DIVERSIFICATION OF WHITE OYSTER MUSHROOM (PLEUROTUS OSTREATUS) BAGLOG MEDIA WITH THE ADDITION OF PALM SAP WATER EXTRACT AND QUICKLIME BASED ON DIFFUSIVE MIXING TECHNOLOGY

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Abstract

Mushroom growth is influenced by various additional nutrients given, including the addition of quicklime and palm sap water extract. The purpose of this study was to determine the addition of quicklime and palm sap water extract to the baglog media on the growth of white oyster mushrooms (Pleurotus ostreatus) and the interaction between the two. The study was conducted from January 2024 to April 2024 in laboratory rooms C106 and C108, Panca Budi Development University, Medan, Jl. Gatot Subroto Medan. The research method used a factorial Completely Randomized Design (CRD) consisting of 2 factors, 16 treatments, 3 replications, and 96 baglogs. The first factor has 4 treatment levels, namely: K0: 0 g/baglog, K1: 15 g/baglog, K2: 20 g/baglog and K3: 25 g/baglog. The second factor has 4 treatment levels, namely: N0: 0 ml/baglog, N1: 10 ml/baglog, N2: 15 ml/baglog and N3: 20 ml/baglog. The parameters observed were the rate of mycelium growth (cm), number of mushroom stalks, height of mushroom stalks (cm), diameter of mushroom caps (cm), thickness of mushroom caps (mm), number of mushrooms (Clumps), and fresh weight of mushrooms/baglog (g).The results of the mycelium growth rate data were highest in the treatmentK3as big as19.57cm. The results of the highest number of stems in the treatmentK37.96 sprigs. The highest data stem height results were in the K treatment$_3$as big as9.61cm. The highest data cap diameter results were in treatment K_3as big as22.57cm. The highest data hood thickness results were in treatment $K_3$of 8.14 mm. The highest number of fungi (clumps) data was in the K treatment.$_3$of 7.96 clumps. The highest fresh weight of mushrooms/baglog (g) was in the K treatment.$_3$as much as 200.60 g.

Keyword : Diversification of White Oyster Mushroom Baglog Media (Pleurotus ostreatus), Palm Palm Juice Water Extract, Quicklime Based on Diffusive Mixing Technology

INTRODUCTION

Indonesia is rich in natural resources, both plants and animals. Among the many plants in Indonesia, oyster mushrooms have economic value.(Nature, & Hermawan 2017). Oyster mushroom (Pluoretus ostreatus) is a saprophyte organism, namely an organism that lives and obtains nutrients from dead or rotting organic matter. Oyster mushrooms are still associated with Pleurotus eryngii. Oyster mushroom caps are one of the agricultural products that can be developed for food diversification and have high taste and nutritional value. In addition, mushrooms have a short growing season, expensive prices and low land requirements so that they can be a profitable business opportunity for mushroom farmers.(Anggaraini, 2017). The demand for oyster mushrooms is increasing from year to year due to domestic and foreign market demand.

Oyster mushrooms usually thrive in high humidity and low temperatures. This mushroom thrives in the highlands. Due to the high temperatures and low humidity of the urban environment, this type of mushroom is very difficult to grow.(Amelia et al., 2017)states that the ideal temperature for oyster mushroom growth is ±28o C-31o C. White oyster mushrooms have a white body, thick fruit flesh, and hard and soft stems. The body of the white oyster mushroom consists of a cap, stem and lamella (tip).(Dewi et al., 2019). The oyster mushroom cap is shaped like a clam shell, measuring 5–15 cm and layered on the lower surface(Anggraini et al., 2022).

The cultivation of edible mushrooms in Indonesia shows encouraging developments. Currently, Indonesia is one of the largest suppliers of mushrooms in the world. Therefore, domestic

needs are neglected. This description only reflects the market needs for fresh mushrooms. In fact, edible mushrooms are not only marketed fresh, but can also be further processed into finished products such as mushroom chips, mushroom bags, mushroom bags and other processed mushroom foods. In addition to adding value, these products also act as an extension of marketing to attract more consumers.(Amalia, 2017).

One of the efforts to increase oyster mushroom production is by increasing nutrition.(Sitompul et al, 2017).). There is also a problem in the oyster service business, namely the amount of production that is not always the same for each bag. This is because mushroom cultivation is very sensitive to hot weather and improper watering. Oyster mushrooms that are watered with too much water will rot, if there is not enough water they will dry out and turn yellow. Not all mushrooms planted in bags are successful because their incubation fails and they are attacked by pests and insects. This is in accordance with research(Amir et al., 2023). explained the obstacles commonly encountered in oyster mushroom cultivation are that they are very sensitive to weather changes, both hot and rainy weather, failure of the hatching process and the presence of pests that cause oysters to not be harvested.

White oyster mushrooms (Pleurotus ostreatus) grow on sawdust, rice bran, quicklime (calcium carbonate) and water.(Pamardining Utami, 2017). The materials used must have criteria and properties that are almost the same as sawdust and have sufficient nutritional content to support the growth of oyster mushrooms.(Jamilah et al., 2017). Sawdust used as a planting substrate is hardwood, because it contains large amounts of cellulose and mushrooms require large amounts of it. feeding the growing media and adding rice bran as a source of carbohydrates, carbon (C) and nitrogen (N). In addition, lime (calcium carbonate) is a source of minerals, fiber builders and pH regulators. Nutrients in the environment such as nitrogen and phosphorus are important elements for mycelium growth. Lack of these nutrients will certainly inhibit the growth of mycelium to the maximum in forming the body of the white oyster mushroom. To achieve the best results, the right seeds and materials are needed and meet the nutritional needs of the mushroom for the growth and production of oyster mushrooms(Nugroho et al., 2019).

