"Effect of wheat straw along with different botanicals on the growth and yield of *Pleurotus florida* (Oyster mushroom)"

ABSTRACT

The present investigation entitled "Effect of wheat straw along with different botanicals on the growth and yield of *Pleurotus florida* (Oyster mushroom)" was carried out in the Mushroom Crop Room and Research Laboratory, Department of Plant Pathology, SHUATS, Prayagraj. The experiment was conducted by using wheat straw as base substrate with different leaves. The experiment's objective was to evaluate the effect of cultivation, substrates *viz.*, wheat straw, bamboo, jamun, beal, drumstick, maize and banana leaves respectively, for the growth and yield of *Pleurotus florida* (Oyster Mushroom) on different combinations of substrate. The Experiment was conducted during July 2021 in a Completely Randomized Block Design (CRD) with five replications and seven treatments. Spawn running, appearance of pinhead and formation of mature fruiting body took less time *i.e.* 16.40 days, 18.0 days and 20.20 days respectively on T_6 (Wheat straw + Maize leaves) in comparision to other treatments. Width of pilus and length of stipe showed significant increase *i.e.* 9.46 cm and 7.67cm respectively, were recorded on T_5 (Wheat straw + Banana leaves). Significant yield *i.e.* 469.87 gram was recorded on T_5 (Wheat straw + Banana leaves). Wheat straw substrate with banana leaves were proven to be the best economical substrate with B:C of 1.73.

Keywords: flush, fruiting body, mycelial, pileus, *Pleurotus florida*, pin head initiation, stipe, spawn.

INTRODUCTION

Mushrooms are macroscopic, spore-bearing fruiting structures that fall under the classification of Basidiomycotina in the kingdom Fungi, division Eumycota. French gardeners were the first to cultivate mushrooms. The first recorded cultivation of mushrooms is thought to have taken place in Asia around 600 A.D. A non-traditional horticulture crop with high protein, high fibre, vitamin, and mineral content is the mushroom. Every year, 61.16 lakh cultivated mushrooms are produced annually worldwide.

An edible fungus native to the tropics and subtropics is the paddy straw mushroom *(Pleurotus florida*). After *Agaricus bisporus*, Plerotus ranks second in terms of global mushroom

production. About 7% of the world's total production of edible mushrooms was made up of *Pleurotus* species in 1986. One million metric tonnes of *Pleurotus* sp. were cultivated by 1990, making up 24% of total production **(Narayanasamy *et al.*, 2008).**

The majority of cellulosic residues, including banana leaves, dried paddy straws, cotton waste, and rice straws, are easily able to support their growth. The only crop that genuinely transforms waste materials like straw, sugar cane bagasse, maize stalks, cotton, coffee, other field wastes, agro-industrial waste, and even animal dung into nutritious, protein- and vitamin-rich food is the mushroom. They can also produce significantly more per square metre of land used than any other crop **(Kurtzman *et al.*, 2010).**

It is believed that employing mushroom fungi to compost organic wastes is the safest way to get rid of xenobiotic pollution **(Murugan and Kannan, 2019).** Mushroom mycelium has the ability to develop a variety of sophisticated extracellular enzymes that can break down trash and aid in pollution reduction.

The majority of cellulosic residues, including banana leaves, dried paddy straws, cotton waste, rice straws, sawdust supplemented with chicken droppings, Jatropha, and even invasive plant species, are suitable for their easy growth. **(Fahad *et al.*, 2015).**

The oyster mushrooms are gaining much popularity in recent years. They have gastronomic and medicinal properties **(Joshi *et al.*, 2018).** Also, they are very easy to cultivate on a large range of substrates within a short span.

On a dry weight basis, oyster mushrooms have a 345 Kcal energy value per 100g and are high in protein (30.4%), fat (2.2%), carbs (57.6%), fibre (8.7%), and ash (9.8%). While mushrooms contain minerals like calcium (98 mg), potassium (292 mg), phosphorus (476 mg), iron (8.5 mg), and salt (61 mg) per 100 g dry weight basis, they additionally rich in vitamins like thiamin (4.8 mg), riboflavin (4.7 mg), and niacin (108.7 mg) **(Yujie *et al.*, 2007).**

In comparison to other kinds of mushrooms, oyster mushrooms are the simplest, cheapest, and fastest to cultivate. They also require the least amount of technology and preparation time. Additionally, the first flush usually has a big volume and doesn't require casing, manure, compost, or limestone. It is guaranteed a special status as a delicacy due to its greater than 100% biological efficiency, unique flavour, aroma, and exceptional drying and

preservation capabilities. You can learn about the botanicals used to produce mushrooms that increase yield and are more productive economically according to studies.

