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EFFICACY OF DIFFERENT SPAWN AND BED SUBSTRATES ON THE PRODUCTION OF OYSTER MUSHROOM (*PLEUROTUS SAPIDUS* (SCHULZ.) SACC.)

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Abstract

Cultivation of mushrooms on lignocelluosic wastes represents one of the most economic organic recycling processes. The research was carried out to investigate the cultivation of oyster mushroom (*Pleurotus sapidus*) on different spawn and bed substrates. The results revealed that among various spawn substrates and bed substrates tested for mushroom production, sorghum grains as spawn substrate and paddy straw as bed substrate proved superior and recorded less spawn run days, higher yield and biological efficiency. Similarly, among five paddy varieties as bed substrates tested, the straw from CR-1009 followed by IR-50 proved as the best substrate. Also the modified cylindrical beds prepared using unchopped paddy straw has recorded the maximum sporophore number and yield.

Key words: *Pleurotus sapidus,* substrates, biological efficiency, spawn, oyster mushroom

Introduction

The world of mushrooms has always been fascinating and mystic to man owing to their sudden appearance in large numbers in groups, rings, bunches and also as a single attractive and fascinating structure. Mushroom cultivation is the only current economically viable biotechnology process, where in the waste plant materials or negative value crop residues may be converted into valuable food (Wood, 1985). In India, the total quantity of agricultural by-products and wastes, which are cellulosic in nature, account for nearly 25 million tonnes per year posing problems of disposal and by cultivation of suitable mushrooms these wastes can be well utilized, recycled and the environment may not be endangered by pollution (Jandaik, 1997). Most of the mushrooms possess the enzyme complexes which enable them to utilize and degrade these industrial and agricultural by products, thereby making them in to a highly valuable protein suitable for direct consumption. The choice of mushroom growers of South India however always has been towards oyster mushroom (*Pleurotus* spp.) which shows wide adaptability for ambivalent climatic conditions (Sivaprakasam, 1983). Like other mushrooms, oyster mushroom can be grown on various agricultural wastes with the use of different technologies. In Tamil Nadu, the main substrate for the production of mushroom is paddy straw. Hence, in the present study, various substrates to be used for both spawn and bed preparation were tested for the production of *Pleurotus sapidus* (schulz.) sacc.

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Materials and Methods

Effect of different spawn substrates

Different spawn substrates namely, cereal grains (sorghum, cumbu, paddy and ill-filled paddy), pulses (horse gram) and other substrates like (black gram husk and red gram husk) were used for spawn preparation as per standard procedure (Munjal, 1973). The ill-filled paddy grains (IFPg) were separated using winnowing technique.

After sterilization, the spawn substrates were inoculated with pure culture of the fungus. The bottles were incubated at room temperature for fifteen days. The completely colonized spawn bottles were used.

Suitability of various substrates for the cylindrical bed preparation

To identify the best substrate for bed preparation *viz*., crop residues (*Mangifera indica* leaves, paddy straw, *Thespesia populanea* leaves, *Icornia* sp. (expect roots) and weeds (*Cynodon dactylon*, *Cyperus rotundus*) were tried. The substrates were soaked and sterilized. These substrates were spawned with *Pleurotus sapidus* following standard procedures.

Suitability of paddy straw from different paddy varieties for the cylindrical bed preparation

The unchopped paddy straw from different varieties *viz*., IR 20, CR 1009, ADT 36, ADT 38 and CO 43 were tried as treatments following modified cylindrical bed preparation method (Eswaran, 1998).

Spawn Run

Number of days taken for 100 percent colonization / mycelial coverage on the substrate was recorded as spawn run period.

Maturity time of Sporophores

The number of days required for first harvest of the sporophores from the date of spawning of the bed was recorded as maturing time of sporophores.

Number of Sporophores

Number of sporophores harvested from the beds were recorded periodically.

Weight of Sporophores

The sporophores were weighed after harvest and yield per bed in gm was recorded.

Biological Efficiency

The biological efficiency of *Pleurotus sapidus* was calculated by

Biologocal Efficiency =

$$\frac{Fresh\ weeight\ of\ the\ \frac{mushroom}{bed}}{Dry\ weight\ of\ the\ \frac{substrate}{bed}} \times 100$$

Results and Discussion

Effect of various spawn substrates on the yield of *P. sapidus*

The results revealed that sorghum grains as the most suitable substrate for early spawn run which took only 11.33 days for complete spawn growth. The number of sporophores and weight of sporophores (114.33 and 465.33g, respectively) were also maximum in the sorghum grains, which was followed by IFPg and paddy grains. The horsegram substrate took maximum spawn run (18.67 days), minimum number of sporophores (74.33) and weight of sporophores (283.67g). The same trend was also noticed with that of biological efficiency (Table 1). Among the spawn base tried, sorghum, IFPg and paddy grains required the lowest period for complete colonization on substrate which was followed by cumbu, blackgram husk, redgram husk and horsegram. The variation in colonisation of different substrate could be due to variation in the amount of moisture absorbed during boiling which is one of the critical factors responsible for mycelial growth (Mehta, 1985). The longest period for colonisation was on pulse grains, which could be due to higher N content which influenced negatively the yield of sporophores (Sivaprakasam, 1980). Sivaprakasam and Kandaswamy (1981) obtained good yield of *P. sajor-caju* with sorghum and pearl millet. Sharma (1984) recorded equally good colonisation of *P. eryngii* on wheat, barely sorghum and pearl millet grains. Beds laid out using half filled grain spawn and Paddy chaff spawn recorded good yield (Gokulappan *et al*., 1994). These earlier reports corroborate with the present findings.