Other supplements that can be used to increase the growth of oyster mushrooms include quicklime and aren sap. Utilization of aren sap as a mixture in preparing planting substrates(Ikhsan & Ariani, 2017). The results of the study showed that mycelium filled the baglog, the initial appearance of pin heads, the diameter of the cap, the fresh weight of oyster mushrooms and the harvest distance had a significant effect on different concentrations. It is known that the combination of treatments that most quickly stimulated mycelium growth was the addition of 20 ml/bag of aren sap, which was an average of 40 days after inoculation. Study(Darma et al., 2021). noted that the supply of sap is very important to supplement the nutrients needed by white oyster mushrooms.

The addition of rice bran is also needed to increase the productivity of white oyster mushrooms. Rice bran acts as food and a source of carbohydrates, carbon and nitrogen. Rice bran is also rich in vitamin B complex which plays a role in the growth and development of mycelium and acts as a trigger for the growth of the body of white oyster mushrooms.(Fatmawati, 2017).(Pribady et al., 2019)stated that the addition of rice bran can increase fresh oyster mushroom production by up to 35%.

Quicklime is a material that comes from white rocks and has a smooth shape. Quicklime generally consists of three compounds in the form of calcium carbonate, calcium oxide and calcium hydroxide.(Haras et al., 2017)Quicklime is a rock that contains the compound CaCO3. According to(Amin, & Kurniasih, 2019)Limestone (CaCO3) is a raw material in the process of making quicklime (CaO). Calcium carbonate ($CaCO_3$) as a source of calcium needed for mushroom growth.(ghareeb, 2019). Palm sap is a liquid released from the trunk of the sugar palm tree which is only a result of the tree's metabolism. This liquid called sap contains sugar which is needed for the growth of oyster mushrooms. One source of organic glucose that can be used to stimulate mushroom growth is palm sap. The nutritional value of palm sap is 91.1% water, 0.28% ash, 0.41% protein, 0% fat, 8.21% carbohydrates and 0.67% sugar(Alfred et al.,2018).

Diffusive mixing is the mixing of media materials that will be carried out in research to find the best results. The diffusive mixing that has been carried out in this research is the best result in the provision of quicklime.K3: 25 g/baglogAndN3: 20 ml/baglog(Ningsih et al, 2020). Based on the explanation above, further research is needed to determine the growth of white oyster mushrooms (Pluoretus ostreatus) on the combination of palm sap water extract and quicklime based on diffusive mixing technology. It is expected that the results of this study can provide an overview of the composition of the media and the right dosage for higher oyster mushroom production.

METHOD

Research Implementation

The research was conducted from January 2024 to March 2024 in the experimental garden and livestock laboratory of Panca Budi Medan Development University.The implementation of the research carried out was the preparation of mushroom houses, sieving, mixing, filling baglogs, sterilizing planting media, cooling, inoculating seeds, incubating, opening newspaper covers, maintenance including oyster mushroom fogging, temperature control; and harvesting. As for the materialsused in this study were white oyster mushroom seeds, sawdust, rice bran, quicklime, water, palm sap water, alcohol, spirits, and newspaper. The tools used in this study were 18 cm x 35 cm plastic baglog and 0.5 pp thick, baglog ring, shovel, baglog press machine, rubber band, sterilization drum, gas stove, gas cylinder, sterilization cover plastic, bunsen burner, spatula spoon, measuring cup, scales, tape measure, micrometer, vernier caliper and stationery.

Research methods

This study used a Factorial Completely Randomized Design (CRD) consisting of 2 treatment factors, 16 treatments, 3 replications and 96 baglogs. The first factor is the provision of Quicklime concentration which is given the symbol "K" which consists of 4 levels, namely: K0 = 0 gr / baglog (control), K1 = 15 gr / baglog, K2 = 20 gr / baglog, K3 = 25 gr / baglog. The second factor is the provision of Aren Nira concentration which is given the symbol "N" which consists of 4 levels, namely: N0 = 0 ml / baglog (control), N1 = 10 ml / baglog, N2 = 15 ml / baglog, N3 = 20 ml / baglog. The data obtained were analyzed using ANOVA followed by Duncan's multiple range test.

Observation Parameters

The observation parameters carried out include: Mycelium growth rate (cm), number of mushroom stalks, mushroom stalk height (cm), cap diameter (cm), cap thickness (mm), number of branches and wet weight of mushrooms (g).

RESULTS AND DISCUSSION

Mycelium Growth Rate (cm)

The results of the study after being analyzed statistically showed that the administration of Quicklime and Palm Sap had a very significant effect on the growth rate of mycelium at the age of 1 to 5 Weeks After Inoculation (MSI). For more details, see the table and graph below.

