Devagiri Journal of Science 11(1),54-60

www.devagirijournals.com
SSN 2454-2091

Assessment of Substrate Suitability for the Cultivation of Oyster Mushroom (*Pleurotus ostreatus*)

***Pramod Kumar N., Aswathy Sudarsan, Anshida Shaik, Archana K.K., Krithika U.V., Sneha. K.S., Arun P.**

Department of Botany, NSS College, Ottapalam, Palakkad-679103

Received: 08-6-2025

Revised and Accepted: 13-10-2025

Keywords: Substrates Suitability, Oyster Mushroom, *P. ostreatus*

Abstract

The present experimental study was evaluated the effect of different substrates paddy straw, sawdust, dried leaves, and a mixture of paddy straw with dried leaves on bud initiation, harvesting time, and yield of oyster mushroom. Four cultivation beds each were prepared for paddy straw, sawdust, and dried leaves, while two beds were prepared for the mixed substrate. Parameters such as mycelial growth, bud initiation, fruit body development, days taken for harvest, and total yield were recorded. The results showed that dried leaves produced the highest mushroom yield among all substrates. Economic analysis revealed variation in cultivation cost, with paddy straw being the most expensive substrate and sawdust being the least expensive. The study highlights dried leaves as a productive and cost-effective substrate for *Pleurotus ostreatus* cultivation.

1. Introduction

Mushrooms are fungi with significant nutritional value currently counting around 2000 edible species distributed around the world (Rathors *et al*., 2019). The most cultivated species include button mushroom (*Agaricus bisporus*), Shiitaka mushroom (*Lentinula edodes*) and Oyster mushroom (*Pleurotus ostreatus*) (Mahari, *et al*., 2020). The current global market value of fresh mushroom reached 38 billion US dollars in 2018, and china is the largest mushroom producer within the Asia region,contributing approximately 35% to the global mushroom market(Elaine & Tan,2009).Asia countries contribute upto 76% of mushroom production,followed by Europe (17.2%) and United states (5.9%)(Sande *et al*., 2019). Mushroom have a saprophytic mode of nutrition, which means they get their food from dead and decaying organic matter .Basidiocarps is the fruiting bodies of the *Agaricus* mushroom.The fruiting body of a mushroom that produces and releases spore for reproduction. The fruting body of the oyster mushroom (*Pleurotus ostreatus*)are shell shaped and the fruiting bodies of the *Agaricus* are umbrella shaped. The production of mushroom needs suitable condition for their optimal growth and yield (Mahari,*et al.,*2020).In the mushroom industry,several species of mushroom are being cultivated for commercial purposes, including oyster mushroom (*Pleurotus ostreatus*),which are sold in markets and easily cultivated in the low lands. While button mushroom (*Agaricus spp.)* are cultivated in the high lands and cold environment. *Pleurotus ostreatus*,accounting for more than 16% of the mushroom produced globally, represents one of the most common edible mushroom species cultivated industrially (Phan & Sabartnum,2012). Oyster mushroom(*Pleurotus ostreatus*)is one of the most cultivated mushroom species globally, which possess high demand and many beneficial properties (eg: Pharmaceutical properties).

Most fungi reproduce asexually by producing a variety of spores. Spores can be released into the environment, and when they come into contact with a favorable environment, they germinate and grow into a new individual. Asexual

*Corresponding author
E-mail: pramodkn27@gmail.com

reproduction is generally the most common type of reproduction among fungi. Fungi also have beneficial relationships with other organisms. Some species of fungi form mutually beneficial relationships with plants, where the fungus provides the plant with essential nutrients and in exchange, the plant provides the fungus with carbohydrates. Additionally, fungi play an important role in soil health by breaking down organic matter and releasing nutrients back into the soil (Neiman, 2011). Oyster mushroom (*Pleurotus ostreatus*), which are also commonly known as the white rot fungi, Abalone, tree oyster mushroom are typical saprophytes (Bernart, 2004). In nature, they usually grow on waste materials and colonized dead organic materials,such as dead cotton wood,oak or maple and they function as primary decomposers, turning dead organic tissues into the nutrients they need for their growth (Mahari, *et al*., 2020).

