Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 7 [4] March 2018 :25-29

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.876
Universal Impact Factor 0.9804
NAAS Rating 4.95

ORIGINAL ARTICLE **OPEN ACCESS**

Studies on Effect of Different Substrates Spawn Rates on Production of Oyster Mushroom *(Pleurotus florida)*

Kumar Pradeep , Singh Gopal , Soam Amarpal , Kumar Sandeep , Mohit , Kannaujia J. P.
Department of Plant Pathology Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut 250110 Uttar Pradesh, India.
Email Address- pradeepveersingh@gmail.com

ABSTRACT
The objective of the study aimed to compare the yield effect of edible mushroom Pleurotus florida by different spawn rates. The moist substrates were sterilized and packed in heat resistant plastic bags seeded with different rates of spawn. The Oyster Mushroom (Pleurotus florida) was cultivated on wheat straw as substrates using different grain spawn at different rates (5% and 6%). In the experiment the different substrates (grain spawn) such as maize spawn, bajra spawn, paddy spawn, and wheat spawn were used in different rates (5% and 6%) for production of oyster mushroom (Pleurotus florida). Different growth parameters such as (DFSR, DFPF, DFFH, NOPI, Yield, Av. Wt. of fruiting body and BE %) were evaluated for each substrate with four replicate. The result of this study indicates, maximum yield (550.00 g/kg dry substrates with 55.00% biological efficiency.) was observed in 6% spawn rate of paddy, Minimum days for spawn run (15.00 days) were observed in 6% spawn rate of maize, Minimum days for pin head formation (17.00 days) were observed in 6% spawn rate of maize, Minimum days for first harvesting (19.66 days) were observed in 6% spawn rate of maize, Maximum number of pin head initiation (56.66) were observed in 6% spawn rate of wheat (control), Maximum number of fruiting bodies (28.33) were observed in 6% spawn rate of wheat (control), Maximum average weight fruiting bodies (41.00 g) was observed in 6% spawn rate of bajra. Based on the results obtained paddy spawn would be recommended as most suitable grain as substrates for production of oyster mushroom (Pleurotus florida).
Keywords: Pleurotus florida, Production, DFSR, DFPF, DFFH, NOPI,

Received 21.11.2017 Revised 18.12.2017 Accepted 11.02.2018

INTRODUCTION

Oyster Mushroom *(Pleurotus spp.*) cultivation has increased tremendously throughout the world during the last few decades [5, 17]. Mushroom are macro fungi eukaryotic, fleshy, spore bearing fruiting body fungus, typically produced above ground on soil or on the food source and also unique within the fungal kingdom itself. There are more than 5000 mushroom varieties which could be employed for foods and medicines. The fungal classification system proposed by Ainsworth and followed by J. Webster [18], includes almost all edible mushrooms as the members of the subdivision Basidiomycotina and Ascomycotina [7, 2, 3]. These fungi are obviously non-toxic as these have been in an intimate human consumption of native and tribal, since antiquity [15]. Mushroom (*Pleurotus spp.*) are also known as Oyster mushroom or Dhingri or abalone mushroom, these are the second most important mushroom after button mushroom all over the world. Spawn comprises mycelium of the mushroom and a supporting medium which provides nutrition to the fungus during its growth. The propagating material used by the mushroom growers for planting beds is called spawn. [16], Growing medium of the mushroom is generally known as substrate. The substrates used for cultivation of oyster mushroom are normally nitrogen deficit. Among many kinds of edible mushrooms, oyster mushrooms have been commercialized and consumed remarkably because of its medicinal and nutritive value. Oyster mushrooms could prevent and reduce several serious diseases, including high blood pressure and cholesterols [1], breast cancer and prostate cancer [11]. The oyster mushroom is grown under natural conditions on living trees as parasite or dead woody branches of trees as saprophyte and primary decomposer. The oyster mushrooms have three distinct parts, a fleshy shell or spatula shaped cap (pileus), a short or long lateral stalk called stipe, long ridges and furrows underneath the pileus called gills or lamellae. The gill stretches from the edge of the cap down to the stalk that bears the spores. The spores are smooth, cylindrical and germinate very

