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Comparative Study on Cultivation and Yield Performance of Oyster Mushroom (*Pleurotus ostreatus*) on Different Substrates (Wheat Straw, Leaves, Saw Dust)

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Abstract: The research experiment was carried out to investigate the cultivation of Oyster mushroom on different substrates. Mushroom cultivation is a profitable agribusiness. Incorporation of non conventional crops in existing agricultural system can improve the economic status of the farmer. Mushrooms are the source of protein, vitamins and minerals and are anticancerous, anticholesteral, and antitumorous. Sawdust produced highest yield, biological efficiency and number of fruiting bodies, recommended as a best substrate for Oyster mushroom cultivation.

Key words: Cultivation, *Pleurotus ostreatus*, substrates, yield

Introduction

The mushroom cultivation is a profitable agribusiness and Oyster mushroom (*Pleurotus ostreatus*) is an edible mushroom having excellent flavour and taste. It belongs to class Basidiomycetes, subclass Hollobasidiomycetidae, order Agricals. It grows wild in the forests of hilly areas and is cultivated in temperate and subtropical regions of the world. The technology of artificial cultivation of mushroom is somewhat recent innovation, incorporation of non conventional crops in existing agricultural system can help in improving the social as well as economic status of small farmers.

Mushrooms are the source of extra ordinary power and virility and are used in the preparation of many continental dishes and have medicinal properties like anticancerous, anticholesteral, antitumorous. Mushrooms are useful against diabetes, ulcer and lungs diseases. (Quimio, 1976). Mushrooms are the good source of protein, vitamins and minerals (Khan *et al*., 1981). Mushrooms contain about 85-95% water, 3% protein, 4% carbohydrates, 0.1% fats, 1% minerals and vitamins (Tewari, 1986). Mushrooms contain appreciable amount of potassium, phosphorous, copper and iron but low level of calcium. (Anderson and Feller, 1942). Mushroom protein is intermediate between that of animals and vegetables. (Kurtzman, 1976). Mushroom also contain appreciable amount of Niacin, pantothenic acid and biotin (Subramanian, 1986).

It can be grown on agricultural and industrial waste. More then the total produce from the land remain unused as waste in the form of straws, leaves, stems, roots etc. (Zadrazil, 1978). These waste can be recycled into food and environment may be less endangered by pollution (Hayes, 1978). Mushroom cultivation is highly labour intensive, short duration crop and land saving, can be welcomed by the poor farmers. At present mushroom production is approximately 1.5 million tons in the world. Every year about 90 tons of mushrooms are exported to Europe from Pakistan. There is a need to develop diversified agriculture in the Pakistan. It is unfortune that in Pakistan and Azad Kashmir they have not caught the imagination of the public at large scale to become an important food item, perhaps the reason for not being taken up widely is non availability of mushrooms at low prices and lack of knowledge. The farmers should come forward to cultivate edible mushrooms like *Pleurotus ostreatus* (Oyster mushroom) on commercial scale to fulfill the requirements of balance diet. The aim of project study was to investigate the cultivation of Oyster mushroom on different substrates.

Materials and Methods

The research project was conducted in the Horticulture laboratory, Department of Horticulture, University College of Agriculture, Rawalakot, Azad Kashmir, during the August to September year 2002. The materials used and methods applied are given below. The substrates used for the cultivation of oyster mushroom where, Saw dust 50% + Wheat straw 50% Saw dust 75% + leaves 25% Saw dust 100% Wheat straw 1 Wheat straw 50% + Leaves 50% Leaves 100%.