Table 1. Average Mycelial Growth Rate in Response to Quicklime and Palm Sap at 1 to 5 Weeks after Inoculation

Treatment	Mycelium Growth Rate (cm)				
	1 MSI	2 MSI	3 MSI	4 MSI	5 MSI
Quicklime (K)					
K0 = 0 g/baglog	3.16bB	6.02bB	11.92bB	16.11bB	19.07bB
K1 = 15 g/baglog	3.61bB	7.45bB	13.06bB	17.12bB	19.15bB
K2 = 20 g/baglog	4.12bB	8.69bB	13.38bB	17.43bB	19.47bAB
K3 = 25 g/baglog	4.74aA	9.33aA	13.76aA	17.74aA	19.57aA
Palm sap (N)					
N0 = 0 ml/baglog	2.96bB	6.78bB	11.88bB	16.00bB	19.06bB
N1 = 10 ml/baglog	3.95bB	7.65bB	13.16bB	17.16bB	19.25bB

N2 = 15 ml/baglog	4.18bB	8.32bB	13.35bB	17.49bB	19.45bB
N3 = 20 ml/baglog	4.55aA	8.75aA	13.73aA	17.74aA	19.50aA

Note: Numbers in the same column followed by the same letter indicate no significant difference at the 5% level (lowercase letters) and very significant difference at the 1% level (capital l
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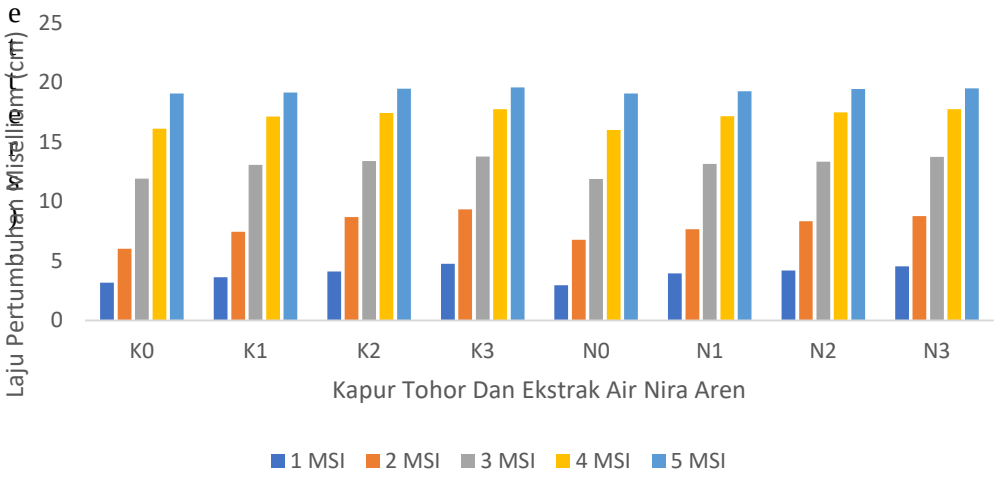

Graph 1. Average Application of Quicklime (g/baglog) and Palm Sap (ml/baglog) on Mycelial Growth Rate (cm).

Number of Mushroom Stems

According to the results of observations and analysis of variance, it is known that the effect of quicklime and aren sap in sawdust media on the diversification of white oyster mushrooms (Pleurotus ostreatus) has a very significant effect on the number of mushroom stalks. The interaction of quicklime and aren sap has a very significant effect on the measurement data on the number of mushroom stalks for the diversification of white oyster mushrooms (Pleurotus ostreatus) after being tested using the Duncan Distance Test. For more details, see the table and graph below.

Table 2. The average number of mushroom stalks in response to the provision of quicklime and palm sap from the first to the third harvest

Treatment	Number of Mushroom Stems		
	1	2	3
Quicklime (K)			
K0 = 0 g/baglog	4.00bB	2.50bB	2.04bB
K1 = 15 g/baglog	5.50bB	5.29bB	4.50bB
K2 = 20 g/baglog	6.83bB	6.67bB	6.08bB
K3 = 25 g/baglog	7.96aA	7.08aA	6.58aA
Palm sap (N)			
N0 = 0 ml/baglog	4.50bB	4.00bB	3.29bB
N1 = 10 ml/baglog	5.58bB	4.75bB	4.21bB
N2 = 15 ml/baglog	6.75bB	6.00bB	5.46bB
N3 = 20 ml/baglog	7.46aA	6.79aA	6.25aA

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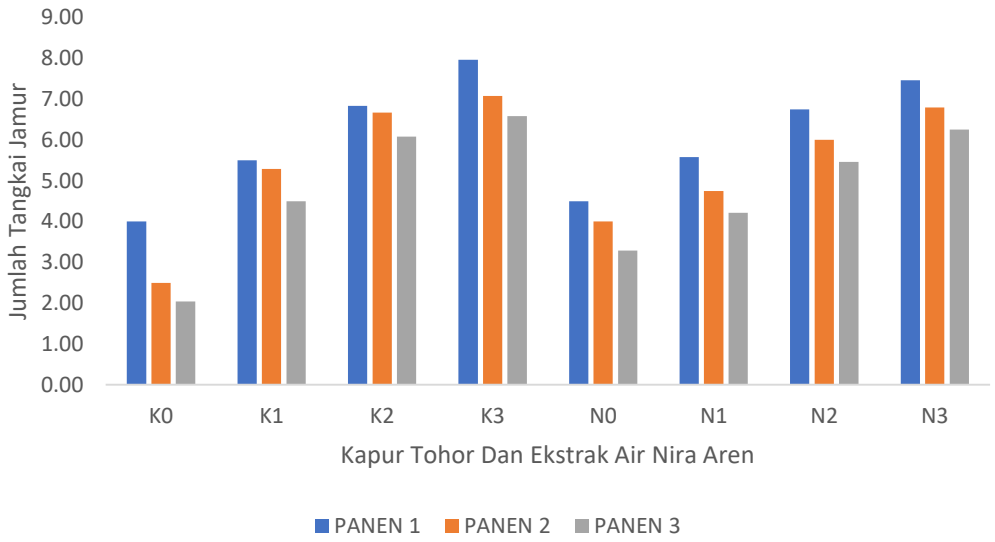

Graph 2. Average application of quicklime (g/baglog) and palm sap (ml/baglog) on the number of mushroom stalks.

