

# The Effect of Harvest Age on The Physical and Chemical Properties of White Oyster Mushrooms (*Pleurotus ostreatus*)

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**Abstract**—Oyster mushrooms have a delicious taste and contain nutrients. One of the popular oyster mushrooms in the community is white oyster mushrooms (*Pleurotus ostreatus*). The content and characteristics of oyster mushrooms are influenced by the age of harvest. This study aims to determine the effect of oyster mushrooms harvesting age on physical and chemical properties. This study used a completely randomized design. The treatment is the age of harvesting namely 2, 3, 4, and 5 days after budding. Each experimental unit was repeated 3 times. This research consisted of nursery, incubation, maintenance, and harvesting oyster mushroom. The results showed that harvest age has a significant effect on the height, diameter of the hood and the wet weight but has no effect on; the number of stalks and water content of white oyster mushrooms. The longer it is harvested, the height, diameter and wet weight will increase, but if it is harvested too long then the height, diameter and wet weight will decrease. The best harvest can be done at the age of 3 days. Where the height, diameter, and weight of the mushrooms produced were higher by 25.92, 95.86, and 68.13% compared to the second day of harvest.

**Keywords**—Oyster mushrooms; *Pleurotus ostreatus*; harvest age

## I. INTRODUCTION

Mushrooms can provide a balanced component in meeting human nutritional needs. Mushrooms can be considered as functional foods that can provide health benefits beyond the conventional supplements they contain [1]. The oyster mushrooms are very popular especially the genus *Pleurotus* and family *Pleurotaceae*. One of them is white oyster mushrooms (*Pleurotus ostreatus*). Oyster mushrooms have nutritional value including rich in protein, with a very important amino acid content equivalent to animal protein and rich in low fat fiber. Mushrooms have antioxidant property due to presence of compounds like ergothioneine [2]. White oyster mushrooms in Indonesia are more widely consumed and in production because it is a fungus whose fruit body is rarely attacked by diseases and pests. In addition, the growth time is shorter compared to other types of mushrooms [3].

The harvest age of white oyster mushrooms when it is 2,3,4 and 5 days after pinhead appears with the physical characteristics of its surface is slippery and somewhat oily when moist, the edges are a bit bumpy, the location of the lateral sprig is slightly beside the hood and the flesh of the fruit is white, has a hood diameter that resembles an oyster shell ranging from 5-15 cm [4]. Oyster mushrooms are ready to be picked when they are 2 days old since growing pinhead by holding the sprig of the mushroom then turning it [5]. According to studies conducted so far, mushrooms of the *Pleurotus*

genus exhibit numerous potentially therapeutic properties. Medicinal substances can be found in the mycelium, the fruiting bodies, and extracts from them. A therapeutic effect can be achieved by consuming fresh oyster mushroom fruiting bodies, foodstuffs containing dried oyster mushrooms or supplements with such content [6].

Harvesting is a closely related aspect to the plant growth phase that reflects the physiological maturity of the plant part and has a strong relationship with the production and content that exists in the material. The harvest age will also affect the texture of the fruit because during the process of maturation and maturation of the fruit there will be biochemical changes, starch changes to glucose, decreased acid levels and increased dissolved solids. In addition to biochemical changes in harvest age will also affect physical appearance, discoloration, texture of the size and shape of fruit or parts of plants that are worth using for consumption. Harvest and post harvest handling of fresh produce has a paramount impact on its quality [7].

The purpose of this research is to determine the effect of harvest age on the physical properties and chemical content of white oyster mushrooms.

## II. MATERIAL AND METHODS

### A. Material

The materials used in this study are sangon wood powder, cornstarch, and lime used for

planting media. White oyster mushroom seedlings from mushroom farmers in Bagan Pete new city, Jambi City, Indonesia. This research consists of the manufacture of baglog, inoculation (nursery), incubation, harvesting and analysis of measurement parameters.

