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Meena Singh and Poonam Dehariya

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Evaluation of Maize and Soybean Powder on the Growth Parameter, Yield and Biological Efficiency of *Pleurotus florida*

Meena Singh¹ and Poonam Deharia^{*2}

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Oyster mushrooms (*P. florida*) are a type of edible fungus that belongs to the Basidiomycetes class. They're growing increasingly popular as a protein-rich, tasty vegetable. *Pleurotus* species are distinguished by a white spore print linked to recurrent gills, which is typically accompanied with an erratic (off-center) stipe or no stipe at all. The popular name "oyster mushroom" stems from the fruiting body's white shell-like appearance [1]. *Pleurotus florida* is a member of the Pleurotaceae family and is known in India as Dhingri. This is an edible fungus with a delicious flavour and aroma. Its productivity is at its maximum in a short period of time, and it produces more protein per unit area than any other. Mushroom cultivation is not only a wonderful source of protein and vitamins in the diet, but it is also a viable source of income, particularly in rural areas. Mushroom has been valued and treated throughout the world as a special kind of food and medicine for thousands of years [2]. *Pleurotus florida* generates medicinal and pharmacologically important compounds, including as antioxidants, antimicrobials, immunological stimulants, and anticancer activity [3-5]. Oyster mushrooms (*Pleurotus florida*) have a number of advantages, including ease of cultivation, role in biodegradation and bio-remediation, and generation of extracellular enzymes and nutraceuticals [6]. Isolating mushrooms from fruiting bodies, preparing primary and secondary spawn, and cultivating mushrooms from such spawns to harvest fruiting bodies are the three key procedures in the cultivation of oyster mushrooms [7]. Cultural media, temperature, carbon and nitrogen supplies, grain sources, and lignocellulosic substrate sources were all important components in mycelium growth for spawn production. The purpose of this study was to analyze oyster mushroom growth parameters and yield with two distinct supplementing treatments: maize powder and soybean powder at different concentrations. The average temperature of Sagar Madhya Pradesh in the month of December to February is usually 12°C

to 18°C in day time which is favourable for the cultivation of *Pleurotus florida*. The objective of the present study was to evaluate the biological efficiency of locally available agro waste (mainly wheat straw which is majorly cultivated in bundelkhand region) as a substrate in comparison to different supplementation used soybean and maize flour on the growth of *Pleurotus florida* under the native condition during winter season.

Spawn preparation

Clean whole grains were taken for the purpose. The grains were pre-wetted by boiling in water for 20-30 min [8]. After boiling, excess water was drained off by spreading the grains on a wire mesh. Grains were now mixed with gypsum (calcium sulphate) and chalk powder (calcium carbonate) at the rate of 2% and 0.5%, respectively on dry weight basis. The grains were filled in flasks, and plugged then sterilized in autoclave at 22 Lb pressure for 1.5-2 hours. The grains were allowed to cool in room temperature for overnight. Next day flasks were inoculated with two bits of agar medium colonized with the mycelium of pure cultures. About 7-10 days after inoculation, flasks were shaken vigorously. Three weeks after incubation, the stock culture becomes ready for further multiplication of spawn. Inoculated flasks were incubated at 26±2°C.

Cultivation

A medium was prepared using wheat straw substrate. Substrate was washed in fresh water. The chopped straw substrate was steeped in water containing 75 ppm Bavistin + 500 ppm formaldehyde for 18 hours [8] for preventing mould infestation due to various other competing fungi. In the present investigation maize powder and soybean powder supplementation was used as 1, 2, 3 and 4 percent concentration on the dry weight basis of substrate respectively. Supplements were sterilized with 25 ppm Bavistin for 12-18 hrs. Excess water was drained and was dried in shed to retain 65-70% moisture content by squeezing with hands and then allowed to cool down for a certain period (1 hr.). Spawning was done @ 2% wet weight basis of substrate by thoroughly mixing. Spawned substrate was filled up in perforated polythene bags (60 × 40 cm) and polythene mouth was closed with rubber band.

* Poonam Deharia

✉ dpoonambot18@gmail.com

¹⁻² Lab of Mushroom Biology, Department of Botany, Dr. Harisingh Gour University, Sagar - 470 003, Madhya Pradesh, India

These bags were transferred to crop room for spawn run. Three replications were maintained for each substrate. For spawn run, temperature and relative humidity were maintained between 25–30°C and 65–90%, respectively. Polythene bags were cut open when the mycelium run was completed. The substrate beds were moistened by sprinkling of water thrice a day which was stopped a day before harvesting. Average values of observation with respect to duration of spawn run, time taken for first harvest yield and total yield was recorded. Biological efficiency of mushroom on fresh weight basis was calculated by using formula given by Chang and Miles [9].