Mushroom Stalk Height (cm)

According to the results of observations and analysis of variance, it is known that the effect of quicklime and aren sap in sawdust media on the diversification of white oyster mushrooms (Pleurotus ostreatus) has a very significant effect on the height of the mushroom stalk. The interaction of quicklime and aren sap has a very significant effect on the measurement data of the height of the mushroom stalk of the diversification of white oyster mushrooms (Pleurotus ostreatus) after being tested using the Duncan Distance Test. For more details, see the table and graph below.

Table 3. The average height of mushroom stalks in response to the provision of quicklime and palm sap from the first to the third harvest.

Treatment	Mushroom Stalk Height (cm)		
	1	2	3
Quicklime (K)			
K0 = 0 g/baglog	6.70bB	6.60bB	6.35bB
K1 = 15 g/baglog	7.62bB	7.53bB	7.35bB
K2 = 20 g/baglog	8.92bB	8.82bB	8.58bB
K3 = 25 g/baglog	9.61aA	9.47aA	9.27aA
Palm sap (N)			
N0 = 0 ml/baglog	7.14bB	7.07bB	6.75bB
N1 = 10 ml/baglog	8.07bB	7.97bB	7.78bB
N2 = 15 ml/baglog	8.61bB	8.50bB	8.30bB
N3 = 20 ml/baglog	9.03aA	8.88aA	8.72aA

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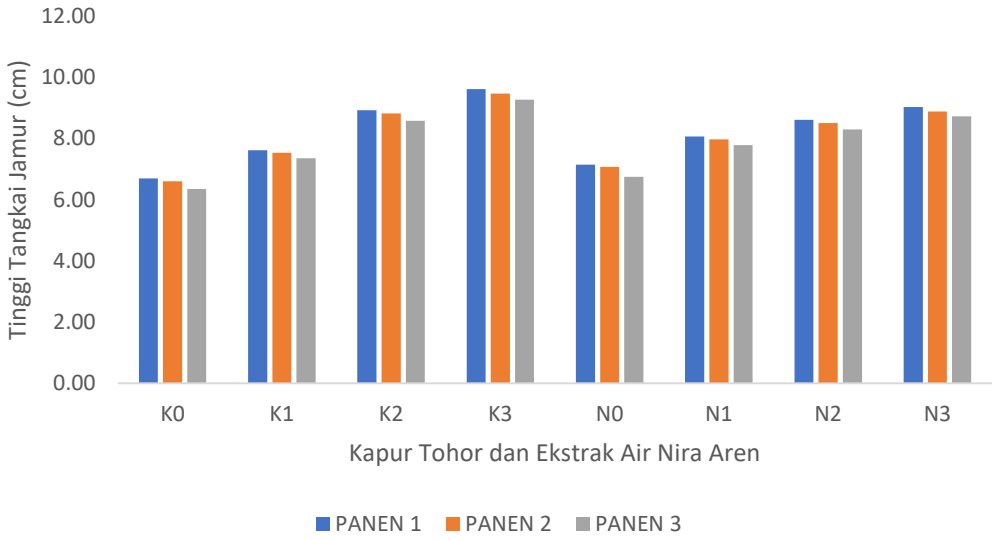

Graph 3. Average Application of Quicklime (g/baglog) and Palm Sap (ml/baglog) on the height of mushroom stalks.

Mushroom Cap Diameter (cm)

According to the results of observations and analysis of variance, it is known that the effect of quicklime and aren sap in sawdust media on the diversification of white oyster mushrooms (Pleurotus ostreatus) has a very significant effect on the diameter of the mushroom cap. The interaction of quicklime and aren sap has a very significant effect on the measurement data of the diameter of the mushroom cap of the diversification of white oyster mushrooms (Pleurotus ostreatus) after being tested using the Duncan Distance Test. For more details, see the table and graph below.

Table 4. The average diameter of the mushroom cap in response to the provision of quicklime and palm sap from the first to the third harvest.

Treatment	Mushroom Cap Diameter (cm)		
	1	2	3
Quicklime (K)			
K0 = 0 g/baglog	17.50bB	14.43bB	13.42bB
K1 = 15 g/baglog	19.10bB	15.88bB	15.28bB
K2 = 20 g/baglog	21.58bB	18.33bB	17.21bB
K3 = 25 g/baglog	22.57aA	19.18aA	18.42aA
Palm sap (N)			
N0 = 0 ml/baglog	18.03bB	15.08bB	13.64bB
N1 = 10 ml/baglog	20.10bB	16.98bB	16.28bB
N2 = 15 ml/baglog	20.91bB	17.53bB	16.80bB
N3 = 20 ml/baglog	21.70aA	18.23aA	17.60aA

