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Performance of oyster Mushroom (*Pleurotus* sp.) using different sources of substrates

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Abstract

Mushroom cultivation was reported as an economically viable bio-technology process for conversion of various lignocellulosic wastes. Given the lack of technology know-how on the cultivation of mushroom, this study was conducted at the Institute of Agricultural Technology, Isabela State University, Cauayan Campus, with the aim to evaluate the effect of different substrates on spawn running time, primordial initiation time, yield performance, and biological efficiency of oyster mushroom. Accordingly, substrates such as banana leaves, grasses, acacia leaves, corn stalk/ leaves were tested for their efficacy in oyster mushroom production. The grain spawn was obtained at the Regional Crop Protection Center, City of Ilagan. The oyster mushroom cultivation was undertaken under aseptic conditions, and the growth and development of mushrooms were monitored. The experiment was laid out in a completely randomized design with three replications. Result of the study revealed that the oyster mushroom can grow on corn stalk/ leaves, banana leaves, acacia leaves, grasses, and sawdust with varying growth performance. The highest economic yield and biological efficiency of oyster mushroom was obtained from banana leaves, while the least was obtained from acacia leaves. The study recommends banana leaves as suitable substrate for the cultivation of oyster mushroom. It also suggests that there is a need for further investigation into various aspects of oyster mushroom cultivation.

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Introduction

Oyster mushroom (*Pleurotus sp.*) belongs to the family of Tricholomatacea and is second widely cultivated mushroom worldwide *Pleurotus* sp. are popular and widely cultivated throughout the world mostly in Asia, America, and Europe because of their simple, low-cost production technology and high biological efficiency (BE). Moreover, the interest in oyster mushroom is increasing largely due to its taste, nutrient, and medicinal properties. *Pleurotus* sp. can efficiently degrade agricultural wastes and they grow at a wide range of temperatures. The main nutrients are less nitrogen and more carbon so materials containing cellulose, hemicellulose, and lignin (i.e., rice and wheat straw, waste paper, leaves, sugar cane residue) can be used as mushroom substrates. However, the yield and quality of oyster mushroom depend on the chemical and nutritional content of substrates. The use of a supportive substrate to enhance the growth and the development of sporophores is a fundamental requirement for the production process of mushrooms. Agricultural substrates are utilized for cultivation of oyster mushrooms. The growth and yield of oyster mushroom differ with various substrates as reported by Dhakal *et al.* (2020). More than 200 different types of substrates have been reported to support the effective growth of *Pleurotus* sp. Based on a worldwide survey done on oyster mushroom substrates (Chang, 1999). Most additives are organic materials like rice bran, corn gluten meal, corn bran, molasses, etc. Despite the significance of additives, farmers are generally not aware of their role in mushroom cultivation. In addition to this various locally available organic substrate like rice straw, grasses, banana leaves are either being burnt or fed to the livestock. As substrate plays an important role in determining yield of mushroom yield and to find the most suitable substrate for its cultivation. The study was carried out to evaluate the performance of Oyster mushroom *Pleurotus* sp. using different sources of substrates.

Materials and methods

Collection of substrates for mushroom production

The different materials as substrate like corn stalk/ leaves, dried banana leaves, grasses, acacia leaves, & saw dust was collected right after harvest to avoid possible contamination.

Preparation of Growing Substrates-

The different materials gathered were sundried and shredded properly to enhance pre-decomposition process and ease of bagging.

Mixing and fermentation of substrate

Prepare all the necessary materials like rice bran, agricultural lime, muscovado sugar, sawdust, and different agricultural waste. Mixed first the small amount of substrate to be used like muscovado sugar and agricultural lime followed by the rice bran. Mixed the substrate two to three times and mixed the larger amount of substrate like saw dust and different agricultural waste. Be sure to add enough amount of water to the mixture and cover it with plastic sheet to facilitate the fermentation process. This is a very important process before bagging. Substrates to be used in mushroom production need to be fermented first prior to bagging.

Bagging and Pasteurization

Bagging of substrate will be done 7-10 days after fermentation process using pedal driven mushroom bagger. The normal weight per fruiting bag will be 800 to 900 grams using a 6x10 inches polypropylene (pp) bag.

Using steel drum, pasteurization was done for at least 4-6 hours to ensure proper sterilization. Extend the pasteurization process by letting it cool inside the drum over night before unloading the fruiting bags from the steel drum. Place the pasteurized fruiting bags in a secure and cool dry place to avoid contamination.

Spawning and Incubation

Before spawning be sure to prepare all the necessary materials needed like alcohol lamp,

grain spawn, paper, cotton, 70% alcohol and rubber band. Spawning was done by placing 15-20 grains spawn per fruiting bags. Cover it with cotton balls and paper then tie it with rubber band.

After inoculation, inoculated fruiting bags were placed in the incubation room for 25-30 days. Regularly monitor the fruiting bags and discard the contaminated bags immediately to avoid the spread of contaminants.

