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# THE EFFECTS OF DIFFERENT SUBSTRATES ON THE GROWTH AND YIELD OF OYSTER MUSHROOMS (*PLEUROTUS FLORIDA*) IN UTTARAKHAND

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**Abstract:** the study was conducted to match the consequences of various agro-wastes on the expansion and yield of oyster mushrooms (*pleurotus florida*). thirteen substrate formulas including wheat straw, corncob, news paper, sugarcane waste alone and in combination of 80:20 (wheat straw and corncob), 80:20 (wheat straw and news paper), 80:20 (wheat straw and sugarcane waste), 100 (wheat straw), 100 (corncob), 100 (news paper), 100 (sugarcane waste), 25:25:25:25 (wheat straw, corncob, news paper and sugarcane waste), 40:20:20:20 (wheat straw, corncob, news paper and sugarcane waste), 50:50 (wheat straw and corncob), 50:50 (wheat straw and news paper), 50:50 (wheat straw and sugarcane waste), 50:50 (corncob and sugarcane waste) were investigated. the results indicated that different substrate formulas gave a big difference in total colonization period, characteristics of fruiting bodies, yield per bag, and total yield of oyster mushrooms. all the treatment significantly increased days taken to spawn raining, days taken to pinning, number of mushroom per bag, yield per bag (kg), total yield (kg) and total dry weight (kg). the best treatment was found to be t4 treatment (100 (wheat straw).

**Keywords:** Oyster mushroom, Substrates, Yield, Growth.

## Introduction

Oyster mushroom (*Pleurotus* spp.) belonging to Basidiomycetes and Agaricaceae is referred to as 'Dhingri' in India and grows naturally within the temperate and tropical forests on dead, crumbling wooden lumbers, sometimes on dying trunks of deciduous, coniferous woods and wood logs. It may also grow on decaying organic matter. The fruit bodies of this mushroom are distinctly shell or spatula shaped with different reminder cream, grey, brown, pink, white, and yellow depending upon the variability . It is one of the most suitable fungal organisms for producing protein rich food from various agro-wastes and forest wastes without composting.

Mushrooms are recognized as important food items from ancient times. Usages of mushrooms are increased day by day because of the significant role in human health and nutrition Khan et al. (2008). Oyster mushroom (*Pleurotus* spp.) belongs to the family of Tricholomataceae and is the second widely cultivated mushroom worldwide following the *Agaricus bisporus*, Sanchez (2010). However, Obodai et al. (2003) reported that oyster mushroom is the third important commercially produced mushroom in the world bazaar. *Pleurotus* species are popular and widely cultivated throughout the planet mostly in Asia, America and Europe due to their simple, low cost production technology and high biological efficiency, Mane et al. (2007). Furthermore, the attention of oyster mushroom is increasing largely due to its medicinal properties, nutrient, and taste Garcha et al. (1993). *Pleurotus* species can efficiently degrade agricultural wastes and they grow at a wide range of temperatures (Sanchez, 2010). In comparison to other edible mushrooms, *Pleurotus* species need a short growth time and their fruiting bodies are not often onset by diseases and pests, Tesfaw et al. (2015). *Pleurotus* species require carbon, inorganic compounds, and nitrogen as their nutritional sources. The main nutrients are less nitrogen and more carbon so materials containing cellulose, hemicellulose and lignin, i.e., rice and wheat straw, cotton seed hulls, sawdust (SD), waste paper, leaves, and sugarcane residue can be used as mushroom substrates (Chang and Miles, 1989). Oyster mushroom can grow on a good sort of substrate. However, the yield and therefore the quality of oyster fungus depend

upon the chemical and nutritional content of substrates observed by Badu et al. (2011) and Patil et al. (2010).

*Pleurotus* species are a rich source of protein, minerals (P, Ca, Fe, K, and Na) and vitamin (thiamine, riboflavin, folic acid, and niacin) (Szabova et al., 2013). Apart from food value, their medicinal value for diabetics and in cancer therapy has been emphasized (Sivrikaya et al., 2002). Several species of oyster mushrooms are vital within the field of drugs. *Pleurotus cystidiosus* (PC) is a strong antioxidant (Li et al., 2007) while *Pleurotus ostreatus* (PO) also possesses antitumor activity (Chorvathova et al., 1993).

