

**Efficacy of different substrates on the growth,
yield and nutritional composition of oyster
mushroom (*Pleurotus florida*) under
sub-tropical conditions**

SUMMARY OF THESIS

**SUBMITTED TO THE
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Summary

Mushrooms, also known as 'white vegetables' or 'boneless vegetarian meat' contains adequate level of proteins, vitamins and fiber apart from having certain valuable properties (Thakur *et al.*, 2013, Meng *et al.*, 2016). Mushroom substrates defined as any kind of lignocellulosic material which supports and enhance the growth of fruiting bodies (Chang and Miles, 1988). *Pleurotus florida* white oyster mushroom, is white in color from primordial head formation to maturity and this mushroom also grows in bunches. The pileus of this mushroom is with thin margins, smooth and pileus thickness is lesser as compared to *Pleurotus ostreatus* and *Pleurotus sajor-caju*. *Pleurotus ostreatus* is the second most cultivated edible mushroom worldwide after *Agaricus bisporus* (Sanchez, 2010). Among the numerous species of mushroom, oyster mushrooms (*Pleurotus florida*) are more advantages in terms of easiness in cultivation, role in biodegradation and bio-remediation, production of extracellular enzymes and nutraceuticals (Rashad *et al.*, 2009). *Pleurotus florida* on the four lignocellulosic substrates: sawdust, corn cobs, oil palm spadix and corn straw. The result showed that *Pleurotus florida* contained 26.28-29.91% protein, 86.60-89.90% moisture, 0.48-0.91% fat, 19.64-22.82% fiber, 31.37-38.17% carbohydrate and 5.18-6.39% ash. The mineral contents ranged from 17-21 mg/100 g iron, 277-359 mg/100 g sodium, 2088-2281 mg/100 g potassium, 342-410 mg/100 g calcium and 1009-1133 mg/100 g phosphorus (Salami *et al.*, 2017).

Oyster mushroom production 21272 metric tonnes as been reported out of total 129782 metric tonnes (official data of 2016, ICMR-DMR). In the last five years, the mushroom production in India has almost doubled from 1.10 lakh metric tonnes to 2.01 lakh metric tones (official data of 2019, ICMR-DMR). It is popularly grown in the states of Odisha, Karnataka, Maharashtra, Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Uttar Pradesh and West Bengal and in the Northeastern States of Meghalaya, Tripura Manipur, Mizoram and Assam. This mushroom is cultivated in about 25 countries of far-east Asia, Europe and America. It is the 3rd largest cultivated mushroom in the world. The major producing countries are China, South Korea, Japan, Italy, Taiwan, Thailand and Philippines.

Cellulose rich organic substance has been reported to be of good substrates for the cultivation of mushrooms (Quimio, 1987). Substrates with high lignin and phenol content decreased the activity of cellulose, but less lignin would enhance enzyme activity and thus ensure high per unit of yield of mushrooms (Sivaprakasam, 1986).

Keeping in view of the above facts in mind, the present investigation entitled “**Efficacy of different substrates on the growth, yield and nutritional composition of oyster mushroom (*Pleurotus florida*) under sub-tropical conditions**” has been undertaken to generate information with the following objectives:

1. To find out the effect of different agro waste as substrates for growth of the oyster mushroom.
2. To assess the nutritional quality of the oyster mushroom grown on different substrates.
3. To investigate the best substrate for the cultivation of oyster mushroom under sub-tropical conditions.
4. To evaluate the influence of different substrates on biological efficiency of oyster mushroom.
5. To estimate the benefit: cost ratio of oyster mushroom production.

The present investigation entitled “**Efficacy of different substrates on the growth, yield and nutritional composition of oyster mushroom (*Pleurotus florida*) under sub-tropical conditions**”. The experiment was carried out in the research laboratory of Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Rae Bareilly Road, Lucknow, 226 025 (U.P.), India from October 2019 to December 2019 and October 2020 to December 2020. The elevation of Lucknow city is situated at of 123 meter above mean sea level in the subtropical tracts of 26⁰-56⁰ North latitude of Central Uttar Pradesh.

