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EFFECT OF DIFFERENT MEDIA ON THE YIELD, PRODUCTION, BIOLOGICAL EFFICIENCY AND BIOCHEMICAL PARAMETERS OF TWO *PLEUROTUS* SPECIES

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ABSTRACT

Present study deals with the utilization of different agro-waste substances like paddy straw and sugarcane baggage singly and in combination for cultivation of two species of *Pleurotus* .The combinations of substrates (in equal proportions) was more productive and gave highest yield. Also comparative analysis of biochemical parameters of *Pleurotus* during the different stages of its development showed that the button stage has higher protein content than the open stage.

Keywords: *Pleurotus*, Paddy straw, Sugarcane baggage.

INTRODUCTION

The oyster mushroom (*Pleurotus* spp.), is commonly called “Dhingri” grows in India from October to mid of March, when the climatic temperature ranges between 20^0 C to 30^0 C and the humidity 80 percent. This mushroom has been extensively used for physiological studies and also for industrial production of mushroom mycelia in submerged culture (Hashimoto & Takahashi, 1994; Dudka et. al., 1978; Sakomoto et. al., 1978 and Khanna and Garcha, 1985).

In India, there are five species of oyster mushroom such as *Pleurotus sajor caju, P. florida, P. flabellatus, P. sapious* and *P. abalonus* are commonly growing by farmers. All of them have delicious flavors, rich in protein, minerals and vitamins and low in carbohydrates (Pani and Patra, 1994).

Different agro wastes can be used for cultivation of mushrooms such as straws of different crops, oil palm bunch, oil palm peri-carp, young banana leaves, saw dust, cotton waste and water hyacinth, but the production of mushrooms depend on the kind of compost used as substrate for mycelium run (Purkauashta *et. al.*, 1980). The present study is aimed to evaluate the utilization of two locally available agrowastes : paddy straw and sugarcane baggasse for yield and biochemical parameters of the fruit body.

MATERIALS AND METHODS

Tall variety of rice straw (*Oryza sativa var*. CR 30; *O.sativa var*. jajati, *O.sativa* var. pathara etc.) was used for preparation of bed. The rice straw bundle of about 2 feet length and 10 cm diameter was used for preparation of bed. The rice straw bundles were soaked in water for 15 to 16 hours and then removed from water and were kept in inclined position for 4 to 5 hours to remove excess water. After that the straw was transferred to boiling water for 30 minutes and then, they were allowed to dry for two hours in shade to drain off excess amount of water.

Besides the rice straw sugarcane baggage were also used for preparation of bed. The sugarcane baggage were washed gently with clean tap water and then boiled for 30 minutes to become soften. The boiled sugarcane baggage was made into small bundles.

Preparation of beds

For cultivation of P*leurotus*, mushroom bed was prepared on the polythene bags of size 18"× 12". The rice straw pieces were filled into a polythene bag in layer by layer manner called as bed. The 1st layer was about 10-12cm thickness. A complete *Pleurotus* mushroom bed constitutes about 5 to 7 layers, which is about 3 feet in length and 1 feet in diameter. The sugarcane baggage beds were also prepared like the rice straw bed.

Spawning the bed

The spawning was done leaving about 2 to 3 inches from the edge and no spawning was done in the middle space. Finally, the open end of polythene bag was closed with a rubber tag. Lastly, the bed was tightly tied with ropes

longitudinally to remove the air gaps among the layers and to make suitable compactness of straw to run the mycelium. Then, the bags were hanged by means of plastic thread inside the "Mushroom house".

Maintenance of bed

The culture room was maintained at 25 ± 3^0 C and the relative humidity was 60% to 70%. After 12 to 15 days on spawning when the mycelium completely cover the bed, the polythene cover was removed gently. Then watering was done at regular intervals by a hand set sprinkler.

Fruiting

The pinhead was emerged on mushroom bed usually after five to six days from the polythene cover was opened. The plucking was done carefully by hand without disturbing the adjoining pinheads. The subsequent flushes of mushroom were harvested at an interval of five to eight days. About four to five crops had been harvested from a single bed.

The fresh weight of the mushroom was measured by Digital balance (Dhona 48), then they were placed immediately in an oven at 80^0C for 48 h, and after drying, recorded the dry weight. Measurements of protein, carbohydrate and nucleic acid contents in mushrooms were estimated according to the methods of Lowary *et. al.*,1951, Morris, 1948 and Mallik and Singh, 1980.