Hanging

Once the fruiting bags were fully ramified, hang the bags in the growing house using rope in alternate orientation to facilitate good setting of oyster mushroom fruit.

Care and Maintenance

Monitor the temperature regularly and water the fruit bags using an atomizer if need arises. Smoke the growing house using coconut husk to prevent the presence of insect pests that infest the fruiting bags. Discard immediately the contaminated bags by burning.

Fruiting/ harvesting

Harvest healthy and well develop fruit 3-4 days after pin head formation by twisting the base of mushroom fruit clockwise.

Results and discussion

Spawn running, pinhead, and fruiting body formation

Five various agro- wastes substrates were used to know the performance in terms of growth and yield of *Pleurotus* sp. Time required for completion of spawn run, pin head and fruiting body formation were presented in Table 1. Time required for completion of spawn running differs depending on the sources of substrates ranged from 22.10 to 27.40 days. The lowest time required for completion of spawn run was recorded in banana leaves with 22.10 days which was comparable to control with 22.55 days. It was followed by corn stalk/leaves & grasses with 25.15 & 25.20 days respectively. The Longest time required for completion of spawn run was observed in acacia leaves with 27.40 days. Similar trend was observed in terms of pinhead formation and fruiting body formation of *Pleurotus sp.* on different substrates used. The lowest days required for pinhead formation were found on the banana leaves & control with a mean value of 25.40 & 25.50 days respectively. It was followed by the corn stalk / leaves & grasses with a mean value of 28.10 & 28.30 days. However, the longest time required for pinhead formation was observed in acacia leaves with 30.15 days. In terms of fruiting body formation, minimum days was observed in banana leaves & control with 28.10 & 28.30 days respectively. It was followed by the corn stalk/ leaves & grasses with 31.00 & 31.15 days respectively. The maximum time required in formation of fruiting body was observed in acacia leaves with 32.90 days.

Table 1. Days for completion of spawn run, pin head formation, fruiting body formation of *Pleurotus sp*. on different substrates.

Treatment (substrates)	Spawn running (day/s)	Pinhead formation (day/s)	Fruiting body formation (day/s)
T1- Control	22.55a	25.50a	28.30a
T2- Corn stalk/ leaves	25.15b	28.10b	31.00b
T3- Banana leaves	22.10a	25.40a	28.10a
T4- Acacia Leaves	27.40c	30.15c	33.90c
T5- Grasses	25.20b	28.30b	31.15b
ANOVA RESULT	*	*	*
C.V.(%)	3.09	1.50	5.14

The appreciable days to complete the spawn run of Oyster mushroom (*Pleurotus* sp.) on different substrates might due to some factors like the differences in terms of chemical composition and C: N ratio as cited by (Bhatti *et al*., 1987. The result is in consonance with the findings of Shah *et al*., 2004 that the spawn running in case of oyster mushroom took 16-25 days after inoculation.

Yield of Oyster mushroom

Total Yield & biological efficiency of Oyster mushroom (*Pleurotus* sp) using different

substrates are presented in Table 2. Among the different substrates, banana leaves obtained the highest yield with 890.00g, followed by control with 800.50g, 720.00g, 700.00g. Lowest yield was obtained in acacia leaves with 490.20g. In terms of biological efficiency similar trends were observed. Highest biological efficiency was observed in banana leaves 89.00%, followed by control 80.05%, corn stalk/ leaves 72.00%, grasses 70.00%. The lowest biological efficiency was observed in acacia leaves with 49.02%.

Table 2. Yield and Biological efficiency of *Pleurotus sp.* on different substrates.

Treatment (substrates)	Yield	Biological efficiency (%)
T1- Control	800.50	80.05
T2- Corn stalk/ leaves	720.00	72.00
T3- Banana leaves	890.00	89.00
T4- Acacia Leaves	490.20	49.02
T5- Grasses	700.00	70.00
ANOVA RESULT	*	*
C.V. (%)	6.15	3.50

Summary and Conclusion

The study was conducted to determine the performance of oyster mushrooms using different substrates. Specifically, it aimed to evaluate the effect of different substrates on the growth and yield of oyster mushrooms. The experiment was conducted at the experimental area of the Institute of Agricultural of Technology, Isabela State University, cauayan campus from July to September 2022. The study was laid out following the randomization procedure for Completely Randomized Design. The treatments were as follows: T1- Control, T2- Corn stalk/ leaves, T3- Banana leaves, T4- Acacia leaves, & T5- Grasses. Result showed that the different substrates like banana leaves, corn stalk/ leaves, acacia leaves, grasses, and sawdust influenced the growth and yield of Oyster mushroom (*Pleurotus* sp.). The banana leaves obtained the highest yield & biological efficiency of Oyster mushroom.

Based on the result of the study, the following statements are concluded: The use of banana leaves as substrates in oyster mushroom production can increase the economic yield & biological efficiency of oyster mushroom production.

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