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Use of Different Agro-Wastes as Substrate for Oyster Mushroom (*Pleurotus Florida*) Cultivation

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ABSTRACT

The study was conducted to compare the effects of different agro-wastes on the growth and yield of oyster mushrooms (*Pleurotus florida*). Thirteen substrate formulas including wheat straw, corncob, newspaper, sugarcane waste alone and in combination of 80:20 (wheat straw and corncob), 80: 20 (wheat straw and newspaper), 80: 20 (wheat straw and sugarcane waste), 100 (wheat straw), 100 (corn cob), 100 (newspaper), 100 (sugarcane waste), 25: 25: 25: 25 (wheat straw, corncob, newspaper and sugarcane waste), 40: 20: 20: 20 (wheat straw, corncob, newspaper and sugarcane waste), 50: 50 (wheat straw and corncob), 50: 50 (wheat straw and newspaper), 50: 50 (wheat straw and sugarcane waste), 50: 50 (corncob and sugarcane waste) were investigated. The results indicated that different substrate formulas gave a significant difference in total colonization period, characteristics of fruiting bodies, yield per bag, and total yield. All the treatments significantly increased days taken to spawn running, days taken to pinning, number of mushrooms per bag, yield per bag (kg), total yield (kg) and total dry weight (kg). The best treatment was found to be T_4 treatment (100 wheat straw).

Key Words: Growth, Mushroom, Oyster, Substrates, Yield.

INTRODUCTION

An oyster mushroom is botanically identified as *Pleurotus* spp. This mushroom belongs to class Basidiomycetes and family Agaricaceae. Traditionally it is known as 'dhingri mushroom' in our country. This mushroom grows naturally in the moderate or temperate, sub-tropical and tropical forests on decaying and dead wooden logs, sometimes on dying tree or plants trunks of deciduous or coniferous woods. It may also grow on weak, decaying and dead organic matter. The fruit bodies of oyster mushroom are particularly shell/ spatula shaped with dissimilar shades of cream, grey, light brown, pink, white and yellow depending upon the species. This is one of the most suitable fungus for producing protein rich food from various agro-wastes/ forest wastes/ different substrate without composting. *Pleurotus species* is the second extensively cultivated mushroom worldwide following the *Agaricus bisporus* (Sanchez , 2010; Kues and Liu, 2000). However, Obodai *et al* (2003) reported that oyster mushroom is the 3rd largest commercially grown mushrooms in the world. *Pleurotus* species 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 (Mane *et al,* 2007). Moreover, the interest on cultivation of oyster mushroom is increasing largely due to its taste, nutritional value, and medicinal properties. *Pleurotus* species can efficiently degrade agricultural wastes and they grow at a wide range of temperatures (Sanchez , 2010). In comparison to other edible mushrooms, *this* species needs a short growth time and their fruiting bodies are not often attacked by diseases and pests (Tesfaw *et al,* 2015 and Baysal *et al*, 2003).

Pleurotus species require 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. However, the yield and the quality of oyster mushroom depends on the chemical and nutritional content of substrates (Badu *et al,* 2011 and Patil *et al,* 2010). *Pleurotus species* are rich source of protein, minerals (P, Ca, Fe, K, and Na) and vitamin (thiamine,

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riboflavin, folic acid, and niacin) Szabova *at el(* 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 very important as medicine. *Pleurotus cystidiosus* is a strong antioxidant (Li *et al,* 2007) while *Pleurotus ostreatus* also possesses antitumor activity.