MATERIALS AND METHODS

Experimental site:

During July 2021 and September 2021, the experiment was conducted in the Mushroom Crop Room and Research Laboratory at the Department of Plant Pathology, SHUATS, Prayagraj, 211007 (U.P.), India.

Mushroom crop room cleaning and sterilization:

The mushroom crop room should be properly cleaned. White washing of the mushroom crop room should be done. Properly sprayed with the insecticide Nuvan/Dichlorvos 76% at the rate of 30ml in 10 litres of water with a fungicide Bavistin/Carbendazim 10 g in 5 liters of water. The mushroom room should be closed for one day. On the next day, the solution consisting of 10 g potassium permanganate and 100 ml formalin should be kept in the four corners of the mushroom room. The doors and windows were closed for 2 days. On the third day, spawning was to be done and the mushroom bags were kept inside the crop room.

Substrate preparation:

For all the treatments, wheat straw was used as the common substrate. The stubbles and hard sticks were removed which can damage the polythene bags. The wheat straw was chopped into small pieces (2-3 cm) and sun dried for 2 to 3 days. The wheat straw was packed in gunny bags with large pores on them in order to facilitate free water passage. 100 litres of water were filled in a clean drum of 500 litres capacity. 150 ml of formalin solution, 50g of bavistin/carbendazim and 30 ml of nuvan/dichlorvos 76% were mixed in the water **(Sharma *et al.*, 2018**). After sterilization of the wheat straw, the bags were taken out and put on the cement floor for 2hrs. The excess water was drained out. The straw was spread evenly on the plastic sheet and was shade dried. The moisture was kept at 60-65% which can be determined by holding the straw in the hand and the water must not drip out of the hand. The substrate was ready for spawning.

Preparation of botanical leaf powder:

Obtain fresh, fragile leaves of the chosen plant from various sites in and around the university. Thoroughly wash them 2-3 times with enough water, then lay them out on a

kitchen towel to absorb any excess moisture. Now spread on a sieve or a napkin and solar dry for a few days in a covered place in the shade or next to a fan. From the dried leaves, make a powder, and keep it in a sealed jar. It stays fresh for 6 months at room temperature. The bags with leaf powders were soaked in 2 litre of water was filled in a clean polythene bag, 1.5 ml of formalin solution, 1g of Bavistin/Carbendazim and 0.5 ml of Nuvan/Dichlorvos were mixed in the water. The prepared botanical leaf powder of 50gm was mixed into each wheat straw per 2 kg wet substrate.

Spawning and bagging:

Spanning was done at the rate of 50g per 2kg of wet substrate. The spawn was mixed with the wet substrate using thorough method (**Siddhant *et al.*, 2013**). The substrate along with the spawn was kept inside the polythene bag and the bags were closed tightly with a rubber band. The bags were kept in the sterilized crop room. 15 to 20 holes were made on the polythene bags using a sterilized needle for facilitating the aeration. Each treatment was replicated five times. All the spawned bags were kept at a distance of 20-25cm apart from each other. The spawned bags were incubated in dark conditions (**Chauhan and Gupta, 2017**) at a temperature range 200 ^{0}C–250 ^{0}C and humidity 70-85%. Temperature and humidity were maintained by spraying water twice a day on the walls and floor of mushroom crop room.

Care after spawning:

When the mycelium covered the substrate entirely, the polythene bags were removed carefully with a sterilized needle without damaging the mushroom substrate. The substrate should be watered daily at least thrice a day. After 3-5 days of removal of polythene bags, smaller pinheads were appeared on the sides of the blocks. To regulate the oxygen and carbon dioxide levels inside the mushroom crop room, windows were kept open for 1-2hrs every day. The temperature was maintained between 20-30°C. The moisture in the crop room was maintained at 80-85%.

