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# Comparative Efficacy of Different Substrates for Cultivation and Yield Performance of Oyster Mushroom (*Pleurotussajor-caju*)

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## ABSTRACT

Mushrooms are extraordinarily nutritious products, can be produced from lignocellulosic waste materials. The present study was conducted on oyster mushroom *Pleurotussajor-caju* with different substrates viz., wheat straw, paddy straw, soybean straw and maize stalks and leaves. Amongst the different substrates wheat straw was found significantly higher in respect of maximum flushes (3.4), number (171.03) and weight of sporophores (4.05 g) as well as yield of sporophores (694.38 g/kg straw). The other substrates gave optimum yield such as paddy straw (619.72 g/kg straw). The lowest yield was observed in maize stalk and leaves (425.30 g/kg straw).

**Keywords :** Oyster mushroom, substrates, yield, biological efficiency

## INTRODUCTION

Mushrooms also called "white vegetables" or "boneless vegetarian meat" contain ample amounts of proteins, vitamins and fiber apart from having certain medicinal properties and are extremely rich in protein and crude fiber, have low fat and calories and good vitamins (Thakur and Singh 2013). Besides that, it holds multi-functional medicinal properties. Mushrooms of *Pleurotus* spp. are commonly known as oyster mushrooms which occupy the second position among cultivated edible mushrooms worldwide due to their nutritional and medicinal values (Khan *et al*., 2008; Adejoye *et al*., 2006).Cultivation of oyster mushroom has increased tremendously throughout the world because of their abilities to grow at a wide range of temperature and harvested throughout the year (Amin *et al*.,2007). The environmental factor is very important for the production of oyster mushrooms. Various mushrooms are known to be sensitive to the climatic conditions (Van Peer *et al*., 2009). The major environmental factors like temperature, humidity, fresh air and compact materials affect in mushroom production (AMGA, 2004).*Pleurotusspp.* grows in a wide range of temperature (15-30$^0$C) which also varies from species to species. Maximum yield of oyster mushroom (*Pleurotussajor-caju*) was observed during rainy seasons when the temperature was nearly 20-26$^0$C and relative humidity 70-90% (Sarkar *et al*., 2007).

The growth of diverse types of mushrooms requiresa different type of substrates and availability of the varied typeof materials may dictate which type is used (Shah *et al*.,2004). The mushroom substrate may be defined as a kind of lignocellulosic material which supports the growth, development, and fruiting of mushroom. There are about 200 kinds of waste in which edible mushrooms can be produced. *P. sajorcaju* commonly known as Dhingri is an important edible mushroom gaining popularity in recent years because of its high nutritional value and ability to grow on diverse agricultural wastes (Poppe, 2000). Most of all, *Pleurotus spp.* can utilize various kinds of substrate materials than any other mushrooms.

Mushroom cultivation is an eco-friendly technology. Oyster mushroom may be grown on wide range of plant waste as substrate e.g. sawdust, wheat straw, paddy straw, maize stalk, sugarcane baggage, corn stalk, corn cobs, waste cotton, leaves and pseudo stem of banana, water hyacinth, duck weed, etc. does not require costly processing method and enrichment material. In this study, an attempt has been made to evaluate the growth performance of oyster mushroom (*Pleurotussajor-caju*) on some locally available substrate as well as to find out the best substrate for mushroom cultivation.

## MATERIALS AND METHODS

The study was undertaken at Krishi Vigyan Kendras of Madhya Pradesh, India. The spawn of *Pleurotussajor-caju*was obtained from Department of Plant Pathology, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, India (Latitude 23.91$^0$ N and longitude 79.95$^0$E with 411.78 m asl Elevation). The selected species of oyster mushroom *Pleurotussajor-caju* was cultivated with different substrates viz., wheat straw, paddy straw, soybean straw and maize stalks and leaves, and these substrates were collected from the local agricultural field. The aforesaid substrates were well dried and chopped into 5-6 cm bits and soaked in fresh water for 12 hrs and then boiled in water for 2 hrs and cooled to ambient temperature and excess of water was drained out to moisture 70 %.The above-prepared substrates were used for spawning with mushroom. The polythene bags of 30 × 20 cm were used for the above purpose. The straws were laid to the height of 5-6 cm and grain spawn of the species was broadcasted on these straw layers. Likewise, 5-6 layers of spawn were spread in these bags. The bags were tied up and perforated with a needle at regular intervals of 9 cm for aeration. The 10 g of spawn was used for 500 g of each dry substrate. The room was

