IDENTIFICATION OF SUITABLE AND EFFICIENT SUBSTRATE FOR THE PRODUCTION OF OYSTER MUSHROOMS (*Pleurotus ostreatus*)

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ABSTRACT

Mushroom production can play an important role in managing farm organic wastes when agricultural and food processing by-products are used as growing media for this edible fungus. The investigation was carried out to identify the suitable and efficient substrate for the production of oyster mushrooms. The experiment in a Complete Randomized Design with seven treatments and three replicates was conducted in the mushroom hut of the Department of Agricultural Biology of Eastern University, Sri Lanka. The mushroom species used was *Pleurotus ostreatus*. The control treatment was sawdust and the other treatments were paddy straw, dried leaves, shredded paper, sawdust + paddy straw mixture, sawdust + dried leaves mixture and sawdust + shredded paper mixture. The average yield in terms of fresh weight, total number of flushes, large cap percentage and harvest interval were recorded.

The results revealed significant differences in yield performance between treatments. The sawdust + paddy straw mixture showed significantly better yield than that of sawdust. Total number of flushes significantly varied among the substrates, in which paddy straw and sawdust + shredded paper substrate have shown the highest and lowest among treatments. There was no significant difference in large bloom percentage among the treatments. The shredded paper substrate showed significantly longer harvest interval compared to the sawdust. In the present study, the substrate consisting of sawdust and paddy straw mixture depicts as efficient substrate than the other substrates as this substrate showed the highest yield, higher number of flushes with acceptable harvest interval. The sawdust + dried leaves mixture is found to be the less efficient substrate for the production of oyster mushrooms because of the lowest yield with longer time period between two harvests.

Key words: Blooms, Harvest interval, Pin heads, Substrate

INTRODUCTION

Mushrooms are reproductive structures of edible fungi that belong to Ascomycetes and Basidiomycetes. The Oyster mushroom (*Pleurotus ostreatus*) is an edible mushroom, which can be grown successfully under tropical conditions. This mushroom resembles the shape of shellfish, therefore mostly known as oyster mushroom in English and it is consumed as a fresh as well as dried. Other species available for cultivation are *P.sajor-caju*, *P.florida*, *P.sapidus*, *P.eryngii*, *P.columbinus*, *P.cornucopiae*, *P.flabellatus*, *P.platypus*, *P.opuntiae*, *P.citrinopileatus* and *P.coticatus*. Mushroom cultivation could be commercialized at all levels. Substrates like, rice bran, rice straw, coconut fibre, saw dust and sugarcane bagasse were used for raising mushroom beds since labour and materials can be obtained relatively cheap , mushroom production can be developed a family project or cottage industry in rural areas(Lalithakumarie *et al* ., 2006).Mushrooms are the good source of protein, vitamins and minerals (Khan *et al*., 1981). They contain about 85-95% water, 3% protein, 4% carbohydrates, 0.1% fats, 1% minerals and vitamins (Tewari, 1986).

This research study was performed to identify more suitable and efficient substrate which contribute highest economic yield within a shorter time period other than the sawdust, which is mainly used as the substrate for mushroom cultivation in our region.

MATERIALS AND METHODS

The experiment was conducted during Maha season (September to November) 2007 at Eastern University of Sri Lanka (Batticaloa region) and it was laid out in a Complete Randomized Design (CRD) with Seven treatments and three replicates.

The seven treatments were four different substrates namely sawdust, paddy straw, shredded paper and dried leaves mixture(including banana leaves, paddy straw and coconut leaves) and combinations of sawdust with other three substrates at 1:1 ratio. The treatments are listed below.

Treatments	**Code**
Sawdust (standard control)	T_1
Paddy straw	T_2
Dried leaves mixture	T_3
Shredded paper	T_4
Sawdust + Paddy straw (1:1)	T_5
Sawdust + Dried leaves mixture (1:1)	T_6
Sawdust + Shredded Waste Paper (1:1)	T_7

The nutrient supplements added were the rice bran, $CaCO_3$, soybean flour and Epsum salt or $MgSO_4$. The bags were filled with substrate mixture and the bags were inserted with pieces of conduit pipe (2.5cm X 5cm diameter) and the mouth was plugged with cotton wool which was covered with paper and tied with rubber band. The substrate filled bags were autoclaved at 121°C, 15 psi for 15 minutes and were allowed to cool to room temperature.

