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Evaluation of the efficacy of crop residues as substrates for the cultivation of oyster mushroom (*Pleurotus eous, Pleurotus platypus*)

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Abstract

The yield of the edible mushroom, *Pleurotus platypus* and *Pleurotus eous* was studied using different substrates such as coir waste, banana leaves, eucalyptus leaves, cotton leaves, paddy straw, saw dust and palmyrah leaves. Among the various substrates tested paddy straw recorded higher yield (350g), when compared to other substrates.

Key words: Oyster mushroom, Paddy straw, *Pleurotus platypus* and *Pleurotus eous*

INTRODUCTION

Mushrooms are the reproductive structure of edible fungi, which belong to Ascomycotina and Basidiomycotina. Mushroom is the fungal fruiting body technically called sporophore, which produces and disseminates large number of spores. Mushrooms grow independent of sunlight without fertile land. It is generally classified as two types, edible mushrooms and poisonous mushrooms. The mushrooms are used as nutrient supplements to the diet in the form of proteins, essential amino acids, minerals and vitamins. There are several substrates suggested for the cultivation of edible mushrooms. Nevertheless, agricultural crop residues left after harvesting are considered as the most suitable substrates for the cultivation of mushrooms. 50% of cereal straw is used as animal feed and the remaining part needs to be be properly recycled (Gaur, 1986).

In Tamil Nadu about 20 million tones of crop residues become available annually and even 25% of them are diverted for mushroom production, an estimated quantity of 2million tones of oyster mushroom can be produced. Oyster mushroom cultivation technology has been recognized as the most suitable agro based small scale industry because it provides value addition to the agricultural crop residues, generate additional income to the rural India, direct use of agro wastes and appropriate climate for its cultivation (Chadha, 1992), and it is a low cost production technology. The present article deals with the results of the investigation on the efficacy of different agricultural crop residues on the production and yield of oyster mushroom.

MATERIALS AND METHODS

Mother spawns: Spawn is the seed material used for mushroom cultivation. It is nothing but the fungal growth maintained in grain based medium. The mother spawn was obtained from Sri Amman Biocare and Research Academy, Thirukkanurpatti, Thanjavur.

Spawn Multiplication: The mother spawn was multiplied using maize grains in polythene (7" x 12.5) under aseptic conditions

Substrates for mushroom cultivation: Substrates such as coconut coir pith, banana leaf sheath, eucalyptus leaves, cotton waste, paddy straw, saw dust and palmyrah leaves were used for the cultivation of edible mushroom. The substrates were collected from the field cut in to pieces of suitable size (3-5''), soaked in water for six hours, then water was drained off, air dried and stored for use as described by Sinden. (1932). Care was taken to see that the spent substrates were not selected for the purpose of mushroom cultivation.

Spawning: Polythene bags measuring about 60 x 30 cm were made cylindrical by tying a knot with jute thread just 5 cm above from the bottom. Pasteurized each substrate, coconut coir pith, banana leaf sheath, eucalyptus leaves, cotton waste, paddy straw, saw dust and palmyrah leaves, was filled in five layers in each polythene bags with moisture level of 80-90%. Each layer of the substrates was seeded with spawn and the mouth of the bags was closed and tied with jute thread. The cylindrical bags thus prepared were transferred to the spawn running compartment of the mushroom shed (Rangad and Jandaik, 1977). Air holes were made for the passage of air.

Spawn Running, Cropping and Harvesting: The cylindrical beds were maintained in the spawn running room for the completion of the process of spawn running (It is the process of complete establishment of the fungal mycelium over the substrate). The process was completed in 17-19 days. Water was sprayed every day in order to maintain the humidity of the room at about 80%. Pin heads appeared after 17-20 days and the polythene cover from each bed was removed, and the beds were transferred to the cropping room. Watering was not done for about 2days over the beds. The pin heads grew in to fruit bodies which were harvested with the help of sharp edged scalpel and collected in fresh polythene bags. The beds were maintained for the subsequent second and third cropping (Gaur, 1986; Jadha, 1991).

