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THE EFFECT OF FERTILIZER PROVISION OF CATFISH POND WATER ON THE GROWTH AND PRODUCTION OF PATCHOULI PLANT (Pogostemon cablin Benth)

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ABSTRACT
This study aims to determine the Effect of Providing Catfish Pond Water on the Growth and Production of Patchouli Plants (Pogostemon cablin Benth). The study has been completed at the Alexa School Complex, Lotta Village, Pineleng District, Minahasa Regency, North Sulawesi Province. The study was carried out for approximately 5 months, starting from May 2024 to October 2024. The research method used in this study was a Non-Factorial Randomized Block Design (RAK) consisting of 6 treatment levels, each consisting of 3 groups. Based on this design, the experimental unit is 18 units. Each experimental unit is designed to consist of 4 plants in polybags and 3 of them were used as sample plants. The total number of plants in this research activity was 72 plants. The results of the study showed that the provision of Catfish Pond Water treatment had a significant effect on the observation parameters of the Number of Leaves, Wet Weight of Stems and Wet Weight of Patchouli Leaves. Referring to the results of the study that have been obtained with the research conducted, it can be concluded that the Provision of Catfish Pond Maintenance Water Treatment had a significant effect on all observation parameters in the form of the number of leaves, wet weight of stems, wet weight of leaves and it was found that the best treatment was in the N5 treatment of providing catfish pond maintenance water (concentration 500 ml/plant) in terms of observing the number of leaves (47.66 strands), Wet Weight of Stems (2.71 kg), wet weight of leaves (3.65 kg).
Keywords: Pond Water, Catfish, Patchouli, Growth, Production,.
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INTRODUCTION

Patchouli (Pogostemon cablin Benth) is a type of plantation plant that produces the main essential oil in Indonesia. Essential oil is oil produced from the secondary metabolism of plants that is volatile, has an aroma, is soluble in alcohol and is composed of terpene or sesquiterpene compounds. Due to its nature, essential oil is also nicknamed volatile oil or etheric oil. In the world trade scheme, essential oil is called "essential oil".

Patchouli plants in Indonesia, especially patchouli plants, have long been cultivated with planting areas spread across Aceh Province, West Sumatra Province, North Sumatra Province. Since 2000, patchouli cultivation has spread widely to Java Island, and in recent years has spread to Kalimantan. Since the early 2020s, patchouli plants have begun to be developed on Sulawesi Island.

Patchouli plant productivity in Indonesia is still relatively low and varies greatly between production centers. One effort that can be made to increase agricultural crop productivity is through intensification. This can be done by using seeds or seedlings from superior varieties, as well as appropriate fertilization.

Hilwan et al., 2021 stated that patchouli oil, better known as patchouli oil, is an essential oil whose role is very important in the development of flavors and fragrances for the aromatherapy and perfume industries. Patchouli oil has a patchouli alcohol content of approximately 30%. Generally, under normal conditions, patchouli oil is clear yellow and has a distinctive and long-lasting fragrance.

Meanwhile Siska et al., 2020; stated that the main content of patchouli essential oil is Trans caryophyllene 4.02%, Alpha-guaien (4.70%), Seikellen (5.26%), Delta-guaien (5.94%) and Patchouli alcohol (51.88%). Patchouli oil has various roles due to the content of ingredients it has such as antimicrobial ingredients against bacteria, viruses and fungi including Aeromonas veronii, Acenitobacter baumannii, Candida albicans, B. Subtilis, Enterococcus faecalis, E. aerogenes, Escherichia coli, Klebsiella pneumonia, in addition Pseudomonas aeruginosa, Staphyllococcus aureus, Salmonella enteric, Helicobacter pylori, H1N1 and H2N2 influenza viruses were also found (Sarifah et al., 2019).

Factors that inhibit obtaining good quality patchouli oil such as the discovery of a mixture of other compounds resulting in low quality patchouli oil in Indonesia, the time required for the distillation process is quite long, which ranges from 6-8 causing the energy required to be quite large and many compounds in the oil evaporate Dwi et al; 2020. In general, the compounds contained in patchouli oil are hydrocarbons such as terpenes,

sesquiterpenes, oxygenated hydrocarbon compounds and other sesquiterpene compounds, especially sesquiterpene alcohol from patchouli oil greatly determine the antibacterial activity to damage bacterial cell membranes. The patchouli alcohol component in patchouli oil is one of the components responsible for the antibacterial activity of patchouli oil. Sarifa et al., 2019.

