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# Effect of Planting Media Composition and Probiotics of Effective Microorganisme 4 Application on the Production of Oyster Mushroom (Pleurotus Ostreatus)

**Abdul Rahmi[1], Noor Jannah[2], Rudy Apriyanto[3]**
[1,2]*Lecturer of Agriculture Faculty, Universitas 17 Agustus 1945 Samarinda, Indonesia*
[3]*Staff of Agriculture Service, Kutai Barat Regency, Indonesia*
*rahmi_untag@yahoo.co.id*

**Abstract:** *The purpose of this research are: (1) to determine the effect of planting media composition and probiotics effective microorganisme 4 (EM4) application as well as its interaction on the production of oyster mushroom, and (2) to find the proper of planting media composition and the probiotics EM4 concentration to obtain the optimal production of oyster mushrooms. The research conducted at Barong Tongkok Village, Barong Tongkok Sub District of West Kutai Regency. It began from April to November 2018 commencing from baglog preparation until the end of observation. The research used a completely randomized design (CRD) factorial 4 x 4 with 5 replications. The first factor was the composition of the planting media (M) with 4 levels of treatment, namely the percentage of different composition of mushroom growing media, they are sawdust: bran: cornflour: lime: SP-36; namely m1 = 75:21:1:2:1; m2 = 80:17:1:2:0; m3 = 85:12:0.5:1.5:1; and m4 = 90:8:0.5:1.5:0. The second factor was the application of probiotics EM4 with 4 levels of treatment, namely: p0 = no probiotics, p1 = 5 ml l-1 water; p2 = 10 ml l-1 water, and p3 = 15 ml l-1 water. The research results revealed that : (1) the mushroom planting media composition affected very significantly on the mushroom mycelium growth (at 14, 18, 22, 26, 30, 34, 38 and 42 days after inoculation (HSI), age at harvest, mushroom production, and biology efficiency ratio (REB). The highest production of oyster mushrooms attained at the m1 treatment, namely 533.0 g baglog-1; in reverse, the lowest one attained at the m4 treatment, namely 406.3 g baglog-1; (2) the application of EM4 on the mushroom growing media affected significantly to very significantly affect on the mushroom mycelium growth (at 18, 38 and 42 HSI), age at harvest, mushroom production and REB, but it was not significantly affect on the mushroom mycelium growth at 14, 22, 26 and 30 HIS. The highest production of oyster mushrooms attained at the p2 treatment, namely 562.0 g baglog-1, meanwhile the lowest one was attained at the p0 treatment with only 406.3 g baglog-1; (3) the interaction effect between the mushroom growing media and EM4 application was very significantly effect on the REB, but it was not significant on the mushroom mycelium growth at all days observed, age at harvest, and mushroom production.*
**Keywords:** *media composition; probiotics EM4; oyster mushroom*

## I. Introduction

Fungal species are scattered all over the world, there are harmful fungi and there is also a favorable mushroom. Adverse fungus is a variety of fungi causing diseases in humans and plants such as causing poisoning when consumed, a source of skin diseases or fungi that cause wood quickly decay. Beneficial fungi are various types of fungi that are beneficial to human life, for example to destroy organic waste, produce antibiotics for drugs or mushrooms that are beneficial in the manufacture of bread, tempeh, tape, taoco, oncom. One of the favorable mushrooms is the oyster mushroom because it can be consumed, has economic value, and is suitable to be cultivated in most of Indonesia's warm temperatures.

According to Agus (2002), there are two main reasons that more and more people are interested in cultivating mushroom business. First, in terms of business profitable because the

price is high enough, local market demand and exports are wide open, short harvest time of about 1-3 months so that the capital turnover is also fast, raw materials easy to obtain and do not require large land. The second reason, the fungus is very useful for health because of its high nutritional quality, contains a variety of essential substances that are useful for the body's metabolism and the exchange of cells and substances it contains medicinal.

According Suriawiria (2003), oyster mushroom nutrient content includes: vitamin consisting of thiamine (vitamin B1), riboflavin (vitamin B2), niacin, biotin, vitamin C and so on. Mineral content in mushrooms consists of K, P, Ca, Na, Mg, Cu, and some micro elements. While the fiber content in mushrooms ranges from 7.4-27.6%, depending on the type of mushroom.