Harvesting:

Before applying water, the ripe fruiting bodies were manually picked in either a clockwise or anticlockwise rotation. Weight and treatment-related data were obtained when the harvested fruiting body was weighed. The second and third harvesting processes each followed the identical steps.

ANALYSIS OF STATISTICS

For the analysis of the collected data in this study, a completely randomised design (CRD) was used. The analysis of variance served as the foundation for the conclusions. At the appropriate degree of freedom, the estimated F was compared to the calculated 5% level of probability. (**Fisher and Yates, 1986**).

RESULTS AND DISCUSSION

At the laboratory and mushroom crop room of the Department of Plant Pathology at the Sam Higginbottom University of Agriculture, Technology, and Sciences in Prayagraj, Uttar Pradesh, 211007, all supplement outcomes were evaluated in an agroclimatic zone.

A. Number of days taken for complete spawn run of *Pleurotus florida* as affected by different treatments:

The average number of days required for the completion of spawn run on wheat substrate with different combinations of botanicals were presented in table. The spawn run was recorded when the mycelial growth had completely covered the mushroom beds. Variation was noticed for *Pleurotus florida* on different substrates. The spawn run was completed within 16.40 to 21.20 days from inoculation on all the treatments under study The results revealed that the T6- Wheat straw + maize leaves was found significantly superior over all other treatments which showed shortest duration (16.40 days) to complete spawn run. Among the treatments (T6, T5, T1, T4), (T5, T1, T4), (T1, T4, T2, T3), (T4, T2, T3) and (T2, T3) were found non-significant to each other. However, they are significantly differing from control.

According to the study's findings, the spawn run was quicker in T6- Wheat straw + Maize leaves (16.40 days), while T0- Wheat straw required the longest amount of time for the entire spawn run (21.2 days). As per (Deshmukh and Deshmukh., 2014), *Pleurotus florida* needed 13 to 19 days to finish its spawn run on various substrates. The ability of the *Pleurotus* species to secrete a variety of degradatory enzymes, including cellulases, hemi-cellulases, xylanases, lignin peroxidase, manganese peroxidase, and laccases, allows them to grow on a variety of lignocellulosic waste materials (Madan 29 and Bisaria, 1983; Buswell and Chang, 1993); (Rajarathnam *et al*., 1998). (Sivaprakasan and Ramaraj, 1991) *Pleurotus* species' degradative capability was investigated, and it was discovered that the fungus favours cellulose-rich substrates. According to (Bhatti *et al*., 2010), the variation in the substrates chemical composition and C: N ratio may account for the difference in days for full mycelial running.

Number of days for primordial initiation of Pleurotus florida as effected by different treatments:

The significant variation in the days required for pinhead formation was observed with the different substrates used for cultivation of *Pleurotus florida*. The pinheads or primordial initiation was observed within 2-4 days after the completion of spawn run. The average number of days required for the primordial initiation on wheat substrate with different botanicals were presented in table. The results revealed that the T6- Wheat straw + maize leaves were found significantly superior over all other treatments which showed shortest duration (18.0 days) to complete pin head formation. Among the treatments (T6, T5, T1), (T5, T1, T4), (T1, T4, T2, T3), (T4, T2, T3) and (T2, T3) found non-significant to each other. However, they were significantly different from control.

As per the findings from this study, it was observed that the shortest duration for primordial initiation was recorded in T6- Wheat straw + Maize leaves (18.0 days), whereas the longest duration taken for primordial initiation was observed in T0- Wheat straw (23.8 days). Similarly, results were also reported by (Iqbal et al., 2016) and (Deshmukh and Deshmukh. 2013) the time duration required for pinhead formation varies between 17 to 23 days after spawning in *Pleurotus florida*.

B. Number of days for formation of mature fruiting body of *Pleurotus florida* as affected by different treatments:

The pinheads grew and attained maximum size to form mature fruiting bodies within 2-3 days. The days required for formation of mature fruiting bodies in wheat substrate with different spawn were recorded and presented in table. The results revealed that the T6- Wheat straw + maize leaves were found significantly superior over all other treatments which showed shortest duration (20.20 days) to complete formation of mature fruiting body. Among the treatments (T6, T5, T1), (T5, T1, T4), (T1, T4, T2, T3), (T4, T2, T3) and (T2, T3) found non-significant to each other. However, they were significantly different from control. The results from this study revealed that the least time taken for formation of mature fruiting body was in T6- Wheat straw + Maize leaves (23 days), whereas the highest time taken for mature fruiting body formation was observed in T0- Wheat straw (27.4 days) The variation in time taken for mature fruiting body formation may be dependent on the use of different substrates (Baysal *et al.*, 2003).