The substrates were soaked in water for 24 hours to moisten them thoroughly and were stalked on the steep cemented floor so as to remove the excessive moisture from the substrates to get 65-75% moisture level. Lime was mixed at the rate of 5% (on dry weight basis). The substrates were fermented for 5 days by covering with polythene sheet before filling the bags. Each substrate was filled in polythene bag and their mouths were plugged by inserting water absorbing cotton with the help of plastic rings. Each of six treatments were replicated three times . The bags were autoclaved at 121^{o}C at 15-20 lbs pressure and allowed to cool. After sterilization next day the bags were inoculated with the

Table 1: Days for completion of spawn running, fruiting bodies formation and pinheads formation of different substrates

Names of substrate	Days for completion of spawn running	Days for pinheads formation	Days for fruiting bodies formation	Average number of fruiting bodies
Saw + wheat straw	16.67	25.33	27.27	11.22
Sawdust + leaves	22.67	29.33	35.00	17.77
Saw dust	17.33	24.33	28.33	22.11
Wheat straw + leaves	23.33	30.33	33.67	13.55
Wheat straw	16.67	24.00	27.00	14.55
Leaves	25.00	30.33	34.00	7.22

Table 2: Biological efficiency, weight and average yield of different substrate

Names of substrate	Weight of each substrate (in gms)	Average yield in three flushes (in gms)	Biological efficiency in percentage
Saw + wheat straw	1000	435.9	43.59
Sawdust + leaves	1000	620.9	62.09
Saw dust	1000	646.9	64.69
Wheat straw + leaves	1000	433.9	57.85
Wheat straw	750	447.2	44.72
Leaves	1000	210.6	21.05

spawn of Oyster mushroom (*Pleurotus ostreatus*) at the rate of 5% per bag according to the dry weight of substrates. The bags were than inoculated for spawn running under complete darkness at controlled temperature of 25^{o}C. Mushroom cultivation has two important phases viz, spawn running and fructification, while temperature and humidity are two vital factors involved at both phases. The temperature was controlled by electric heaters. 25^{o}C for spawn running and 17-20^{o}C for fruiting body formation. The humidity of bags were accomplished by spraying of water on them twice a day. Oxygen is essential for mushroom during fructification. For this purpose exhaust fans were used for the exhaust of gases from mushroom growing room. The pinholes were also made in the bags with the help of paper pins for exhaust of gases. The bags were watered three times in a day during cropping. The experiment was laid out in a completely randomized design (CRD) with three replications and six treatments. The data was analyzed statistically on various aspects described as follows.

Time was recorded in days for the completion of growth of mycelium on substrates, appearance of pinheads, maturation of fruiting bodies in different treatments. The data were also recorded for the yield number of fruiting bodies and biological efficiency of substrates. The total biological efficiency was worked out against the dry weight of each substrate.

Results and Discussion

The various results obtained from the research work are presented in Table 1 and 2. The spawn running, pinheads formation and fruiting bodies formation are three important phases in the cultivation of mushroom, require proper humidity and temperature. Temperature 25^{o}C for spawn running and 17-20^{o}C for fructification showed good results.

Spawn running: It is evident from the Table 1 that spawn running took 2-3 weeks after inoculation. All substrates were inoculated at the same day. These results agree with the findings of Tan (1981) who reported that the spawn running took three weeks and fruiting bodies appeared after 2-3 days.

Pinheads formation: The pinheads formation is the second stage of mycelial growth during cultivation of mushroom. Small pinheads like structures were observed, these pinheads were formed 6-7 days after the spawn running. These results are in agreement with Ahmad (1986) who stated that *Pleurotus ostreatus* completed spawn running in 17-20 days on different substrates and time for pinheads formation was noted as 23-27 days.

Fruiting bodies formation: This is the third and final stage during the cultivation of mushroom. The fruiting bodies appeared 3-6 weeks after pinheads formation and took 27-34 days later after inoculation of spawn. These findings are in conformity with Quimio (1976, 1978) who reported that fruiting bodies 3-4 weeks after inoculation of spawn.

Yield of Oyster mushroom: The crop of Oyster mushroom was harvested in three flushes. The maximum yield was obtained in first flush than the second and third flush. Maximum average yield 646.9 gms was estimated from the sawdust. So recommended as a best substrate for the cultivation of Oyster mushroom which is in agreement with the findings of Hami (1990) who studied the Oyster mushroom cultivation on sawdust of different woods and found that Pleurotus ostreatus gave the maximum yield.