6] Tomi et al., 2020, stated that the elements that affect the quality of patchouli oil include the type of plant, harvest time and number of patchouli leaves. Including the equipment used during the distillation process, the distillation time and the oil packaging used for storage greatly affect the quality of the patchouli oil produced. According to the latest analysis from Future Market Insights (FMI), the patchouli oil industry is projected to reach a value of 101.4 million US dollars in 2033, with an annual growth rate of 3 percent. For the short term (2022-2025), the market is expected to reach 75.3 million US dollars in 2025 Zonapedia ., 2024

Referring to the results of research conducted by Ade., 2020. Processing in Wandoke Village, Tiworo Islands District, West Muna Regency, namely by water and steam distillation system. From the results of the feasibility analysis of patchouli oil processing business, the results of the R/C Ratio analysis were 1.34. This indicates that there are good business prospects to be developed.

One of the problems often encountered by farmers in implementing organic farming is the low organic matter content and soil nutrient status. Organic farmers overcome this problem by using organic fertilizers. Organic fertilizers are obtained from agricultural waste, one of which is catfish farming wastewater. Catfish farming wastewater is found to have the potential to be developed, but currently it is still rare or few people use it. The results of the study Muhammad et al. (2022) stated that the content of catfish farming wastewater consists of 1.32% nitrogen, 2.64% phosphorus, 0.35% potassium, and 0.63% organic C.

From the explanation above, it shows that a solution is needed to add organic nutrients for the growth and production of Patchouli and materials that are easily available in the community, in essence Patchouli plants really need a lot of nutrients for growth and oil production, therefore regular fertilization is needed. Rendi., 2021, stated that catfish farming wastewater contains macro nutrients that are very much needed by plants. The nutrient content contained in liquid organic fertilizer from intensive catfish farming wastewater has a range of 0.06-0.62% (COrganic), 0.49-1.32% (Nitrogen), 06-0.35%.

Based on the problems described above, the author has conducted research with the title "The Effect of Catfish Pond Water on the Growth and Production of Patchouli Plants (Pogostemon cablin Benth)

2. RESEARCH METHODOLOGY

2.1. Place and Time

The research was conducted at the Alexa School Complex, Lotta Village, Pineleng District, Minahasa Regency, North Sulawesi Province. The research was conducted for approximately 5 months, starting from May 2024 to October 2024.

2.2. Tools and Materials

The materials used in this study were Aceh type Patchouli plant shoots, catfish pond water, Mutiara NPK fertilizer (16:16:16). While the tools used were Pollibags measuring 40 cm x 40 cm, paranet with 50% light intensity, meters, scales, sprayers, stationery and cameras.

2.3. Research Method

This study used a Non-Factorial Randomized Block Design (RAK) consisting of 6 treatment levels, each consisting of 3 groups. This study itself consists of 18 experimental units.
Where the treatment consists of:
N0: Without Provision of Catfish Pond Water,
N1: Provision of Catfish Pond Water 100 ml/plant/week
N2: Provision of Catfish Pond Water 200 ml/plant/week
N3: Provision of Catfish Pond Water 300 ml/plant/week
N4: Provision of Catfish Pond Water 400 ml/plant/week
N5: Provision of Catfish Pond Water 500 ml/plant/week

2.4. Research Implementation

1. Planting Preparation

Initial preparation is filling the soil in a 45 x 45 cm Pollibag, where the soil that is inserted is soil that has been mixed in the form of a mixture of soil taken under bamboo clumps mixed with rice husks, sand (ratio 2: 1: 1) watered and left for one week to neutralize the soil from pests and diseases.

2. Placement of Pollibag Planting Media

The placement of planting media in the form of Pollibags is each 60 cm apart between Pollibags in the treatment, while the distance between treatment blocks is 100 cm.