Oyster mushrooms have been found to be a rich food, having most of the essential amino acids, minerals and vitamins with low caloric value.Investigation on medicinal value of oyster mushroom have shown that it can modulate the immune system, possess hypoglycemic activity and antithrombotic effect, lower blood pressure and blood lipid concentration and inhibit tumour growth, inflammation and microbial action (Kaul, 2002).

All the *Pleurotus* species requires high relative humidity (70-80%) during fruiting. Fructifications and harvest flush can be controlled by temperature,air exchange and humidity.The key factors for fruit body formation and yield in *Pleurotus* production are concentrated in the ecological factors (climate, microclimate and air condition) and there can be controlled at will and altered during the harvest period (Zaidrazil, 1974).

In the early days, mushrooms were grown outdoors in most parts of the world. But, most modern mushroom farmers cannot rely on the natural environment, and hence, build temporary mushroom growing houses and provide good conditions for higher yield of mushrooms. Oyster mushrooms can be cultivated in bags, trays or plastic bottles on lignocellulosic substrates. They need substrates abundant in polysaccharides and lignin for their growth. During vegetative growth, mushroom mycelia secrete enzymes that degrade different components of plant material such as cellulose and lignin, present in the substrate. The degraded compounds are then absorbed by the hyphae, and the mycelium enlarges. Environmental factors such as temperature and light are known to be critical to stimulate the fruiting body formation during reproductive growth stage. Matured fruiting bodies are harvested on time.

During cropping also, oyster mushroom encounters various competitor moulds, bacterial, fungal and insect pests which adversely affects the rate of substrate colonization by mushroom mycelia, initiation of fruit primordia, mushroom yield leading to significant yield loss and sometimes even crop failure (Kapoor, 1999; Royse; 2003; Upadhyay, 2011). Infestation by insect pests also damages the quality of fruit bodies thus reducing the market value. Diseases of oyster mushrooms also occur due to other reasons: materials, spawn, excessive use of supplementing materials leading to high bed temperatures and moisture; unhygienic and poorly managed cropping room as well as the effect of the prevailing environment at the time of cultivation.

After harvest, a considerable amount of mushroom substrate (spent mushroom substrate / spent substrate) remains as residual material. It is acidic in nature and high in organic matter. Presently, spent substrate is used for cultivation of other mushroom species or vegetables, for preparation of vermiculture or animal feed, or as compost for application in farm fields (Rinker, 2002). But, it needs heat treatment before being removed from the mushroom house. Being expensive,

some mushroom growers discard the spent substrate far from the farm. But, without proper treatment, spent substrate can pose health problems. Conversely, recycling of spent substrate can increase sustainability and help farm economy (Rinker & Castle, 2005). Spent substrate can be utilized for various other value added purposes.

The various parameters such as spawn, growing medium, pH, temperature, moisture content, and light intensity all have a significant impact on the growth of mushrooms. The creation of spawn and the growing of fruiting bodies are the two distinct phases of mushroom farming. Technically speaking, spawn is a spreading mycelium of a mushroom that is colonizing a certain substrate medium.The importance of oyster mushrooms (*Pleurotus ostreatus*) was increasing worldwide because of its excellent flavor, taste and also it has various medicinal and therapeutic values.

2. Materials and Methods

The species selected for the study was *Pleurotus ostreatus* (Oyster mushroom). The mushroom are cultivated in ideal room at NSS College Ottapalam. In order to compare the hyphal growth and production of this species, using different substrates. Then selected paddy straw, dried leaves from *Mangifera indica*, saw dust and the paddy straw mixed with dried leaves of *Mangifera indica* as the substrates. Spawn of the mushroom *Pleurotus ostreatus* was obtained from IRTC (Integrated Rural Technology Centre), Mundur in Palakkad District (Plate-1)

2.1 Materials Required: Paddy straw, Saw dust, Dried leaves, Polythene bags, Spawn, Large Vessel, Dettol, Blade, Nail, Sanitizer, Rubber band, Wood, Mat, Match stick.