Large volumes of unused lignocellulosic by-products are available in tropical and subtropical areas. These by-products are usually left to rot in the field or are disposed through burning (Tesfaw et al., 2015). Using locally available lignocellulosic substrates to cultivate oyster fungus is one solution to rework these inedible wastes into accepted edible biomass of high market and nutrient values (Tesfaw et al., 2015). Presently, in Asia (including Taiwan), the most substrate used for the commercial cultivation of oyster fungus is SD. Using large quantities of SD for mushroom cultivation causes reduction of wooded areas while information on the potential use of other locally available resources is lacking (Rizki and Tamai, 2011). The potential shortages of SD and high potential of agro-waste residues are the explanations why we'd like to spot alternatives for sustainable cultivation of oyster mushrooms. The study was conducted to compare the effects of different agro-wastes on the growth, yield, and nutritional composition of oyster mushrooms PO and PC. The final aim is to seek out the simplest substrate formulas for effective cultivation of oyster mushrooms PO and PC.

## Materials and Methods

The trial "The effects of different substrates on the growth and yield of oyster mushrooms in Uttarakhand" was conducted in lab and indoor condition of Dehradun region. The present investigation was carried out at the Horticulture lab and production (dark) room during the winter season of 2018-19. The experiment was laid out in Horticulture lab and mushroom production room under Uttaranchal (PG) College of Bio-Medical Sciences and Hospital, Dehradun (Uttarakhand). Geographically, the experimental site falls under humid, subtropical climate and is located at 30.19 N latitude and 78.04 E longitudes on an elevation of about 460 meters above mean sea level. The spawn of oyster mushroom were collected from private NGO spawn broker, Dehradun during October 30 & 31, 2018. The experiment was laid out in Completely Randomized Design (RBD) with three replications (n=3). Each replication consisted of thirteen treatments.

treatments.

$T_1$ treatment 80:20 (Wheat straw and corncob)
$T_2$ treatment 80: 20 (Wheat straw and news paper)
$T_3$ treatment 80: 20 (Wheat straw and sugarcane waste)
$T_4$ treatment 100 (Wheat straw)
$T_5$ treatment 100 (corncob)
$T_6$ treatment 100 (news paper)
$T_7$ treatment 100 (sugarcane waste)
$T_8$ treatment 25: 25: 25: 25 (Wheat straw, corncob, news paper and sugarcane waste)
$T_9$ treatment 40: 20: 20: 20 (Wheat straw, corncob, news paper and sugarcane waste)
$T_{10}$ treatment 50: 50 (Wheat straw and corncob)
$T_{11}$ treatment 50: 50 (Wheat straw and news paper)
$T_{12}$ treatment 50: 50 (Wheat straw and sugarcane waste)
$T_{13}$ treatment 50: 50 (corncob and sugarcane waste)

## Result and Discussion

Data presented in table 1 reveals that the treatment effect was found to be significantly different for days taken to spawn raining, days taken to pinning, number of mushroom per bag, yield per bag (kg), total yield (kg), and total dry weight (kg). Significantly lowest days taken to spawn raining were found on T1 & T4 treatments application of 80% Wheat straw and 20% corncob (T1 treatment) and 100% Wheat straw (T4 treatment) per bag. It was observed that the days taken to spawn raining with minimum spawn raining were 6 days, respectively and maximum days taken to spawn raining was 13 days T6 treatment 100% news paper. Minimum days taken to pinning were found on T1 & T4 treatments application of 80% Wheat straw and 20% corncob (T1 treatment) and 100% Wheat straw (T4 treatment) per bag. It was observed that the days taken to pinning with minimum pinning were 28 days, respectively and maximum days taken to pinning was 35 days T6 treatment 100% news paper. Significantly maximum number of mushroom was found on application of 80% Wheat straw and 20% sugarcane waste per bag being recorded T3 treatment. The highest numbers of mushroom recorded at time of harvesting were 65.33 per bag respectively. The highest yield per bag being recorded T4 treatment (2.667 kg) was noted on application of 100% Wheat straw per bag at time of harvesting and the minimum yield 1.900 kg per bag were counted in the T2 treatment 80% Wheat straw and 20% news paper followed by T1 treatment (80% Wheat straw and 20 % corncob) 2.633 kg. The total yield of mushroom 13.33 kg was counted in the T4 treatment at harvesting time followed by T1 treatment (80% Wheat straw and 20 % corncob) 13.17 kg and the varied range from 9.50 to 13.33 kg