MATERIALS AND METHODS

The experiment was conducted uner lab. and indoor condition of Pithoragarh and Dehradun region. The experiment was laid out in completely randomized design with three replications. Each replication consisted of thirteen treatments.T_1 treatment 80:20 (WS & CC)

T_2 treatment 80: 20 (WS & NP)

T_3 treatment 80: 20 (WS & SW)

T_4 treatment 100 (WS)

T_5 treatment 100 (CC)

T_6 treatment 100 (NP)

T_7 treatment 100 (SW)

T_8 treatment 25:25:25:25 (WS, CC, NP & SW)

T_9 treatment 40:20:20:20 (WS, CC, NP & SW)

T_{10} treatment 50: 50 (WS & CC)

T_{11} treatment 50: 50 (WS & NP)

T_{12} treatment 50: 50 (WS & SW)

T_{13} treatment 50: 50 (CC & SW)

* WS = Wheat Straw, CC = Corn Cob,
NP = News Paper, SW = Sugarcane Waste

RESULTS AND DISCUSSION

The growth of *P. florida* mycelia was relatively faster on wheat straw

Days taken to spawn running

The data (Table 1) showed that the days taken for spawn running have a significant effect on mushroom cultivation. Compared to other substrates, the T_4 treatment using 100 percent wheat straw took least number of days 18 to complete the spawn run, followed by the T_1 treatment (a mixture of 80 % wheat straw and 20 % corncob). T_6 treatment (100 % newspaper) took 25.00 days to complete the spawn run compared to other substrates. The number of days to complete the spawn run ranged from 18 to 25 days and the average number of days was 20.74.

Days taken to pinning

The data revealed that there was a significant difference in the time taken from spawning to first pinhead formation among the different substrates. The T_4 treatment with 100 per cent wheat straw took the least number of days 24.67 to become pinhead formation followed by the T_1 treatment with a mixture of 80 percent wheat straw and 20 percent corncob, taking 25.33 days. T_6 treatment (100 % of the newspaper) had the longest number of days 32.33 from spawning to pinhead formation. The time from spawning to pinhead formation ranged from 24.67 to 32.33 days. The average day from spawning to pinhead was 28.36.

Number of pinheads per bag

The total number of pinheads of oyster mushrooms from the different substrate treatments differed significantly. T_4 treatment 100 per cent wheat straw was recorded the highest 47.33 number of pins followed by T_{10} treatment 50 per cent wheat straw and 50 per cent corn cob 46.0 days recorded. The minimum number of pinheads per bag recorded was 42.0 in T_6 treatment using 100 per cent newspaper. The number of pinheads was recorded from 42.00 to 47.33.

Days taken to the first fresh mushroom harvesting

The first harvest from each of the substrate investigated was statistically significant. T_4 treatment (100 % wheat straw) took about 30.67 days to harvest the first fresh mushroom crop, followed by 31.67 days for the T_{10} treatment (50 % wheat straw and 50 % corncob). The T_6 treatment using 100 percent newspaper took late harvesting 38.00 days for the first harvest and the number of days to reach the first harvest ranged from 30.67 to 38.00 days.

Yield per bag (kg)

The fresh mushroom yield per bag by the different substrate treatments was significantly different and is shown in table and figure 2. The T_4 treatment which used 100 percent of wheat straw had the highest yield of 2.900 kg followed by the T_1 treatment which used a mixture of 80 per cent wheat straw and 20 per cent corncob was recorded a yield of 2.850 kg. Compared to other substrates the 100 per cent newspapers used in the T_6 treatment had the minimum yield of 2.033 kg. The average mushroom yield per bag was 2.519 kg and yield of oyster mushroom ranged from 2.033 to 2.900 kg per bag was recorded.

Total yield/ fresh weight (kg)

The total fresh mushroom yield (fresh weight) by the different substrate treatments was significant different. The T_4 treatment used 100 per cent wheat straw yielded the highest of 8.700 kg followed by T_1 treatment containing 80 per cent wheat straw and 20 percent corncob mixture yielding 8.550 kg. The yield of T_6 treatment in which 100 per cent newspaper was used was found to be minimum (6.100 kg) as compared to other substrates. The average mushroom yield was 7.557 kg and yield of oyster mushroom ranged from 6.100 to 8.700 kg was recorded.

Total dry weight (kg)

The total dry mushroom yield (dry weight) by the different substrate treatments was significant different. The highest dry weight of oyster mushroom was recorded at 1.194 kg in T_4 treatment using 100 per cent wheat straw, followed by T_5 treatment using 100 per cent corncob which recorded 0.944 kg dry weight of oyster mushroom. The T_2 treatment containing 80 percent wheat straw and 20 per cent newspaper mixture recorded the lowest dry weight of oyster mushrooms at 0.694 kg compared to other substrates. The average dry weight was 0.908 kg and dry weight ranged from 0.694 to 1.194 kg.