3. Liming

Before liming, the soil pH is measured first in each treatment in the Pollibag. Liming needs to be done because the soil pH at the location is found to be 5.5 and is given two weeks before planting. The dose of liming/dolomite lime is 2 tons/ha

equivalent to 1.8 x 1.2x 2,000 = 0.432 kg or equivalent to
10,000

with 432 gr/plot. Which is sprinkled on the surface of the soil in the pollibag.

4. Making Shade

Making Shade is done to regulate the sunlight entering the planting area, the size of the shade area made is 4 X 3 meters.

The shade used is a paranet that is made facing the sun so that it can illuminate the position of the plants by using bamboo for shade poles.

5. Label Installation

Before planting, each Pollibag plot is given a label made of thick map paper wrapped in plastic measuring 5 cm x 5 cm, where the label is installed according to the treatment plan in the research Layout.

6. Planting Patchouli Shoots

Before the Patchouli Shoots are planted, the soil in the polybag is first watered so that the planting of the Patchouli plant shoots that are stuck does not break easily. The shoots that have been prepared in the form of 3 plant segments on each shoot are planted by sticking one shoot segment into the soil and two shoot stem segments are above the soil surface.

After the Patchouli shoots are finished being stuck, followed by watering again, so that the soil is not hollow, the time for planting seedlings is in the afternoon.

7. Provision of Basic Fertilizer

The basic fertilizer given uses a balanced dose of NPK pearl fertilizer (16 N: 16 P: 16 K) poured with water in each Pollibag, the time for giving basic fertilizer is given 1 week before planting.

8. Treatment of Catfish Pond Water

The treatment of catfish pond wastewater is carried out 7 Days Before Planting (DAP) consecutively every 10 days, until 1 week before harvest (DAP), catfish pond water is given according to the dosage of each treatment1.1.1 Heading 3

3. RESULTS AND DISCUSSION

Based on the results of the study, the Effect of Fertilizing Catfish Pond Water on the Growth and Production of Patchouli Plants (Pogostemon Cablin Benth) is as follows;

3.1. Average Number of Leaves

Based on the results of the analysis of variance, it shows that the provision of catfish pond water treatment has a significant effect on the average number of leaves. The average number of leaves of the Patchouli plant after being tested with BNJ at a level of 5% can be seen in table 1.

Table 1. Average Number of Patchouli Plant Leaves from Without Catfish Pond Water and Catfish Pond Water Treatment

Treatment	Average
N0 : Without Catfish Pond Water	27 e
N1 : Catfish Pond Water 100 ml/Plant	34,66 d
N2 : Catfish Pond Water 200 ml/Plant	35 cd
N3 : Catfish Pond Water 300 ml/Plant	35,33 bc
N4 : Catfish Pond Water 400 ml/Plant	37,66 b
N5 : Catfish Pond Water 500 ml/Plant	47,66 a
KK = 0,32%	BNJ=1,04

Note: The numbers in the column followed by the same lowercase letter are not significantly different at the 5% level according to the BNJ further test.

The results of the average calculation presented in table 1 above show that the treatment with the highest number of leaves was obtained in the N5 treatment (average 47.66 strands) and the treatment with the fewest number of leaves was in the N0 treatment (27 strands). After further testing according to BNJ at the 5% level, it showed that the N5 treatment was significantly different when compared to the N0, N1, N2, N3, and N4 treatments. Based on this study, it can be seen that the N5 treatment had a greater number of leaves compared to the N4 treatment (35.66 strands), N3 (35.33 strands), N2 (35 strands), N1 (34.66 strands) and compared to the control (N0) which had the least, namely 27 strands. The N5 treatment had more leaves than the other treatments. This is because the volume of catfish pond water given is the largest, so it provides sufficient nutrients for the plants. Therefore, administering the appropriate dose of catfish pond water is able to fulfill the nutrients in the soil, so that it can stimulate the growth of patchouli plant roots, thereby stimulating rapid and abundant leaf growth. The number of leaves that appear is generally influenced by the amount of N, P and K nutrients in the soil.