The experiment was laid down in completely randomized design consisted of twelve treatment combination in each replication and replicated thrice. The details of the treatments combination are T₁ - Wheat straw(100%), T₂ - Paddy straw (100%), T₃ - Wheat straw (95%) + Paddy straw (5%), T₄ - Wheat straw (90%) + Paddy straw (10%), T₅ - Wheat straw (85%) + Paddy straw (15%), T₆ - Wheat straw (80%) + Paddy straw (20%), T₇ - Wheat straw (75%) + Paddy straw (25%), T₈ - Wheat straw (70%) + Paddy

straw (30%), T₉ - Wheat straw (65%) + Paddy straw (35%), T₁₀ - Wheat straw (60%) + Paddy straw (40%), T₁₁ - Wheat straw (55%) + Paddy straw (45%) and T₁₂ - Wheat straw (55%) + Paddy straw (45%). Mother culture of oyster mushroom was collected from Buddha Mushroom Spawn Lab, Rajgir, Bihar. 100 liters of water were taken into a rust proof drum specially in G.I. tub of 200 liters water holding capacity. Total 3 tubs has been taken for given amount of substrate. 12 kg of wheat straw was taken slowly steeped in water. In another plastic bucket, Carbendazim (Bavistin) 7.5 g and 125 ml formaldehyde (37-40%) was readily dissolved and slowly poured on the already soaked wheat straw. Straw is pressed deeply and mixed thoroughly and covered with a polyethylene sheet. After 18 hour the straw is taken out and excess water was drained. The wet substrate was taken up to a moisture content of 75-78%.

The substrates were spread on a pre-sterilized polyethylene sheets and thoroughly spawned at 2% of the wet substrate. Spawned substrates as per treatment combinations were filled in polyethylene bags size dimensions of 80cm length and 40 cm width having thickness of 125- 150 gauge. 15 to 25 small holes were made having diameter of 0.5- 1.0 cm on all sides of the polyethylene bags for draining excess water. Polyethylene sheets of 200-300 gauge having thickness of 1.25 x 1.25 m are spread in floor. Spawned substrates were filled and the polyethylene sheet is folded from all the four sides and compressed to make a compact rectangular block. The block is incubated as such and after mycelium growth polyethylene sheet is removed.

The observations on the various parameters, viz., stipe length (cm), diameter of stipe (cm), diameter of pileus (cm), diameter of fruiting bodies (cm), primordial initiation days, pinhead initiation days, maturity time of sporophore, days required to pin head initiation to first harvest, days required to pin head initiation to second harvest, days required to pin head initiation to third harvest, number of sporophore, weight of sporophore per bunch (g), number of pinhead , number of fruiting bodies, number of primordial, duration of spawn run days, yield of first harvest per bed (g), yield of second harvest per bed (g), yield of third harvest per bed (g), total yield (g), biological efficiency, moisture content, dry matter content , pH content, acidity content (%), total soluble solids (Brix), ascorbic acid (mg/100g), total sugars (mg/100g), protein content, benefit : cost ratio were recorded.

The data were subjected to statistized analysis . The salient findings of the present investigation are summarized as below.

- **Length of stipe:** The maximum of the length of stipe was observed in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum the length of stipe was recorded under the treatment T₂ (Paddy straw 100%).
- **Diameter of stipe (cm):** The maximum diameter of stipe was recorded under the treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum diameter of stipe was recorded under the treatment T₂ (Paddy straw 100%).
- **Diameter of pileus (cm):** The maximum diameter of pileus was recorded under the treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum diameter of pileus was recorded under the treatment T₂ (Paddy straw 100%).
- **Diameter of fruiting bodies (cm):** The maximum diameter of fruiting bodies was recorded under the treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum diameter of fruiting bodies was recorded under the treatment T₂ (Paddy straw 100%).
- **Primordial initiation days:** The minimum days to primordial initiation was recorded under the treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, maximum days to primordial initiation was recorded under the treatment T₂ (Paddy straw 100%).
- **Pinhead formation days:** The minimum days to pinhead formation was recorded under the treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, maximum days to pinhead formation was recorded under the treatment T₂ (Paddy straw 100%).
- **Maturity time of sporophore:** The minimum maturity time of sporophore was recorded under the treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, maximum maturity time of sporophore was recorded under the treatment T₂ (Paddy straw 100%).
- **Days to pin head initiation to first harvest:** The minimum days to pin head initiation to first harvest was recorded under the treatment T₆ (Wheat straw 80% +

Paddy straw 20%) whereas, maximum days to pin head initiation to first harvest was recorded under the treatment T₂ (Paddy straw 100%).