Before doing all the work we were sterilized our hands, legs,and the place where we kept the substrate for drying and the room itself it with Dettol (Aseptic condition).

2.2 Selection of Substrates: Good quality paddy straw was obtained from the nearby rice field and not more than one year old. Dried leves from *Mangifera indica* is collected from college campus.Saw dust is obtained from nearby wood mill.

2.3 Bed preparation and Spawning: Transparent polythene bags of size 60cm x 30cm were used for bed preparation.100g of spawn were used for one bed preparation.Small round bundles of the substrate were made and filled in the bag layer by layer. The spawn was added intermediate at 5cm gap to spawn of neighboring layer. Each time pressed with hand for making it even.Similarly more substrate and spawn were added layer by layer till the bag was about to fill. Finally at the top,a hand full of spawn was spread over the substrate,before it was tighten with the string.After tightening, about 10-15 holes were made on the surface of the polythene bags with the help of sterilized nail. The beds were then hanged in mushroom cultivation room.There are 14 beds or bags are prepared for mushroom cultivation.Each bed is consist of 100g of spawn.one packet of spawn consist of 200g.In 14 bags there are 2 bags filled with mixture (paddy straw+Dried leaves) substrate,4 bags contain paddy straw,another 4 bag contain saw dust and the remaining 4 bags are filled with dried leaves.

2.4 Spawn running stage (Incubation stage): The growth and spreading of white coloured mycelium through the substrate is called spawn running stage.The incubation period varies in different substrates ranging from 10-25 days. During spawn run, the temperature should be 25°C-28°C,relative humidity 75-80%,no direct sunlight and minimum ventilation. After completion of the spawn run,the polythene bags were removed to facilitate proper development of fruiting bodies.After 10-15days depending on the substratum fruiting bodies were appeared and then

the polythene bags were removed. After opening the bed, watering should be done thrice daily. Mushroom primodia were developed on the bed and after 1-3 days harvesting was done with care.

2.5 Preparation of Substrates: Soaking and hot water treatment: The paddy straw, dried leaves and saw dust were soaked in water for 12 hours.Then they were boiled for half an hour at 100°C.The excess water is drained from the substratum and dried in shade.

PLATE-1: Methodolgy-different steps involved

Fig.1 Sterilization of Substrate

Fig.2 Drying of substrate

Fig.3. Preparation of Bed

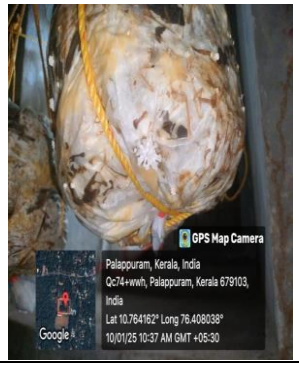

Fig.4 Sprouting of Basidiocarp (Fruiting Body)

3. Results and Discussion

The present investigation entitled "Assessment of Substrate Suitability for the Cultivation of Oyster Mushroom (*Pleurotus ostreatus*)" was conducted to evaluate the effectiveness of different substrates used for the cultivation of Oyster Mushroom are summarized and discussed below (Table:1-4)

Table-1: Days taken for bud initiation with respect to different substratum.

Substratum	Days taken for bud Initiation
Paddy straw	26
Mixed(paddy straw+dried leaves)	25
Dried leaves	26
Saw dust	0

Table-2:Days taken for harvest with respect to various substratum.

Substratum	Days taken for harvest
Paddy straw	29
Mixed(Paddy straw+dried leaves)	28
Dried leaves	29
Saw dust	0

Table-3:Yield of mushroom with respect to various substratum.

