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The Effect of Planting Media Composition and Liquid Organic Fertilizer Concentration of Maja Fruit on the Growth and Yield of White Oyster Mushrooms (*Pleurotus Ostreatus*)

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***Abstract*— Oyster mushroom (Pleurotus ostreatus) is a popular mushroom in Indonesia, with several factors affecting its yield, including seed quality, cultivation methods, and environmental conditions. The choice of planting media is crucial, as it must provide essential nutrients. Common media include straw and coffee husks, with the addition of liquid organic fertilizer (LOF) enhancing productivity. Maja fruit is particularly beneficial due to its NPK content, supporting mushroom growth. This research, conducted from February to May 2024 in Klungkung Village, Jember Regency, employed a completely randomized design (CRD) with three replications. The study tested media compositions—100% sawdust (M_1), 75% sawdust and 25% straw (M_2), and 75% sawdust and 25% coffee husk (M_3)—alongside varying LOF concentrations: no LOF (P_0), 75 ml/liter (P_1), 150 ml/liter (P_2), and 225 ml/liter (P_3). Results indicated that the interaction between LOF concentration and media composition significantly affected the total number and weight of fruiting bodies. The best combination was P_1M_2 (75 ml LOF/liter with 75% sawdust + 25% straw). Media composition significantly influenced the number and weight of fruiting bodies, with M_3 (75% sawdust + 25% coffee skin) recommended as the optimal choice. LOF concentration notably impacted total fruit body weight, while other parameters showed no significant differences.**

Keywords*— *Liquid Organic Fertilizer, Maja Fruit, Oyster Mushroom, Planting media

I. INTRODUCTION

White oyster mushrooms (Pleurotus ostreatus) are one of the most widely consumed mushroom commodities by the Indonesian people [1]. White oyster mushrooms can be used as an alternative food ingredient and a source of vegetable protein besides nuts [2]. On the other hand, white oyster mushrooms have a fairly high nutritional content. The content of white oyster mushrooms includes vitamins C, B1, B2, niacin, biotin, and there are minerals K, P, Ca, Na, Mg and Cu [3]. However, oyster mushroom cultivation activities in Indonesia are not sufficient compared to the needs or demands of consumers every day [4]. Based on BPS records [5], the production of white oyster mushrooms in East Java Province in 2021 was 312,977 kg. This amount decreased by 47.4% compared to 2022, which was 164,737 kg. There are several factors that can affect the results of oyster mushrooms, such as the quality of the seeds used, the cultivation process, and environmental factors or planting media used during the white oyster mushroom cultivation process [6].

Planting media is one of the important aspects that determine the level of success of oyster mushroom cultivation. The planting media for white oyster mushrooms can be called baglog. Baglog is a substrate where mushrooms grow, consisting of a mixture of sawdust, bran, and lime [7]. A good baglog must contain the nutrients needed by oyster mushrooms. According to [8], oyster mushrooms require nutrients in the form of phosphorus, nitrogen, sulfur, potassium, carbon and other elements. Other elements needed for the growth of oyster mushrooms such as protein, fat, carbohydrates are not available in wood tissue. These nutrients play an important role during the growth period of oyster mushrooms. White oyster mushrooms also require additional nutrients during their growth period. These nutrients can be obtained by using various planting media, such as straw and coffee skin.

The use of white oyster mushroom media as a substrate in growth that is commonly used is sawdust. Continuous use of sawdust can cause the availability of sawdust to be limited so that alternative materials are needed that can be used in oyster mushroom cultivation. Oyster mushrooms can grow on various media such as straw and coffee skins which are agricultural waste, so that the waste can be utilized and can have added value. Straw and coffee skins are agricultural waste that is quite abundant in various regions. However, the use of straw and coffee skins is still not widely used as a planting medium for oyster mushrooms. The nutritional content in 100 g of rice straw consists of 29.63% cellulose, 17.11% hemicellulose and 12.17% lignin. Coffee skin has a high cellulose content,

reaching 34.2%, 24.5% hemicellulose and lignin content of 23.4% [9]. These data can be used as a reference in the use of other planting media so that the use of agricultural waste as a planting medium can be used widely.