easily on any kind of mycological media within 48-96 hrs. and the mycelium of *Pleurotus* is pure white in color. Oyster mushroom can grow at moderate temperature ranging from 20^0 C to 30^0 C and humidity 55-80% for a period of 6 to 8 months in a year. It can also be cultivated in summer season, by providing the extra humidity for its growth. Hilly areas (above 900m) are also suitable for its growth. Three primary factors affecting the yield of oyster mushrooms are temperature, compost component and humidity. The process of cultivating oyster mushrooms has 3 main steps: isolating mushroom from fruiting bodies, preparing primary and secondary spawn and cultivating mushrooms from these spawns to harvest, fruiting bodies [6, 12, 13]. *Pleurotus* have grown on wheat straw, sugarcane bagasse, corn cobs or sawdust by mixing 120-130 g of spawn with 2 kg of substrate and placing the mixture in sterilized polyethylene bags which were kept in the dark at 25^0 C for 2-3 weeks. Fan *et al.,* [8] carried out the studies with 2.5-25% spawn rates, 25% spawn rate appeared superior, but recommended 10% spawn rate in view of the process economics. The first fructification occurred after 20-23 days of inoculation and the biological efficiency reached about 90-97% after 50-60 days. The present studies were undertaken on the effect of different grain (Maize, bajra, paddy and wheat) spawn rate on growth, development and yield of oyster mushroom *Pleurotus florida*, with a target to find out the best grain spawn rate for getting early and high yield crop with short duration.

MATERIALS AND METHODS

The experiments were conducted during 2016-17 in Mushroom Laboratory of Department of Plant Pathology, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh which is situated on the Delhi-Dehradun highway NH-58 at a distance of 10.0 km away in the north western side of Meerut city. The Culture of *Pleurotus florida* were purified and maintained by single hyphal tip method. For this purpose, the culture was grown in sterilized Petri plates on Potato Dextrose Agar Medium (PDA) for 8-10 days. Single branched hyphae from the periphery of the growing colony were marked under low power (10x) in the compound microscope and transferred to PDA slants. These tubes were incubated at 21-24°C for about a week, again sub cultured on PDA and then stored in a refrigerator at 5-10°C for further use.

Spawn Production Technology

The Spawn was prepared on different grains such as maize, bajra, paddy, and wheat. Wide mouthed glass bottles at 500 ml capacity. The grains were cleaned to remove any broken, shrivelled grains either by sieving or winnowing or by hand picking of undesired grains. After this, the grains were soaked overnight in clean water and then washed. They were boiled in 15 minutes taking care that grains should not split but remain slightly hard after boiling. The boiled grains were spread in thin layer over a wire net to remove excessive water and enable them to cool about 25-30°C. The cooled grains were then mixed with 1.2 per cent commercial grade gypsum ($CaSO_4$) and 0.3 per cent calcium carbonate ($CaCO_3$). Gypsum prevents the sticking of wheat grains together and calcium carbonate maintains the pH 5.5 - 7.5. The grains were filled in clean bottle upto 2/3 rd of its capacity. The bottles were plugged with non-absorbent cotton and covered with butter paper or aluminium foil. These bottles were then sterilized at 121°C (15 lbs pressure) for 2 hours on two consecutive days. Sterilized bottles were taken out from the autoclave, while still hot and were shaken to avoid clumping of grains. Sterilized bottles were inoculated from the pre maintained culture of *Pleurotus florida* by 9 mm disc in individual bottle. The spawn bottles were incubated without shaking at 24±1°C in B.O.D incubator.

Mushroom Production Technology

Spawning

Spawning was done under aseptic condition. Different grain spawn of *Pleurotus florida* (preparation method described under spawn production) was mixed in Wheat straw (substrate) @ 5 and 6 percent per kg on dry weight basis and 3kg substrate (containing 60-75% moisture) filled in each polythene bags (22×12″) in four replications and made 8-10 holes in each bags for aeration. After spawning bags were kept in the spawn running room under dark condition. The observations were recorded as DFSR (days for spawn run), DFPF (days for pinhead formation), DFFH (days for first harvesting), NOPI (number of pinhead initiation), NOFB (number of fruiting bodies), Yield (gm/kg of dry substrates) and Average weight of Fruiting bodies(gm).