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kept free from contaminants by spraying the disinfectants solution with diffused light and 85% humidity. These bags were incubated at room temperature (20$^0$ C to 28$^0$C) for the period of 15 days. Approximately 15 days after inoculation the mycelium growth takes place. The bags were opened and the whole mass of substrates were kept on rack for fruiting (Ingale and Ramteke, 2010). The watering was given twice a day and humidity was maintained between 80 to 90%. After opening, the formation of fruiting bodies of mushrooms was noted. After 15-20 days, the complete growth takes place. The watering was stopped a day before harvesting and the sporophore were harvested before spore shedding. Observation on the period of spawn run, the appearance of pinhead formation, fruiting body formation, stipe length, pileus size, number and weight of sporophore, yield and biological efficiency were recorded. Biological efficiency was determined by dividing average yield of mushroom per bed by dry weight of the substrate.

## RESULTS AND DISCUSSION

### Growth contributing character

The experimental results shown in Table 1 revealed that least period of time (17 days) was required for spawn run grown on the wheat straw substrate while soybean straw was found equally effective to grow spawn which takes 17.7 days to spawn run period. Both the substrates application were statistically at par (P=0.05) for spawn run period. Maize stalk and leaves substrate took longer period (19.6 days) for spawn run which is not the desirable character of good substrate for spawn run. In the present study, wheat straw was found to be a good substrate for cultivation of *Pleorotussajor-caju* which is in agreement with the earlier reports of several scientists. Wheat straw had superior performance over another substrate by Ali *et al.* (2007) and Dundar*et al.* (2008) and *Fanadzo et al.* (2010).

The pinhead and fruiting body formation significantly took least period of time for growth in the wheat straw substrate (25.6 and32.6 days respectively) to another substrate. While average time taken for pinhead formation on paddy straw, soybean straw and maize stalks and leaves substrate were 32.1, 33.3 and 35.2 days respectively. The application of soybean straw and maize stalks and leaves substrate was statistically at par (P=0.05) for pinhead formation period. Similarly, the average time taken by fruiting bodies formation in paddy straw, soybean straw and maize stalks and leaves substrates 38.9, 40.8 and 41.6 days respectively.

**Table 1:** Growth period of various phases of *Pleurotussajor-caju* cultivation on different substrates

| Substrates | Spawn running (Days) | Pinhead formation (Days) | Fruiting body formation (Days) |
|---|---|---|---|
| Wheat straw | 17.0c | 25.6c | 32.6c |
| Paddy straw | 18.8ab | 32.1b | 38.9b |
| Soybean Straw | 17.7bc | 33.3ab | 40.8a |
| Maize stalks and leaves | 19.6a | 35.2a | 41.6a |
| CD (0.05) | 1.70 | 2.10 | 0.86 |

### Yield contributing characters

Data regarding the effects of different substrates on several yield contributing characters viz., stipe length, pileus size, number of sporophore and weight of sporophore presented in Fig. 1. The results revealed that the stipe length of fruit bodies was significantly varied due to different substrates ranged from 2.18 to 3.16 cm. The maximum stripe length was observed on soybean straw substrate (3.16 cm) followed by wheat straw (2.84 cm), Maize stalks and leaves (2.44 cm) and minimum length obtained on a paddy straw substrate (2.18 cm).Similarly, the pileus size of the fruiting body (*Pleurotussajor-caju*) was significantly diversed. The pileus size of mushroom fruit bodies under different substrates ranged between (23.50 to 27.83 cm$^2$).The maximum size of pileus (27.83 cm$^2$) recorded on the wheat straw substrate while minimum on paddy straw substrate (23.50 cm$^2$).

Number of sporophores were significantly varied with the use of different substrates and ranged from 142.25 to 171.03. The highest numbers of sporophores were obtained in wheat straw (171.03). The lowest sporophores were recorded in case of Maize stalks and leaves (142.25/kg substrate). Similarly, the weight of sporophores of mushroom fruit bodies was also influenced significantly due to different types of straws. The weight of sporophores grown on wheat straw was significantly higher (4.05 g) than another substrate. Whereas lowest was seen in maize stalks and leaves (2.98 g).