Maja (Aegle marmelos) is a type of plant that is quite unique and rarely known by the public. The maja plant is a plant from the citrus family that is distributed in lowlands with an altitude of ± 500 m above sea level [10]. The distribution of this plant is found in several countries in South Asia to Southeast Asia including Indonesia. The maja plant is rarely used by the public due to the lack of knowledge about the benefits of this plant. All parts of the maja plant, from the stem, leaves, and fruit, have various benefits. The maja fruit itself has several contents that can be beneficial for plants, but the maja fruit is still not widely used by the Indonesian people. Maja fruit is known to have a nitrogen content of 12.91 ml/L, phosphorus 80.25 ml/L, potassium 1.96 ml/L, magnesium 110 ml/L and iron 0.79 mg/L [11]. Nitrogen and phosphorus elements are macronutrients that are very important for the growth and development of white oyster mushrooms [12]. The tannin compound content in maja fruit can also act as plant protection from insect attacks [13].

Liquid organic fertilizer (LOF) is a solution derived from the fermentation of organic materials derived from plant remains, agro-industrial waste, and animal waste that has more than one nutrient content [14], [15]. Liquid organic fertilizer has advantages including being able to improve the physical and chemical properties of the soil, increase water absorption in the soil, increase the effectiveness of soil microorganisms, be environmentally friendly, and can improve the quality of plant production [16]–[18]. The use of liquid organic fertilizer is relatively easy and cheap so that it can reduce production costs [19]. The use of maja fruit as LOF is one example. People still rarely use maja fruit because they do not know in detail the contents of maja fruit. With the contents contained in maja fruit, it is expected to increase plant productivity in obtaining maximum results [20].

Based on research by [21], it was stated that a mixture of straw, rice husk, and sawdust planting media affected the growth rate and wet weight of oyster mushroom fruit bodies. Meanwhile, based on research by [2], the provision of liquid organic fertilizer of maja fruit can affect the growth of diameter, number and wet weight of fruit bodies in white oyster mushrooms. With this research, it is hoped that the right composition of planting media and the concentration of liquid organic fertilizer of maja fruit can be obtained which is suitable for the growth of white oyster mushrooms so that maximum results are obtained.

II. METHODOLOGY

A. Tools and Material

The tools used are sterilization drums, scissors, stoves, baglog press tools, glass bottles, knives, buckets, thermometers, inoculation spoons, sprayers, calipers, meters, scales, stationery, cameras, and bunsen burners. The materials used are sengon wood powder, coffee skin waste, rice straw, lime, water, corn flour, bran, white oyster mushroom seeds (*Pleurotus Ostreatus*), maja fruit LOF, polypropylene plastic, rubber, spirits, cover paper, ring caps, water, and 70% alcohol.

B. Research Design

This study used a basic pattern of Completely Randomized Design (CRD) with 3 replications. The treatment of various factors is as follows:

The first factor is the composition of the media consisting of 3 levels, namely:

M1: Sawdust 100%

M2: Sawdust 75%: Rice Straw 25%

M3: Sawdust 75%: Coffee Skin 25%

The second factor is the concentration of liquid organic fertilizer consisting of 4 levels, namely:

P0: Control

P1: 75 ml/liter

P2: 150 ml/liter

P3: 225 ml/liter

The observation data were analyzed using Analysis of Variance, if there was a significant difference between the treatments, then a further test was carried out using Duncan's Multiple Range Test at the 5% level.

III. RESULT AND DISCUSSION

The results of the analysis of variance carried out on all observation variables are presented in Table 1.

TABLE I. SUMMARY OF VARIANCE ANALYSIS RESULTS (F-COUNT) ON ALL OBSERVATION VARIABLES

No	Observed Variable	Value of F-Count		
		LOF (P)	***Media (M)***	***Interaction (P x M)***
1	Harvest Speed (days after planting)	0,84 ^{ns}	0,53 ^{ns}	0,59 ^{ns}
2	Fruit Body Diameter (mm)	1,04 ^{ns}	0,71 ^{ns}	0,41 ^{ns}
3	Number of Fruit Bodies Per Harvest (fruit)	0,86 ^{ns}	5,10 *	1,93 ^{ns}
4	Total Number of Fruit Bodies (fruit)	2,37 ^{ns}	0,94 ^{ns}	5,55 **
5	Fruit Body Weight Per Harvest (fruit)	0,54 ^{ns}	4,11 *	0,85 ^{ns}
6	Total Weight of Fruit Body (g)	3,41*	2,51^{ns}	4,33 **