Table 1. The effects of different substrates on the days taken to spawn running, days taken to pinning, number of pinheads per bag and days taken to the first harvesting of oyster mushrooms (*Pleurotus florida*) in Uttarakhand.

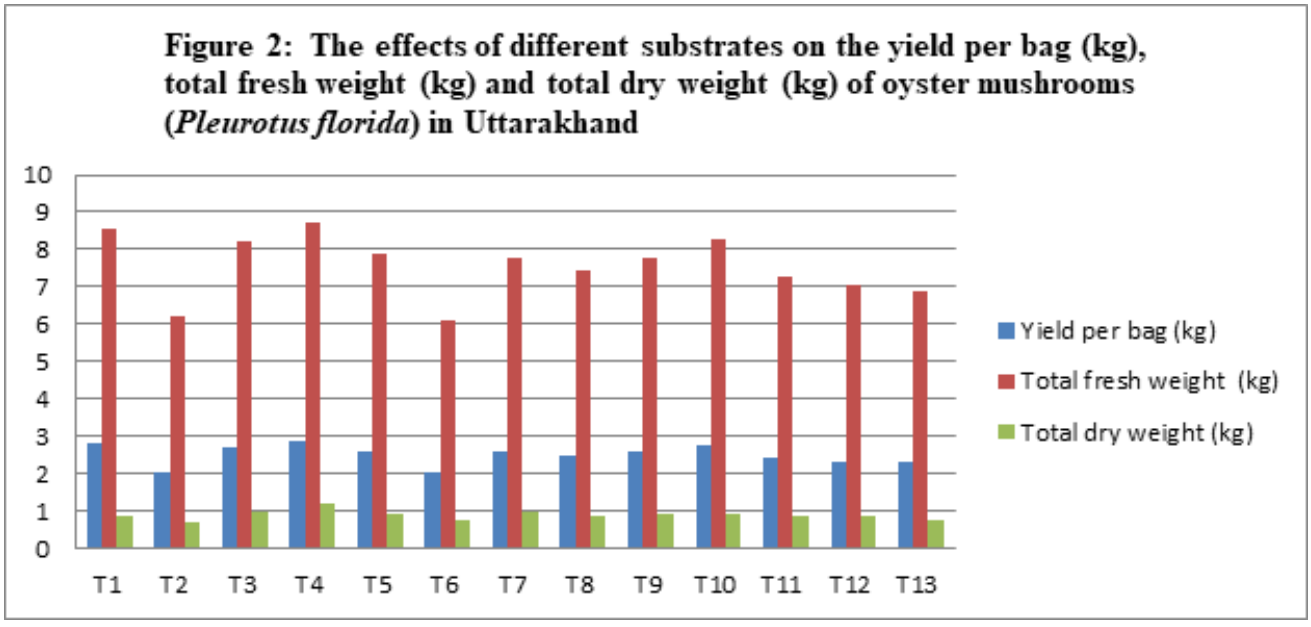
Sr. No	Treatment	DTSR	DTP	NP	DTFH
1	T_1 treatment 80:20 (wheat straw & corncob)	18.33	25.33	43.00	33.00
2	T_2 treatment 80: 20 (wheat straw & newspaper)	23.33	30.00	42.33	36.33
3	T_3 treatment 80: 20 (wheat straw & sugarcane waste)	19.00	26.33	43.33	32.33
4	T_4 treatment 100 (wheat straw)	18.00	24.67	47.33	30.67
5	T_5 treatment 100 (corncob)	18.67	27.00	42.67	33.33
6	T_6 treatment 100 (newspaper)	25.00	32.33	42.00	38.00
7	T_7 treatment 100 (sugarcane waste)	20.00	28.67	43.33	35.33
8	T_8 treatment 25: 25: 25: 25 (wheat straw, corncob, newspaper & sugarcane waste)	21.67	30.00	42.33	36.00
9	T_9 treatment 40: 20: 20: 20 (wheat straw, corncob, newspaper & sugarcane waste)	21.33	28.67	41.67	34.67
10	T_{10} treatment 50: 50 (wheat straw & corncob)	19.33	26.67	46.00	31.67
11	T_{11} treatment 50: 50 (wheat straw & newspaper)	22.67	31.67	43.00	37.67
12	T_{12} treatment 50: 50 (wheat straw & sugarcane waste)	21.00	28.00	44.67	34.33
13	T_{13} treatment 50: 50 (corncob & sugarcane waste)	21.33	29.33	44.33	35.67
S.E.M.		0.71	0.95	1.58	1.33
CD at 5%		2.06	2.75	4.58	3.88
CV		5.92	5.79	6.27	6.69

