 0.989 p-value >0.05 and at concentrations of 100 ml (391.60) and 150 ml (406.60) with a sig. value of 0.874 p-value >0.05.

At the concentration of 0 ml (Control) and the concentration of 150 ml showed a significant difference, in contrast to the concentrations of 50 ml and 100 ml both concentrations also had differences but they were not noticeably different. This shows that POC egg shell waste is effective in promoting the growth of tomato plants with the most effective concentration being 150 ml.

DISCUSSION

Based on the results of the descriptive analysis and ANOVA test results, it was found that the application of liquid organic fertilizer from eggshell waste had an effect on the growth of tomato plants, and the results of Tukey's follow-up test found that there was a significant difference between the control and the concentration of 150 ml. Therefore, the most effective concentration of POC of eggshell waste for tomato plant growth was the concentration of 150 ml. These results indicate that the application of liquid organic fertilizer from eggshell waste can supply diverse nutrients in optimal concentrations to support the growth of tomato plants.

Plant height

From the results of the ANOVA test, the administration of POC of eggshell waste resulted in the growth of plants that were significantly different, this can be seen from the valuable parameters p-value <0.05. In addition, further tests Tukey It also shows that there is a significant difference between concentrations. This means that the difference in the concentration of POC of eggshell waste affects the height parameters of plants in tomato plants. Organic Fertilizer Liquid egg shell waste at a concentration of 150 ml is more effective compared to control, 50 ml concentration and 100 ml concentration. The optimal POC concentration limit for eggshell waste for tomato plant growth is a POC concentration of 150 ml which indicates an average plant height of 119.20 cm. Febriyanti et al., 2023 stated that the use of liquid organic fertilizer from eggshell waste with a concentration of 150 ml is very effective in increasing the height of tomato plants because this treatment significantly results in better plant height than other treatments.

Lots of leaves

The results of ANOVA's analysis showed that the administration of POC egg shell waste had a real effect on increasing the number of leaves of tomato plants. This can be seen from the parameters that are p-value <0.05. In addition, further tests Tukey shows that there are significant differences between treatments. This means that the difference in the concentration of POC of eggshell waste affects the number of leaves in tomato plants. The most effective application of eggshell waste POC on the number of leaves was a concentration of 150 ml with an average of 406.60 sheets. The increase in the number of leaves in tomato plants is related to the height of the tomato plant, the higher the stem, the more leaves are formed. Febriyanti et al., 2023 It also added that the concentration of 150 ml of liquid organic fertilizer from eggshell waste had a positive effect on the number of leaves of tomato plants as a significant increase in the number of leaves showed that this treatment favored optimal vegetative growth. The use of POC in this concentration not only increases the height of the plant, but also strengthens the formation of leaves that are important for plant health and productivity.

CONCLUSION

Liquid Organic Fertilizer (POC) egg shell waste with concentrations of 50 ml, 100 ml and 150 ml has a real effect on the growth of tomato plants (Lycopersicum esculentum Mill) in this case, namely the increase in height and number of leaves.

The most effective concentration of Liquid Organic Fertilizer (POC) of eggshell waste that gives the best results to the growth of tomato plants is a concentration of 150 ml.

SUGGESTIONS

It is hoped that the community can use chicken egg shell waste as Liquid Organic Fertilizer (POC) to help the absorption of good nutrients for plants and can reduce piles of household waste that can pollute the environment.

For future researchers who are interested in the use of eggshell waste, they can use this as a reference for research by testing the content of heavy metals in the soil, soil pH, POC safety quality tests on soil quality, stability of tomato products and seeing that there is no pathogen growth.

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