**Table 1. The effects of different substrates on the growth and yield of oyster mushrooms (*Pleurotus florida*) in Uttarakhand**

| Sl. No. | Treatment | Days taken to spawn raining | Days Taken to pinning | Number of mush-room per bag | Yield per bag (kg) | Total yield (kg) | Total dry weight (kg) |
|---|---|---|---|---|---|---|---|
| **1** | $T_1$ treatment 80:20 (Wheat straw and corncob) | 6.00 | 28.00 | 62.67 | 2.633 | 13.17 | 1.36 |
| **2** | $T_2$ treatment 80: 20 (Wheat straw and news paper) | 11.00 | 33.00 | 59.00 | 1.900 | 9.50 | 0.95 |
| **3** | $T_3$ treatment 80: 20 (Wheat straw and sugar-cane waste) | 7.00 | 29.00 | 65.33 | 2.533 | 12.67 | 1.26 |
| **4** | $T_4$ treatment 100 (Wheat straw) | 6.00 | 28.00 | 64.00 | 2.667 | 13.33 | 1.33 |
| **5** | $T_5$ treatment 100 (corncob) | 7.00 | 29.00 | 65.00 | 2.517 | 12.58 | 1.21 |
| **6** | $T_6$ treatment 100 (news paper) | 13.00 | 35.00 | 61.67 | 1.967 | 9.83 | 0.82 |
| **7** | $T_7$ treatment 100 (sugarcane waste) | 9.00 | 31.00 | 63.33 | 2.417 | 12.08 | 1.21 |
| **8** | $T_8$ treatment 25: 25: 25: 25 (Wheat straw, corncob, news paper and sugarcane waste) | 10.00 | 32.00 | 59.33 | 2.350 | 11.75 | 1.02 |
| **9** | $T_9$ treatment 40: 20: 20: 20 (Wheat straw, corncob, news paper and sugarcane waste) | 9.00 | 31.00 | 61.00 | 2.467 | 12.33 | 1.28 |
| **10** | $T_{10}$ treatment 50: 50 (Wheat straw and corn-cob) | 7.00 | 29.00 | 63.33 | 2.550 | 12.75 | 1.28 |
| **11** | $T_{11}$ treatment 50: 50 (Wheat straw and news paper) | 11.00 | 33.00 | 62.67 | 2.117 | 10.58 | 1.03 |
| **12** | $T_{12}$ treatment 50: 50 (Wheat straw and sugar-cane waste) | 8.00 | 30.00 | 63.67 | 2.183 | 10.92 | 1.02 |
| **13** | $T_{13}$ treatment 50: 50 (corncob and sugarcane waste) | 9.00 | 31.00 | 57.33 | 2.150 | 10.75 | 1.00 |

