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Effect of Different Agricultural Substrates on Yield of *Pleurotus sajor caju*

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ABSTRACT

Oyster (Pleurotus sajor-caju) was cultivated on different agricultural viz. wheat straw (Triticum aestivum), black gram straw (Vigna mungo), sesame straw (Sesamum indicum), sarson (Brassica juncea (L.) and soybean straw (Glycine max (L.) to determine the effect of these agro-waste on spawn running, fruit bodies formation and pinhead formation, yield and biological efficiency. Wheat straw showed significantly highest yield (8.6 % B.E.) and lesser time for spawn run 16.66 d) and pin head appearance (24.33 d). Sarson straw required more time for spawn run (23.66 d) and pin head appearance (30.66 d) and resulted less yield (2.40kg/5.0 kg substrate) with 48.0 per cent biological efficiency. The study revealed that lesser time taken to colonize the substrates is consistent with better yield and highest biological efficiency.

Key Words: Agricultural wastes, Biological efficiency, Cultivation, Pleurotus sajor-caju, Yield.

INTRODUCTION

Pleurotus spp. are the most talented group among the cultivated mushrooms, which have ability to degrade many lignocellulosic substrates and are capable to colonize successfully on these substrates (Patrabansh and Madan, 1997). P. sajor-caju is one of the most successfully cultivated species of these mushrooms and it is considered to be delicious (Zhang *et al*, 2002). Pleurotus species contain high potassium to sodium ratio, which makes mushrooms an ideal food for patients suffering from hypertension and heart diseases. They are also rich source of proteins, minerals and vitamins (Caglarirmak, 2007). The carbohydrate content of mushrooms represents the bulk of fruiting bodies accounting for 50 to 65 per cent on dry weight basis. On a dry weight basis, mushrooms normally contain 19 to 35 per cent proteins where as fat content is very low as compared to carbohydrates and proteins (Wani *et al*, 2010).

Mushroom production gives additional or alternative income to farmers looking for a value-added product and a way to supplement farm income while making use of byproducts or co-products from other crops. However, development of cost-efficient and alternate substrate to cultivate oyster mushroom without sacrificing mushroom quality is a major focus of many researchers and growers. Therefore, cultivation of *P. sajor-caju* on various agricultural residues offers high value products with nutritional and medicinal properties. Hence, the study was undertaken during March-May, 2016 at Krishi Vigyan Kendra under one of the training programme in Attaining and Attracting Youth in Agriculture (ARYA) project.

MATERIALS AND METHODS

The substrates used for cultivation of Oyster mushroom were wheat straw (*Triticum aestivum*), black gram straw (*Vigna mungo*), sesame straw (*Sesamum indicum*), sarson (*Brassica juncea* L.) and soybean straw (*Glycine max* L.). All the substrates were dried and cut into 3-4cm long pieces. The substrates were soaked in water for 8-10 hours in cemented pond to obtained 70-75 per cent moisture level. All the substrates were sterilized by boiling method where the substrates were boiled for one hour at 70-75°C. Then they were stalked on the steep cemented floor so as to

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remove the excessive moisture from the substrates to get 65-75 per cent moisture level. The substrates were cooled up to room temperature (25°C). A local method was developed for determination of moisture. In this method moisture was determined by pressing a handful mixture. If there was no water runoff and the material stayed in form indicates that the moisture content was around 65 per cent.

Five kilogram of each substrate was filled in transparent polythene bag (30x45cm and seeded with 150g of *P. sajor-caju*. The pinholes at 10-12cm distance were also done in the bags with help of led pencil after sterilization in 2 per cent formaldehyde solution. The bags were incubated in dark cropping room where ambient temperature ranged between 22-28+10C. The humidity 80 – 90 per cent of the room was maintained by spraying of water twice a day on the floor covered with jute bags. After complete colonization of substrate polythene was removed and bags were put on the bamboo made structure for fruiting. The humidity of the bags was accomplished by spraying of water on them twice a day. The experiment was laid out in complete randomized design (CRD) with three replications and five treatments. Time was recorded in days for the completion of growth of mycelium on substrates, appearance of pinheads and maturity of fruit bodies in different treatments. The data on average values of observations were also recorded for the yield, number of fruit bodies. Biological efficiency of mushroom on fresh weight basis was calculated by using formula given by Chang and Miles (1989).

RESULTS AND DISCUSSION

Spawn running

All the substrates were spawned at the same day. It was evident from the Table 1 that spawn running took 2-3 wk after spawning.

