

EVALUATION OF DIFFERENT AGRICULTURAL WASTES ON BIOLOGICAL EFFICIENCY OF *PLEUROTUS OSTREATUS*

AUTHOR

Dr. Shifa Vanmathi . J¹ Assistant professor, PG Department of Zoology, Sadakathullah Appa College, Affiliated to Manonmaniam Sundaranr University, Tirunelveli-11. Tamilnadu, India.

Dr.V.Lakshmi,² Assistant professor, PG Department of Zoology, Pasumpon muthuramalinga thevar college, Melaneelithanallur, Tirunelveli, Tamilnadu.

Abstract

The Present study was conducted in mushroom house to determine the effect of different substrates like saw dust, paddy straw and sugarcane bagasse on growth and production of *Pleurotus ostreatus* (oyster mushroom). Initially, the stalk length and pileus diameter of oyster mushroom was recorded . Among the three treatments, the maximum stalk length (6.87 ± 2.10) and pileus diameter (6.41 ± 0.60) was observed in paddy straw treatment followed by saw dust (4.40 ± 0.05), (5.50 ± 0.06) and sugarcane bagasse (3.14 ± 0.77), (4.48 ± 1.41). Mycelium running took less time i.e. 11 days on paddy straw as compared to sugarcane bagasse (12.33) and saw dust (15.33). The appearance of pinhead and their maturity also took less time i.e. 17 days and 22 days, respectively on paddy straw and sugarcane bagasse. The maximum number of fruiting bodies were observed in paddy straw treatment (12.33) and saw dust treatment (10.66). The highest yield was recorded on paddy straw (41.66 ± 17.55) followed by sugarcane bagasse (32.1 ± 16.70) and saw dust (19.24 ± 11.13) treatment. Among the three different substrates tested, paddy straw substrate was recorded in better growth and yield of *Pleurotus ostreatus*.

Keywords: Substrates; growth; production; mycelium running, *Pleurotus ostreatus* .

1. Introduction:

Mushroom is a special type of edible forming flesh umbrella like fruiting bodies. It is a human diet and considered a highly nutritive food delicacy in most parts of the world. (Sanchez, 2010) reported that *P.ostreatus* is the second most cultivated edible mushroom worldwide after *Agaricus bisporus* which constitute about 25% of total world production of cultivated mushrooms. Compost of wheat and paddy straw, banana leaves, sugarcane bagasses,wheat barn, rich husk, saw dust etc can be used as substrate for growing mushroom (Gupta, 1986).

Mushrooms are a rich source of carbohydrates, proteins, vitamins, and minerals (Ananbeh, 2003). Mushrooms grow on decayed organic matters rich in lignin, cellulose, and other complicated carbohydrates. *P. ostreatus* is an easily cultivable mushroom that colonizes various crop residues as substrates. *Pleurotus* spp. are able to degrade and convert lignocellulosic compounds into protein-rich biomass (Mamiro and Mamiro, 2011), and help in managing agro-wastes whose disposal has become a problem (Das and Mukherjee, 2007).

Methew *et al.* (1996) successfully cultivated five species of oyster mushroom on paddy straw. According to Jiskani (1999), it can easily and successfully be cultivated on wheat, paddy, barley, oat and gram straw, banana, sugarcane and maize leaves, empty corn cobs and millet heads, cotton waste, sticks and boll locules, sugarcane bagasse, banana pseudostems, saw dust, logs, straw papers, manure. The objectives of this research are to evaluate the effect of different substrates for the growth and production of oyster mushroom, *Pleurotus ostreatus*.

2. Materials and methods:

2.1. Collection of Spawn bag:

Spawn of *P.ostreatus* prepared on white sorghum grains was obtained from Tamilnadu Agriculture Research Institute, Killikulam, Tutucorin.

2.2. Preparation of substrates and treatment bags

The experiment was carried out with three different substrates of Paddy straw; sugarcane bagasses and saw dust were used for the growth of *P.ostreatus* mushrooms. The paddy straw and sugarcane bagasses were cut in to many pieces (5 cm) and soaking in water for overnight. Substrates were allowed to ferment for hours and spread on floor for evaporation of excess moisture. Then the substrates were cooked in autoclave for 30 minutes for sterilization and allowed to dry for few hours. The sterilized substrates was filled with polypropylene bags @5kg/bag (6 x 9 inches) . Inoculation was made with prepared pure grain spawn of *P. ostreatus* at 250 g per 5 kg of substrate on dry weight basis under aseptic conditions. Plastic necks were used on the mouth of packets. 3 packets were prepared for each treatment.

