



Effect of Fish Water Waste Liquid Organic Fertilizer on Strawberry Flowering (*Fragaria Sp*)

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Received: October 28, 2022

Revised: November 25, 2022

Accepted: December 5, 2022

Published: December 10, 2022

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DOI:

[10.29303/jppipa.v8iSpecialIssue.2475](https://doi.org/10.29303/jppipa.v8iSpecialIssue.2475)

Abstract: Strawberry plant (*Fragaria sp*) is one of the fruit plants grown in Indonesia, although it is not native to Indonesia. The growth of strawberry farmers continues to increase from year to year, especially those outside Lombok Island. This research was conducted at the Green house of the Jeruk Manis Farmer Group, Pejeruk Village, Mataram City. This research was conducted for 4 months starting from April 2022 to August 2022. This research was carried out experimentally using a complete randomized design with 6 treatments and 3 replications so that 18 experimental units were obtained, and each polybag consisted of 2 plants so that there were 36 plant units in total. The treatment given was the difference in concentration of POC fish waste water with concentrations (0.0, 1.5, 2.0, 2.5, 3.0, 3.5) ml/1 liter of water. Parameters observed were plant height (cm), number of leaves (strands), age of flowering, age of first harvest. The research results were analyzed statistically using variance. If the data obtained shows a real effect, a further test is carried out with Duncan's New Multiple Range Test (DNMRT) at the 5% level. Based on the results of the research that has been done, it can be concluded that the application of fish waste liquid organic fertilizer at a dose of 3.5 gives the best results on generative growth parameters.

Keywords: Strawberry; Growth; Production; Fish water

Introduction

Strawberry plants (*Fragaria sp*) are one of the fruit plants grown in Indonesia (Megasari, 2019), although they are not native to Indonesia (Sari et al., 2020). As one of the plants that can thrive in tropical climate conditions, strawberries are a source of income (Alhadi et al., 2019; Tulak et al., 2020).

The growth of strawberry farmers continues to increase from year to year, especially those outside Lombok Island. Strawberry cultivation has been planted by several farmers in the areas of Sukabumi, Cianjur, Cipanas, and Lembang (West Java); Batu (Malang); Bedugul (Bali); as well as in Loka and Malino (South Sulawesi).

The market demand for strawberries is increasing, so that strawberry cultivation techniques need attention, the resulting production will increase in line with increasing demand, by improving the cropping system, as well as proper cultivation techniques need to be applied, in addition to using varieties that have superior characteristics.

Strawberries are a type of fruit that has high economic value (Shafiyullah & Thoriq, 2021). Several farmers in Indonesia, especially in the highlands, have cultivated strawberries commercially. The prospect of strawberry farming is very promising. Currently, the supply of strawberries from existing farmers has not been able to meet market demand due to the limited ability of farmers, even though strawberries have a high selling value (Saraswati, 2005).

One way to increase the production of strawberry plants is to provide liquid organic fertilizer, which will help fertilize the soil (Mindhayani, 2022; Ariyanti, 2019; Hayati, 2020). Many Indonesian farmers and agribusiness entrepreneurs are interested in organic farming, one of which is using organic liquid fertilizer. According to Nugroho (2013) organic fertilizers are also said to be natural fertilizers including all fertilizers made from all the remains of living organisms that contain the nutrients needed by plants (Abror & Harjo, 2018; Ramadhan & Abror, 2022). The use of organic fertilizers is very important for the sustainability of soil organic

How to Cite:

Rosadi, N.A., & Catharina, T.S. (2022). Effect of Fish Water Waste Liquid Organic Fertilizer on Strawberry Flowering (*Fragaria Sp*). *Jurnal Penelitian Pendidikan IPA*, 8(SpecialIssue), 96-100. <https://doi.org/10.29303/jppipa.v8iSpecialIssue.2475>

matter in addition to providing nutrients to plants (Chew et al., 2019; Jin et., 2020).

Fertilization is an activity that functions to add nutrients to plants (Gao et al., 2020; Dimkpa et al., 2020). Fertilizers that can be given to plants can be in the form of organic fertilizers or inorganic fertilizers (Wang et al., 2018; Fallah & Omrani, 2018). The use of organic fertilizers is one solution to reduce the need for inorganic fertilizers so that the nutrients needed by plants are met. According to (Nurbaiti & Robi, 2017). Then the application of organic fertilizers can improve the chemical, physical and biological properties of the soil. Liquid organic fertilizer (POC) is a solution of decomposing organic materials derived from plant residues, animal and human waste (Puspawati et al., 2016).

The remaining internal and external fish waste from fish processing has the potential to be processed into fertilizer. In general, fish waste contains many nutrients, namely N (nitrogen), P (phosphorus) and K (potassium) which are components of organic fertilizer (Hapsari & Welasi, 2013). One of the wastes found in fish is offal or fish stomach contents. Skipjack tuna is commonly found in the Indonesian seas and food for this fish includes small fish, shrimp, squid and molluscs. Squid and shrimp contain potassium, phosphorus, sodium, magnesium, and calcium (Santoso & Irawan, 2008) while plant growth requires three important nutrients, namely nitrogen (N), phosphorus (P), and potassium (K) (Suprihatin, 2011). So that the offal of cakalang fish is expected to increase the nutrients needed by plants in liquid organic fertilizer.

Method

This research was carried out at the Green house of the Jeruk Manis Farmer Group, Pejerk Village, Mataram City. This research was conducted for 4 months starting from April 2022 to August 2022. The materials used in this research were strawberry seeds (local variety), husks, poc nutrient solution fish water waste, compost, vegetable insecticides (soursop leaves, Decis 25 Ec, dab soap, white onion and water).