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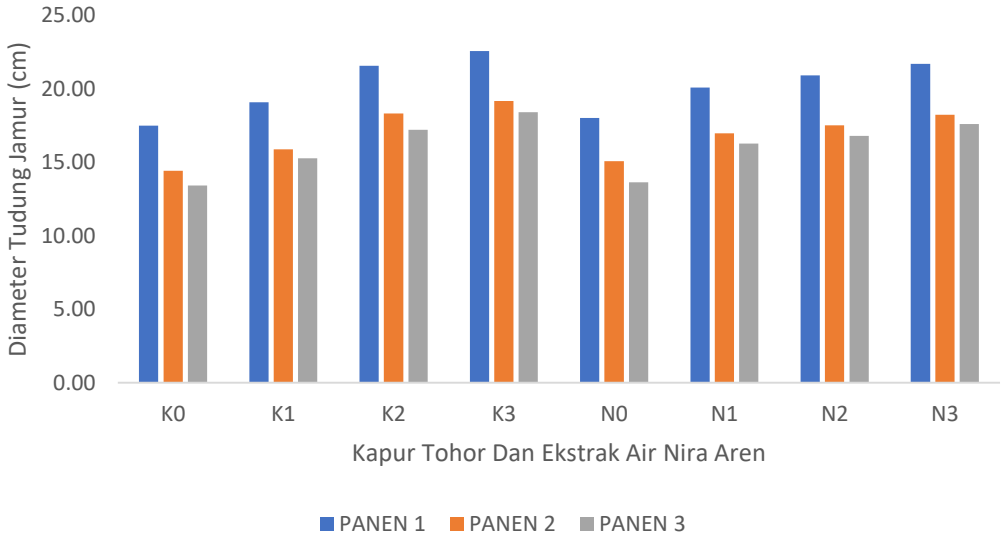

Graph 4. Average Application of Quicklime (g/baglog) and Palm Sap (ml/baglog) on the diameter of the mushroom cap.

Mushroom Cap Thickness (mm)

According to the results of observations and analysis of variance, it is known that the effect of quicklime and aren sap in sawdust media on the diversification of white oyster mushrooms (Pleurotus ostreatus) has a very significant effect on the thickness of the mushroom cap. The interaction of quicklime and aren sap has a very significant effect on the measurement data of the thickness of the mushroom cap of the diversification of white oyster mushrooms (Pleurotus ostreatus) after being tested using the Duncan Distance Test. For more details, see the table and graph below.

Table 5. The average thickness of the mushroom cap in response to the provision of quicklime and palm sap from the first to the third harvest.

Treatment	Mushroom Cap Thickness (mm)		
	1	2	3
Quicklime (K)			
K0 = 0 g/baglog	5.65bB	5.01bB	4.70bB
K1 = 15 g/baglog	7.50bB	7.01bB	6.05bB
K2 = 20 g/baglog	7.78bB	7.27bB	6.79bB
K3 = 25 g/baglog	8.14aA	7.71aA	7.04aA
Palm sap (N)			
N0 = 0 ml/baglog	6.49bB	6.02bB	5.33bB
N1 = 10 ml/baglog	7.18bB	6.67bB	5.88bB
N2 = 15 ml/baglog	7.55bB	6.94bB	6.45bB
N3 = 20 ml/baglog	7.85aA	7.38aA	6.91aA

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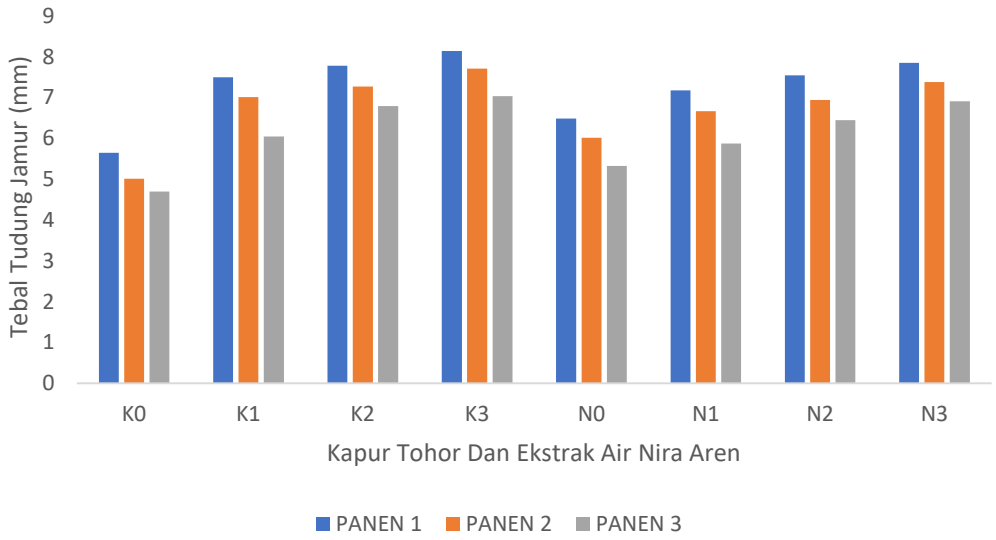

Graph 5. Average application of quicklime (g/baglog) and palm sap (ml/baglog) on the thickness of the mushroom cap.

Number of Mushroom Clumps

According to the results of observations and analysis of variance, it is known that the effect of quicklime and aren sap in sawdust media on the diversification of white oyster mushrooms (Pleurotus ostreatus) has a very significant effect on the number of mushrooms/clump. The interaction of quicklime and aren sap has a very significant effect on the measurement data on the number of mushroom clumps of white oyster mushroom diversification (Pleurotus ostreatus) after being tested using the Duncan Distance Test. For more details, see the table and graph below.