Substratum	Yield in grams
Paddy straw	315g
Mixed(paddy straw+dried leaves)	551g
Dried leaves	769g
Saw dust	0

Table 4:Profit from the experiment

Substratum	Total expenditure	Income	Profit
Paddy straw	90 Rs	126/-	36/-
Mixed(paddy straw + dried leaves	No expenditure	220/-	220/-
Dried leaves	No expenditure	307/-	307/-
Saw dust	100 Rs	0	0

The present study was made into 4 beds for each substratum and the following observations were made.The days taken for bud initiation, days taken for harvest, yield etc. are taken into consideration. It is observed from the table 1 that early bud initiation is obtained from the combination of substrate,paddy straw and dried leaves baggage.Early harvesting was also found on the same combination of substrate. The present observation also noted that the yield of mushrooms out of the total harvest, substrate dried leaves yield more(*ie*.769gms)than other substrates. Thus with respect to yield dried leaves alone as the substrate is considered as the best substratum.

Pleurotus is one of the easiest mushroom to grow because it does not require complicated substrate preparation technique. It is less time consuming and labour intensive. Any plant residue fresh or partially fermented can be used for its growth. Species of *Pleurotus* are characterized by rapidly of growth under wide range of temperature conditions, ability to colonize substrate on short duration and potential to tolerate concentrations of CO_2 which act as a protection over against competitor molds.

Most of the *Pleurotus* species may require high humidity (70-80%) during fruiting. Fructification and harvest flesh can be controlled by temperature,air

exchange and humidity. The composition of air and development of fruit bodies are related with greater exchange of air the amount of fruit bodies per surface unit area will be reduced. Insufficient ventilation and low light exposure induced branched growth.Table 4. shows the expenditure of mushroom cultivation using various substrates.

Pleurotus is strongly saprophytic, highly adaptable and the most extensively studied white rod edible fungus possessing exceptional ligninolytic properties (Philippousis *et al*., 2001; Oliveiri*et al*., 2006; Pant *et al*., 2006; Nasir *et al*., 2012; Li & Shah, 2016). Since mushroom cultivation needs relatively little space and offers quick and high return of profit on a small investment (Alam & Raza,2001; Sher, 2006; Sham *etal*., 2004; Flores, 2006), therefore, development of a region specific suitable protocol would help in its popularization in the state thus providing economic betterment to the farmers,unemployed youths,young entrepreneurs,women and other weak sections of the local communities.

In the present experiment was used *Pleurotus ostreatus*. A wide variety of agro-waste materials rich n lignocelluloses are used as the substrates. They include paddy straw,saw dust and the combination of these materials. Appearence of bud initiation, days taken for harvest and the yield are the various parameters tool in to account. Bud initiation and the days taken for harvest was earlier in case of combination of paddy straw with dried leaves baggage where as the yield was more in case of dried leaves as the substrates.

Mushrooms are relatively fast growing organisms.By the use of different varieties of,mushroom can be cultivated year around.Mushroom cultivation can be labour intensive which can create gainful employment especially for unemployed, underemployed youths, weaker sections of the society and the women world. Mushrooms can serve as agents for promoting equitable economic growth in society. Through mushroom cultivation we can pilot a nongreen revolution in less developed countries and in the world at large.They demonstrate great potential for generating a great socio-economic impact in human welfare,national and regional levels.

4. Conclusion

The present experimental studywas conducted to evaluate the effect of different substrates on bud initiation, harvesting period, and yield of oyster mushrooms. The substrates selected for the study were paddy straw, sawdust, dried leaves, and a combination of paddy straw and dried leaves. A total of four beds each were prepared using paddy straw, dried leaves, and sawdust, while two beds were prepared using the mixed substrate (paddy straw + dried leaves). Parameters such as mycelial growth, time taken for bud initiation, fruit body development, days required for harvest, and yield were recorded and analyzed. Among the substrates tested, dried leaves resulted in the highest total mushroom yield. The cost of cultivation varied among the substrates, with paddy straw incurring the highest expenditure (Rs. 180), whereas sawdust required the lowest investment (Rs. 100). These results indicate that both yield and economic feasibility differ significantly depending on the substrate used for cultivation.