The development prospect of mushroom business in Indonesia recently began to increase, this is in line with the increasing demand of mushroom as processed food product. Based on data from Agribusiness Society of Mushroom Indonesia (MAJI) that every day in West Java produced 15-20 Mg of mushroom and 10 Mg oyster mushroom which mostly marketed in fresh form.

Market demand continues to rise from year to year makes people start trying to cultivation of oyster mushrooms in a very simple way with the raw material planting in the form of straw and husk. However, because the results are not optimal then conducted research on the cultivation of white oyster mushrooms with various raw materials both with media straw, sawdust and so forth.

For the success of mushroom cultivation business is very necessary to pay attention to the composition of planting media used, because it will greatly affect the growth and yield of these mushrooms. In addition, to increase or increase the availability of nutrients to support the growth of mushrooms should also be added from outside nutrients such as probiotics EM4. Anonymous (2001) states that EM4 can be used to improve health and fertility in soil and plant media.

The purpose of this study were: (1) to determine the effect of planting media composition and the provision of probiotics (EM4) and their interaction on the oyster mushroom production; and (2) to obtain the proper planting composition and concentration of probiotic (EM4) so as to obtain optimal oyster mushroom production.

## II. Research Methods

### 2.1 Place and Time

The research was conducted in Kampung Barong tongkok, Barong Tongkok Subdistrict, Kutai Barat District. The study started from April to November 2018 from the preparation of the baglog to the end of the observation.

### 2.2 Materials and Tools

The materials used in this research are: meranti sawdust, bran/fine bran, lime CaCO3, cornmeal, SP36, F2 oyster mushroom spore and well water.

The equipment used is shovels, sieves, wood pieces to compress the media, tweezers, penile drums, bunsen, paralon pipes, cutter, strainer, beko, wide black plastic sheet, handsprayer, scales, calculator, computer, printer and other tools which supports in this study.

### 2.3 Research Design

This study used Completely Randomized Design (RAL) with 4 x 4 factorial pattern and 5 replications. The first factor was the composition of planting medium (M) consisting of 4

treatment levels that is the percentage of different composition of mushroom growing media, they are sawdust : bran : cornflour : lime : SP-36; namely : 75: 21: 1: 2: 1 (m1); 80: 17: 1: 2: 0 (m2); 85: 12: 0.5: 1,5: 1 (m3); and 90: 8: 0.5: 1,5: 0 (m4). The second factor was the application of probiotics EM4 with 4 levels of treatment, namely : no probiotics (p0); 5 ml l-1 water (p1); 10 ml l-1 water (p2), and 15 ml l-1 water (p3).

**2.4 Implementation of Research**

The stages of the research activities are as follows: (1) making of shelves and building kumbung, (2) making of planting media or baglog (preparation of materials, mixing all additives with sawdust, water addition and giving of EM4 probiotics, sacks for composting, composting, packaging of sawdust mixtures for each composition and treatment, sterilization, cooling), (3) inoculation, (4) incubation, (5) growth, and (6) harvesting.

**2.5 Data Collection and Analysis**

The data collected were as follows: (1) Mycelium growth in each treatment (cm) at age 14, 18, 22, 26, 30, 34, 38 and 42 days after inoculation, (2) harvest age (days after inoculation), mushroom production (g), and biological efficiency ratio or REB (%).

To know the influence of planting media composition and giving of EM4 probiotics and its interaction on the oyster mushroom production is done by analyzing data of observation result with analysis of variant.

If the result of variance to the treatment has no significant effect that shows F arithmetic ≤ F table 0,05 then no further test, but if result of variance to the treatment have significant effect (F-count > F-table 5%) or very significant influence (F arithmetic > F table 1%), then to compare the two treatment rates performed with the Least Significant Difference test (BNT) level of 5%.

## III. Discussion

The results of research on the effect of planting media composition and the provision of probiotic EM4 and their interactions on the growth and yield of oyster mushrooms.

