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PRODUCTION OF OYSTER MUSHROOM(*PLEUROTUSPULMONARIUS*)ON DIFFERENT AGRICULTURE WASTES COMBINATION WITH LEMON GRASS (*CYMBOPOGON CITRATUS*)

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A B S T R A C T

The aim of this work was to evaluate the lemon grass with different combinations of agriculture waste for mushroom cultivation. Lemon grass alone and its combination with Lemon grass 50% + wheat straw 50%, Lemon grass 50%+cotton waste 50%, lemon grass 50% + cotton waste 25% + wheat straw 25%, Cotton waste 100% for cultivation of exotic mushroom *Pleurotus* (*sajor-caju*) *pulmonarius* WC-537. Result revealed that the maximum production of mushroom recorded in treatment T_5 (Cotton waste 100%) that was about 418g compared with other treatments. The treatment T_3 (Lemon grass 50% + cotton waste 50%) showed all over best result produce 385.20g but as far as lemon grass alone and its combined effect all other treatments. Combination of lemon grass with cotton waste and wheat straw also showed significant produce while, using lemon grass 100% does not show better results. Spawn running was significantly affected by lemon grass which was minimum 15.5 days in T_3 combination and maximum 25.5 days with alone lemon grass. Cotton waste showed minimum days of spawn running 13 days. Cotton waste was the best substrate for mushroom growth while lemon grass 50% + cotton waste 50% combination can also be used.

Keywords: *Exotic, Pleurotus*, *Sajor-caju*, *Cymbopogon citratus* cotton waste, combination.

INTRODUCTION

Oyster mushrooms are third largest cultivated mushroom. Mushrooms (*Pleurotus spp.)* belonging to the class basidiomycetes and agaricaceae family. Mushroom contains 20-40% protein, 0.3 to 3.5% fat, 0.5-1.5% Vitamin B, D, E and K (Shukla *et al*., 2005). In Pakistan, these are observed during the rainy season in Northern areas and harvested by the farmers and sold at retail stores, local markets (Shah, 2004). They can easily grow in local conditions if the appropriate requirements of food and moisture for growth are available. *Pleurotus* species is an edible mushroom having excellent flavor and taste. Its current production is about 1.5 million tons in the world. Every year about 90 ton of mushrooms are export to Europe from Pakistan (Shah *et al*., 2004). *Pleurotus* species are lignin degraders that can develop effective variety of agricultural waste with wide adaptability to various agro-climatic conditions. Several studies proved that wild grasses (goose grass, kikuyu grass etc.) are suitable substrate for the cultivation of oyster mushroom (Das *et al.,* 2000). Therefore present work was carried out to evaluate the lemon grass alone and in combinations with different easily available agricultural wastes like cotton waste and wheat straw. The objectives of this study are**:**

1. Evaluation of spawn running at 25%, 50%, 75% and 100% lemon grass combination with cotton waste and wheat straw
2. Estimation of yield on these substrates with their combination at 25%, 50%, 75% and 100% lemon grass

MATERIALS AND METHODS

Collection of culture: The culture of*P. Pulmonarius* (WC-537) was procured from Mushroom Laboratory of department of Plant pathology, University of Agriculture, Faisalabad.

Multiplication of culture on Malt extract agar medium: *P. pulmonarius* (WC-537) was cultured on Malt extract agar medium (Malt Extract 20g Dextrose 20g, Agar Agar 20 gm, Peptone 1gm, 1000 ml distilled water). The inoculums were inoculated on Petri plates of 90 mm diameter containing Malt extract medium (MEM) and plates were incubated at 25°C for 7 days. After seven days of inoculation fungal colony was ready for spawn preparation.

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Preparation of Spawn: Spawn was prepared on 1 kg wheat grains boil for 15-20 minutes. After drying, the grains were put into flask and autoclaved at 121°C at 15 psi for thirty minutes (Nasir *et al*., 2010). The culture was inoculated on wheat grains prepared in the flasks with the help of sterilized needle and inoculated material was incubated at 25°C. After 21 days the spawn was ready for the cultivation of Oyster mushroom.