C. Width of pileus (cm) of *Pleurotus florida* as affected by different treatments:

The width of pileus (cm) of *Pleurotus florida* on different substrate in combination with botanicals were presented in table. The results revealed that the T5- Wheat straw + banana leaves were found significantly superior over all other treatments which showed highest width of pilus (9.46 cm). Among the treatments (T0, T2, T3, T6), (T2, T3, T6), (T3, T6, T4, T1), (T6, T4, T1), (T4, T1, T5) and (T1, T5) found non-significant to each other. However, they were significantly different from control. As per the findings from this study it was observed that significant width of pileus (cm) was obtained in T5- Wheat straw + Banana leaves (9.46 cm).

Similar result found according to (Mondal *et al.*, 2010 A greater mycelium running rate and higher mycelial development in banana leaves are caused by the presence of the proper amounts of lignin, hemicellulose, and alpha-cellulose; a suitable C: N ratio may also be to blame, which results in a higher yield. Changes in the stipe length, pileus breadth, and total yield of the mushrooms produced in the various farm substrates may be caused by the type of agricultural wastes, single or blends of two separate agricultural wastes, employed in preparing the farm substrates. similar outcome was discovered by (Chukwurah *et al.*, 2013). Additionally, the primary ecological elements of temperature, humidity, fresh air, and compact material have an impact on the mushroom's stalk height, stalk diameter, and cap size (AMGA, 2004). The different biochemical compositions of the substrates may be responsible for the variation in stipe size (Jonathan *et al.*, 2012).

D. Yield (g) of *Pleurotus florida* as affected by different treatments:

The data regarding total yield obtained from three flushes of *Pleurotus florida* on different substrate in combination with botanicals were presented in table. The results revealed that the T5- Wheat straw + banana leaves were found significantly superior over all other treatments which showed significant yield (469.87 g). Among the treatments (T0, T3), (T4, T6) and (T1, T5) found non-significant to each other. However, they were significantly different from one another. The results revealed that the significant yield of mushroom was obtained in T5- Wheat straw + Banana leaves (469.87g). This is in agreement with the results obtained by (Neupane *et al*., 2018). Similar results were seen according to (**Mondal et al., 2010**). The presence of the proper amounts of alpha-cellulose, hemicellulose, and lignin may be the cause of the faster mycelial development and running rate in banana leaves as well as the appropriate C: N ratio, which results in a higher yield. Changes in the stipe length, pileus breadth, and total yield of the mushrooms produced in the various farm substrates may be

caused by the type of agricultural wastes, single or blends of two independent agricultural wastes, utilised in preparing the farm substrates.

similar outcome was discovered by (Chukwurah *et al.*, 2013). According to Mamiro and Mamiro (2011), the high-water holding capacity of banana leaves might be the explanation of the higher yield from banana leaves. Additionally, the primary ecological parameters of temperature, humidity, fresh air, and compact material have an impact on the mushroom's stalk height, stalk diameter, and cap size (AMGA, 2004).

Table 1 : Effect of various treatment combinations on the growth parameters of *pleurotus florida.*

S. No.	Treatments	Average number of days for complete spawn run	Average number of days primordial initiation	Average number of days for mature fruiting body formation	Width of pileus (cm)	Length of stipe (cm)	Yield(g)
T_0	Wheat straw	21.2	23.8	26.00	7.59	6.14	331.42
T_1	Wheat straw + Bamboo leaves	17.00	19.4	21.60	9.16	7.44	454.64
T_2	Wheat straw + Jamun leaves	18.2	20.6	22.80	7.79	6.66	394.26
T_3	Wheat straw + Beal leaves	18.20	20.8	23.20	8.03	6.17	345.88
T_4	Wheat straw + Drum stick leaves	17.60	20.0	22.40	8.75	7.02	422.50
T_5	Wheat straw + Banana leaves	16.60	18.8	21.00	9.46	7.67	469.87
T_6	Wheat straw + Maize leaves	16.40	18.0	20.20	8.52	6.83	430.55
	S. Ed. (±)	**0.632**	**0.763**	**0.818**	**0.437**	**0.380**	**7.512**