Effect of different substrates on the sporophore yield of *P. sapidus*

Various substrates like paddy straw, *Cynodon dactylon, Cyperus rotundus, Mangifera indica* leaves, *Icornia* sp, *Thespesia populanea* leaf were tested to find out their suitability for the cultivation of *P. sapidus*. Among the various substrates tested paddy straw substrate obtained maximum sporophore yield and biological efficiency (428.58g and 85.72 %, respectively) followed by *Cynodon dactylon* (300.28g and 60.01%,

Table 1: Effect of various spawn substrates on the sporophore production of *Pleurotus sapidus.*

Tr. No.	Spawn substrates	Spawn run (days)	No. of sporophores Per bed	Weight of sporophores (g/bed)	Biological efficiency (%)
1	Sorghum grains	11.33	114.33	465.33	93.06
2	Cumbu grains	12.67	107.67	405.42	81.08
3.	Paddy grains	14.33	99.33	450.00	90.00
4.	Ill-filled paddy grains	12.67	106.67	460.50	92.10
5.	Horse gram	18.67	74.33	283.67	56.73
6.	Black gram husk	16.33	96.33	315.08	63.02
7.	Red gram husk	16.67	87.33	288.42	57.68
	S.EdCD(p = 0.05)	0.351.01	0.882.52	3.389.61	0.120.37

respectively). The minimum sporophore yield and biological efficiency (20.5g and 4.1%, respectively) recorded that *Mangifera indica* leaves. No yield was recorded in *Icornia* sp (Table 2).

Cellulose and lignin in the substrates were important components deciding the yield of sporophores (Zadrazil, 1974). The yield of sporophores was related positively with cellulose content and negatively with the lignin and ortho-dihydroxy phenolics content of the substrates (Sivaprakasam, 1980). A good performance of paddy straw for the cultivation of *Pleurotus* spp. was reported by several workers. (Sivaprakasam *et al*., 1987; Ragunathan *et al*., 1996; Kumar *et al*., 1997). Eventhough, Bhandari *et al.,* (1991) and Jadhav and Jagtap, (1991) observed low yield of *Pleurotus* spp. in grass substrates. In the present study, the yield was found moderate when *Cyperus rotundus* and *Cynodan dactylon* were used as substrates. It is probable that paddy straw substrates provide a more balanced supply of cellulose and nutrients to the mushroom that resulted in the increased biological efficiency.

Table 2: Effect of different substrates on the sporophore yield of *Pleurotus sapidus*

Tr. No.	Substrates	Spawn run (days)	Weight of sporophores (g/bed)	Biological efficiency (%)
1	Paddy straw	11.33	428.58	85.72
2	*Cynodon dactylon*	16.33	300.28	60.01
3.	*Cyperus rotundus*	15.66	272.17	54.43
4.	*Mangiferae indica*	23.66	20.50	4.10
5.	*Icornia sp*	0.00	0.00	0.00
6.	*Thespesia populanea*	24.0	52.5	10.50
	S.EdCD(p = 0.05)	0.330.95	2.525.70	0.250.71

Table 3: Effect of different paddy varieties on the sporophore yield of *Pleurotus sapidus*

Tr. No.	Substrates	Spawn run (days)	Weight of sporophores (g/bed)	Biological efficiency (%)
1	ADT 36	12.66	362.98	72.59
2	ADT 38	12.00	380.27	76.05
3.	CR 1009	9.66	458.77	91.75
4.	CO 43	11.33	435.42	87.68
5.	IR 50	11.00	440.32	88.07
	S.EdCD(p = 0.05)	0.481.36	3.329.42	0.511.46

Table 4: Suitability of chopped and unchopped paddy straw for the cylindrical bed preparation for *Pleurotus sapidus*

Sl. No.	Characters	Coiling method (Unchopped)	Cutting method (Chopped)
1	Spawn run (days)	11.33	12.33
2	Sporophore maturity (days)	17.33	18.00
3.	Number of sporophore per bed	124.67	110.00
4.	Weight of sporophores g/bed	471.83	443.33
5.	Biological efficiency (%)	94.36	88.67
	S.EdCD (p = 0.05)	5.1914.77	2.446.94

Effect of different paddy varieties on the sporophore yield of *P. sapidus*

Among the various varieties of paddy straw tested, CR 1009 straw was the best substrate recording minimum spawn run days, maximum sporophore yield and biological efficiency (9.66, 458.77g and 91.75 %, respectively) followed by IR50 (11.0, 440.32 g and 88.07 %, respectively) which was closely followed by Co43 (11.33, 435.42 g and 87.68 %, respectively). The maximum spawn run days, minimum sporophore yield and biological efficiency (12.66, 362.98g and 72.59 %, respectively) recorded in the paddy variety ADT 36 (table 3). Hayes (1978) outlined the functions of cereal straws in mushroom cultivation as under: (i) to provide a reservoir of cellulose, hemi cellulose and lignin to be utilised during the growth of spawn and fructification period and (ii) to provide a variable quantity of nitrogen and minerals. Gerrits *et al.,* (1972) found that lignin loss occurred in spawn running stage, while cellulose and pentose were utilized in the sporophore formation. Thus, the straw from paddy varieties CR 1009 and IR50 could have supplied required nutrients which positively reflected in the maximum sporophore yield and biological efficiency.

Suitability of chopped and unchopped paddy straw for the cylindrical bed preparation for *P. sapidus*

The results revealed that the best performance was observed in unchopped paddy straw with minimum Spawn run days (11.33), Sporophore maturity days (17.33), Sporophore yield (471.83g) and biological efficiency (94.36) compared to chopped paddy straw. Eswaran (1998) also revealed similar such better performance with unchopped paddy straw (Table 4). Thus the results of the present study proved that the sorghum grains as spawn substrate, unchopped paddy straw from varieties CR 1009 could be efficiently used for the successful production of *P. Sapidus*.

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