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Analytical Studies

Moisture content (%), dry matter (%), crude protein (%), crude fiber (%), ash content (%), crude fat (%) and total carbohydrate content (%) were determined following the standard methods (Ouzouni *et al*.,2009; Bano and Rajarathnam, 1988) by using the following formulae

$$\text{Moisture (\%)} = \frac{\text{Initial Wt - Final Wt}}{\text{Wt of Sample}} \times 100$$

$$\text{Drymatter (\%)} = \frac{\text{Wt of acid x acid N}}{\text{Wt of Sample}} \times 100$$

$$\text{N (\%)} = \frac{\text{ml of acid x acid N}}{\text{Wt of Sample}} \times 100$$

$$\text{Crude fiber (\%)} = \frac{\text{Wt of an oven dried sample - wt of ash}}{\text{Wt of Sample}} \times 100$$

$$\text{Ash content (\%)} = \frac{\text{Ash Wt}}{\text{Wt of fresh sample}} \times 100$$

$$\text{Crude fat (\%)} = \frac{\text{Wt of other extracts}}{\text{Wt of Sample}} \times 100$$

$$\text{Crude Carbohydrate (\%)} = (100 - (\text{Crude protein} + \text{Crade fat} + \text{Crude fiber} + \text{Crude ash}))$$

RESULTS AND DISCUSSION

Effect of different substrates on the completion of spawn running period of *Pleurotus platypus* and *Pleuotus eous*

Among the seven substrates tested for determining the spawn running period, *Pleurotus platypus* and *Pleurotus eous* completed the process over the paddy straw in 17 and 19 days respectively, which is comparatively earlier when compared to other substrates. Coir waste and saw dust substrates were the next effective substrates, but there was no spawn running where *Eucalyptus* leaves were used as substrates.

Effect of different substrates on the time taken for first harvest of *Pleurotus platypus* and *Pleurotus eous*

Among the various substrates studied, *Pleurotus platypus* and *Pleurotus eous* came for harvesting over the paddy straw substrate on 22nd- 23rd day respectively. It was followed by coir waste in 14 and 24 days respectively. However the sporophore production was not found in the beds where *Eucalyptus* leaves were used.

Effect of different substrates on the sporophore production of *Pleurotus platypus* and *Pleurotus eous*

The highest yield of 350 and 580g of sporophore of *Pleurotus platypus* and *Pleurotus eous* respectively was recorded, when paddy straw was used as substrate. The bioefficiency of *Pleurotus platypus* and *Pleurotus eous* was 70 and 86 % respectively. Coir waste recorded the next highest yield of 290 and 350 g per bed respectively with the bioefficiency of 58 and 70% respectively. Though the other substrates also gave yields which were very less when compared to the paddy straw substrate (Table 1).

Moisture content (%), Dry matter (%), Protein (%), Fiber (%), Ash(%), Fat(%) and Carbohydrates (%) content of *Pleurotus platypus* and *Pleurotus eous a*re presented in Table 2. In the present study, the spawn running period and time taken for first harvest of *Pleurotus platypus* and *Pleurotus eous* were found earlier in beds prepared with paddy straw when compared to other substrates. This might be due to high content of nutrient that would have positively correlated with fast growth of mycelium and sporophore production (Quimio, 1978).

TABLE-1. Effect of different substrates on sporophore production of *Pleurotus eous* and *Pleurotus platypus*

S.No	Substrates	*Pleurotus eous*		*Pleurotus platypus*	
		Yield (g/bed)	Bioefficiency(%)	Yield (g/bed)	Bioefficiency(%)
1	Coconut Coir Pith,	350	70	290	58
2	Banana Leaf Sheath,	250	50	200	40
3	Eucalyptus Leaves,	-	-	-	-
4	Cotton Waste,	280	56	230	46
5	Paddy Straw,	580	86	350	70
6	Saw Dust	310	62	270	54
7	Palmyrah Leaves	210	42	180	36

TABLE-2. Chemical analysis of two varieties of Oyster mushroom grown under domestic conditions

