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Assessment of Different Organic Supplements (pulses flour) on Growth and Yield of Oyster Mushrooms (*Pleurotus djamor*)

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ABSTRACT

As a nutritious and delicious food Mushroom is becoming popular among the people during these days. Mushroom which is a fleshy saprophyte fungus are found growing on damp rotten log of wood trunk of trees, agricultural waste material, decaying organic matter and in damp soil rich in organic substrates. The experiment was conducted with the aim to evaluate the most effect organic supplement for enhance the yield (gm. /kg dry straw) and minimum days for spawn run (DFSR), minimum days for first harvesting (DFFH), number of lobe per beg (NOL), number of fruiting body per beg (NOFB) and maximum average weight of fruiting body (g/FB) of Oyster mushroom (Pleurotus djamor). In the present study five locally available differentorganic supplements viz. Soybean, Chickpea gram, Black gram, Pigeon pea and Lentil flour were mixed in wheat straw. The results obtained during the present investigation, maximum yield (593.33g/Kg of dry substrate with 59.33% B.E.), highest number of fruiting bodies (34.33), minimum days for first harvesting (18.67 days) and minimum days for spawn run (16 days) was observed in Pigeon pea flour, while highest number of lob (75.00) was observed in lentil flour and maximum average weight of fruiting body (30.00) was observed in Chickpea flour. Based on the results obtained, for production of Oyster mushroom (Pleurotus djamor), Pigeon pea flour would be recommended as most appropriate organic supplements for Wheat straw.

Key words: *Pleurotus djamor, oyster mushroom, wheat straw, organic supplements, yield*

INTRODUCTION

Mushroom is the fleshy, spore-bearing reproductive structures of fungi grown on organic substrates and for a long time, have played an important role as a human food due to its nutritional and medicinal properties[1].

Mushroom not only provides nutrients, protein-rich food, but some species also produce medicinally effective products. Mushrooms are low in calories but rich in protein, and the nutritionally placed between meat and vegetable hence mushrooms may be called as vegetable meat. A protein revolution is possible through mushrooms after the green, white and blue revolutions.

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Mushrooms being low calorie food with very little fat are highly suitable for obese persons. With no starch and very low sugars, they are the "delight of the diabetic". Due to its alkaline nature and high fibre content, it is highly suitable for the people with hyper acidity and constipation. Dried oyster mushrooms contain relatively higher amount of good quality protein (27.00%), polyunsaturated fatty acids (1.6-2%), carbohydrates (58.00%), fibers, water (11.50%) soluble vitamins (1-2%) as well as minerals (1-2%) and very low amount of total fat [2]. Edible mushrooms are also rich in vitamins such as niacin, riboflavin, vitamin D, C, B1, B5 and B6 [3].

Oyster mushrooms also have anticancerus (carcinostatic), hypolipidemic, hypocholesterolemic, hypoglycaemic, hypotensive, immunomodu latory, haematoprotective properties including properties of lowering blood sugars and blood pressure, antibacterial, antiviral and antifungal activities. They are also useful in bioremediation[6,7].

Oyster mushrooms are one among the cultivable varieties. They are wide spread in temperate zones, can grow at moderate temperature and are suitable to grow in most places in India[4,5]. In India, mushroom commercialization is hardly four decades old and with initial lag phase, it has started showing upward trend. After 1986, mushroom production increased rapidly in India, and in 1994, about 30,000 tonnes of fresh mushroom was produced, which has further increased to more than one lakh tone by 2012. However, button mushroom dominated in Indian mushroom market, followed by oyster (*Pleurotus* spp.*)* and paddy straw (*Volvariella volvacea*) mushroom which together shared only 10 per cent of the total mushroom production of India[8]. Thus, in spite of excellent climatic conditions, multiple cropping possibilities, low cost of production and better shelf life, *Pleurotus* spp. are cultivated on a limited scale. This is mainly due to the non-availability of quality spawn of suitable strain with substrate, role of environment and identification of new high yielding strain which possess attractive colour, fleshy sporophore and other quality traits.