5. References

Bernat, S. (2004). Mushrooms. cultivation, nutritional value, medicinal effect and environmental impact. *J. Sci*.,12: 23-34.

Elaine, M. and Tan, N.(2009). Makes Money by Growing Mushrooms. Food and Agricultural Organization (FAO). 18: 34-45.

Flores, C. (2006). High-value wild mushrooms-A livelihood development strategy for earthquake affected Pakistan. *Soil. Sci.,* 36: 221-234.

Kapoor, J.N. (1999). Mushroom Cultivation. Publications and Information Division.IBH Publishers, New Delhi.

Li, S. and Shah, N.P. (2016). Characterization, antioxidative and bifidogenic effects of polysaccharides from *Pleurotus eryngii* after heat treatments. Food chem.., 197: 240-249.

Mahari, W.A.,Peng, W., Nam, W.L, Yang, H., Lee, X.Y. and Lee, Y. (2020).A review on valorization of oyster mushroom cultivation industry. *J. Hazard. Mater.,* 5: 76-84.

Nair, A.K. (2012). Impact of sawdust using various woods for effective cultivation of oyster mushroom. *Pak. J. Bot.,*44:399-402.

Oliveri, G. (2006). Olive mill waste water remedition by means of *Pleurotus osteratus*. *Biol. Engin. J.,* 31:180-187.

Pant, D. (2006). Cultivation of oyster mushroom on wheat straw and baggase substrate amended with distillery effluent. *World J. Microbiol. Biotechnol.,* 22: 267-275.

Phan, C.andSabaratnam,V. (2012). Potential uses of spent mushroom substrate and its associated lignocellulosic enzymes. *Appl. Microbiol. Biotechnol.,*96: 863-873.

Phillipousis, A., Zerrakis, G., Diamantopolou, P.(2001). Bioconversion of lignocellulosic wastes through the cultivation of the edible mushrooms Agrocybeaegertia, *Volvariella volvacea*and *Pleurotus* sp. *World J. Microbiol. & Biotechnol*. 17: 523-530.

Rinker, D.L. (2002). Handling and using "spent" *Mushroom substrate around the world in mushroom biology and mushroom products*, Cuernava, Mexico. 22: 43-60.

Rinker, D.L., Castle, A. (2005). Green moulds and bacterial blotch of the cultivated mushroom, *Agaricus bisporus* proceeding of the fifth international conference of mushroom products, Shanghai, China, 12: 368-372.

Royse, D.J. (2003). Cultivation of oyster mushrooms. College of Agricultural Science, Pemnsylrania State University.12: 44-53.

Sande, D., Oliveria, G., Moura, M.A., Martins, B.A., Lima, M.T., Takahashi, J.A. (2019). Edible mushrooms as a ubiquitous source of essential fatty acids. *Food Res. Int.,* 10:85-94.

Shah, Z.A., Asharaf, M. and Ishtiqq, C.M. (2004). Comparative study on cultivation and yield performance of oyster mushroom (Pleurotus osteratus) on different substrates (wheat straw, leaves, sawdust). *Pakistan J. Nutri*., 3(3):158-160.

Sher, H. (2006). Ecological and economic evaluation of some Morels mushroom (*Morchella* spp.).*Wild Mushr*., 33: 23-44.

Upadhyay, R.C. (2011). Oyster mushroom cultivation: cultivation, marketing and computation. Directorate of Mushroom Research (ICAR). 22:129-138.

Zadrazil, F.(1974). Conservation of different plant wastes into feed by Basidiomycetes *Eur. J. Appl. Microbiol. Biotechnol*., 9: 243-248.