Spawn run

In crop room temperature (22-26°C) and relative humidity (80-90 %) was maintained during spawn run. Humidity was maintained by water spraying three times a day. After the compilations of spawn run in the straw it becomes a compact mass which also sticking to the polythene bags and after the complete spawn run in the bags, bags were opened for sporophores formation by removing of polythene and kept in cropping room. At the time of sporophores formation the windows were kept open for 1–2 hrs to provide fresh air, to release CO_2 and to maintain the relative humidity at 80-90 per cent inside the crop room.

Sporophores production

After spawn run, compact stack of substrate (wheat straw) were kept in crop room for the sporophores production. The fruiting bodies were started to appear in 6-8 days. The sporophores were harvested 3-4 days after pinhead initiation. These were harvested by one gentle twisting at the base, taking care that the broken stumps were not left there to avoid rotting in the remaining flushes of running crop. 3-4 flushes were taken after that very few fruiting bodies appear. After the first two flushes, the spawn run blocks were over turned to allow the lower surface and the base to produce fruiting bodies. The fruiting bodies were protected from the sun light but some diffused light was allowed to induce fruiting body formation. To prevent the fungal infection, two sprays of Carbendazim 0.02- 0.05 per cent were given. A total time for cropping up to 3rd flush is about 55±2 days. Watering of the crop is quite important which must be done with a mist sprayer. The crop room floor and wall were sprayed with 0.1 per cent Malathion or Sevin and/or light trap to protect it from insect infestation.

Harvesting

The sporophores of oyster mushroom *P. florida* were harvested after the maturity. The yield obtained in 7 weeks harvesting period were compared with each other. The water spraying should be done by sprinkler on the blocks after the fruit body start coming up but the floor and walls of the mushroom crop room must be kept moist to maintain requisite humidity (80-90 %). Adequate ventilation in the crop room was provided by opening the doors and windows at night for a short time. After the first harvesting begs were scraped and remain without irrigation for three days and then again irrigated after pinhead initiation. Same process was follow after second harvesting. Adequate ventilation in the crop room was provided by opening the doors and windows at night for a short duration during cropping. The fruiting bodies must be protected from direct sunlight but some diffused light (2500-3000 Lux) should be allowed to induce fruiting body formation for two hours per day.

Biological efficiency of substrate was calculated by using following formula:

$$\text{Biological efficiency} = \frac{\text{Fresh weight of fruit body}}{\text{Dry weight of substrate}} \times 100$$

RESULTS AND DISCUSSION

The results indicated that maximum yield (550.00 g/kg dry substrates with 55.00% biological efficiency.) was observed in 6% spawn rate of paddy which was statistically higher than all other spawn rates. It was followed with 6% spawn rate of bajra (540.00 g/kg dry substrates with 54.00% biological efficiency). The minimum yield was observed in 5% spawn rate of maize (503.33 g/kg dry substrates with 50.33% biological efficiency). Which was statistically lower than all other spawn rates. Bughio [4] cultivated the oyster mushroom,(*Pleurotus ostreatus)* on combination of wheat straw, cotton boll locules, paddy straw, sugarcane and sorghum leaves at 1:1 ratio in polythene bags (650 g/bag) using sorghum grain spawn @ 30 grams per bag, followed by boiling of substrates and sterilization of bags. He also reported 43.25 to 53.00 days after spawning by using sorghum grains @ 30 g per 650 g in case of using wheat straw, sugarcane and sorghum leaves at 1:1 ratio on substrate dry weight basis.

Minimum days for spawn run (15 days) were observed in 6% spawn rate of maize which was statistically at par with 5% spawn rate of maize (16.33 days). Maximum days of spawn rune (20.00 days and 20.00 days) were observed in 6% spawn rate of wheat (control) and 5% spawn rate of bajra respectively which was statistically similar with 5% spawn rate of paddy.