	C. D. (at 5%)	**1.296**	**1.564**	**1.675**	**0.937**	**0.815**	**16.028**

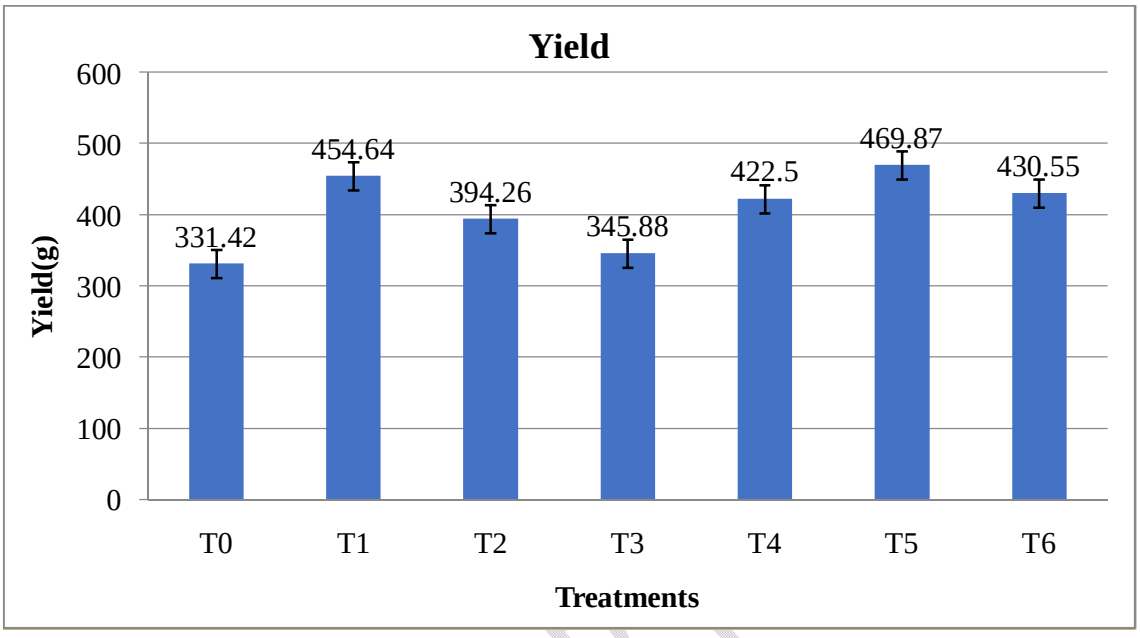

Fig 1. Effect of various treatments on yield of *Pleurotus florida.*

CONCLUSION

The experiment was conducted to check the "Effect of wheat straw along with different botanicals on the growth and yield of *Pleurotus florida* (Oyster mushroom)". The trail was analysed by using CRD (completely randomized design) with five replications. Seven treatments T1 – wheat straw + bamboo leaves, T2 - wheat straw + jamun leaves, T3 - wheat straw + beal leaves, T4 - wheat straw +drumstick leaves, T5 - wheat straw + banana leaves, T6 - wheat straw + maize leaves along with the control T0 - wheat straw was taken. Observations recorded were number of days taken for completion of spawn run (days), primordial initiation (days), fruiting body formation (days). Diameter of pileus (cm), length of stipe (cm) and yield (g) were recorded in three flushes respectively. The significant results obtained were as follows, the lowest time taken for spawn run, pin head formation, fruiting bodies formation were recorded in T6- Wheat straw + Maize leaves 48 (16.40 days, 18.0 days and 20.20 days respectively). Significantly increased pileus width and stipe length (cm) were recorded in T5- Wheat straw + Banana leaves (9.46 cm and 7.67 cm). However, Significant

yield was also recorded in T5- Wheat straw + Banana leaves (469.87 g). The most beneficial treatment obtained was T5- Wheat straw + Banana leaves (B:C of 1.73).

FUTURE SCOPE:

Wheat straw and banana leaves have both been found to be effective in enhancing the development and output of white oyster mushrooms, respectively.

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