**3.1 Effect of Plant Media Composition on the Oyster Mushroom Production**

The results showed that the treatment of mushroom plant composition had significant effect on the growth of mushroom mycelium at 14, 18, 22, 26, 30, 34, 38 and 42 days after inoculation, harvest age, mushroom production and biological efficiency ratio (REB ). The results presented in Table 1 (recapitulation) showed that m1 treatment resulted in better mycelium growth, harvest age, mushroom production and biological efficiency ratio (REB) compared with treatment of m2, m3 and m4. This is thought to be caused by: (1) the amount of additional material in the treatment of m1 (sawdust = 75%: bran = 21%: corn flour = 1%: lime = 2%: SP-36 = 1%) more than the treatment m2 (sawdust = 80%: bran = 17%: corn flour = 1%: lime = 2%: SP-36 = 0%), m3 (sawdust = 85%: bran = 12%: corn flour = 0, 5%: lime = 1.5%: SP-36 = 1%) and m4 (sawdust = 90%: bran = 8%: corn flour = 0.5%: lime = 1.5%: SP-36 = 0%). The amount of auxiliary materials affects the nutrient content required in the formation of primordium because the bran contains N which is necessary for protein synthesis and thiamin (vitamin B1) which plays a role to stimulate the growth of mycelium and the formation of oyster mushroom body so that the growth and production of fungus will increase. The results of the research on 100 grams of rice bran is obtained vitamin B1 = 0.82 milligram (Anonymous, 2013). Besides, it was proposed by Tanijogonegoro (2012) that mushroom planting media such as bran and bran and corn starch serve as substrate and also produce calorie for fungus growth; (2) in the treatment m1 there is addition of phosphorus (P) element which is indispensable for the growth phase of mycelium (root). According to

Warisno and Dahana (2002) that phosphate fertilizers can also be added to increase the availability of phosphorus (P) elements. This nutrient P element is required by the fungus to form vegetative parts such as hoods, body fungi, and roots. Phosphate fertilizers commonly used include SP-18, SP-36, guano, natural phosphate, and so on; (3) the fast and slow harvest time associated with the growth of primordium in the media. Primordium growth is related to the availability of nutrients and O2 in the molding medium of the fungus. With greater availability of nutrient sources at the m1 treatment, it will accelerate the growth of fungal primordium so that the harvesting age becomes faster.

### 3.2 Effect of EM4 Probiotics on the Oyster Mushroom Production

The result of variance showed that the addition of probiotic EM4 on planting medium had significant effect on the growth of mycelium of mushrooms at age 18, 38 and 42 days after i grafting, harvest age, mushroom production and biological efficiency ratio (REB) not significant to the growth of mycelium fungus at age 14, 22, 26 and 30 days after inoculation.

The results presented in Table 1 (recapitulation) showed that the addition of probiotic EM4 concentration of 5 ml l-1 water (p1), 10 ml l-1 water (p2) and 15 ml l-1 water (p3) resulted in higher mycelium growth, faster harvest age, higher fungus production and greater biological efficiency (REB) ratio compared with treatment without the addition of probiotic EM4 (p0). This is because with the addition of probiotics EM4 will accelerate the process of substrate decomposition on the media planting mushrooms in the form of both basic ingredients and additives, so the planting medium will be compost and ready to be used as a medium material to plant white mushrooms.

The results of the study (Table 1) also showed that treatment of p2 (addition of probiotic EM4 concentration of 10 ml l-1 water) resulted in higher mycelium growth, faster harvest age, higher fungus production and more biological efficiency (REB) large compared with treatment of p1 (addition of probiotic concentration 5 ml l-1 water) and p3 (addition of probiotic concentration 15 ml l-1 water). This is presumably caused by the treatment of p2, the concentration of probiotic EM4 added to the planting medium is very precise compared to the treatment of p0, p1, and p3, so that the decomposition process of base material and additive in planting medium runs very optimally. The addition of probiotic EM4 on the fungus media serves to increase the fertility of planting media in order to spur the growth of fungi and produce optimal mushroom production. EM4 probiotics contain cellulosic decomposing bacteria capable of fermenting organic materials into inorganic compounds that are easily absorbed by plants (Anonymous, 2001).