**B. Planting Media**

The materials used for the manufacture of planting media in this study are a mixture of sengon sawdust 67%, bran 27%, CaCO<sub>3</sub> 4% and corn flour 2%. All of these ingredients are mixed and add enough water. After that, composting was carried out for ± 48 hours. After composting is complete, the planting media is put into heat-resistant plastic with a media weight of 1200 ± 100 g for each plastic and then compacted. The planting media package resembles a bottle called a baglog. Furthermore, baglog is sterilized at a temperature of 100 -110°C for 12 hours. Furthermore, the media is put into the inoculation chamber to be cooled for 24 hours until the temperature reaches 35-40°C.

**C. Inoculation**

The inoculation process is carried out in a special room that has been sprayed with alcohol 70% for 24 hours and 1 hour before inoculation. Incubation is carried out until the entire medium is filled with fungal mycelium in a special room with a temperature of 24-28°C. The fully grown mycelium envelops the baglog within 30-40 days, so it is best to move the baglog in the maintenance room (kumbung). The process of harvesting mushrooms is done by taking the body of the mushroom fruit up to its base [1]. Mushrooms were harvested when the mushroom cap surface were flat to slightly up-rolled at the cap margins. Harvesting white oyster mushrooms with a harvest age of 2, 3, 4, and 5 days is calculated after the pinhead appears [9].

**D. Physical Analysis**

The number of stalks grown in a single baglog is calculated based on the number of clumps on each baglog. The overall height of the mushrooms measured is from where the fungus grows to the peak of the fungus. The diameter of the mushroom hood measured is the widest diameter. The overall hood diameter is measured from the right end to the left end of the mushroom part that grows in a single baglog. The widest diameter measurement and overall height using a long measuring instrument with centimeters. Wet weight is done by weighing freshly harvested oyster mushrooms using digital scales type SF400.

**E. Chemical Analysis**

The measurement of water content is carried out for the harvest age of the day to 2, 3, 4, and 5

after the pinhead appears. Measurement of moisture content is done by oven drying method [8]

**F. Data Analysis**

This study uses a Complete Randomized Design. Treatment is the harvest age of 2, 3, 4, and 5 days after pinhead appears. Each test unit is repeated 3 times. Data analysis using the SPSS 21 software.

**III. RESULT AND DISCUSSION**

**A. Number of stalks**

The number of oyster mushroom stalks is calculated based on the number of mushrooms that have hoods. The results show that the number of stalks indicates that the age of the harvest has no significant effect on the number of stalks in white oyster mushrooms (P>0.05). The difference in the number of stalks harvest age occurs due to the growth of different white oyster mushrooms each baglog.

TABLE 1  
Number of Stalks of White OysterMushrooms

Age of the harvest (day)	Number of stalks (piece)
2	15.1
3	12.1
4	10.7
5	10.7

The difference in the number of oyster mushroom stalks is due to the body of the fruit formed usually depending on the number of pinheads that grow. If the pinhead is large, then the number of bodies of fruit formed is also a lot because the nutrients contained in the planting media are spread on each pinhead that forms the body of the fruit. Other studies have suggested that the number of stalks of each clump of oyster mushrooms is influenced by the diameter of the fruit body in which the two have an inverse relationship [11]. Other studies have also mentioned that nitrogen content (N) plays a role in the growth of white oyster mushroom stalks [12].

The results of the study (Table 1) shows that at the harvest age of 2 days the number of oyster mushroom stalks is more than the age of other harvests. This is because in addition to the source of nutrients that are still available quite a lot of moisture factor also affects. If humidity conditions (RH 60-70%) will accelerate the growth of both the spread of oyster fungus mycelium in the incubation phase and in the body formation phase of oyster mushrooms [13]. other research shows that the environment conditions has an effect on improving

the growth, yield and quality of oyster mushrooms [9].

