Productivity of oyster mushrooms (*Pleurotus ostreatus*) on media corncobs mixed with sawdust

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Abstract. Mushrooms live wild in nature and widely used by the community as food and medicinal. Mushroom cultivation is a way to meet the growing demand for mushroom consumption. Oyster mushrooms can grow in medium containing lignin and nutrients needed for the growth of mushrooms. The purpose of the study was to measure the effect of mixture corn cob with sawdust as planting media for growth and productivity of white oyster mushroom (*P. ostreatus*) and get the best planting media composition for growth and productivity of white oyster mushroom. This research used a Completely Randomized Design (CRD) with six treatments and five replications. Corn cob are added as much 0%, 10%, 20%, 30%, 40%, and 50%. The results showed that the best composition of growing media for the growth and productivity of white oyster mushroom is the addition of 30% corn cob. Mixed corn cob 30% have lignin, cellulose and hemicellulose levels more optimal for growth and productivity of white oyster mushrooms.

1. Introduction
Mushrooms are biological sources that live wild in nature and are used by the community as food and medicine. Oyster mushroom is a consumption mushroom favored by the public because it has a delicious taste and high nutritional value. Dundar [1] stated that the nutrient content in 100 grams of dry weight of white oyster mushroom consisted of protein 17.12 gr, fat 2.60 g, carbohydrate 37.87 g, energy 243.66 g, fiber 30.25 gr, and ash 4.8 gr. Mushroom cultivation is one way to meet the increasing demand for oyster mushrooms.

Oyster mushrooms can be cultivated in a medium (Baglog) derived from wood powder or lignin material that has been weathered and wrapped in plastic and sterilized. The media used usually contains nutrients needed for fungal growth, namely lignin, carbohydrates (cellulose and glucose), nitrogen, fiber, and vitamins. In general, the powder used is derived from sengon wood which has a cellulose content of 49.90%, hemicellulose 24.59%, and 26.80% lignin [2]. The raw material for wood sawdust is increasingly difficult to obtain because of the reduced utilization of wood, which causes the price of sawdust to be higher and the cost of mushroom production will increase. So that alternative lignocellulose waste is needed as a medium for fungal growth, one of which is corn cobs. Corn cobs are one of the abundant and easily available lignocellulose wastes. Corn cobs are usually used as animal feed, discarded or burned to reduce waste accumulation. The use of corn cobs as a sawdust mixture on the oyster mushroom growing media can reduce...
production costs. Corn cobs can be used as a planting medium for mushrooms because they contain lignocellulose which is needed for fungal growth. Corncob contains cellulose 40 - 44%, hemicellulose 31 - 33% and lignin 3 - 5% [3].

The purpose of this study was to measure the effect of corn cobs composition as sawdust mixture on the planting medium of white oyster mushrooms (*P. ostreatus*) and obtain the best composition of growing media for growth and productivity of white oyster mushrooms (*P. ostreatus*).

2. Research methods

2.1. Preparation of material
Corn cobs were crushed with a chopper in a UPT Mekanisasi Pertanian Medan, North Sumatra. The corn cobs that are used must be clean, still new, so they are not moldy. Corn cobs were crushed to produce ± 0.5 cm in size.

2.2. Planting media preparation
The planting media formulation used in each treatment is presented in the following Table 1.

| Treatment | Formulation of planting media per 1,000 gr |
|-----------|-----------------------------------------|
| P0        | Sawdust (gr) 850 | Corncob (gr) 0 | Rice bran (gr) 100 | Chalk (gr) 50 |
| P1        | 750           | 100           | 100            | 50            |
| P2        | 650           | 200           | 100            | 50            |
| P3        | 550           | 300           | 100            | 50            |
| P4        | 450           | 400           | 100            | 50            |
| P5        | 350           | 500           | 100            | 50            |

2.3. Observed variables
Parameters observed in this study were mycelium growth, the age of harvest, stalk length, number of hoods, hood diameter, hood area and wet weight of white oyster mushrooms (*P. ostreatus*).