The results showed that the addition of EM4 probiotic on mushroom media had no significant effect on the growth of mycelium mushrooms at 14, 22, 26, and 30 days after planting. This is suspected because at that age, the process of plant media decomposition has not run optimally. It can also be caused because during the growth and development of mushrooms there are various growth processes of varying intensity, so the need for mushrooms will vary the nutrients during the phase of his life is not need different time and not the same amount.

### 3.3 Effect of Interaction between Planting Media Composition and Probiotic Giving (EM4) on the Oyster Mushroom Production

The results of variance showed that the interaction between plant growth media factor and EM4 probiotic was highly significant on the biological efficiency ratio (REB), but it had no significant effect on the mycelium growth at 14, 18, 22, 26, 30, 34, 38 and 42 days after inoculation, age of harvest and mushroom production. The circumstances indicate that between the composition factor of planting medium and EM4 probiotic factors can be together or individually in affecting the growth and production of mushrooms. As described by Gomez and Gomez (1995) that between the two treatment factors is said to interact if the

influence of a treatment factor changes at the time of change in the level of other treatment factors. Subsequently stated by Steel and Torrie (1991) that if the influence of interaction is not significant, then it is concluded that among the factors of treatment is free or its influence stands alone.

The results of the research showed that at various treatments of mushroom plant composition combined with various treatments of EM4 probiotic concentration (5 ml 1-1 water, 10 ml 1-1 water and 15 ml 1-1 water) tend to produce better growth and fungus production compared to treatment without EM4 probiotics. This suggests that between mushroom cultivation media and the provision of probiotics at appropriate concentrations can be mutually supportive in increasing the availability of nutrients necessary for growth and mushroom production.

The addition of probiotic EM4 on the fungus media serves to increase the fertility of planting media in order to spur the growth of fungi and ultimately can produce optimal mushroom production. This is because EM4 contains cellulosic decomposing bacteria capable of fermenting organic materials into inorganic compounds that are easily absorbed by plants (Anonymous, 2001).

## IV. Conclusion

### 4.1 Conclusion

Based on the results of research and discussion can be concluded as follows:

1. The treatment of mushroom cultivation media composition significantly affected the growth of mycelium at 14, 18, 22, 26, 30, 34, 38 and 42 days after inoculation, harvest age, production and biological fungic efficiency ratio (REB) oyster mushroom. The highest oyster mushroom production resulted from m1 treatment with planting media composition: sawdust (75%), bran (21%), corn flour (1%), lime (2%), SP-36 (1%) ie 533 g baglog-1, while the lowest was obtained in the m4 treatment with the composition of planting media: sawdust (90%), bran (8%), corn flour (0.5%), lime (1.5%), SP-36 (0%) ie 406.3 g baglog-1;
2. The treatment of EM4 probiotic on planting medium had significant effect on the growth of mycelium at age 18, 38 and 42 days after inoculation, harvest age, production and biological fungic efficiency ratio (REB) oyster, but had no significant effect on growth mycelium at 14, 22, 26 and 30 days after inoculation. The highest oyster mushroom production resulted from the treatment of probiotic EM4 concentration of 10 ml l-1 water (p2) was 562 g baglog-1, while the lowest was produced in the treatment without the probiotic EM4 (p0), 406.3 g baglog-1; and
3. The interaction between planting media composition factor and EM4 probiotic factor had significant effect on biological efficiency ratio (REB), but it had no significant effect on the mycelium growth at 14, 18, 22, 26, 30, 34, 38 and 42 days after inoculation, harvesting age and oyster mushroom production.

### 4.2 Suggestions

Based on the results of research can be put forward some suggestions as follows:

1. To increase production in oyster mushroom cultivation it is recommended to use the composition of planting medium: sawdust (75%), bran (21%), corn flour (1%), lime (2%), SP-36 (1%) and given additional probiotic EM4 with a concentration of 10 ml 1 - 1 water.
2. It needs to do further research about the effect of planting media composition and provision of probiotic EM4 on the quality of oyster mushroom production and or other types of fungi.

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