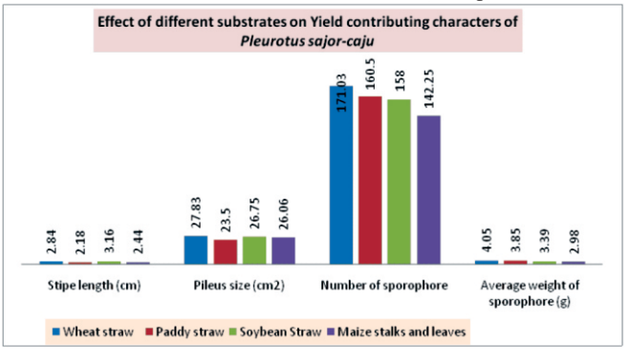


**Fig. 1:** Effect of different substrates on Yield contributing characters of *Pleurotussajor-caju*

### Number of flushes and flushes intervals

The data regarding number of flushes and flushes intervals are presented in Fig. 2 showed that *P. sajar-caju* gave the maximum flushes (3.4) on wheat straw. Maximum time

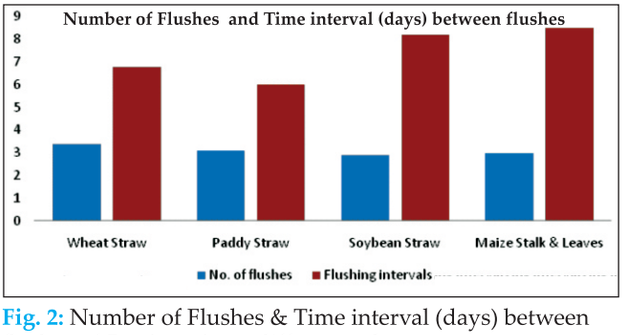


**Fig. 2:** Number of Flushes & Time interval (days) between flushes of *P. sajor-caju* on different substrates

intervals for flushing were observed in maize stalk and leaves (8.5 days) followed by soybean straw (8.2 days). It was the minimum on paddy straw (6.0 days).

**Yield and Biological Efficiency**

Data presented in Table 2 depicted that the significantly highest yield of mushroom was recorded on wheat straw (694.38g/kg) followed by paddy straw(619.72g/kg). The lowest yield of mushroom was obtained in Maize stalks and leaves (425.30 g/kg).Biological efficiency of mushrooms gives the best response estimate of economic importance output. Maximum biological efficiency (BE) was noted on wheat straw (138.88%) while minimum biological efficiency (BE) was recorded (85.06%) on Maize stalks and leaves. A positive interaction was observed between number of sporophores and yield. There was also a correlation between pileus size, yield, and biological efficiency.

There was also no relation between stipe length and weight of sporophores. Maximum biological efficiency (BE) was also noted on the wheat straw while the minimum was recorded on maize stalks and leaves. Same results on biological efficiency of different strains of oyster mushrooms were recorded by Omoanghe *et al.*(2009) and Sangitrao (2000) and Taniguchi *et al.*(2005). This study showed that the composition of the substrate has a great influence on yield and BE. These results are consistent with findings by Peksen and Yakupoglu (2009), who reported a positive correlation among yield and Biological Efficiency (%).

**Table 2:** Effect of different substrates on the yield of *Pleorotussajor-caju*

| Substrate | Yield (g/kg) | Biological Efficiency (%) |
|---|---|---|
| Wheat straw | 694.38a | 138.88a |
| Paddy straw | 619.72b | 123.94b |
| Soybean Straw | 535.65c | 107.13c |
| Maize stalks and leaves | 425.30d | 85.06d |
| CD (0.05) | 6.14 | 1.22 |

## CONCLUSION

In conclusion, we found that amongst the different substrates wheat straw was significantly higher in respect of number (171.03) and weight of sporophores (4.05 g) as well as yield of sporophores (694.38 g/kg straw). *P. sajar-caju* gave the maximum flushes (3.4) on wheat straw. Pleurotus mushroom cultivation will shine as a profitable agricultural business. Farmers should choose locally available substrate for reduction in the cost of cultivation and transport expenses. It will improve the income and status of rural people.

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