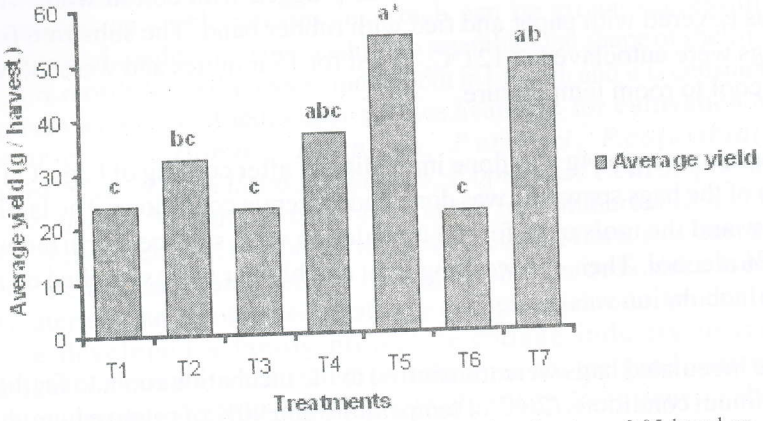
The spawning at 4g was done immediately after cooling of bags. On the top of the bags spawning was done under aseptic conditions. The laminar flow and the tools used for the inoculation were surface sterilized with 70% alcohol. Then, the working light and blower were switched on and the inoculation was done.

The inoculated bags were transferred to the incubation room to facilitate optimum conditions (20°C of temperature and 90% of relative humidity) for mycelial growth. After the mycelium growth up to bottom of the bag, they were transferred to growing room where the temperature (20-23°C), humidity (88- 90%) and ventilation (by exhaust fan) were maintained. Before the placement to growing room, the opening end of bags was cut to facilitate the flushing of mushrooms.

The data collected were total yield (g/ harvest), total number of flushes per harvest, large cap formation and harvest interval (time gap between two harvests) and analysis of mean, standard deviation and variance were performed using the Excel packages, SAS (Statistical Analysis System) and SPSS 11th Version (Statistical Package of Social Science).

RESULTS AND DISCUSSION

Effect of substrate on yield



The bars with the same letters do not differ significantly at p = 0.05 based on Duncan's Multiple Range Test.

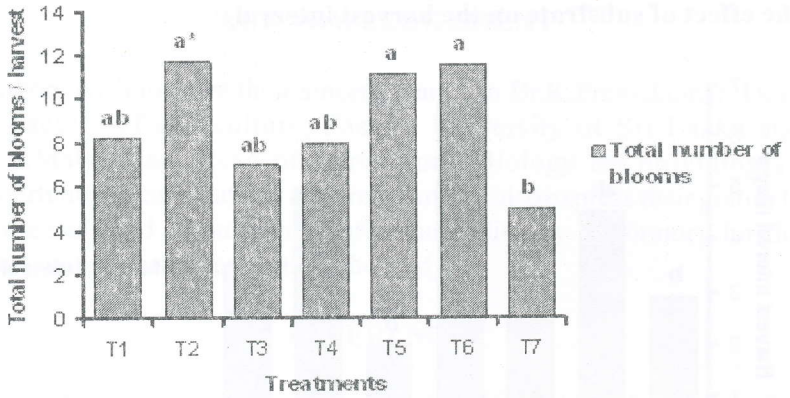
The values are means of three replicates.

Figure 1: The average yield (fresh weight) of oyster mushrooms on different substrates

The highest yield was recorded from substrate mixture of sawdust + paddy straw mixture (T_5) (Figure: 1) which was significantly ($p < 0.05$) higher than that of sawdust alone (T_1).It could be supported from the outcome of previous studies which have shown that straw alone is not effective as culture material as it contains a little food value and slow decomposing characteristics and the *Pleurotus sp* has the ability to break down cellulose and lignin bearing materials without chemical or biological preparation (Zadrazil, 1978).Therefore the nutrient required for the pinhead formation and blooming of mushrooms may have been higher in sawdust + paddy straw mixture due to comparatively better availability of nitrogen, carbon and minerals from this substrate. The lowest yield was recorded from the substrate of sawdust + dry leaves mixture (T_6).