The following parameters were computed basing on following formula: -

Biological efficiency (BE) = Fresh weight of mushroom / Air dry weight of substrate × 100

Production rate (PR) = Biological Efficiency (%) / time (days)

Compost net loss = Compost dry weight. – (Compost dry weight after cultivation + mushroom dry weight)

Dry material loss rate = (Net weight loss of dry material /total dry weight of original substrate) × 100

Bioconversion rate = (Dry weight of the fruiting body / Dry material net loss)× 100

Moisture content = (Fresh weight of fruiting body – Dry weight of fruiting body) / fresh weight of fruiting body) × 100

RESULTS AND DISCUSSION

The Table 1 shows the Production of *Pleurotus* on compost of rice straw, sugar cane baggage and their combinations . The rice straw and sugar cane baggage (1:1) combinations observed earlier pin head emergence (20 days) as compared to

other combinations. Similarly the number of mushrooms appeared in this bed was 105±7 in *P.sajor-caju* and 104±6 in *P.florida.* The minimum production were recorded in *P.sajor-caju* in the bed of 25% rice straw + 75% sugarcane baggage and in *P.florida* on 75% rice straw + 25% sugarcane baggage bed.

Table I. Production of *Pleurotus* on compost of rice straw, sugarcane baggage and with their different combinations. Each value is mean of 10 replicates ± SEM

Substrates	*Pleurotus sajor -caju*				*P.florida*			
	days after pin head emerged	no .of mushrooms/bed	fresh wt. (g)	dry wt. (g)	days after pin head emerged	no. of mushrooms /bed	fresh wt. (g)	Dry wt. (g)
Straw	21	104±5	2080.91 ±30.46	241.55 ±25.03	22	100±5	2037.38 ±30.71	240.48 ±10.22
75%rice straw +25% sugarcane baggage	28	100±6	2000.88 ±31.17	237.04 ±16.75	26	95±3	1967.69 ±26.68	234.77 ±12.65
50% rice straw +50% sugarcane baggage	20	105±7	1960.92 ±32.73	240.26 ±26.66	21	104±6	2099.38 ±34.75	243.34 ±20.43
25%rice straw +75% sugarcane baggage	26	96±3	1982.84 ±27.92	236.68 ±12.52	27	97±2	2002.68 ±18.50	233.46 ±18.23
Sugarcane baggasse	22	102±4	2106.76 ±25.67	244.24 ±17.53	24	98±3	2030.42 ±22.54	236.41 ±19.32

The bio-efficiency of *Pleurotus sajorcaju* and *P. florida* are presented in Table 2. The compost used for *P.sajorcaju* was 970.50 gm and *P. florida* was 985.80 gm. Both are harvested on 20th day of inoculation. The bio-efficiency rate was

84.30% in *P.sajor-caju* and 80.55% in *P. florida.* Similarly, the production rate was 4.32 and 4.27 respectively in these two species.

Table2: Bioefficiency of *Pleurotus* grown on rice straw as substrate. Each value is mean of 10 replicates ± SEM

Species	Compost dry wt. (g)	Days after harvested	Mushroom fruit body fresh wt. (g)	Mushroom fruit body dry wt. (g)	Bioefficiency(%)	Dry mushroom yield rate (%)	Production rate
P.sajor-caju	970.50± 20.18	20	840.12± 10.41	55.62± 3.15	84.30	5.65	4.32
P.florida	985.80± 20.15	20	842.25± 11.42	50.18± 4.10	80.55	5.28	4.27

The fruit body conversion rate of *Pleurotus* mushroom grown on rice straw substrate is presented in Table 3. The compost used for preparation of bed was 565.28 ±15.16 gram of rice straw in *P.sajor-caju* and 587.24 ± 20.18 gram in *P.florida*, the fruiting body conversion rate were 15.93% and 14.40 % respectively. The carbohydrate, protein and nucleic acid content were 34.12 %, 38.50 % and 2.7 % in *P.sajor-caju* and 34.28%, 37.21% and 2.8 % in *P.florida* respectively. "Biomass conversion efficiency" is dependent on the occurrence of the contaminants and growth competitors, in the growth substrate while culturing the mushroom (Rajarathnam *et. al.*, 1987 and Grandy, 1985). The biomass includes the mycelium generated in the growth substrate, developed fruiting bodies, and also mycelium grown in liquid culture. Rajarathnam, 1981 has identified several enzymes responsible for degradation of growth substrate of the mushroom mycelium.