Each treatment consisted of five replications in which each replication consisted of one baglog of oyster mushroom seeds. The results of the research data were analyzed by variance with linear models

\[ Y_{ij} = \mu + \tau_i + \varepsilon_{ij} \]

(1)

Note:

- \( Y_{ij} \): Observation results from various planting media and replications
- \( \mu \): Average value
- \( \tau_i \): Effect of various planting media
- \( \varepsilon_{ij} \): Effect of trial errors from various planting and replicating media

2.4. Data analysis
The data obtained will be analyzed with a variance with a 95% confidence level. If there is an influence on the treatment, then continue with a The Duncan Multiple Range Test (DMRT) with a 95% confidence level.
3. Results and Discussion

The results of the research on the growth and productivity of white oyster mushrooms with corn cobs as sawdust mixture showed that in general there is a significant effect on mycelium growth, an age of harvest, stalk length, hood diameter, and hood area. According [4] stated It is concluded that corn cob used as a substrate for oyster mushroom cultivation performs better than sawdust in terms of the growth and yield of the mushroom. Corn cob can be mixed with sawdust to increasing production of oyster mushroom. However, the number of hoods and the wet weight of white oyster mushrooms shows an unreal effect.

According to [5] even though sawdust is known to be the most suitable substrate for mushroom production, maize residues (with or without rice bran supplement) have also proven to be suitable substrates for oyster Mushroom cultivation at the farmlvel.

The results of this study of the addition of corn cobs to the planting medium of white oyster mushrooms (P. ostreatus) showed in Table 2.

Table 2. Data from the study of the addition of corn cobs to the planting medium of white oyster mushrooms (P. ostreatus)

| Treatments | The growing of mycelium (day) | Age of harvesting (day) | The number of fruiting body (fruit) | Diameter of a hood (cm) | Length of a stalk(cm) | Area of a hood (cm²) | A wet weight (gr) |
|------------|-------------------------------|-------------------------|-----------------------------------|-------------------------|----------------------|----------------------|------------------|
| P0         | 37b                           | 55ab                    | 7,4a                              | 12,20ab                 | 9abc                 | 127,97ab            | 144a             |
| P1         | 32a                           | 49,6a                   | 5,6a                              | 14,03                   | 10,20bc              | 150,05b             | 118a             |
| P2         | 34ab                          | 50,2a                   | 7,4a                              | 13,86                   | 9,30bc               | 110,05b             | 121a             |
| P3         | 36,8b                         | 50,4a                   | 8,4a                              | 12,39ab                 | 11,10c               | 116,09ab            | 151a             |
| P4         | 43c                           | 57,8a                   | 7,8a                              | 12,39ab                 | 7,40a                | 114,77ab            | 115a             |
| P5         | 46,4c                         | 58,2b                   | 7,8a                              | 11,43c                  | 8,14ab               | 95,08a              | 107c             |

3.1. The growing of mycelium

The results of variance showed that the composition of the addition of corn cobs on the planting medium of white oyster mushrooms (P. ostreatus) significantly affected the growth rate of oyster mushroom mycelium with a 95% confidence interval. Duncan Multiple Range Test (DMRT) test results showed that the growth rate of mycelium in the addition of corn cobs was 10% and 20% significantly different from the addition of corn cobs 40% and 50%. The growth of mycelium in fungi according to [6] is influenced by several factors, namely temperature and humidity, light intensity and air circulation. According to [7] stated that the growth rate of mycelium in each treatment requires a different time because the levels of cellulose, lignin, pentosan, and other substances differ, so that the lower the lignin content with the ability of a large fungus in describing the lignin content, the mycelium will grow fast.

3.2. The age of harvesting

Observation of the age of harvesting is done from inoculation until the body of the fruit is ready for harvest. The body of mushroom fruit that is ready to harvest has the characteristics of an optimal fruit body size with the edge of the hood thinner. Based on the observations on the planting of white oyster mushrooms (P. ostreatus) on the additional media corn cobs waste was obtained the fastest start to harvest age was found in P1 treatment with the addition of 10% corn cobs while the longest harvest was in P5 treatment with the addition of 50% corn cobs. Age begins to harvest is affected by the growth of mycelium, the faster mycelium
meets baglog, then the age to start harvesting the oyster mushrooms is faster. Conversely, the growth of old mycelium causes age to begin harvesting old oyster mushrooms.)

The results of variance showed that the composition of the addition of corn cobs to the oyster mushroom growing media significantly affected the age of harvesting oyster mushrooms with a 95% confidence interval. Duncan Multiple Range Test (DMRT) test results showed that the age of harvesting at the addition of corn cobs 10%, 20%, and 30% was significantly different from the addition of corn cobs 40% and 50%.