Description: ** Very Real Difference
* Real Difference
Not Significant

The results of the analysis of variance in Table 1 show that the interaction of the treatment of liquid organic fertilizer (LOF) concentration and media composition had no significant effect on the observation variables of harvest speed, fruit body diameter, number of fruit bodies per harvest, and fruit body weight per harvest but had a very significant effect on the observation variables of total fruit body weight and total number of fruit bodies. The main effect of the treatment of

LOF concentration had a significant effect on the observation variables of total fruit body weight, but had no significant effect on the observation variables of harvest speed, fruit body diameter, number of fruit bodies per harvest, total number of fruit bodies, and fruit body weight per harvest. The main effect of the treatment of media composition had a significant effect on the number of fruit bodies per harvest and fruit body weight per harvest, but had no significant effect on the observation variables of harvest speed, fruit body diameter, total fruit body weight, and total number of fruit bodies.

A. The Effect of Interaction of Planting Media Composition Treatment and LOC Concentration on Oyster Mushroom Growth and Yield

Based on the results of the analysis of variance in Table 1, it shows that the interaction of the treatment of planting media composition and LOF concentration has no significant effect on the observation variables of harvest speed, fruit body diameter, number of fruit bodies per harvest, and fruit body weight per harvest but has a very significant effect on the observation variables of total fruit body weight and total number of fruit bodies. This is because the simple effect of LOF concentration at the same media composition level has a very significant effect on the observation variables of total fruit body weight and total number of fruit bodies so that it has a real effect on the observation variables of total fruit body weight and total number of fruit bodies, while the interaction of media composition treatment and LOF concentration has no significant effect on the variables of harvest speed, fruit body diameter, number of fruit bodies per harvest, and fruit body weight per harvest. This shows that the simple effect of LOF concentration at the same media composition level as well as the simple effect of media composition at the same LOF concentration level do not show significant differences. This means that the difference between the two averages of each treatment has an insignificant difference in the simple effect of LOF concentration at the same level of media composition as well as the simple effect of media composition at the LOF concentration level, thus providing an insignificant effect on the observation variables of harvest speed, fruit body diameter, number of fruit bodies per harvest, and fruit body weight per harvest.

Based on the research that has been done, it shows that the treatment of LOF concentration of 75 ml/liter of water and media composition of 75% sawdust + 25% straw (P1M2) gives the best results in a total weight of fruit bodies of 306.00 grams and a total number of fruit bodies of 23.00 pieces. In the oyster mushroom cultivation process, the composition of the media plays an important role in the growth and development of oyster mushrooms. The composition of the media used must meet the needs of oyster mushrooms. The nutrients needed for mycelium growth and fruit body formation include cellulose, hemicellulose, lignin and protein [3]. According to [7], the nutrients contained in sengon sawdust have a cellulose content of 49.90%, hemicellulose 24.59%, and lignin 26.80%. The content of cellulose, hemicellulose, and lignin is also found in other media, namely straw. This content can be used by oyster mushrooms as a source of nutrition, carbon and energy in the growth of oyster mushrooms [22].

The addition of liquid organic fertilizer to oyster mushrooms has an important role in increasing the productivity and quality of oyster mushrooms. Maja fruit LOF contains N, P, and K which can help the growth process in oyster mushrooms. According to [2] the addition of maja fruit LOF affects the wet weight of the fruit body and the number of oyster mushroom fruit bodies. This can be proven in a study conducted with a combination of LOF concentration treatment of 75 ml/liter of water and a media composition of 75% sawdust + 25% straw (P_1M_2) giving a total fruit body weight of 306.00 grams and a total number of fruit bodies of 23.00 pieces. The combination of LOF concentration treatment and media composition has a significant effect on the total fruit body weight and the total number of fruit bodies.