Pinhead formation

The pinhead formation is the second stage of mycelia during cultivation of mushroom. Small pinhead like structures were observed, these pinhead were formed 4-5 days after spawn running (Table1). Our results were corroborated with Ahmed (1986) who stated that Pleurotus ostreatus completed spawn running in 17-20 d on different substrates and the time for pinhead formation was noted as 23-27 d.

Fruit bodies formation

This is the third and final stage during the cultivation of mushroom. The fruit bodies appeared 4-5 wk after pinhead formation and took 25-34 d later after inoculation of spawn (Table1). Sharma and Jandaik (1981) reported that *P. sajor-caju* cultivation on wheat straw took 32 d for the first harvest.

$$\text{Biological efficiency (\%)} = \frac{\text{Yield of fruiting body (g)}}{\text{Total weight of substrate used (g)}} \times 100$$

Table.1. Days for completion of spawn running, fruiting body formation and pinhead formation on different substrates.

Substrate	Days for completion of spawn running	Days for pinhead formation	Days of fruiting bodies formation	Average number of fruiting bodies
Black gram straw	17.67	26.66	28.33	27.66
Soybean straw	16.67	24.66	26.65	30.55
Sesame straw	20.33	28.33	31.69	22.22
Wheat straw	16.66	24.33	25.66	31.11
Sarson straw (Check)	23.66	30.66	34.33	17.33
CD (P<0.05%)	2.06	2.09	3.12	3.01

Number of fruit bodies

The caps of mushroom was also counted in three flushes, average 17.33-31.11 were formed in three flushes (Table1). Highest number of fruiting body (31.11) were produced by wheat straw followed by soybean straw (30.55), black gram straw (27.66) and sesame straw (22.22) whereas least number of fruit bodies (17.33) were harvested from sarson straw. Asraf *et al* (2013) reported that cotton waste took maximum number of fruit bodies 4.33 ± 0.42 followed by wheat straw and rice straw with the number of fruit bodies 3.80 ± 0.30 and 3.53 ± 0.24, respectively.

Yield of Oyster mushroom

The crop was harvested in three flushes where maximum yield was obtained in first flush than the second and third flush. The results (Table2) showed that out of five substrates evaluated for their potential to produce sporophores of P. sajor-caju, wheat straw supported 4.88 per cent higher yield as compared to soybean straw. Other substrates have also proved to be the promising substrates for the cultivation of oyster. Mane *et al* (2007) grew *P. sajor caju* in several agro-industrial residues viz., cotton processing residue, wheat straw, soy straw, pea stalk and peanut stalk. Tupatkar and Jadhao (2006) conducted the similar studies on different substrates including wheat straw, paddy straw, soybean stalks and reported that paddy straw (613 g/kg of dry straw) followed by soybean straw (557 g/kg of dry straw) and combination of soybean straw plus wheat straw 1:1 w/w (508 g/kg of straw) gave optimum yield. The lower performance and yield of different agricultural wastes might be due to low lignolytic and cellulytic activity. However, high and significant performance of other substrates ensures the possibilities of utilizing the locally available substrates for Pleurotus sajor- caju cultivation.

Biological Efficiency

Considerable variation was found in yield of Oyster Mushroom using different substrates. The biological efficiency was calculated on the dry weight basis of the substrate. It was evident (Table2) that as a substrate wheat straw showed best biological efficiency 86.0 per cent followed by soybean straw 82.0 per cent, black gram straw 78.0 per cent, sesame straw 65.0 per cent and sarson straw 48.0 per cent. Dehariya and Vyas (2013) reported that the soybean straw showed significantly highest yield (with 93.3% B.E.) followed by wheat and paddy straw. Pleurotus sajor- caju was found to utilize all the agricultural wastes and were observed suitable for spawn run, yield and biological efficiency (Das et al, 2000).

CONCLUSION

The study revealed that wheat straw showed significantly highest yield (8.6 % B.E.) and lesser time for spawn run 16.66 d) and pin head appearance (24.33 d). Sarson straw required more time for spawn run (23.66 d) and pin head appearance (30.66 d) and resulted less yield (2.40kg/5.0 kg substrate) with 48.0 per cent biological efficiency. The study revealed that lesser time taken to colonize the substrates is consistent with better yield and highest biological efficiency.

Table.2. Effect of different substrates on average yield and biological efficiency of *P. sajor-caju*.

Substrate	Average yield of three flushes (kg)	Biological Efficiency (%)
Black gram straw	3.90	78.0
Soybean straw	4.10	82.0
Sesame straw	3.25	65.0
Wheat straw	4.30	86.0
Sarson straw (Check)	2.40	48.0
CD ($p<0.05$)	4.83	6.82

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