and maximum dry weight of mushroom one replication (1.36 kg) was noted in the T1 treatment followed by T4 treatment 1.33 kg, the varied range of dry weight of mushroom 0.82 to 1.36 kg. The results were accordance with the findings Sharma and Jandaik, (1981) reported that wheat straw is better than paddy straw for the cultivation of Oyster mushroom. Das et al. (1987) used different agricultural waste like banana pseudo stem, wheat straw, water hyacinth, congress grass for cultivation of *P. Sajorcaju* and *P. flabellatus*. The best results were obtained from wheat straw using spawn multiplied on wheat straw. Upadhyay and Verma (2000) evaluated the malt industry waste, tea leaves industry waste and dry popular leaves for cultivation of *Pleurotus* spp. Tea leaves alone proved to be poor substrate for mycelial growth of *P. sapidus* and *P. flabellatus* but together with wheat straw (3:1 and 1:1), it gave better yield. Dias et al. (2003) were also cultivated P. florida on wheat straw: soybean straw (1:1) to show highest biological efficiency (93%) Dlamini et al. (2012). Mondal et al. (2010) reported that the stipe length, pielus diameter and total yield of mushroom was higher in rice straw than in banana leaves. Khanna and Garcha (1981) recorded 20 to 24 days for the maturity of pinheads on paddy straw. Ahmed (1998) reported pinhead formation of oyster mushroom cultivated in different substrates to be between 23 and 27 days from spawning, while Fan et al. (2000) reported it to be 20-23 days. Tan, (1981) recorded 23-26 days for the appearance of pinheads. Patra and Pani (1995) recorded 20-24 days on paddy straw. Bhatti et al. (1987) observed the highest yields from with shortest incubation period in case of wheat straw. It was generalized from the info that first flush yield was highest altogether treatments followed by second and third flush. Other scientists also recorded similar results. Tan (1981) got three flushes. Jiskani (1999) reported that one kg of dry substrate can produce one kg of fresh mushroom which is the 100% substrate dry weight. The difference in results between this finding and other workers may be due to environmental factors, physiological requirements, controlled, semi controlled conditions, e.g. constant humidity, light temperature etc.

## Conclusion

The study was conducted to check the effect of pure substrate and mixed substrate on the growth and yield of *Pleurotus florida*. It can be concluded that Wheat straw (substrate) supported the growth and yield of the *Pleurotus florida*, thus Wheat straw would be recommended as most suitable substrate for the cultivation of *Pleurotus florida*.

## References


Ahmed, S. (1998). Development of mushroom varieties suitable for rural level in Bangladesh Report presented in BARC Annual Review Programme, 72-73.

Badu, M., Twumasi, S.K., & Boadi, N.O. (2011). Effect of lignocellulosic in wood used as substrate on the quality and yield of mushrooms. Food Nutr. Sci., 2, 780–784.

Bhatti, M.A, Mir, F.A. & Siddiq, M. (1987). Effect of different bedding materials on relative yield of oyster mushroom in the successive flushes. Pakistan J. Agri. Res., 8(3), 256- 259.

Chang, S.T., & Miles, P.G. (1989). Edible mushroom and their cultivation. Boca Raton (Florida): CRC Press.

Chorvathova, V., Bobek, P., Ginter, E., & Klvanova, J. (1993). Effect of the oyster fungus on glycaemia and cholesterolaemia in rats with insulin-dependent diabetes. Physiology Res., 42, 175 –179.

Das, T.K., Sharma, R., & Singh, B. (1987). Himalayan Hort., Tezpur, pp. 41- 42.

Dias, E.S., Koshikumo, E.M.S., Schwan, R.S. & Silva, R. (2003). Cultivo do cogumelo *Pleurotus sajor-caju* em diferentes resíduos agrícolas. Ciencia e Agrotecnologia, 27, 1363-1369.

Dlamini, B.E., Earnshaw, D.M., & Masarirambi, M.T. (2012). Growth and yield response of oyster mushroom (*Pleurotus ostreatus*) grown on different locally available substrates. Current Research Journal of Biological Sciences, 4 (5), 623-629.

Fan, L., Pandey, A., Mohan, R., & Soccol, C.R. (2000). Use of various coffee industry residues for the cultivation of *Pleurotus ostreatus* in solid state fermentation. Acta Biotechnolica, 20(1), 41-52.

Garcha, H., Khanna, P., & Soni, G. (1993). Nutritionla importance of mushrooms. In S.T. Chang, J.A. Buswell & S.W. Chiu (Eds.), Mushroom biology and mushroom products (pp. 227–236). Hong Kong: Chinese University Press.