Based on research conducted by Rina et al., 2022, it can be concluded that the response of patchouli growth to the administration of NPK fertilizer to the tapaktuan variety with a dose of 2 grams has a significant effect on plant height, wet weight and dry weight of plants. The results of the study Yulinda et al., 2022, found that the combination of shade and type of ZPT and the single factor of shade level had no significant effect on the number of patchouli seedling leaves. The type of ZPT was only significantly different in the 5th week after treatment

The results of the study conducted by Rizky et al., 2022 showed that the administration of NPK fertilizer (15-15-15) had an effect on increasing plant height growth, number of leaves, dry weight of the crown, dry weight of the roots, ratio of root shoots and total dry weight. Different doses of NPK fertilizer showed different effects on the growth parameters of Merbau darat plants and gave the best results at a dose of 8 g/polybag

Based on Research Arif et al., 2022, the 350 kg/ha dose treatment had a significant effect on plant height, this is thought to be due to the availability of nutrients that can increase plant height, namely at a concentration (350 kg/ha) higher and significantly different from M0 (without fertilizer), M1 (150 kg/ha), and M2 (250 kg/ha). The average plant height obtained in the M3 treatment (350 kg/ha) was 66.23 cm.

Treatment N0 is the slowest growth observation result. This is because the treatment in N0 was not given fertilizer so that the plants lacked nutrients for their vegetative growth.

Research results Nurwasila et al., 2023; The effect of the interaction of giving NPK fertilizer 6.00 g/polybag and POC 15 ml/l shows the number of leaves. Giving NPK 3.0 g/polybag with POC showed no effect. Giving NPK 4.5 g/polybag with POC also showed no effect. Giving NPK 6.0 g/polybag with POC showed no effect

The number of leaves is related to plant height, because the taller the plant, the more leaves are formed. This shows that the process of leaf formation in plants is greatly influenced by the availability of nutrients in the soil such as nitrogen and phosphorus obtained by the plants.

From the results of the research conducted, it shows that the presence of nutrients greatly affects the growth and development of plants, especially leaves, is nitrogen. This shows that Nitrogen is a component of the formation of chlorophyll in plant leaves, resulting in increased photosynthesis if chlorophyll increases. By itself, if N is available in large quantities, it will facilitate the plant's metabolism process, thus affecting the improvement of organ growth such as stems, leaves and roots.

3.2. Stem wet weight (Kg)

Although the raw materials used for processing Patchouli essential oil are stems and leaves, in the measurement parameters, the weight that is weighed is not the stem and leaves at the same time, but is weighed

separately. Based on the results of the analysis of variance, it shows that the provision of Catfish Pond Water treatment has a significant effect on the Stem Weight parameter. The average stem weight of the Patchouli plant after being tested with BNJ at a level of 5% can be seen in table 2.

Table 2. Average Wet Weight of Patchouli Plant Stems without Providing Catfish Pond Water and Catfish Pond Water Treatment (Kg).

Treatment	Average
N0 : Without Providing Catfish Pond Water	1,96 d
N1 : Providing Catfish Pond Water 100 ml/Plant	2,09 d
N2 : Providing Catfish Pond Water 200 ml/Plant	2,31 c
N3 : Providing Catfish Pond Water 300 ml/Plant	2,48 b
N4 : Providing Catfish Pond Water 400 ml/Plant	2,57 b
N5 : Providing Catfish Pond Water 500 ml/Plant	2,71 a
KK = 0,92%	BNJ=0,21

Note: The numbers presented in the column followed by the same lowercase letter are not significantly different at the 5% level according to the BNJ further test.

Based on the average results presented in table 2 above, it can be seen that the best stem weight treatment is in the N5 treatment (2.71 Kg) and the lowest treatment is in the N0 treatment (1.96 Kg). After further testing according to BNJ at the 5% level, it was found that the N5 treatment was significantly different compared to the N0, N1, N2, N3, and N4 treatments. The N4 treatment was not significantly different compared to the N3 treatment but was found to be significantly different from the N2, N1, and N0 treatments. The N3 treatment was found to have a significant difference with the N2, N1, and N0 treatments, likewise the N2 treatment was found to have a significant difference with the N1 and N0 treatments while the N1 treatment was found to be not significantly different when compared to the N0 treatment.