Table 3. Bio conversion of dry compost into fruit body in *Pleurotus* grown on rice straw substrate with their carbohydrates, Protein and nucleic acid content. Each value is mean of 10 replicates ± SEM

Species	Compost dry wt(g) after cultivation	Compost net loss (g)	Fruit body conversion rate %	Compost lossrate (%)	Carbohydrates content (% dry wt.)	Protein content (% dry wt)	Nucleic acid content (% dry wt.)
P.sajor-caju	565.28±15.16	349.10±8.28	15.93	35.97	34.12	38.50	2.7
P.florida	587.24±20.18	348.38±9.58	14.40	35.33	34.28	37.21	2.8

The mycelial growth of *Pleurotus* on rice straw, sugarcane baggage and rice straw and sugarcane baggage (1:1) were given in Table 4. The data were analyzed statistically by using Duncan's multiplicative model, linear model and exponential model. The table, reveals that the substrate rice straw and sugarcane baggage (1:1)combination gives better mycelial diameter in compare to either rice straw or sugarcane baggage alone. The better mycelial growth is reflected in better yield of the mushroom.

Table 4. Mycelial growth (mm)of *Pleurotus* spp.on different agricultural substrates

Substrate Used	Mycelia diameter (mm)	
	P. sajorcaju	***P. florida***
Rice straw	0.79c	0.77b
Sugarcane baggage	0.75a	0.72a
Rice Straw+ Sugarcane baggage (1:1)	0.84a	0.81

C a = Duncan's multiplicative model ($y = ax^b$)

b = linear model ($y = a + bx$)

c = exponential model. ($y = \exp (a + bx)$)

Cultures are 14 days after inoculation

The Correlation coefficient of the biochemical content of *Pleurotus* mushroom at different stage of development is given in Table 5. From the Table, It indicates that *Pleurotus* contain more biochemical contents (protein, DNA, RNA and total nucleic acids) in button stage as compared to primordial and open stage. These values are significant in this stage at 0.05 level.

Table 5. Correlation coefficient of the biochemical content of *Pleurotus* spp. at different stage of development

Biochemical Parameters	*P. sajor-caju*			*P. florida*		
	Primordial stage	Button stage	Open stage	Primordial stage	Button stage	Open stage
Protein	27.24	30.15*	26.26	28.24	30.56*	26.53
DNA	0.72	0.73	0.70	0.70	0.71	0.68
RNA	2.0	2.02*	1.98	1.98	2.0	1.95
Total Nucleic acid	2.72	2.75*	2.68	2.68	2.71*	2.63

The inoculation day is considered as 1st day * Significant at 0.05 Level.

The correlation coefficient between yield and loss in bed weight of *Pleurotus* mushrooms are represented in Table 6. The *Pleurotus* spp.were grown at 25 to 30^{0}C. In all cases, the correlation coefficient between yield and loss in bed weight were significantly high at 0.05 level.

Table 6. Correlation coefficient between yield and loss in bed weight of *Pleurotus* mushroom

Mushrooms	Temperature (^{0}C)	Relative humidity (%)	Spawn run period (in day)	Yield in fresh wt./ bed (g)	Loss in bed (% dry wt.)	Correlation coefficient between yield and loss in bed wt. (g)
P.sajor-caju	25 - 28	80 – 85	20 - 25	320.13	35.2	0.91*
P. florida	25 - 30	80 – 85	18 - 24	318.61	38.3	0.92*

* Significant at 0.05 Level.

CONCLUSION

From the experiment it is clearly observed that the mixture of rice straw and sugarcane baggage in equal proportion (1:1) give early pinhead emergence than pure rice straw or pure sugarcane baggage, and also the mixture of these two substrate gave better yield of mushroom. Our finding are also in agreement with earlier reports of Padhy, 2003; and Tripathy, 2001.

The bio-efficiency and bioconversion rate of *Pleurotus sajor caju and P.florida.* are 80 to 85 % respectively during our experiment, which is approximately five times that of cereals like rice per unit land. Their protein conversion efficiency, is approximately twenty times that of meat generating animals. A comparative analysis of biochemical content in mushroom during different stage of its development revealed that the button stage of *Pleurotus* have significantly higher protein content .So button stage may be adopted during the harvesting of the mushrooms.