Sub states	Moisture content (%)		Dry matter (%)		Protein (%)		Fiber (%)		Ash (%)		Fat (%)		Carbohy drate (%)	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Coco nut Coir Pith,	85.27 ±0.0 33	87.1 7±0. 043	12.7 3±0. 03	10.9 3±0. 02	42± 0.0 56	41± 0.0 66	27± 0.2 64	20± 0.2 6	11± 0.0 87	14± 0.0 87	10 ±0. 03	12 ±0. 07	11 ±1. 13	13 ±1. 13
Banana Leaf Sheath,	83.27 ±0.0 23	84.1 7±0. 033	15.7 3±0. 06	12.9 3±0. 02	38± 0.0 56	32± 0.0 66	24± 0.2 64	23± 0.2 6	10± 0.0 87	15± 0.0 87	16 ±0. 03	20 ±0. 07	12 ±1. 13	10 ±1. 13
Eucaly ptus Leaves,	83.27 ±0.0 33	82.1 7±0. 043	13.7 3±0. 03	12.9 3±0. 02	38± 0.0 56	42± 0.0 66	22± 0.2 64	23± 0.2 6	14± 0.0 87	15± 0.0 87	16 ±0. 03	20 ±0. 07	10 ±1. 13	10 ±1. 13
Cotton Waste,	84.27 ±0.0 33	85.1 7±0. 043	14.7 3±0. 03	13.9 3±0. 02	36± 0.0 56	40± 0.0 66	24± 0.2 64	22± 0.2 6	16± 0.0 87	14± 0.0 87	12 ±0. 03	10 ±0. 07	12 ±1. 13	14 ±1. 13
Paddy Straw,	86.27 ±0.0 33	83.1 7±0. 043	10.7 3±0. 03	11.9 3±0. 02	38± 0.0 56	44± 0.0 66	24± 0.2 64	20± 0.2 6	12± 0.0 87	15± 0.0 87	13 ±0. 03	10 ±0. 07	13 ±1. 13	11 ±1. 13
Saw Dust	88.27 ±0.0 33	87.1 7±0. 043	13.7 3±0. 03	11.9 3±0. 02	41± 0.0 56	43± 0.0 66	23± 0.2 64	21± 0.2 6	12± 0.0 87	11± 0.0 87	11 ±0. 03	13 ±0. 07	13 ±1. 13	12 ±1. 13
Palmy rah Leaves	82.27 ±0.0 33	87.1 7±0. 043	12.7 3±0. 03	10.9 3±0. 02	39± 0.0 56	45± 0.0 66	23± 0.2 64	20. ±0. 26	11± 0.0 87	16± 0.0 87	15 ±0. 03	19 ±0. 07	12 ±1. 13	10 ±1. 13

where, A- *Pleurotus eous*; B- *Pleurotus platypus*

It is because of the fact that the removal of tannins and the specified material during the preparation of the paddy straw for the bed could lead to make the nutrients readily available for the process of spawn running. More over the paddy straw substrate is relatively consistent and prevent competition from other groups of fungi, when compared to other types of substrats tested. The Eucalyptus leaf substrate did not permit the spawn to establish over the substrate which could be because of the fact that the plant contains volatile oil, that could have prevented the growth of the mycelium.

CONCLUSION

The period of spawn running and time for first harvest of two oyster mushroom varieties (*Pleurotus platypus*, *Pleurotus eous*) were found to be very earlier with the substrates of paddy straw. Among the various substrates tested paddy straw recorded higher yield in *Pleurotus platypus* and *Pleurotus eous* when compared to other substrates. Considering the availability and cost of paddy straw, coir waste may be put to use for the cultivation of oyster mushroom. The sporophore production was completely in beds were dried eucalyptus leaves used. Among the two species of *Pleurotus platypus* and *Pleurotus eous* recorded higher yield in all the substrates tried. The cellulose – lignin content in the substrates are positively correlated with cellulose – lignin ratio (Sivaprakasam,1980).

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