Based on the research conducted, it was found that the higher the volume of catfish pond water, the greater the weight of the stem. The fact shows that the weight of the stem is largely determined by the vegetative and generative periods of the plant, this is because at that time the plant experiences a period of growth and development. While entering the generative phase, the nutrients that play a role in the formation of flowers and stems and leaves are the P and K nutrients contained in catfish pond wastewater. This is in line with the results of the study Nurwasila., 2023 where the administration of NPK fertilizer with a dose of 6.00 g / polybag showed the best response due to the presence of N, P and K nutrients that are very much needed by kale plants which are available in sufficient quantities for plant needs, so that it leads to the process of plant growth and development forming new shoots, increasing plant height, and forming an enlargement of the stem diameter. Macro nutrients in plants are needed in large quantities, especially the Nitrogen element which is useful for the vegetative growth process of plants to lead to the formation of new cells such as leaves, new shoots, branch extension and replacing damaged cells.

This is in line with the results of research conducted by Ayu et al., 2024. In the tomato research object, the best wet weight of tomato plants was obtained in the treatment with an average of 0.22 grams/plant, compared to other treatments. This can be understood how the role of nitrogen in forming important compounds for the process of photosynthesis and cell division, thus triggering plants to be able to form their structural organs properly. The results of the study obtained in the N0 treatment gave the lowest stem weight results (1.96 grams) compared to other treatments, because the N0 treatment was a control, the N1, N2, N3 and N4 treatments also gave low stem weight results compared to the N5 treatment. As a result of giving too little concentration, plants experience stunted or less than optimal growth, both during the vegetative period and during the generative period.

Research Results Gelamona et al., 2022 found that the process of increased plant growth (heightening process) is thought to occur because liquid tofu dregs waste can stimulate cell division at the tip of the shoot, especially in the meristem area. Providing fertilizers containing N, P, K, Mg, and Ca can stimulate the process of cell wall synthesis and division, thereby accelerating plant growth. The process of increasing plant height that occurs continuously indicates that there is a process of cell division and enlargement. In addition, carbohydrates produced from the photosynthesis process result in stimulation of the formation of new organs in plants Aji & Bahri, 2020.

Likewise, Retno et al., 2020, stated that the nutrients N, P and K are very important elements and are needed in large quantities when compared to other elements. The intake of N elements in patchouli plants is the

main element because the part of the patchouli plant that is harvested is the leaves. The right intake of N elements is very important in spurring the vegetative growth process of patchouli plants, especially for the formation of new leaves, leaf area and leaf thickness.

3.3. Patchouli Leaf Wet Weight (Kg)

Based on the results of the analysis of variance, it shows that the provision of catfish pond water treatment has no significant effect on the Leaf Weight parameter. The average Leaf Weight of the Patchouli plant can be seen in table 3.

Table 3. Average Wet Weight of Patchouli Plant Leaves with No provision of Catfish Pond Water and Treatment of Provision of Catfish Pond Water (Kg).

Treatment	Average
N0: Without Providing Catfish Pond Water	2,48 e
N1: Provision of Catfish Pond Water 100 ml/Plant	3,11 c d
N2: Provision of Catfish Pond Water 200 ml/Plant	3,17 c
N3: Provision of Catfish Pond Water 300 ml/Plant	3,33 b
N4: Provision of Catfish Pond Water 400 ml/Plant	3,33 b
N5: Provision of Catfish Pond Water 500 ml/Plant	3,65 a
KK =6,49 %	

Note: The numbers in the column followed by the same lowercase letter are not significantly different at the 5% level according to the BNJ further test.

Based on the average results presented in table 3 above, it can be explained that the provision of catfish pond water does not have a significant effect on the leaf weight parameter. The best leaf weight treatment was in the N5 treatment (3.65 kg) and the treatment with the lowest leaf weight was in the N0 treatment (2.48 kg). Although there was no significant difference between the N0, N1, N2, N3 and N4 treatments, the N5 treatment gave a higher leaf weight for the Patchouli plant given catfish pond water than the lower concentration.