A hole of 1 to 2 inch was made with pointed steel on polypropylene bags and the treatments were marked and hanging in incubation room at 25°C under 80 – 85% relative humidity. Water was spraying twice or thrice days until the mushrooms were matured and proper ventilation is maintained for fruiting. The experiment was laid out in completely randomized design with three replications for each treatment. (Khan *et al.*, 2006).

2.3. Growth and yield parameters

After 15-16 days, white mycelium was formed and fully covered the substrates bags.. After 7–8 days, the small size pin heads appearance was noted on all sides of the bags. These pinheads attained the full size in about 2-3 days and when fruiting body fully matured then they were harvested. The pin heads appearance time and fruit body developing also recorded. Mushrooms were harvested from the substrate when the caps got fully mature and before the fruiting bodies start to curl up.

The data for different morphological traits that is stalk length (cm) and pileus diameter (cm) and also the harvesting parameters like mycelium running time (days), number of effective fruiting bodies , harvesting(days) and biological yield (g/packet) was determined using the methods of (Aoac,1984).

Statistical analysis: The recorded data were analyzed by using analysis of mean and standard deviation.

3. RESULTS AND DISCUSSION:

The growth and yield parameters of *Pleurotus ostreatus* treated with different substrates were analysed and also tabulated

3.1. Stalk length and pileus diameter of *Pleurotus ostreatus*-

The stalk length and pileus diameter of *P. Ostreatus* are presented in table 1 and 2. In first flush, the maximum stalk length was recorded in paddystraw (6.87 ± 2.10 cm) and saw dust (4.40 ± 0.05 cm) and the lowest stalk length was observed in sugarcane bagasse (3.14 ± 0.77 cm). In 3rd flush, The maximum length was observed in paddy straw substrate (5.59 ± 0.49 cm) and it was followed by sugarcane bagasse (5.02 ± 0.73 cm) and minimum stalk length was noticed in saw dust (4.56 ± 0.23 cm).

In first flush, the maximum pileus diameter was recorded in paddy straw (6.41 ± 0.60 cm) and saw dust (5.50 ± 0.06 cm). The lowest pileus diameter was observed in sugarcane bagasse (4.48 ± 1.41 cm). In 3rd flush, the maximum pileus diameter was noticed in paddy straw (5.79 ± 0.08 cm) followed by sugarcane bagasse (5.54 ± 0.91 cm) and the minimum bud formation was recorded in dust (5.35 ± 0.55 cm)). The better stalk length and pileus diameter was observed in paddy straw treatment when compared to other treatment.

Ajonia *et al* (2012) reported on three flushes of *P. Ostreatus*, the highest stalk length was found in saw dust and lowest recorded in palm cones. Bhatti (1984) cultivated *Pleurotus* spp. on chopped wheat straw, paddy straw, cotton waste and saw dust. Sugarcane bagasses also proved a better substrate in case of pin-head formation. It was observed that time taken for first appearance of pinhead after spawning of the substrate was 16, 18 and 23 days, respectively in the local and exotic strains of *P. ostreatus* and *P. sajarcaju*. In case of the maturity of fruiting bodies, it was revealed that the minimum number of days was taken on the sugarcane bagasse (20.3, 22 & 37 days), which proved to be the best substrate followed by cotton waste (33.3, 38 & 37.7 days). Sh.Muhammad Iqbal1, (2005).

3.2. Mycelium running and pin head formation of *Pleurotus ostreatus*

The experiment was carried out to find the effective substrate for rapid mycelium running and pin head formation among paddy straw, saw dust and sugarcane bagasse. The result shown in Table 3 indicates that the earliest mycelium running was found in paddy straw (11 days) and sugarcane bagasse (12 days). The maximum days required by saw dust (15 days). It was observed that time taken for first appearance of pinhead after spawning of the substrates was fastest (17 days) in paddy straw. Saw dust and sugarcane bagasse also proved a better substrate in case of pinhead formation. It ranked second after paddy straw having 22 days for the appearance of pinheads. The highest number of fruiting body produced and also the shortest harvest time was taken by paddy straw substrate (25 days) and sugarcane bagasse (26 days), whereas the longest harvest time was taken by saw dust (30 days)

Mehta and Bhandal (1988) reported that mycelium growth rate was higher in *P.ostreatus* followed by other species at 25°C. It was shown that similar result in variety of HK-51 oyster mushroom,

average performance on straw, and banana leaf midribs. Al Amin (2004) in his experiment revealed that the highest number of primordia and fruiting bodies of Oyster mushroom was found in sterilized paddy straw. Patra and Pani (1995) reported that oyster species took 48 days for complete harvesting.