Keeping in view the above points of significance and possibilities of cultivating *Pleurotus* mushroom in the rural as well as urban areas of the country, the present investigation was carried out with objectives to estimate the beneficial effect of organic supplement to enhance the yield of oyster mushroom.

MATERIALS AND METHODS

Experimental Site

The experiments were conducted during 2014-2015 in Mushroom Laboratory, Department Plant of Pathology, S. V. P. University of Agriculture and Technology, Meerut, U.P, India, which is situated on the Western side of the Delhi-Dehradun high way (NH-58) at a distance of 10.0 km away in the north of Meerut city. On the basis of meteorological observation Meerut is situated between 29^{o} 01'N latitude and 77^{o} 45'E longitude at an altitude of 237 meters above the mean sea level.

Mushroom Production Technology

Spawn Production

Spawn was prepared in half litre capacity wide mouthed glass bottles. 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 water for 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^{0}C. The cooled grains were then mixed with 1.2 percent commercial grade gypsum ($CaSO_4$) and 0.3 percent 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 up to (100 mm) in the bottle in three replicates. The bottles were plugged with non-absorbent cotton and

covered with butter paper. These bottles were then sterilized at 121^0C (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 by 9 mm disc in individual bottle. The spawn bottles were incubated without shaking at 24 ± 1^0C in B.O.D incubator.

Substrate Preparation

Wheat straw was used as substrate for this experiment. It was soaked (10kg wheat straw/100liter water) in a tank with solution of Carbendazim (8gm/100liter water) + Formalin (120ml/100liter water) for 18 hr (tank should be covered with polythene sheet to prevent the evaporation of formalin[9]. Thereafter, straw was taken out from the solution and kept for 2-3 hours to drain out the excess water.

Spawning

Spawning was done under aseptic condition. Oyster mushroom spawn mixed with Wheat straw (substrate) @ 4 percent per kg on dry weight basis and 3kg substrate (containing 60-65% moisture) filled in each polythene bags (22×12″) in three replications and made 8-10 holes in each bags for aeration. After spawning bags were kept in the spawn running room under dark condition.

Supplementation

In this experiment Pigeon pea flour, black gram flour, chickpea flour, lentil flour and soybean flour, was mixed in wheat substrate as organic supplements. The grain of all sun dried and then ground to all and then sterilized in autoclave at 121^0C (15 lbs pressure) for 20 min. These supplements were mixed with substrate (wheat straw) separately @ 5 per cent dry weight before spawning. The observations were recorded as total yield (gm. /kg dry straw) and minimum days for spawn run (DFSR), minimum days for first harvesting (DFFH), number of lobe per beg (NOL), number of fruiting body per beg (NOFB) and maximum average weight of fruiting body (g/FB).

Spawn Run

In crop room temperature (22^o to 26^oc) and relative humidity (80 to 90 percent) 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 then polythene were cut and opened for Sporophore formation and it kept in cropping room. At the time of sporophores formation the windows were kept open for 1 – 2 hour to provide fresh air, to release CO_2 and to maintain the relative humidity at 80-90 per cent inside the crop room. Total cropping period given was about 60 days.

Sporophore 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. A total time for cropping up to 3rd flush is about 60-70 days. Watering of the crop is quite important which must be done with a mist sprayer. 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 per cent). Adequate ventilation in the crop room was provided by opening the doors and windows at night for a short time.The fruiting bodies must be protected from direct sunlight but some diffused light (2500-3000 Lux) should be allowed to induce fruiting body formation.

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. To prevent the fungal infection, two sprays of Carbendazim 0.02 per cent were given.

Harvesting

The Sporophores of *P. djamor* were harvested after the maturity. Before the harvesting sporophores were irrigated for keep it fresh. The yield obtained in 7 weeks harvesting period were compared with each other. After 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.