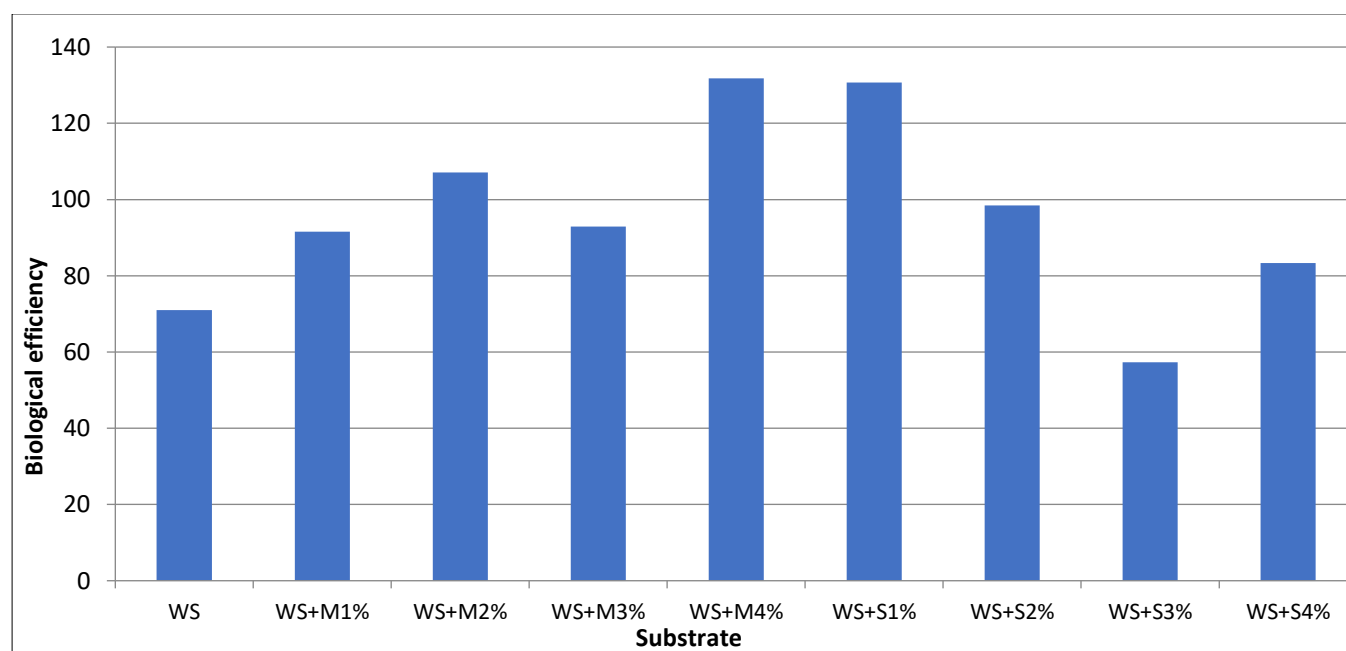
$$\text{Biological efficiency (\%)} = \frac{\text{Yield of fruiting body (gm)}}{\text{Total weight of substrate used (gm)}} \times 100$$

The data presented in (Table 1) shows the impact of

supplementation of maize powder and soybean powder on the growth and yield of *Pleurotus florida* cultivated on wheat straw. It was observed that supplementation of 1% powder of maize improve growth parameter as well yield. It takes 17.4 days for spawn run and total yield 916.88 gm/kg obtained which is greater than control. Respectively 2%, 3% and 4% maize powder supplementation gives 1071.52 gm/kg, 929.14 gm/kg and 1318gm/kg yield. Thus, significant changes were record from 4% supplementation of maize powder. It was observed that supplementation of 4% powder of soybean improve growth parameter as well yield but significant change was recorded with 1% supplementation. Wheat straw was given 1307gm/kg, 984.98gm/kg and 833.69gm/kg yield at 1%, 2% and 4% supplementation respectively. But here we observed lower yield than control from 3% supplementation of soybean powder. It gives 573.98 gm/kg yield.