Effect of substrate on the total number of flushes

The highest numbers of flushes were obtained from the paddy straw substrate (Figure: 2). In contrast, a research study revealed that, the sawdust produced highest number of fruiting bodies for oyster mushroom cultivation (Shah *et al.*, 2004). The lowest numbers of blooms were observed from sawdust + shredded paper mixture (T_7) as it mostly produced large size of blooms but low in number.



* - The bars with the same letters do not differ significantly at p = 0.05 based on Duncan's Multiple Range Test.

The values are means of three replicates.

Figure 2: The total numbers of blooms produced from different substrates

Effect of substrate on large cap formation

The large cap percentage is denoted as the percentage of large caps produced out of the total number of blooms in a harvest. The large cap diameter was above 5cm and small cap size was below 5cm. The highest percentage of large blooms were obtained from the substrate composed of sawdust + shredded paper (T_7) (Table: 1) and is accounting the formation of more number of large blooms. The lowest percentage of large blooms resulted from the substrate of paddy straw (T_2) as it produced more numbers of pinheads formed but not the size of bloom. However, there was no significant ($p < 0.05$) difference of large bloom percentage among all the treatments and therefore no significant effect of substrate on large bloom percentage of oyster mushrooms is seen.

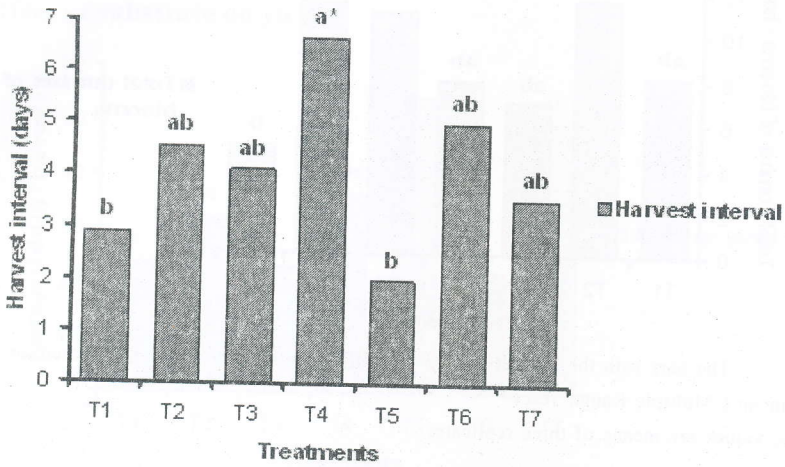
Table 1: The percentage of large cap produced from different substrates

Treatment	Large cap percentage	
T_1	31.551 ± 2.4528	a*
T_2	24.9863 ± 16.4311	a
T_3	31.2607 ± 6.8495	a
T_4	27.1925 ± 7.6683	a
T_5	36.6527 ± 23.9670	a
T_6	27.1083 ± 7.1975	a
T_7	48.254 ± 6.6040	a

* The figures followed by the same letters do not differ significantly at p = 0.05 based on Duncan's Multiple Range Test.

The values are means of three replicates.

The effect of substrate on the harvest interval



* The bars with the same letters do not differ significantly at p = 0.05 based on Duncan's Multiple Range Test.
The values are means of three replicates.

Figure 3: The harvest interval of oyster mushrooms produced from different substrates

The harvest interval is the time period taken between the two harvests of a substrate bag of oyster mushrooms. It revealed that, the highest harvest interval (7 days) was observed for the substrate of shredded paper (T_4) and as the gap between two harvests is high, the productivity of this substrate is low (Figure: 3).The lowest harvest interval (2 days) was observed from the sawdust + paddy straw mixture (T_5) and hence it is the most suitable substrate for the production of oyster mushrooms as time period to harvest.

CONCLUSIONS

This research clearly indicated that the cultivation of oyster mushrooms (*Pleurotus ostreatus*) can be productively grown in Batticaloa district. The research study also revealed that average yield, total number of flushes, large cap percentage and harvest interval obtained from sawdust + paddy straw mixture were significantly better compared to the sawdusperhaps it is the most suitable and efficient substrate for the production of oyster mushrooms (*Pleurotus ostreatus*).

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