Table 6. The average number of mushroom clumps in response to the provision of quicklime and palm sap from the first to the third harvest.

Treatment	Number of Mushroom Clumps		
	1	2	3
Quicklime (K)			
K0 = 0 g/baglog	4.00bB	2.50bB	2.04bB
K1 = 15 g/baglog	5.50bB	5.29bB	4.50bB
K2 = 20 g/baglog	6.83bB	6.67bB	6.08bB
K3 = 25 g/baglog	7.96aA	7.08aA	6.58aA
Palm sap (N)			
N0 = 0 ml/baglog	4.50bB	4.00bB	3.29bB
N1 = 10 ml/baglog	5.58bB	4.75bB	4.21bB
N2 = 15 ml/baglog	6.75bB	6.00bB	5.46bB
N3 = 20 ml/baglog	7.46aA	6.79aA	6.25aA

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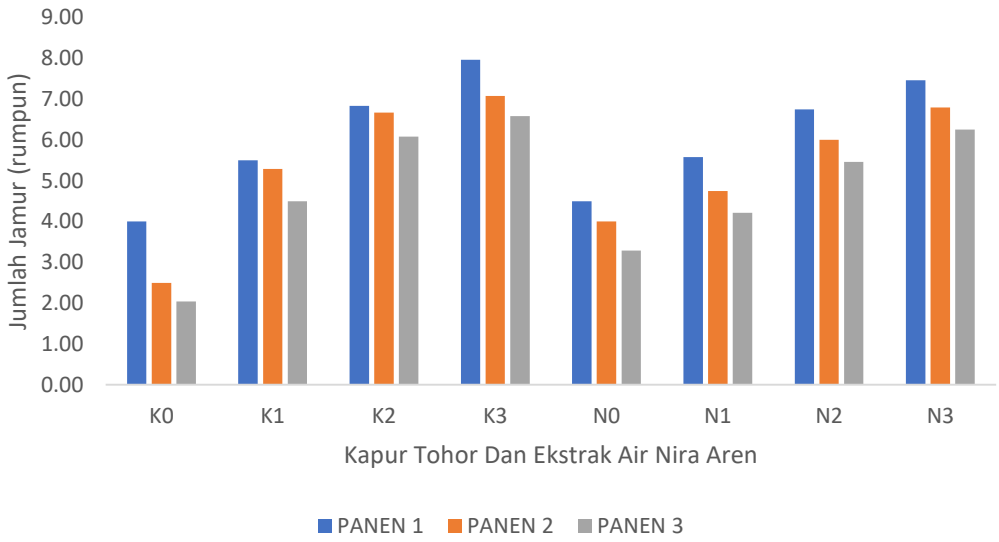

Graph 6. Average application of quicklime (g/baglog) and palm sap (ml/baglog) on the number of mushrooms/clump.

Fresh Weight of Mushrooms/Baglog

According to the results of observations and analysis of variance, it is known that the effect of quicklime and aren sap in sawdust media on the diversification of white oyster fungi (Pleurotus ostreatus) gives a very significant effect on the fresh weight of mushrooms/baglog. The interaction of quicklime and aren sap has a very significant effect on the measurement data of the fresh weight of mushrooms/baglog of diversification of white oyster fungi (Pleurotus ostreatus) after being tested using the Duncan Distance Test. For more details, see the table and graph below.

Table 7. Average fresh weight of mushrooms/baglog in response to the provision of quicklime and palm sap from the first to the third harvest.

Treatment	Fresh Weight of Mushrooms/Baglog (g)		
	1	2	3
Quicklime (K)			
K0 = 0 g/baglog	111.58bB	77.28bB	66.92bB
K1 = 15 g/baglog	160.78bB	134.44bB	108.46bB
K2 = 20 g/baglog	189.95bB	176.98bB	152.23bB
K3 = 25 g/baglog	200.60aA	187.09aA	171.37aA
Palm sap (N)			
N0 = 0 ml/baglog	126.50bB	106.52bB	85.94bB
N1 = 10 ml/baglog	167.63bB	141.43bB	120.17bB
N2 = 15 ml/baglog	181.95bB	161.15bB	142.10bB
N3 = 20 ml/baglog	186.84aA	166.68aA	150.76aA

Note: Numbers in the same column followed by the same letter indicate no significant difference at the 5% level (lowercase letters) and very significant difference at the 1% level (capital letters).