3.3. The number of fruiting bodies
The number of fruiting bodies of oyster mushroom was significantly influenced by addition concorb. The highest number of hoods was found in P3 treatment with the addition of 30% corn cobs. According to [8] states that if the pinhead grows a lot, the number of fruit bodies that are formed are also many because the nutrients contained in the growing media are spread on each pinhead that forms the fruit body. The least number of caps is in P1 treatment with the addition of 10% corn cobs. Results of variance showed that the composition of the addition of corn cobs to the planting medium of white oyster mushrooms (P. ostreatus) had no significant effect on the number of white oyster mushroom hoods.

3.4. The diameter of hood
Measuring the diameter of the mushroom hood is done using a ruler. The measured diameter of the hood is the largest diameter in each clump. The diameter of the oyster mushroom cover on the planting medium with the addition of corn cobs ranged from 11.43 cm - 14.03 cm. The widest hood diameter was found in the treatment of P1 with the addition of 10% corn cobs and the lowest cap diameter found in the P5 treatment with the addition of 50% corn cobs. The results of variance showed that the composition of the addition of corn cobs on the oyster mushroom growing medium (P. ostreatus) significantly affected the diameter growth of oyster mushroom hoods with a 95% confidence interval. Duncan Multiple Range Test (DMRT) test results show that the addition of corn cobs 10% and 20% significantly different from the addition of corn cobs to 50%. The diameter of the hood is influenced by a large number of fruit bodies that grow. According to [9] stated that the number of mushroom hoods that many will have a small hood diameter because they do not have much space for the mushroom hood to expand because they coincide with each other.

3.5. The length of stalk
The length of a stalk of the oyster mushroom hood is measured using a ruler. The length of the stalk is measured starting from the base of the stem to the tip of the stem. The results of observations of white oyster mushrooms (P. ostreatus) on the additional media of corn cobs waste obtained an average stem length of about 7.4 - 11.1 cm. The highest stalk length was found in the treatment of P3 with the addition of corn cobs 30% while the lowest stalk length was in the treatment of P4 with the addition of corn cobs 40%. The results of variance showed that the addition of corn cobs to the oyster mushroom growing media significantly affected the length of the oyster mushroom with a 95% confidence interval. Duncan Multiple Range Test (DMRT) test results showed that the addition of corn cobs was 40% significantly different from the addition of 10% and 30% corn cobs.

3.6. The large area of the hood
The harvested mushroom hood is calculated by using paper millimeters. The average area of white oyster mushroom (P. ostreatus) cover ranged from 95.08 - 150.05 cm2. The highest covering area was found in P1 treatment with the addition of 10% corn cobs while the smallest mushroom area was found in P5 treatment with the addition of 50% corn cobs. According to Table 2, the average area of white oyster mushroom cover (P. ostreatus). The results of variance showed that the composition of the addition of corn
cobs to the planting medium of white oyster mushrooms \((P. \textit{ostreatus})\) significantly affected the growth of the area of oyster mushroom cover with a 95\% confidence interval. Duncan Multiple Range Test (DMRT) test results showed that the addition of corn cobs was 10\% and 20\% significantly different from the addition of 50\% corn cobs.

3.7. \textit{The wet weight.}

The wet weight of oyster mushrooms is measured at the time after harvest using a scale. The wet weight of white oyster mushrooms is the same as the fresh weight of white oyster mushrooms. The results of the calculation of the wet weight of white oyster mushroom \((P. \textit{ostreatus})\) showed the highest mushroom wet weight found in P3 treatment with the addition of 30\% corn cobs. The P3 treatment has a high wet weight because it has the most number of hoods. According to [10] states that there is a positive relationship between wet weight and number of fruit bodies. The more the number of fruit bodies, the higher the wet weight. Because each fruiting body has a water content so that the more the fruit body, the wet weight is higher. The lowest weight of oyster mushroom is found in P5 treatment with the addition of 50\% corn cobs which is 107 gr. But if the amount of fruit produced is a lot but the wet weight is low \((P. \textit{ostreatus})\) can occur due to the small size of the fruit body so that the water content in each fruiting body is small.

4. \textit{Conclusion}

The mixture of corn cobs with sawdust on the planting medium of white oyster mushrooms results in longer mycelium growth and age from harvesting. Corncob mixture produces a hood area, stem length and hood diameter smaller and produces a number of hoods and wet weights that are not better or equal to 100\% sawdust treatment. The best composition of planting media for growth and productivity of white oyster mushrooms \((P. \textit{ostreatus})\) is the addition of 30\% corn cobs. 30\% corn cobs mixture is thought to have levels of lignin, cellulose, and hemicellulose more optimal for the growth and productivity of white oyster mushrooms.

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