Table 1 Effect of supplementation of different concentrations of maize powder and soybean powder with wheat straw

Substrate	Supplementation concentration	Spawn run (days)	Pin head appearance (days)	Stipe length (cm)	Cap diameter (cm)	Total yield (gm/kg)	Biological efficiency (%)
Wheat straw without treatment (WS)	-	19	24	2.6	8.7	710	71
Wheat straw with supplementation of maize powder (WS+M)	1%	17.4	22	3.1	7.5	916.88	91.68
	2%	17.5	22	3.3	7.7	1071.52	107.1
	3%	23.0	27	2.4	7.8	929.14	92.91
	4%	18.1	23	2.1	5.3	1318	131.8
Wheat straw with supplementation of soybean powder (WS+S)	1%	19.2	24	2.7	7.6	1307	130.7
	2%	18.6	23	2.9	7.3	984.98	98.49
	3%	19.7	24	1.9	7.7	573.98	57.39
	4%	15	18	2.1	7.8	833.69	83.36



WS = Wheat straw

WS+M1% = Wheat straw + 1% of maize powder

WS+M2% = Wheat straw + 2% of maize powder

WS+M3% = Wheat straw + 3% of maize powder

WS+M4% = Wheat straw + 4% of maize powder

WS+S1% = Wheat straw + 1% of soybean powder

WS+S2% = Wheat straw + 2% of soybean powder

WS+S3% = Wheat straw + 3% of soybean powder

WS+S4% = Wheat straw + 4% of soybean powder

Graph 1 Effect of different concentrations of maize powder and soybean powder on biological efficiency of *Pleurotus florida*

Graph 1 indicates the effect of supplementation of maize powder and soybean powder on the biological efficiency of *Pleurotus florida*. It was observed that supplementation of 4% powder of maize and 1% powder of soybean was gave maximum biological efficiency which was 131.8% and

130.7%. Minimum biological efficiency (57.39%) was observed from 3% supplementation of soybean powder.

On wheat straw, *P. florida* mycelia grew more quickly (15 days) [10–11]. Many workers have suggested that organic and inorganic additives be added to the substrate from the

outside to increase mushroom yield [12-15]. The number of days it takes for a spawn to fully colonise is dependent on the fungal strain, growth conditions, and supplementation concentration. Pinheads appeared faster in the WS+S4% (18 days) treatment than in the other treatments. There is difference in the appearance of pinheads of different treatment. Ahmed [16] reported pinhead formation of oyster mushroom cultivated in different substrates to be between 23 and 27 days from spawning, while [17], reported it to be 20-23 days. Tan [18] recorded 23-26 days for the appearance of pinheads. Patra and Pani [19] recorded 20-24 days on paddy straw, and in this study the pinhead formed in 18-27 days of *Pleurotus florida* cultivation in wheat straw as control and supplemented with soybean and maize powder with different concentration. During our study also found that if we increase the amount of supplement powder (10%, 20%, 30% of the total weight of dry substrate) there is no mycelium growth shown, it means mycelium growth is inhibited with the increasing of supplementation of nutrient rich flour. When comparing the two supplements for the growing of *Pleurotus florida*, it is clear that the lower concentration of soybean is far more effective, resulting in the best development and colonization, generating a compact white mass of mycelium within 15-20 days of inoculation. The best growth in a maize powder treated bag is at 4% maize powder concentration. The number of fresh fruiting bodies was higher in the soybean-treated mushroom, but the thickness and size of the maize-treated mushroom were greater. The availability and use of low-cost resources, among

which agricultural ligno-cellulosic waste is the optimal and most promising substrate for growing, determines the commercial production of oyster mushrooms. Due to their year-round availability at low cost in large quantities, the substrates and supplementation used in this study can be regarded practical and economically practicable. The use of these agro-wastes and by-products in the production of oyster mushrooms could be more cost-effective and environmentally friendly.

SUMMARY

The purpose of this research was to determine the effect of various supplements on the growth and yield of oyster mushrooms (*Pleurotus florida*) in order to determine the best alternative supplements and their amounts that support oyster mushroom growth, produce the highest yield, and have the highest biological efficiency. Under the complete randomize design; two supplements viz. Maize powder and Soybean powder were taken at different concentrations. The minimum time taken for mycelium run (15 days) was in 4% soybean powder supplementation (WS+S4%) and maximum was observed (23 days) in 3% maize powder supplementation (WS+M3%). Maximum yield was obtained on WS+M4% and WS+S1% (1318 and 1307 g/kg) with highest biological efficiency (131.8% and 130.7%). Therefore, it can be concluded that the effect of supplementation as well as concentration of supplement proved to be best yield for *Pleurotus florida*.

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