**B. Height**

The harvest age has a significant effect on the height of white oyster mushrooms ( $P < 0.05$ ). The height of the white oyster mushroom with a harvest age of 2, 3, 4, and 5 days after growing the pinhead ranges from 8.1 - 11.2 cm (Table 2). The results of this study are the same as the results of rambe et al. (2020) where the height of white oyster mushrooms in various planting media is 7.4 - 10.3 cm [14].

TABLE 2  
 Height of White Oyster Mushrooms

Age of the harvest (day)	Height (cm)
2	8.1 <sup>a</sup>
3	10.2 <sup>ab</sup>
4	11.5 <sup>ab</sup>
5	11.2 <sup>b</sup>

The height of white oyster mushrooms are affected by the nutrient, media, oxygen, and carbon dioxide content. All elements contained in carbon such as monosaccharides, polysaccharides, organic acids, amino acids, fats and lignin can be used by fungi to meet energy needs in the growth and development of oyster mushrooms [11]. The age of harvest affects the time of appearance, the number and diameter of the body of the fruit. If the body of the fruit is large then the stem will be short and small in diameter. Conversely, if the number of bodies of fruit in one baglog is small then the mushroom sprig will be longer and the diameter wide. Conversely, if the body count of the fruit in one baglog is small then the mushroom sprig will be longer and the diameter is wide [12].

**C. Widest Diameter of the Hood**

The diameter of the hood is measured based on the diameter of the widest hood for each harvest age. The harvest age has a significant effect on the widest diameter of white oyster mushrooms ( $P < 0.05$ ). The results show that the longer the harvest age, the wider the diameter of the mushroom hood (Table 3). The widest diameter is owned by white oyster mushrooms with a harvest age of 5 days with a diameter of 13 cm but the widest diameter for harvest age of 3, 4 and 5 days is no different.

TABLE 3  
 Widest Diameter of White Oyster Mushrooms

Age of the harvest (day)	Widest diameter (cm)
2	7.25 <sup>a</sup>
3	14.20 <sup>b</sup>
4	15.25 <sup>b</sup>
5	13.33 <sup>b</sup>

The diameter of the resulting hood ranges from 7.25-13.33cm. The diameter of the resulting fungus is the same as that of researchers Rambe et al. (2020) where the diameter of the mushroom hood ranges from 10.73 -12.47 cm. The smallest diameter is produced in oyster mushrooms harvest age 2 days. The diameter of the hood on each baglog is influenced by the number of bodies of fruit formed. If the number of bodies of the fruit is small then the diameter of the hood will get larger. The more bodies the fruit forms, the smaller the diameter. This is due to the competition of nutrients between the bodies of the fruit formed. The growth of the fungal hood is numerous and cramped causing the mushroom hood to grow not maximally.

The width of the diameter of the mushroom hood is influenced by the temperature and nutrient content in the mushroom planting media. The nutrient content needed in the growth of the mushroom fruit body is water content, pH, cellulose levels, hemiselulose levels, lignin levels, and C/N ratio [9]. Carbohydrate content affects the diameter of the mushroom hood, carbohydrates are a source of energy for the growth of mycelium until the formation of the pinhead and support nutrients for the growth of the width of the mushroom hood until the growth of the maximum hood width. The growth of fungi depends on complex carbohydrate sources of nutrients. These complex carbohydrates are described first into a form of monosaccharides with extracellular enzymes, then newly absorbed fungi for further assimilation. The glucose will be utilized for the development of generative form pinhead fungus and develop into a mushroom hood [11][12].

**D. Wet Weight**

The wet weight is calculated based on the amount of oyster mushrooms grown on each baglog. The wet weight of oyster mushrooms at various harvest ages can be seen in Table 4. The results showed that the harvest age has a significant effect on the wet weight of white oyster mushrooms. The longer the harvest age, the higher the wet weight of oyster mushrooms. The highest wet weight is produced at the harvest age of 5 days after the pinhead appears at 122.2 g, but the wet

weight for the harvest age of the 3, 4 and 5 days is no different.