Preparation of substrate: Lemon grass was sun dried and chopped into small bits (1-2 cm long) and soaked in water for about (18-24 hours) and excess of water was drain off. The other agricultural wastes like wheat straw and cotton waste were soaked in water for 24 hours to moisten them thoroughly and then stacked on a cemented floor to remove the excess water from the substrates to get desired moisture 70% (Nasir *et al*., 2010). Lime was mix at the rate of 5% to retain its pH level. These substrates were ferment for 5 days by covering with polythene sheets before filling the bags. Substrate was filled @ 1kg in polypropylene bags and plugged by inserting cotton with the help of plastic rings. These bags were autoclaved on 121°C at 15 Psi pressure for 20 minutes then kept cooling for 24 hours. The subsequent substrates used with given treatments.

T1= Lemon grass 100%

T_2= Lemon grass 50% + wheat straw 50%

T_3 = Lemon grass 50% +cotton waste 50%

T_4 = Lemon grass 50% + cotton waste 25%+ wheat straw 25%

T_5 = Cotton waste 100%

Spawning of bags: Spawn was mixed in substrate @56g in each bag and tied with rubber band. Bags were placed at room temperature (15-20°C) and relative humidity maintained at 80-90% because pleurotus species require during fruiting. The mushrooms were grown in growth room consists of iron-cum-plastic racks. Temperature was maintained at 25-30°C. Data was recorded at the number of days taken for full growth (100%) in substrate bags.

Biological yield efficiency: Mushroom harvesting was done at maturity in each flush. Yield data was recorded based on weight of fruiting body. Biological efficiency was calculated by following formula:

$$\text{B. E (\%)} = \frac{\text{Fresh Weight of mushroom harvested}}{\text{Substrate dry matter}} \times 100$$

Statistical analysis: The experiment was laid out in a complete randomized design (CRD) with three replications. The data were analyzed statistically by using LSD test (Steel *et al*., 1997).

RESULTS AND DISCUSSION

Effect of lemon grass combination with different substrate on spawn running (in days): Among all the treatments results showed in Table (1) that the treatment T_3 (lemon grass + cotton waste 50%) took minimum number of days for completion of spawn running as 15.5 number of days but maximum number of days were taken by the treatment T_1 (lemon grass100%) as 25.5days for spawn running from the day of spawn inoculation. The remaining treatments have different days in between these two values as treatment T_2 lemon grass+ wheat straw take 21days, T_4 (lemon grass + cotton waste+ wheat straw) 18.50 days for the same observation. Results showed that treatment T_5 that comprised cotton waste (100%) is best for cultivation of oyster mushroom. Cotton waste was observed best for this purpose and its combination with lemon grass can also best combination for mushroom cultivation. According to Leong 1978 cotton waste was best for mushroom as compare to rice husk. Cotton waste showed best performance because it contains plenty of cellulose and hemicelluloses and digestion of cellulose produces glucose and cellobiose, while digestion of hemicelluloses (Albersheim, 1976; Clarke, 1997; Keller, 1993). It also showed that lemon grass treatment combination affect the cotton waste efficiency.

Table No. 1. Comparison of spawn running (in days) by using lemon grass combination with different substrate for Oyster mushroom production.

Treatments	25%	50%	75%	100%
T1=Lemon grass 100%	18.00A	19.00A	22.50A	25.50A
T2=Lemon grass 50%+wheat straw 50%	11.00B	17.50B	19.50B	21.00B
T3=Lemon grass 50%+cotton waste 50%	6.50C	10.50D	13.00D	15.50D
T4=Lemon grass 50%+cotton waste 25%+wheat straw 25%	8.00C	12.50C	16.00C	18.50C
T5=Cotton waste 100%	4.50D	8.50E	11.00E	13.00E

Maximum 5% level of probability by using LSD test.