- **Days to pin head initiation to second harvest:** The minimum days to pin head initiation to second harvest was recorded under the treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, maximum days to pin head initiation to second harvest was recorded under the treatment T₂ (Paddy straw 100%).
- **Days to pin head initiation to third harvest:** The minimum days to pin head initiation to third harvest was recorded under the treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, maximum days to pin head initiation to third harvest was recorded under the treatment T₂ (Paddy straw 100%).
- **Number of sporophore:** The maximum number of sporophore was recorded under the treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum number of sporophore was recorded under the treatment T₂ (Paddy straw 100%).
- **Weight of sporophore per bunch:** The maximum weight of sporophore per bunch was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum weight of sporophore per bunch was recorded under the treatment T₂ (Paddy straw 100%).
- **Number of pinhead:** The maximum number of pinhead was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum number of pinhead was recorded under the treatment T₂ (Paddy straw 100%).
- **Number of effective fruiting bodies:** The maximum number of effective fruiting bodies was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum number of effective fruiting bodies was recorded under the treatment T₂ (Paddy straw 100%).
- **Number of primordia:** The maximum number of primordia was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum number of primordia was recorded under the treatment T₂ (Paddy straw 100%).
- **Substrate spawn run (days):** The minimum days to substrate spawn run was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas,

maximum days to substrate spawn run was recorded under the treatment T₂ (Paddy straw 100%).

- **Yield of first harvest per bed (g):** The maximum yield of first harvest per bed (g) was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum yield of first harvest per bed (g) was recorded under the treatment T₂ (Paddy straw 100%).
- **Yield of second harvest per bed (g):** The maximum yield of second harvest per bed (g) was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum yield of second harvest per bed (g) was recorded under the treatment T₂ (Paddy straw 100%).
- **Yield of third harvest per bed (g):** The maximum yield of third harvest per bed (g) was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum yield of third harvest per bed (g) was recorded under the treatment T₂ (Paddy straw 100%).
- **Total yield (g):** The maximum total yield (g) was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum total yield was recorded under the treatment T₂ (Paddy straw 100%).
- **Biological efficiency:** The minimum biological efficiency was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum biological efficiency was recorded under the treatment T₂ (Paddy straw 100%).
- **Moisture (%):** The minimum percentage of moisture was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, maximum percentage of moisture was recorded under the treatment T₂ (Paddy straw 100%).
- **Dry matter content (%):** The maximum dry matter content was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum dry matter content was recorded under the treatment T₂ (Paddy straw 100%).
- **pH content:** The maximum pH content was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum pH content was recorded under the treatment T₂ (Paddy straw 100%).

- **Acidity content (%):** The minimum acidity content was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, maximum acidity content was recorded under the treatment T₂ (Paddy straw 100%).
- **Total Soluble Solids (⁰B):** The minimum total soluble solids was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, maximum Total soluble solids was recorded under the treatment T₂ (Paddy straw 100%).
- **Ascorbic acid (mg/100mg):** The minimum ascorbic acid (mg/100mg) was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, maximum ascorbic acid (mg/100mg) was recorded under the treatment T₂ (Paddy straw 100%).
- **Total sugars (mg/100mg):** The minimum total sugars (mg/100mg) was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, maximum total sugars (mg/100mg) was recorded under the treatment T₂ (Paddy straw 100%).
- **Protein content (mg/100mg):** The maximum protein content (mg/100mg) was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum protein content (mg/100mg) was recorded under the treatment T₂ (Paddy straw 100%).
- **Benefit: cost ratio:** The maximum benefit : cost ratio was recorded in treatment T₆ (Wheat straw 80% + Paddy straw 20%) whereas, minimum maximum benefit : cost ratio was recorded under the treatment T₂ (Paddy straw 100%).

Considering the various parameters of growth, yield and nutritional composition of oyster mushroom (*Pleurotus florida*) with different ratios of wheat straw and paddy straw. On the basis of experimental findings, it is obvious that wheat straw (80%) along with paddy straw (20%) is more conducive for growth and yield than higher levels. However, yield of treatment wheat straw (80%) along with paddy straw (20%) was equally effective in 85%, 90% and 95% of wheat straw and 15%, 10% and 5% paddy straw, respectively in different days of harvest. It also indicated that one can save up to 20% wheat straw and grow suitably in ratio of paddy straw. Hence, it can be concluded that use of different combinations showed positive attributes and utilization of different substrates in combination. Therefore, oyster mushroom can be grown throughout the

year by maintaining the temperature, relative humidity and carbon dioxide level so it was better way to doubling of farmers income and livelihood security of the poor masses. It is evident from the findings that cultivation of *Pleurotus* mushroom is economically viable, technically feasible, socially acceptable and eco - friendly. Therefore, cultivation practices can be adopted in small level in beginning followed by commercial level in subtropical conditions.