TABLE 4  
 Wet Weight of White Oyster Mushrooms

Age of the harvest (day)	Wet weight (g)
2	62.1 <sup>a</sup>
3	104.7 <sup>b</sup>
4	128.6 <sup>b</sup>
5	122.2 <sup>b</sup>

The results of the study (Table 4) show that the weight of fresh white oyster mushrooms is getting higher as the harvest age of white oyster mushrooms. This can happen because the fungus has enough energy reserves to produce optimal fresh weight because the elements contained in the media are decomposed evenly at the time of the formation of the fruit body, so that it can be utilized by oyster mushrooms. The nutrients available in the planting media absorbed by oyster mushrooms will be able to increase the fresh weight of the timam mushrooms.

The wet weight of oyster mushrooms produced ranges from 62.1 - 122.2 g. The results of this study are smaller than the results of rambe et al. (2020) where the wet weight of oyster mushrooms in various media grows ranging from 133 – 160 g. This is due to differences in media and the growing environment of fungi. Oyster mushrooms require carbon, nitrogen and inorganic compounds as their source of nutrients. The main nutrients are less nitrogen and more carbon, so materials containing cellulose, hemicellulose, and lignin (i.e. rice and wheat straw, cotton, sawdust, waste paper, leaves, and sugar cane residue) can be used as a mushroom substrate. The quality and quantity of oyster mushrooms depending on the source of their chemical and nutritional content [1] [15].

#### E. Moisture Content

The results show that the harvest age has no significant effect on the water content of white oyster mushrooms ( $P > 0.05$ ). In the results of the study (Table 4) it is known that the value for each harvest age is above 85% then the data goes into the range of water content needed by mushrooms to grow optimally. Generally fruits and vegetables have a water content of 80-90%.




TABLE 5  
 Moisture Content of White Oyster Mushrooms

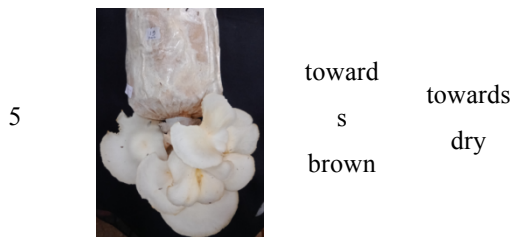
Age of the harvest (day)	Moisture content (%)
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2	86.64
3	87.50
4	87.67
5	86.92

The change in water content due to the longer the age of the mushroom harvest will be heavier so that the moisture content contained in one mushroom stem will increase, but at the harvest age of 5 days the water content decreases because the fungus becomes dry so that the moisture content contained in the fungus will be reduced. In the initiation phase of the fruit until the young fruit, the moisture content of the fruit will increase sharply and in the phase of the young fruit towards adulthood the moisture content of the fruit will decrease drastically.

The water content in the substrate is very influential to the growth and development of white oyster fungus mycelium. If the water content is too low that is less than 45 % then the growth and development of fungal mycelium will be disturbed even can be stopped altogether. On the other hand, if there is too much water, the mycelium will rot and die. Water is required for particle transport between cells so that water content must be sufficient [16].

Age of The Harvest (day)	Visual Apparition	Colour	Freshness of The Hood
2		white	fresh
3		white	fresh
4		white	fresh



**Fig.1** White oyster mushrooms harvest age 2, 3, 4 and 5 days after pinhead appears

#### IV. CONCLUSION

The conclusion of this study is that of white oyster mushrooms harvest age has a significant effect on height, widest diameter and wet weight, and has no significant effect on number of stalks, overall height, and moisture content. The longer it is harvested, the higher the height, diameter and wet weight of the mushrooms was resulted, but if it is harvested too long, the height, diameter and wet weight will decreased. The best harvesting age of the best white oyster mushrooms is 3 days after the appearance of pinhead.

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