Obtained from the N5 treatment (Provision of 500 ml/plant catfish pond water) produced the highest leaf weight for the Patchouli plant compared to other treatments. The provision of 500 ml/plant catfish pond water gave a significant impact in terms of the availability of better nutrients when compared to the amount of catfish pond water given which was less or not at all. The availability of nutrients for plants is very important for the growth process because the presence of potassium (K) in the catfish pond water has an impact on stimulating the rapid growth of patchouli plants.

Based on the research results Maya et al., 2024. pointed out that the combination of POC material and fertilizer dosage had no significant effect on wet weight, but based on the physical treatment of banana peel POC with a dose of 10.2 ml/polybag produced the highest wet weight and dry weight so that this treatment was said to have a better photosynthesis process. Other parameters also show that different dose treatments produce the highest shoot length, number of shoots and number of leaves, resulting in high wet and dry weight. The main role of Nitrogen in the process of accelerating vegetative growth is because the nitrogen element can accelerate the conversion into protein which is then converted into protoplasm so that it affects the reaction of increasing leaf growth and development.

Research by Irdika et al., 2022, found that increasing the number of cells can increase water content and have an impact on increasing the wet weight of plants. The results of the analysis of variance showed that the administration of two types of compost fertilizers on the total wet weight of ylang-ylang seedlings had no significant effect. The results of the comparison of the total wet weight of ylang-ylang seedlings given a single type of compost fertilizer treatment had a higher value of 13 g, while the Fertile Land treatment had a lower value of 8.8 g. The treatment of a compost fertilizer dose of 25 g obtained a higher value than the other treatments, namely 12.9 g, while the treatment of a compost fertilizer dose of 50 g obtained a lower result of 7.7 g.

Agus Sadono., 2020. Presenting the results of observations of production components in Patchouli plants showed that drought stress treatment had a significant effect on biomass production, especially the weight of fresh stems and leaves of the five Patchouli varieties tested. The Girilaya variety is a type of Pogostemon heyeanus Benth (Javanese patchouli) which is still seen to be able to produce the highest biomass, reaching 29.3 g/plant. Meanwhile, the highest fresh stem weight of the Pogostemon cablin Benth type (Aceh patchouli) was

found in the Tapak Tuan variety, followed by Aceh Merah, Lhokseumawe and the lowest was the Sidikalang variety, only able to produce fresh stems of 3.5 g/plant

Retno et al., 2020, found that the increase in fresh plant weight can be influenced by the absorption of nutrients absorbed by plants, especially water and carbohydrates. It is explained that in terms of physiology, fresh weight usually consists of 2 contents, namely water and carbohydrates. We know that together water is the main component of green plants, which is around 70-90% of the fresh weight of the plant.

This is in line with that obtained by Aprilia et al., 2025, The leaf section as a place for the photosynthesis process, which synergizes with root support to absorb nutrients greatly influences the formation of leaf sheaths that are arranged in a circle so that they are very active and abundant during the vegetative phase. This is what causes plant growth in the vegetative vase which produces photosynthate for its growth, so that at the time of harvest the height of the plant, the size of the stem, the number of leaves and the thickness of the leaves can reach optimal conditions

4. CONCLUSION AND SUGGESTIONS

Based on the results of the study The Effect of Fertilizing Catfish Pond Water on the Growth and Production of Patchouli Plants (Pogostemon Cablin Benth) Can Be Stated As Follows

4.1. CONCLUSION

Referring to the results of the research that has been obtained with the research conducted, it can be concluded that the Provision of Water Treatment for Catfish Pond Maintenance has a significant effect on all observation parameters in the form of number of leaves, wet weight of stems, wet weight of leaves and it was found that the best treatment was in the N5 treatment of providing catfish pond water (concentration 500 ml/plant) in terms of observing the number of leaves (47.66 strands), wet weight of stems (2.71 kg), wet weight of leaves (3.65 kg).

4.2. Suggestion

A good harvesting pattern used by the community is a pattern with dry materials under shade, because it produces a fairly high yield and level of Patchouli alcohol. It is recommended that further research is needed with other patchouli quality standard tests, such as refractive index, optical rotation, solubility in alcohol, acid number and ester number.

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