Production of pinhead, fruiting body in number of days on lemon grass combination with different substrate: Data were taken after pinhead emergence when the mycelia have completely impregnated the substrate. In Table (2) T3 showing minimum days as 7.5 for the initiation of pin head and maximum days taken by treatment T1 as 17.5 days while T2, 13 days, T4, 11 days and T5, 4.5 days for the same observation. The table

also describes the number of days of harvesting stage or fruiting body after primordial initiation. Results showed that fruit formation take minimum days in treatment T_3 (Lemon grass 50%+ cotton waste 50%) 13 days and the maximum number of days taken by a treatment T_1 (Lemon grass 100%) was 23days. Table 2 also showed that number of fruiting bodies produced in T_3 was 10 in 13 days while T_1 produced 19 fruits in 23 days. TreatmentT_1 and T_3 take maximum and minimum number of days for fruiting bodies respectively in this experiment. The treatment as T_2, T_4, and T_5 take 19.5, 15.5, and 10.5days respectively.

Table No. 2. Performance of Oyster mushroom (*Pleurotus pulmonarius*) on lemon grass and combination with different substrate.

Treatments	Pinhead	Fruiting body	Maximum days
T1=Lemon grass 100%	17.50A	19.00A	23.00A
T2=Lemon grass 50%+wheat straw 50%	13.00B	16.00B	19.50B
T3=Lemon grass 50%+cotton waste 50%	7.50D	10.00D	13.00D
T4=Lemon grass 50%+cotton waste 25%+wheat straw 25%	11.00C	13.50C	15.50C
T5=Cotton waste 100%	4.50E	7.50E	10.50E

Figures sharing the same letters are non-significant at 5% level of probability by using DMR test.

Yield performance of Oyster mushroom (*Pleurotus pulmonarius*) on Lemon grass and its combination with other agriculture wastes substrate: The results of Table (3) showed that in all three flushes the production of mushroom was very low on T1which was 264.8 gm on lemon grass 100% while maximum production was on T5 (418g) cotton waste 100% while T2,T3 and T4 showed322g,385.20g, 358.60g yield respectively. According to these finding Lemmon grass 100% is not fit for mushroom cultivation as substrate and cotton waste 100% is best for production. Treatment 4 showed best combination for mushroom cultivation while T2 was not suitable combination and T3 combination was better than T2combination. Sopit., 2006 described the Oyster mushroom cultivation on different substrates which were peat of coconut husk, sawdust, narrow leaf cattails and bagasse. The sawdust produces the maximum mushroom yield (536.85 g per kg substrate) and this was significantly different to those found from other substrates.

Ibekwe *et al*., 2008 reported the cultivation of Oyster mushroom on different agricultural wastes like corn, millet, rye and rice. Millet gave the maximum yield while rye gave the lowest. Khan e*t al*., 2009 reported different strains of oyster mushroom (*Pleurotus* spp) on commonly available agricultural wastes. Exotic strain *P. (florida) ostreatus* (WC-536) produced maximum yield where as *P. cystidiosus* (WC-609) and *P. (flabellatus) djamor (R-22)* gave the minimum yield.

But in my results, *P. (sajor-caju) pulmonarious* (WC-537) gave maximum yield on cotton waste and minimum on lemon grass substrate. The difference in our results due to environmental situation and genetic makeup of exotic strain and due to lemon grass.

Table No. 3.Total yield of Oyster mushroom production on lemongrass with different substrate

Treatments	1st flush	2nd flush	3rd flush	Yield (gm)
T1=Lemon grass 100%	99.00E	89.60E	76.20E	264.80E
T2=Lemon grass 50%+wheat straw 50%	116.40D	106.20D	99.40D	322.00D
T3=Lemon grass 50%+cotton waste 50%	139.40B	127.80E	118.00B	385.20B
T4=Lemon grass 50% +cotton waste 25%+wheat straw 25%	130.00C	119.60C	109.00C	358.60C
T5=Cotton waste 100%	151.00A	139.00A	128.00A	418.0A

Figures sharing the same letters are non-significant at 5% level of probability by using LSD test.

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