The tools used in this research were polybags measuring 30 x 25 cm, large duct tape, stickers, buckets, scissors, rulers, handcounters, data books, stationery, digital scales, and shovels.

This research was carried out experimentally using a completely randomized design with 6 treatments and 3 replications so that 18 experimental units were obtained, and each polybag consisted of 2 plants so that the total plant was 36 plant units. The treatment given was the difference in concentration of fish waste POC with concentrations (0.0, 1.5, 2.0, 2.5, 3.0, 3.5) ml/1 liter of water.

Parameters observed were plant height (cm), number of leaves (strands), age of flowering (DAP). The

results were statistically analyzed using variance. If the data obtained shows an effect, do a follow-up test with Duncan's New Multiple Range Test (DNMRT) at the 5% level.

Result and Discussion

Plant Height (cm)

The results of observations of plant height after analysis of variance showed that the application of several concentrations of fish waste liquid organic fertilizer had a significant effect for each treatment. The results of the DMRT advanced test at the 5% level can be seen in Table 1.

Table 1. Average Height of Strobe Plants (*Fragaria Sp*) With Liquid Organic Fertilizer Application of Fish Water Waste

Concentration of liquid organic fertilizer from fish waste (ml/1 water)	High Plant (cm)
0.00	16.39c
1.50	17.69bc
2.00	18.24bc
2.50	18.40bc
3.00	22.39a
3.50	20.21ab

Note: Numbers followed by the same lowercase letters are not significantly different according to the DNMRT test at the 5% level

The data in Table 1 shows that the application of fish waste liquid organic fertilizer at a concentration of 3 ml/1 water resulted in the highest average plant height, namely 22.39 cm and was not significantly different from the treatment of 3.5 ml/1 water, but significantly different from the treatment used others, namely 0 ml/1 water, 1.5 ml, 2 ml water and 2.5 ml water.

Provision of organic fertilizer from fish water liquid waste which functions as a nutrient at a dose of 3 ml/1 water is suspected to be able to stimulate vegetative growth of strawberry plants for 9 weeks after planting, nutrition is a source of energy for plants, fertilization according to recommended doses causes good plant growth, this is supported by opinion Okya (2017) which states that plants can grow optimally if the nutrient content in the soil can be absorbed properly by plant roots.

This liquid organic fertilizer from fish water contains nutrients (Holifah, 2019); phosphorus 12.84 ppm, potassium 7612.99 ppm, calcium content 77.20 ppm and magnesium 53.32 ppm (Barudah, 2021).

Number of leaves (strands)

The results of observing the number of leaves after analyzing the variance showed that the administration of several concentrations of fish waste liquid organic

fertilizer had no significant effect for each treatment. The results of the 5% level DNMRT follow-up test can be seen in Table 2.

Table 2. The average number of leaves of storeberry plants (*Fagaria Sp*) with the application of liquid organic fertilizer from fish water waste

Concentration of liquid organic fertilizer Fish water waste (ml/l water)	Number of Leaves (strands)
0.00	6.23b
1.50	6.21b
2.00	7.55bb
2.50	7.96ab
3.00	9.74a
3.50	7.25b

Note: Numbers followed by the same lowercase letters are not significantly different according to the DNMRT TEST at the 5% level.

Data Table 2 shows that the application of fish waste organic fertilizer at a concentration of 3 ml/l water resulted in an average number of leaves that were the highest, namely 9.74 leaves, and was not significantly different from the treatment with a concentration of 2.5 ml/water, but significantly different from the other treatments i.e. 0 ml/l/water, 1.5 ml/water, 2 ml/l water and 3.5 ml/l water.

As with the plant height parameter, a dose of 3 ml/l of water is able to fulfill plant nutrients in forming young strawberry leaf shoots thereby stimulating leaf formation. This statement is supported by research conducted (Mala, 2021) to store nutrient solutions will affect growth.

Age of flowering (DAP)

The results of observations of flowering age after analysis of variance showed that the application of several concentrations of fish waste liquid organic fertilizer had a significant effect on each treatment.

Table 3. Age of flowering of storeberry plants (*Fagaria Sp*) by applying liquid organic fertilizer from fish water waste

Concentration of liquid organic fertilizer Fish water waste (ml/l water)	Age of flowering (DAP)
0.00	49.49c
1.50	45.24bc
2.00	33.47ab
2.50	33.49abc
3.00	33.41ab
3.50	27.74a

Note: Numbers followed by the same lowercase letters are not significantly different according to the DNMRT TEST at the 5% level.

The data in Table 3 shows that the application of liquid organic fertilizer for waste water at a concentration of 3.5 ml/l liter of water resulted in the fastest flowering age, namely 27.7 days after planting and was not significantly different from the concentration of 2 ml/l of water, but significantly different from other treatments, namely 0 ml/l water and 2.5 ml/water. It is suspected that this concentration is the optimal concentration that can support the generative growth of strawberries, the availability of nutrients, especially P and K, is very important in influencing the generative growth of plants, including flowering. This is supported by the opinion (Hasibuan et al., 2019) in the generative phase the availability of element P plays a very important role in the formation of flowers.



Figure 1. Flowering strawberry plant

Conclusion

Based on the results of the research that has been done, it can be concluded that the application of fish waste liquid organic fertilizer at a dose of 3.5 ml/l water gives the best results on growth parameters.

Acknowledgements

The researchers thank the Al-Azhar and Mahasaraswati Islamic Universities who have provided support to participate in the national seminar on technological innovation and socio-economic engineering to increase the productivity of dryland agriculture in 2022.

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