Minimum days for pin head formation (17.00 days) were observed in 6% spawn rate of maize which was statistically at par with 5% spawn rate of maize (18.66 days) Maximum days for pin head formation (22.00 days) were observed in 6% spawn rate of wheat (control) and 5% spawn rate of bajra (22.00 days) respectively. which was statistically lower than all other spawn rate. Patra & Pani [14] revealed that mushroom took20-24 days but Jiskani [9] stated 25-50 days for pinhead formation, whereas Jiskani *et al.,* [10] concluded that pinhead formation took 51.6 days after spawning in case ofusing wheat straw.

Minimum days for first harvesting (19.66 days) were observed in 6% spawn rate of maize. Which was statistically lower than other spawn rate. Maximum days for first harvesting (24.33 days) were observed in 5% spawn rate of bajra. which was statistically higher than all other spawn rate.

Maximum number of pin head initiation (56.66) were observed in 6% spawn rate of wheat (control) which was statistically at par with 6% spawn rate of bajra (55.00) (51.00).Minimum number of pin head initiation (46.66) were observed in 5 % spawn rate of maize which was statistically lower than all other spawn rate.

Maximum number of fruiting bodies (28.33) was observed in 6% spawn rate of wheat (control) which was statistically higher than all other spawn rate. Minimum number of fruiting bodies (22.66) was observed in 5% spawn rate of maize which was statistically lower than all other spawn rate.

Maximum average weight of fruiting bodies (41.00 g) was observed in 6% spawn rate of bajra, which was statistically at par with 6% spawn rate of paddy (40.33 g). While minimum average weight of fruiting bodies (33.66 g) was observed in 6% spawn rate of wheat (control). which was statistically lower than all other spawn rates. Jiskani *et al.,*[9] obtained 24 and 7.6% fresh and dry yield on the basis of substrate dry weight, in case of using wheat straw. Jiskani [10] reported that100% of substrate dry weight, means one kg of fresh mushroom can be obtained from
one kg of dry substrate (before soaking and boiling). According to Bughio [4] the maximum fresh (wet) and dry 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 cotton boll locules, paddy straw, sugarcane and sorghum leaves at 1:1 ratio in case of using sorghum grain spawn @ 30 g per bag.

Table-1 Effect of different substrates on same spawn rates on production of oyster mushroom *(Pleurotus florida*) on dry weight basis

Treatments	Grain Spawn Rate	DFSR	DFPF	DFFH	NOPI	NOFB	Yield (g/kg Dry substrates	Average Weight of Fruiting Body (gm.)	Biological Efficiency (%)
1.	Maize @ 5%	16.33	18.66	20.66	46.66	22.66	503.33	39.00	50.33
2.	Maize @ 6%	15.00	17.00	19.66	49.00	24.33	533.33	39.66	53.33
3.	Bajra @ 5%	20.00	22.00	24.33	53.66	26.33	516.66	34.66	51.66
4.	Bajra @ 6%	18.33	20.00	22.00	55.00	28.00	540.00	41.00	54.00
5.	Paddy @ 5%	19.00	20.66	23.66	48.33	23.33	510.00	34.66	51.00
6.	Paddy @ 6%	17.33	19.00	21.00	51.00	27.66	550.00	40.33	55.00
7.	Wheat (control) @ 6%	20.00	22.00	24.00	56.66	28.33	530.00	33.66	53.00
	CD at 5 %	1.49	1.85	2.04	1.68	1.33	21.13		
	SE(m)	0.48	0.60	0.66	0.54	0.43	6.90		

DFSR= Days for Spawn Run, DFPF= Days for Pinhead Formation, DFFH= Days for First Harvesting, NOPI= Number of Pinhead Initiation, NOFB=Number of Fruiting Bodies.