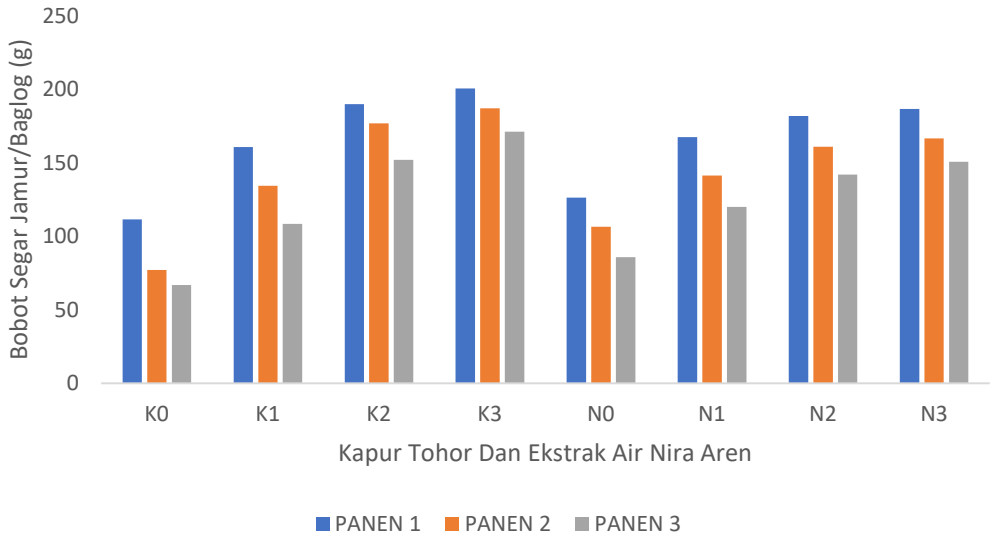

Chart 7. Average Application of Quicklime (g/baglog) and Palm Sap (ml/baglog) on the fresh weight of mushrooms/baglog.

Discussion

Mycelium Growth Rate (cm)

According to the results of observations on the growth rate of mycelium, it is known that the provision of quicklime is very different, where the average highest growth rate of mycelium is in the K treatment.$_3$=25g/baglog=19.57 cm, K2=20g/baglog=19.47 cm, K1=15g/baglog=19.15 cm, and K0=0g/baglog= 19.07 cm.This shows that the provision of quicklime can increase the rate of mycelial growth.The mineral elements are calcium (Ca) and magnesium (Mg). The Ca and Mg elements are mineral elements needed by mushrooms. The Ca element functions to neutralize oxalic acid released by the mushroom mycelium. The addition of quicklime is needed to regulate the acidity level (pH) of the growing medium. The calcium and carbon elements can enrich the mineral content of the medium, accelerate the growth of mycelium so that it can prevent contamination and function as an enzyme activator.(Berutu et al., 2020).

According to the results of observations on the growth rate of mycelium, it is known that the provision of palm sap water extract is very different, where the average highest mycelium growth rate is in the treatment N3 = 20ml / baglog = 19.50 cm, N2 = 15ml / baglog = 19.45 cm, N1 = 10ml / baglog = 19.25 cm, and N0 = 0ml / baglog = 19.06 cm. This is becausePalm sap contains sugar needed for the growth of oyster mushroom mycelium. One source of organic glucose that can be used to stimulate mushroom growth is palm sap. The nutritional content of palm sap is 91.1% water, 0.28% ash content, 0.41% protein, 0% fat, 8.21% carbohydrates and 0.67% sugar content(Ningsih et al, 2020).

Number of Mushroom Stems

According to the results of observations on the number of mushroom stalks, it is known that the first harvest on the provision of quicklime is very significantly different, where the average number of mushroom stalks is the largest in the treatment K3 = 25g / baglog = 7.96 stalks, K2 = 20g / baglog = 6.83 stalks, K1 = 15g / baglog = 5.50 stalks, and K0 = 0g / baglog = 4.00 stalks. This is because quicklime contains calcium carbonate which can help the growth rate of mushroom mycelium and white oyster mushroom stalks so that they can grow optimally.(Vironika & Rohmawati, 2022). According to the results of observations on the number of mushroom stalks, it is known that in the first harvest, the administration of palm sap water extract was very significantly different, where the average number of stalks was the largest in the treatment N3 = 20ml / baglog = 7.46 stalks, N2 = 15ml

/ baglog = 6.75 stalks, N1 = 10ml / baglog = 5.58 stalks, and N0 = 0ml / baglog = 4.50 stalks. According to the study(Rian et al., 2022) Protein in palm sap has a function as an enzyme. As is known, enzymes are needed in the metabolism of carbohydrates that are abundant in the palm sap content needed by the growth of white oyster mushroom stalks.

Mushroom Stalk Height (cm)

According to the results of observations on the height of the mushroom stalks, it is known that the first harvest on the provision of quicklime is very significantly different, where the average height of the highest mushroom stalks is in the treatment K3 = 25g / baglog = 9.61 cm, K2 = 20g / baglog = 8.92 cm, K1 = 15g / baglog = 7.62 cm, and K0 = 0g / baglog = 6.70 cm. This is because quicklime contains calcium carbonate, calcium oxide, and calcium hydroxide, the content of limestone can help the growth rate of oyster mushrooms and the process of stalk height in white oyster mushrooms.(Limpoe & Suppa, 2019),

According to the results of observations on the height of the mushroom stalks, it is known that in the first harvest, the provision of palm sap water extract was very different, where the average height of the highest mushroom stalks was in the treatment N3 = 20ml / baglog = 9.03 cm, N2 = 15ml / baglog = 8.61 cm, N1 = 10ml / baglog = 8.07 cm, and N0 = 0ml / baglog = 7.14 cm. according to research(Siburian, 2021) that the main content of palm sugar includes carbohydrates, protein and fat. In addition, brown sugar is also rich in vitamin C and niacin (Vitamin B3). Its minerals are also diverse, such as calcium, phosphorus, iron and others. The sucrose content of palm sap ranges from 9-16%, this can increase the growth rate of white oyster mushroom stalks.

Mushroom Cap Diameter (cm)

According to the results of observations on the diameter of the mushroom cap, it is known that the first harvest on the provision of quicklime is very significantly different, where the average diameter of the first harvest mushroom cap in the treatment K3 = 25g / baglog = 22.57 cm, K2 = 20g / baglog = 21.58 cm, K1 = 15g / baglog = 19.10 cm, and K0 = 0g / baglog = 17.50 cm. This is because quicklime contains calcium carbonate which is very much needed by the growth rate of white oyster mushroom caps so that they can grow optimally.(Habibah, 2020).