Jiskani, M.M. (1999). A brief outline "The Fungi" (cultivation of mushrooms). Tandojam: Izhar Publication.

Khan, M.A., Ruhul Amin, S.M., Uddin, M.N., Tania, M., & Alam, N. (2008) Comparative study of the nutritional composition of oyster mush rooms cultivated in Bangladesh. Bangladesh Journal of Mushroom, 2, 9-14.

Khanna, P.K., & Garcha, H.S. (1981). Nutritive value of mushroom *Pleurotus florida*. Mushroom

science. XI, 561-572.

Li. L., Ng, T.B., Song, M., Yuan, F., Liu, Z.K., Wang, C.L., Jiang, Y., Fu, M., & Liu, F. (2007). A polysaccharide-peptide complex from abalone mushroom (*Pleurotus abalonus*) fruiting bodies increases activities and gene expression of antioxidant enzymes and reduces lipid peroxidation in senescence-accelerated mice. Appl. Microbiol. Biotechnol., 75, 863–869.

Mane, V.P., Patil, S.S., Syed, A.A., & Baig, M.M. (2007). Bioconversion of low quality lignocellulosic agricultural waste into edible protein by *Pleurotus sajor-caju* (Fr.) Singer. J. Zhejiang Univ. Sci. B., 8, 745–751.

Mondal, S.R., Rehana, M.J., Noman, M.S., & Adhikary, S.K. (2010). Comparative study on growth and yield performance of oyster mushroom (*Pleurotus florida*) on different substrates. J. Bangladesh Agril. Univ., 8, 213-220.

Obodai, M., Cleland-Okine, J., & Vowotor, K.A. (2003). Comparative study on the growth and yield of *Pleurotus ostreatus* mushroom on different lignocelluloses by-products. Journal of Indian Microbiology and Biotechnology, 30, 146–149.

Patil, S.S., Ahmed, S.A., Telang, S.M., & Baig, M.M. (2010). The nutritional value of *Pleurotus ostreatus* (Jacq.:Fr) Kumm cultivated on different lignocellulosic agro-wastes. Innov. Rom. Food Biotechnol., 7, 66–76.

Patra, A.K., & Pani, B.K. (1995). Yield response of different species of oyster mushroom (*Pleurotus*) to paddy straw. Curr. Agric. Res., 8, 11-14

Rizki, M., & Tamai, Y. (2011). Effects of different nitrogen rich substrates and their combination to the yield performance of oyster mushroom (*Pleurotus ostreatus*). World Journal of Microbiology and Biotechnology, 27, 1695–1702.

Sanchez, C. (2010). Cultivation of *Pleurotus ostreatus* and other edible mushrooms. Apple Microbiology & Biotechnology, 85, 1321–1337.

Sharma, A.D. & Jandaik, C.L. (1981). Quality of paddy straw and its effect on spawn run and yield of *Pleurotus sajor-caju.* Indian J. Mushrooms, 7, 84-87.

Sivrikaya, H., Bacak, L., Saracbasi, A., Toroglu, I., & Eroglu, H. (2002). Trace elements in *Pleurotus sajor-caju* cultivated on chemithermo mechanical pulp for biobleaching. Food Chem., 79, 173–176.

Szabova, E., Rohalova, L., & Hedvigy, M. (2013). Semi-solid fermentation of *Pleurotus ostreatus*. J. Microbiol. Biotechnol. Food Sci., 2, 1950–1958.

Tan, K.K. (1981). Cotton waste is a fungus (*Pleurotus*). Good substrates for cultivation of *Pleurotus ostreatus* the oyster mushroom. Mush. Sci., 11, 705-710.

Tesfaw, A., Tadesse, A., & Kiros, G. (2015). Optimization of oyster (*Pleurotus ostreatus*) mushroom cultivation using locally available substrates and materials in Debre Berhan, Ethiopia. J. Appl. Biol. Biotechnol., 3, 15–20.

Upadhyay, R.C., & Verma, R.N. (2000). Non-conventional substrates for growing oyster mushrooms. Mushroom Res., 9, 35-38.