CONCLUSION

The study was conducted to check the different substrates (grain spawns) at different rates give higher production of oyster mushroom *(Pleurotus florida).* It can be concluded that paddy grain (substrates) were recommended most suitable substrates (spawn) for the production of oyster mushroom (*Pleurotus florida).*

REFERENCES

1. Agrawal, R. P, Chopra, A. Lavekar, G. S, Padhi M.M, Srikanth, N, Ota, S. and Jain, S. (2010).Effect of oyster mushroom on glycemia, lipid profile and quality of life in type 2 diabetic patients. Australian Journal of Medical Herbalism, 22 (2): 50-54.
2. Bano, Z. and Rajarathanam, S. (1982).*The Mushroom Journal*, 115, 243-245.
3. Bhatti, M. I., Jiskani, M. M., Wagan, K. H., Pathan, M. A. and Magsi, M. R. (2007). Growth, development and yield of oyster mushroom*, Pleurotus ostreatus* (jacq. Ex. Fr.) kummer as affected by different spawn rates. *Pak. J. Bot.,* 39(7): 2685-2692, 2007.
4. Bughio, I. (2001). Yield performance of oyster mushroom, *Pleurotus ostreatu* (Jacq. ex. Fr.) Kummer on combination of different straws. M. Sc. Thesis, Deptt. of P. Path. S.A.U. Tandojam. 69.
5. Chang, S. T. (1999). World production of cultivated edible and medicinal mushroom in 1997 with emphasis on *Lentinus edodes* (Berk) in China. *Int. J. of Med.Mush.*, 1(4): 291-300.
6. Dung, L. B. (2003). Mushrooms in Tay Nguyen (in Vietnamese). Ha Noi: Science and Technique.
7. Dung, N. L. (2007). Techniques of Mushroom cultivation (vol 1) (in Vietnamese). Ha Noi: Agriculture.
8. Fan, L.A. Pandey, R. Mohan, and C. R. Soccol. (2000). Use of various coffee industry residues for the cultivation of *Pleurotus ostreatus* in solid state fermentation. *Acta Biotechnol*, 20(1): 41-52.
9. Jiskani, M. M. (1999).*A brief outline "The fungi" Cultivation of mushrooms*. Izhar Pub. Tandojam. p.94.
10. Jiskani, M. M., M. A. Pathan and K. H. Wagan. (1999). Yield performance of oyster mushroom, *Pleurotus florida* (Strain Pk-401) on different substrates. *Pak. Jr. Agri., Agril. Engg. Vet. Sci*., 15 (2): 26-29.
11. Jedinak, A. andSliva, D. (2008).*Pleurotus ostreatus* inhibits proliferation of human breast and colon cancer cells through p53-dependent as well as p53-independent pathway. *International Journal of Oncology,* 33: 1307-1313.
12. Khan, M.A., Ruhul Amin, S.M., Uddin M.N., Tania M. and Alam N. (2008).*Bangladesh Journal of Mushroom,* 2: 9-14.
13. Kumbhar, C. T. (2012). Effect of spawn substrates on yield of *Pleurotus eous (Berk.) Sacc. International journal of Plant Science*7: 224-229.

14. Patra, A. K. and B. K. Pani. (1995). Yield response of different species of oyster mushroom (*Pleurotus*) to paddy straw. *Current Agril. Res. Supplement* No. 8:11-14.
15. Pandey, V.N and Srivastava, A.K. (1994). Fleshy fungi of ethno botanical food use in North Eastern Tarairegion of Uttar Pradesh. Proc. National Symposium on Mushroom, NRCM Solan: 3.
16. Pathak, V. N. Yadav, N. and Gour, M. (2000). Mushroom production and processing technology *Agribious India.*
17. Royse, D.J. (2002). Influence of spawn rate and commercial delayed release nutrient levels on *Pleurotus cornucopiae* (oyster mushroom) yield, size, and time to production. *Appl.Microbiol.Biotechnol.*58: 527-531.
18. Sharma, O. P. (1989). Textbook of Fungi.5thedn. New Delhi:

CITATION OF THE ARTICLE

Kumar Pradeep , Singh Gopal , Soam Amarpal , Kumar Sandeep , Mohit , Kannaujia J. P.Studies on Effect of Different Substrates Spawn Rates on Production of Oyster Mushroom *(Pleurotus florida)*. Bull. Env. Pharmacol. Life Sci., Vol 7 [4] March 2018 : 25-29