STATISTICAL ANALYSIS

The Complete randomized design (CRD) was applied and the data thus obtained were analyzed statistically. Analysis of variance (ANOVA) technique and critical difference (CD) was calculated at five percent level of significance for comparison with other treatment[10].

RESULTS AND DISCUSSION

In the present investigation of different organic supplements results depicted that:

The experiments results indicated that, maximum yield (593.33g/Kg of dry substrate with 59.33% B.E.) was observed in pigeon pea flour which was significantly higher than all other treatments while minimum yield was observed at control i.e. straw without organic additive (410.00g/kg of dry substrate with 41.00% B.E.) which was significantly lower than all other treatments.

The minimum days for spawn run (16 days) were observed at pigeon flour which was significantly at par with black gram flour (18.33days).The maximum days for spawn run (25.00 days) were observed in control i.e. straw without organic additive which was significantly similar with soybean flours. The minimum days for first harvesting (18.67 days) were observed at Pigeon pea flour which was significantly lower than all other flours while maximum days for first harvesting (31.00 days) were observed in control i.e. straw without organic additive which was significantly higher than all other flour.

The highest number of fruiting bodies (34.33) was observed from Pigeon pea flour which was significantly higher than all other treatments. The minimum number of fruiting body (14.00) was observed from chickpea flour which was significantly at par with lentil flour and black gram flour. The highest number of lob (75.00) was observed in lentil which was significantly higher than all other flour. The number of lob in black gram (50.33) was observed significantly similar to Pigeon pea flour. The minimum number of lob (36.33) was observed at Chickpea flour which was significantly lower than all other flour. The highest number of fruiting body (34.33) was observed in Pigeon pea flour which was significantly higher than all other flour. The minimum number of fruiting body (14.33) was observed at Chickpea flour which was significantly lower than all other flour. The highest pileus length as well as width (10.00 cm and 7.16 cm) was observed in soybean flour which was significantly at par with Pigeon pea flour (9.50 cm and 8.16 cm).The minimum pileus length and width was observed in chickpea (6.10 cm and 6.00 cm) which was significantly lower than all other flours.

The maximum days for cropping period (60.33 days) were observed at control i.e. straw without organic additive which was significantly similar with pigeon pea flour as well as soybean flour. The minimum days for cropping period (55.33 days) were observed at chick pea flour which was significantly lower than all other flours. The maximum average weight of fruiting body (30.00) was observed in Chickpea flour which was significantly similar with control i.e. straw without organic additive while minimum average weight of fruiting body (30.00) was observed in Pigeon pea flour (17.28) which was significantly similar with lentil flours. Results are shown in Table 1 and Fig 1.

The results were accordance with the findings of Jandaik[11] reported that on addition of oat meal, Arhar dal and Bengal gram powders singly to the substrate (banana pseudo stems and paddy straw), increased the

yield of *P. sajor-caju.* Bano[12] supplemented cotton seed substrate with horse gram powder, which resulted in enhanced yield in *P. flabellatus*. Cho[13] recorded more yield of *P. sajor-caju,* when the substrate was supplemented with wheat brawn. Dubey[14] was observed that supplementation of the paddy straw substrate with Pigeon pea and gram flour, resulted in enhanced yield of *P. flabellatus, P. sajorcaju*, *P. ostreatus* and *P. cystidiosus*. Maheshwari[15] were also observed that on addition of soybean meal and wheat bran to the substrate, not only increased the yield of *P. eryngii* but the texture and flavour characteristics were also improved. Saurabh[16] were reported highest yield of *P. sajor-caju* and *P. florida* when substrate supplemented with the Soybean flour while minimum yield was recorded under control in both species of Oyster mushroom. Bhadana[17] were also reported organic supplements increased the yield and number of sporophores of *P. florida* and *P. djamor*. Maximum sporophores yield and average numbers of sporophores were noticed in *P. flabellatus* and *P. djamor* respectively in Pigeon pea flour.