** DTSR= Days taken to spawn running, DTP= Days taken to pinning, NP= No. of pinheads per bag, DTFH= Days taken to the first harvesting*

Table 2. The effects of different substrates on the yield per bag (kg), total fresh weight (kg) and total dry weight (kg) of oyster mushrooms (*Pleurotus florida*) in Uttarakhand.

Sr. No.	Treatment	Y	TFW	TDW
1	T_1 treatment 80:20 (wheat straw and corncob)	2.850	8.550	0.885
2	T_2 treatment 80: 20 (wheat straw and news paper)	2.067	6.200	0.694
3	T_3 treatme nt 80: 20 (wheat straw and sugarcane waste)	2.733	8.200	1.013
4	T_4 treatment 100 (wheat straw)	2.900	8.700	1.194
5	T_5 treatment 100 (corncob)	2.633	7.900	0.944
6	T_6 treatment 100 (news paper)	2.033	6.100	0.763
7	T_7 treatment 100 (sugarcane waste)	2.600	7.800	0.990
8	T_8 treatment 25: 25: 25: 25 (wheat straw, corncob, news paper and sugarcane waste)	2.483	7.450	0.868
9	T_9 treatment 40: 20: 20: 20 (wheat straw, corncob, news paper and sugarcane waste)	2.600	7.800	0.940
10	T_{10} treatment 50: 50 (wheat straw and corncob)	2.767	8.300	0.942
11	T_{11} treatment 50: 50 (wheat straw and news paper)	2.433	7.300	0.901
12	T_{12} treatment 50: 50 (wheat straw and sugarcane waste)	2.350	7.050	0.895
13	T_{13} treatment 50: 50 (corncob and sugarcane waste)	2.300	6.900	0.780
S.E.M.		0.14	0.42	0.079
CD at 5%		0.41	1.22	0.230
CV		9.60	9.60	15.106

* *Y= Yield per bag (kg), TFW= Total fresh weight (kg), TDW= Total dry weight (kg)*



COCLUSION

The findings of this study will have a direct impact on those farmers, who due to lack of knowledge, are unable to use these crop waste materials or burn it in the field.

REFERENCES

Badu M, Twumasi SK and Boadi NO (2011). Effect of lignocellulosic in wood used as substrate on the quality and yield of mushrooms. *Food Nutr Sci* **2**:780–784.

Baysal E, Peker H, Yalinkilic MK, Temiz A (2003) Cultivation of oyster mushroom on waste paper with some added supplementary materials. *BioRes Technol* **89**:95–97.

Chang ST (2003) Mushroom cultivation using the "ZERI" principle: potential for application in Brazil. *Micol Aplicada Int* **19**:33–34.

Kues U, Liu Y (2000) *Fruiting body production in Basidiomycetes*. Apple Microbiology & Biotechnology, **54**:141–152.

Li L, Ng TB, Song M, Yuan F, Liu ZK, Wang CL, 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 VP, Patil SS, Syed AA, Baig MM (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.

Obodai M, Cleland-Okine J, Vowotor KA (2003) Comparative study on the growth and yield of *Pleurotus ostreatus* mushroom on different lignocelluloses by-products. *J Indian Microbiol and Biotech* **30**:146–149.

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

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

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

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

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 Biotech* **3**:15–20.

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