3.3. Average yield of *Pleurotus ostreatus*

The data regarding number of flushes flush wise yield, and total yield are presented in Table 4. The average yields of these substrates from first flush were 60g (Treatment 2), 38g (Treatment 3) and 32 gm (Treatment 1) respectively. In the second flush these substrates had shown an average yield of 40g, (Treatment 2), 33g (Treatment 3), and 11g (Treatment 1), respectively. The third flush showed the lowest yield having an average of 25g, 25g and 12.63gm respectively. The crop of oyster mushroom was harvested in three flushes. The maximum total biological yield was obtained from paddy straw (Treatment 2), (125g/packet), (99 g/packet) and (57g/packet) when they grow on and sugarcane bagasses (Treatment 3), and saw dust (Treatment 1), .

According to Dey and Nasiruddin, 2008, sugarcane bagasse performed best followed by rice straw and mustard straw for the production of Oyster mushroom using cylindrical block system. Ramzan (1982) cultivated *Pleurotus* spp. and got 3-5 flushes of the crop and paddy straw proved to be the best substrate followed by wheat straw. According to Bughio (2001) the maximum dry and fresh (wet) yield percentage on substrate dry weight basis (29.61 to 77.91 and 5.91 to 21.70) were obtained from wheat straw using in combination with sugarcane bagasse, paddy straw, cotton boll locules and sorghum leaves.

Babar Iqbal, *et al* (2016) reported that The highest total yield of oyster mushroom was obtained in case of wheat straw followed by rice straw having the total yield of 1230 gram. Moonmoon *et al.*, (2010) studied *P. eryngii* King Oyster mushroom on rice straw and saw dust in Bangladesh and found that saw dust. Present study revealed that biological efficiency (BE) was maximum on Paddy straw followed by other substrates.

Table 1: Influence of different substrates on stalk length of *P.ostreatus*

Treatment	First flush (cm)	Second flush (cm)	Third flush (cm)
Treatment 1 (Saw dust)	4.40±0.05	3.94± 0.16	4.56 ±0.23
Treatment 2 (Paddy straw)	6.87 ±2.10	5.45 ±0.36	5.59 ± 0.49
Treatment 3 (Sugarcane bagasse)	3.14 ± 0.77	4.72 ±0.16	5.02 ±0.73

Table 2 : Influence of different substrates on pileus diameter of *P.ostreatus*

Treatment	First flush (cm)	Second flush(cm)	Third flush (cm)
Treatment 1 (Saw dust)	5.50 ±0.06	4.26 ±0.50	5.35 ± 0.55
Treatment 2 (Paddy straw)	6.41 ±0.60	5.93±1.09	5.79 ± 0.08
Treatment 3 (Sugarcane bagasse)	4.48 ±1.41	5.04 ±0.74	5.54 ± 0.91

Statistical methods: The experiment data was expressed as Mean ± SD

Table 3. Mycelium running time and yield characters of *P.ostreatus*

Treatment	Total mycelium running time (days)	Pin head formation (days)	Days required for harvesting	Number of fruiting bodies (days)
Treatment 1 (Saw dust)	15.33	22.66	30.33	10.66
Treatment 2 (Paddy straw)	11.00	17.33	25.33	12.33
Treatment 3 (Sugarcane bagasse)	12.33	22.12	26.33	8.66

Table 4. Total yield of *P.ostreatus* on different substrates

No. of harvest	Saw dust (Treatment 1)			Paddy straw (Treatment 2)			Sugarcane bagasse (Treatment 3)		
	Fresh weight (g)	Dry weight (g)	Powder weight (g)	Fresh weight (g)	Dry weight (g)	Powder weight (g)	Fresh weight (g)	Dry weight (g)	Powder weight (g)
1 st flush	32.10	12	6.7	60	22	10.9	38.33	21.9	12.50
2 nd flush	13	9.41	4.1	40	8.20	8.1	33	18	11.6

3rd flush	12.63	7.45	3.5	25	6.70	4	25	17	9
Total yield	57.73	9.6± 2.28	4.76± 1.70	125	12.3± 8.43	7.66± 3.47	96.33	18.96 ± 2.58	11.03± 1.81

Conclusion

Paddy straw was found most suitable substrate for mushroom cultivation. The mycelium running, appearance and maturity of pinheads were fastest in paddy straw treatment. Paddy straw also showed the highest flush wise yield, total yield and biological efficiency. Through our research area, paddy straw is the first recommended substrate for the growth and yield of oyster mushroom. Even though farmers can also use sugarcane bagasse and saw dust as substrate for the production of high quality mushrooms.

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