B. The Effect of Planting Media Composition on Oyster Mushroom Growth and Yield

The results of the analysis of variance in Table 1 show that the provision of media composition has a significant effect on the number of fruit bodies per harvest and the weight of the fruit body per harvest but has no significant effect on the harvest speed, fruit body diameter, number of fruit bodies per harvest, and total number of fruit bodies on the influence of media composition. This is because the provision of media composition given to oyster mushroom cultivation produces different magnitudes on the observation variable of the number of fruit bodies per harvest so that it gives a real effect while the observation variables of fruit body diameter, total weight of fruit bodies, total number of fruit bodies, and harvest speed show no real effect because the provision of media composition to oyster mushroom cultivation produces the same magnitude.

Based on the results of the research that has been conducted, it shows that the M3 treatment (75% sawdust + 25% coffee skin) gives the highest results in the single factor of media composition on the variable number of fruit bodies per harvest and the weight of the fruit body per harvest of 7.58 fruits and 96.33 grams. Coffee skin has several contents such as nitrogen, phosphorus, potassium and calcium which can help support the nutritional needs of oyster mushrooms. According to [23], the use of a media composition of coffee horn waste and sawdust with a ratio of 60%: 40% gives the best results on the number of fruit bodies. The combination of media composition treatment of 75% sawdust + 25% coffee skin has been proven to give the highest results on the observation variable of the number of fruit bodies per harvest.

The composition of the media in oyster mushroom cultivation must use the right ratio to support the nutritional needs of oyster mushrooms. According to [24], the most important thing in oyster mushroom cultivation is the use of media that contains three main components, namely cellulose, hemicellulose, and lignin. The use of the right media composition can help oyster mushrooms meet their nutritional needs during the growth period so that they can provide optimal results [25]. However, an inappropriate composition ratio can also inhibit the growth of oyster mushrooms.

C. *The Effect of LOF Concentration on Oyster Mushroom Growth and Yield*

The results of the analysis of variance in Table 1 show that the administration of LOF concentration has a significant effect on the total weight of the fruit body but has no significant effect on the harvest speed, fruit body diameter, number of fruit bodies per harvest, total number of fruit bodies, and fruit body weight per harvest on the influence of LOF concentration. This is because the concentration of LOF given to oyster mushroom cultivation produces different values on the total weight variable of the fruit body so that it has a significant effect, while the observation variables of fruit body diameter, number of fruit bodies per harvest, total number of fruit bodies, and harvest speed show no significant effect because the concentration of LOF given to oyster mushroom cultivation produces almost the same value.

Adding LOF concentration is one effort to increase oyster mushroom productivity. Adding the right concentration is needed to increase oyster mushroom productivity. According to [2], giving a concentration of LOF maja fruit of 250 ml/liter of water has an effect on the wet weight of the oyster mushroom fruit body. This is evident in the combination of LOF treatment of 225 ml/liter of water and a media composition of 75% sawdust + 25% coffee skin (P_3M_3) showing results that have a significant effect on the total weight of the fruit body.

The addition of excessive LOF concentration can affect the growth of oyster mushrooms to be suboptimal and can even inhibit the growth and development process of oyster mushrooms . The frequency of LOF administration also affects the growth of oyster mushrooms because LOF contains NPK. Excessive NPK content can result in excess nutrients which can inhibit the growth of oyster mushrooms [26].

IV. Conclusion

Based on the results of the research that has been done, the following conclusions can be drawn:

1. The interaction between LOF concentration and media composition significantly affects the total number of fruit bodies and total weight of fruit bodies but is not significantly different from the harvest speed, fruit body diameter, number of fruit bodies per harvest and fruit body weight per harvest. The combination of LOF treatment 75 ml/liter of water and 75% sawdust + 25% straw (P1M2) is recommended as the best treatment combination.

2. Media composition significantly affects the number of fruit bodies per harvest and fruit body weight per harvest but is not significantly different from the fruit diameter, total weight of fruit bodies, total number of fruit bodies and harvest speed. Treatment M3 (75% sawdust + 25% coffee skin) is recommended as the best media composition.

3. Liquid Organic Fertilizer Concentration significantly affects the total weight of fruit bodies but is not significantly different from the fruit diameter, number of fruit bodies per harvest, total number of fruit bodies and harvest speed.

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