Table-1. Effect of different organic supplements (in substrate) on spawn run and yield of Oyster mushroom (*P. djamor*)

ORGANIC ADDITIVE	DFSR	DFFH	DFCP	NOFB	NOL	Pileus length (in cm)	Pileus width (in cm)	Yield (g/kg dry Substrate)	Average Weight /FB	Biological efficiency (%)
Soyabean flour	23.33	25.67	59.00	23.67	70.67	10.00	7.16	552.00	23.32	55.20
Black gram flour	18.33	23.00	59.67	18.33	50.33	8.83	8.16	530.00	28.91	53.00
Pigeon pea flour	16.00	18.67	59.00	34.33	50.33	9.50	8.16	593.33	17.28	59.33
Chickpea flour	20.33	24.33	55.33	14.33	36.33	6.10	6.00	430.00	30.00	43.00
Lentil flour	19.00	24.00	58.00	26.00	75.00	9.03	7.00	523.33	20.11	52.33
Control (without additive)	25.00	31.00	60.33	17.00	47.00	8.00	8.00	410.00	24.11	41.00
SE	1.15	0.88	0.88	2.73	1.00	0.73	0.68	8.165	2.88	_
CD at 5%	2.54	1.94	1.94	6.02	2.20	1.62	1.51	17.98	6.34	_

Average of three replications
DFSR= Days for spawn run, DFCP= Days for cropping period, DFFH= Days for first harvesting,
NOFB= Number of fruiting body, NOL- Number of lob

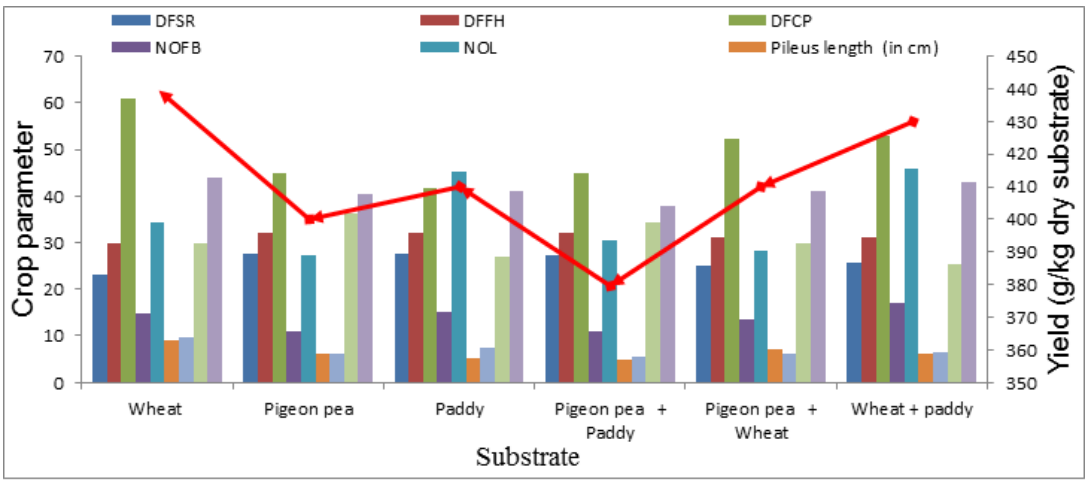

Fig. 1: Effect of different type substrate on spawn run and yield of oyster mushroom (*P. djamor*)

CONCLUSION

In mushroom cultivation yield have a great importance for mushroom growers in the rural as well as urban areas hence a study was conducted to determine the effect of different organic supplement in substrate to enhance the yield and growth of Oyster mushroom. The maximum yield, highest number of fruiting bodies, minimum days for first harvesting and minimum days for spawn run were observed in Pigeon pea flour. On the basis of above study it is recommended that the cultivation of *Pleurotus djamor*as is appropriate for organic supplement (in substrate) to be use.

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