Number of fruiting bodies: The caps of Oyster mushroom was also counted in three flushes, average

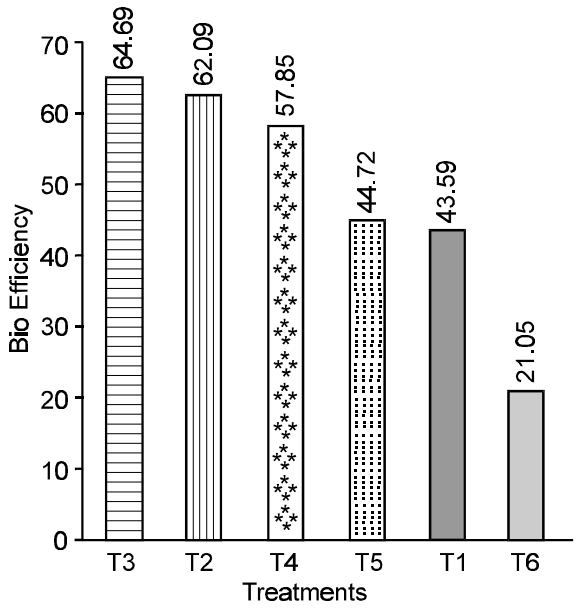

Fig. 1: Biological efficiency of substrate
T1 = Sawdust 50% + Wheat straw50%
T2 = Saw dust 75%+ Leaves25%
T3 = Saw dust 100%
T4 = Wheat straw 100%
T5 = Wheat straw 50%+Leaves50%
T6 = Leaves 100%

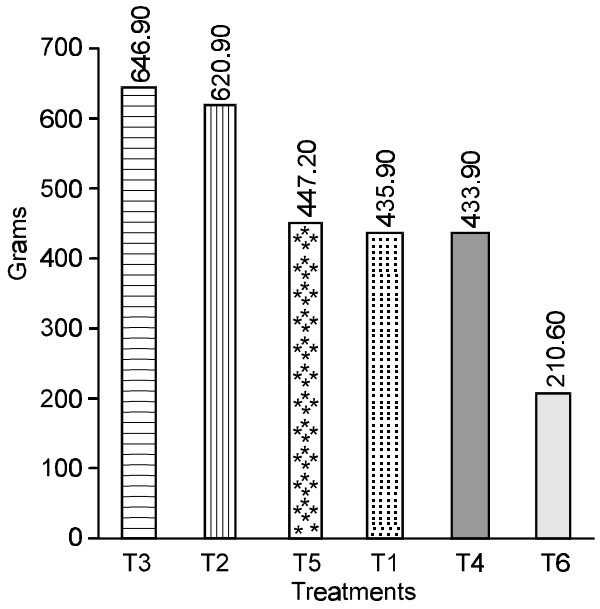

Fig. 2: Average yield in three flushes
T1 = Sawdust 50% + Wheat straw50%
T2 = Saw dust 75%+ Leaves25%
T3 = Saw dust 100%
T4 =Wheat straw 100%
T5 =Wheat straw 50% + Leaves50%
T6 = Leaves 100%

7.22-22.11 were formed in three flushes. Sawdust produced more number of fruiting bodies than other substrate.

Biological efficiency: The biological efficiency was worked out against the dry weight of each substrate. It is clear from the Table 2 that as a substrate saw dust showed best biological efficiency 64.69% followed by saw dust + leaves 62.9%, wheat straw + leaves 57.85%, wheat straw 44.72%, sawdust+wheat straw 43.59% and leaves 21.05%. These results are in line with Hami (1990) who reported that Pleurotus ostreatus gave maximum bioefficiency on sawdust. Thus the farmer must utilize the sawdust to convert the food in the form of mushrooms.

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