The best results obtained during the course of investigation showed that the rice straw along with sugarcane baggage in equal proportion have synergized to give highest yield in *Pleurotus* mushrooms as compare to rice straw and sugarcane baggase alone and also other combinations of substrate.

REFERENCES

1.Alexopolous, C.J and Mine, C. W. (1979). Introduction Mycology. *J. wilcy and Sons*. New York, p 632.

2.Anderson, F.E. and Fellers. C.R.(1942). The food value of mushrooms .*Agaricus cumpestris*. *Proceedings of the American society of Horticulture Science,* **41:** 301-309.

3.Bano, Z. and Srivastava, H.C. (1962). Studies on cultivation of *Pleurotus* sp. on paddy straw. *Food Sci.* **12:** 363-365.

4.Bihary, L. (2003). Physiological studies on edible mushrooms cultivated in south Orissa, M.phil dissertation, Berhampur University p.52

5.Dudka, I.A.; Soldatova, I.M.; Beragovaya, V.I.; Isachenko, A.A. and Skribitskaya, T.M. (1978). Cultural characteristics of cultivated *Agaricus*, *Pleurotus and Lentinus. Pr VO Vyssn "s" edobn Gribov V SSSR Kiev*, Ukrainin SSSR, p. 56-69.

6.Gandy, D.G. (1985). Bacterial and fungal diseases. In: The Biology and Technology of the Cultivated Mushroom.(Flegg, P.B., Spencer, D.M., and Wood, D.A. eds.), John Wiley and Sons, New York, p 261-278.

7.Hashimoto, K. and Takahashi, Z. (1974). Studies on the growth of *Pleurotus flabellatus*. *Mush. Sci*., **9**: 585-598.

8.Jandaik, C.L.(1980). How to grow Dhingri (*Pleurotus*)mushroom cultivation in India. (MGA Bull-II eds.): 35-40.

9.Khanna, P. and Garcha, H.S. (1985). Physiological studies on *Pleurotus*

species. I. Nitrogen utilization. *Mushroom Newsletter for the Tropics* .**5(3):** 16 -19.

10.Lowary, O.H., Rosenbrough, N.J., Farr, A.L and Rondoll, R.J.(1951). Protein measurement with the folin phenolic reagent. *J. Biol. Chem*., **193:** 265-275.

11.Mallik, C.P. and Singh, M.B. (1980). Measurement of nucleic acid In: Plant enzymology and histoenzymology (Mallik and Singh eds) Kalyani Publishers, New Delhi. p 268-272.

12.Morris, D.L.(1948). Quantitative determination of carbohydrates by anthrone reagent science, **107 :** 254 – 255.

13.Padhy, B (2003). Investigations on the physiological processes of cultivated mushrooms of South-East Orissa, M.phil dissertation Berhampur University p 36.

14.Pani, B.K. and Patra, A.K.(1994). Growth of some *Pleurotus* (oyster mushroom) in different liquid media, *Orissa J. Agric. Res.* **Vol. 7** (suppl.), 66-68.

15.Purakyastha R.P.; Biswas, S. and Das, A.K. (1980). Some experimental observations of the cultivation of *Volvariella volvaceae* in the plains of West Bengal. *India J. Mushroom* **6:**1-9.

16.Rajarathnam, S. (1981). Studied on pathological and biochemical aspects during cultivation and storage of the white oyster mushroom *Pleurotus flabellatus*. Ph.D.Thesis, University of Mysore.

17.Rajarathnam, S.; Wankhede, D. B. and Zakia Bano,(1987).Biotechnological implications of degradation of rice straw degraded by *Pleurotus flabellatus. J.Chem. Tech. Biotech.* **37:** 203-214.

18.Sahoo, D. (1999). Studies on spawn culture and edible mushroom growing technique. M.Phil. Dissertation. B.U.

19.Sakamoto, R.; Nimmi, T. and Takahashi, S. (1978). Submerged culture of edible fungi in high consistency starch media. *J. Agric. Chem. Soc*. Japan, **52:**

20.Tripathy, A (2001). Biotechnological processes for some edible mushroom Productions. Ph.D thesis BU. p 114.