According to the results of observations on the diameter of the mushroom cap, it is known that in the first harvest, the administration of palm sap water extract was very significantly different, where the average diameter of the mushroom cap of the first harvest in the treatment N3 = 20ml / baglog = 21.70 cm, N2 = 15ml / baglog = 20.91 cm, N1 = 10ml / baglog = 20.10 cm, and N0 = 0ml / baglog = 18.03 cm. according to the results of the study(Swastini & Ramona, 2018) Palm sap contains citrate compounds of around 0.9 ppm, contains sufficient sucrose and minerals, so it can accelerate the growth rate of mushroom cap diameter. In addition to nutritional content, the high sucrose content (10-13%) in sap is a medium for the growth of good bacteria so it can accelerate the growth of white oyster mushrooms.

Mushroom Cap Thickness (mm)

According to the results of observations on the thickness of the mushroom cap, it is known that the first harvest on the provision of quicklime is very significantly different, where the average thickness of the mushroom cap of the first harvest in the treatment K3 = 25g / baglog = 8.14 mm, K2 = 20g / baglog = 7.78 mm, K1 = 15g / baglog = 7.50 mm, and K0 = 0g / baglog = 5.65 mm. according to the results(Irfansyah et al., 2021)Research shows that calcium carbonate in quicklime is a very important ingredient in the growth process of mycelium and white oyster mushroom caps so that they can grow well. According to the results of observations on the thickness of the mushroom cap, it is known that in the first harvest, the administration of palm sap water extract was very different, where the average thickness of the first harvest mushroom cap in the treatment N3 = 20ml / baglog = 7.85 mm, N2 = 15ml / baglog = 7.55 mm, N1 = 10ml / baglog = 7.18 mm, and N0 = 0ml / baglog = 6.49 mm. This is because there is sufficient carbohydrate, protein, and mineral content, which can help the growth process of white oyster mushroom caps.(Daye et al., 2023).

Number of Mushroom Clumps

According to the results of observations on the number of mushrooms/clump, it is known that the first harvest on the provision of quicklime is very significantly different, where the average number of mushrooms/clump of the first harvest in the treatment K3 = 25g / baglog = 7.96 clumps, K2 = 20g / baglog = 6.83 clumps, K1 = 15g / baglog = 5.50 clumps, and K0 = 0g / baglog = 4.00 clumps. Quicklime (cacO3) is an important component in mushroom cultivation and has been widely used in various fields of research to increase the pH and growth of white oyster mushrooms so that it can produce good mushroom clump growth.(Wajid Khan et al., 2019).

According to the results of observations on the number of mushrooms/clump, it is known that in the first harvest, the administration of palm sap water extract was very significantly different, where the average number of mushrooms/clump of the first harvest in the treatment N3 = 20ml / baglog = 7.46 clumps, N2 = 15ml / baglog = 6.75 clumps, N1 = 10ml / baglog = 5.58 clumps, and N0 = 0ml / baglog = 4.50 clumps. According to the results of the study(Setiawan, 2020)Additional nutritional sources in palm sap water contain sugar, carbohydrate, ash content, protein content and fat content which can support the growth and formation of new clumps of white oyster mushrooms.

Fresh Weight of Mushrooms/Baglog (g)

According to the results of observations on the fresh weight of mushrooms, it is known that the first harvest with the provision of quicklime is very significantly different, where the average fresh weight of mushrooms at the first harvest in the treatment K3 = 25g / baglog = 200.60 g, K2 = 20g / baglog = 189.95 g, K1 = 15g / baglog = 160.78 g, and K0 = 0g / baglog = 111.58 g.From the results of the fresh weight measurement of mushrooms in all harvests, the lowest fresh weight of mushrooms was obtained in the control treatment. This is because the addition of lime containing calcium and magnesium enriches the mineral content in the planting medium (baglog) so that the source of nutrients is sufficient and supports the growth of the mushroom fruit body. This is in accordance with research(Saputri et al., 2016)that the addition of lime produces the highest average weight of oyster mushroom fruit. which states that calcium functions to strengthen cell walls while magnesium acts as an activator of various types of enzymes related to protein and carbohydrate metabolism.

According to the results of observations on the fresh weight of mushrooms, it is known that in the first harvest, the administration of palm sap water extract was very significantly different, where the average fresh weight of mushrooms in the first harvest in the N treatment$_3$=20ml/baglog= 186.84 g, N2=15ml/baglog= 181.95 g, N1=10ml/baglog= 167.63 g, and N0=0ml/baglog= 126.50 g.Palm sap is a clear liquid obtained from the water of flower bunches of plants by tapping or tapping. Palm sap has a sweet taste, smells good, and is colorless. The composition of palm sap generally consists of carbohydrates, protein, fat, and water. This composition affects the growth of oyster mushrooms so that it can produce good fresh mushroom weight.(Sjarif et al., 2021).

CONCLUSION

The results of this study indicate that quicklime and aren sap water extract have a very significant effect on the growth rate of mycelium, the number of mushroom stalks, the height of mushroom stalks, the diameter of mushroom caps, the thickness of mushroom caps, the number of mushrooms (clumps), and the fresh weight of mushrooms/baglog. Overall, the quicklime and aren sap water extract treatments used in this study are effective in diversifying white oyster mushrooms.

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