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Effect of cereal, millet and legume bran supplement on yield and biological efficiency of oyster mushroom (*Pleurotus flabellatus*)

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ABSTRACT

Different brans, viz., wheat, rice, maize, barley (cereal bran), sorghum (millet bran) pea, gram and pigeon pea (legume bran) were evaluated as supplement @ 10% on dry weight basis of substrate for enhancing yield and biological efficiency of *Pleurotus flabellatus*. Among the bran used, wheat, rice, sorghum, pea and pigeon pea bran produced significantly higher yield and biological efficiency of mushroom than the control. Maximum yield was recorded with rice bran (655 g, 131%) followed by wheat bran (615 g, 123%), pea bran (600 g, 120%), pigeon pea bran (595 g, 109%) and sorghum bran (580 g, 116%). Significantly (P=0.05) higher weight/sporocarp was obtained from the barley (12.50 g), pea (13.63 g) and pigeon pea bran (15.42 g) while none of them produced significant no of sporocarp.

Key words: Cereal, millet and legume bran, Supplements, biological efficiency, *Pleurotus flabellatus*

Pleurotus spp., commonly known as oyster mushroom, are the 2nd largest produced mushroom in the world. Although, in India, it is admired especially due to its excellent flavor, taste and above all, easy and less expensive method of growing with a wide choice of species available for cultivation under different climatic conditions. Different approaches have been done to increase mushroom yield at different time interval. These include selection (Siddhant *et. al.*, 2009; Chandravanshi *et. al.* 2012) and preparation of substrate (Vijay and Sohi, 1987), spawn and spawning strategy (Kumar and Suman, 1979; Siddhant *et. al.*, 2013), supplementation of organic (Khare *et.al.* 2010; Shashirekha *et.al.* 2005; Vijay and Upadhyay, 1989) and inorganic nitrogen sources (Quimio *et al.* 1995) etc. The nutrient composition of the substrate is one of the important factors limiting the saprobiotic colonization of cultivated mushrooms and particularly the fruiting of *Pleurotus* spp. The growth of micro-organisms as well as qualitative and quantitative yield of the desirable product also depends on the utilization of nutrients from the growing medium (Mukhopadhyay *et. al.*, 2002). The nutritional content of the substrate can be enhanced by the addition of nitrogen to the substrate that helps in getting higher mushroom yield (Azizi *et. al.*, 1990).

Keeping this in mind, in the present communication, different cereal, millets and legume bran were evaluated as organic nitrogen supplements to find out their effect on biological efficiency of mushroom.

The pure culture of *Pleurotus flabellatus* was obtained from the mushroom section of Plant Pathology Department, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) India. The culture was maintained and subcultured on potato dextrose agar (PDA) medium.

The spawn was prepared by the conventional method by using wheat grains as a basal medium. The wheat grain is washed separately and water soaked overnight. On the following day, these were washed again in water for at least 10-15 minutes until they expanded but not broken. The water was then drained out and boiled grains were allowed to cool. Two per cent gypsum and four per cent calcium carbonate was added to grains thoroughly. The mixture obtained was loosely packed in spawn containers and autoclaved at 15 lbs (121°C) for 1-1½ hour. After autoclaving, the containers were removed from autoclave. These were inoculated with *P. flabellatus* inoculum under aseptic conditions and incubated at 24-25 °C until complete colonization.

Wheat straw, used as a growing medium, was washed separately in fresh water and chemically pasteurized as per the method of Vijay and Sohi (1987). Different kind of brans like wheat, rice, maize, barley (cereal bran), sorghum (millet bran) pea, gram and pigeon pea (legume bran) were autoclaved at 15 lbs for 30 min and supplemented with wheat straw substrate @ 10% on dry weight basis at the time of spawning.

The spawning was done in multilayered (3) manner @ 15 % to the substrate. The mushroom bags were incubated in a cultivation room at 24±2°C for spawn run. When the mycelium had completely covered the beds, the polythene covering was gently taken off. The compact solid substrate was irrigated as per requirement. The room was moistened to maintain the relative humidity 85-95 per cent. The fruit bodies of appropriate size were picked-up by gentle handling.

The yield parameters recorded were, time taken for spawn run, pin head initiation and maturity of fruit bodies, number of flushes, mushroom yield, biological efficiency, total number and weight per sporocarp for different supplementations. The biological efficiency of mushroom was worked out as percentage yield of fresh mushrooms in relation to the dry weight of the substrate according to Chang and Miles (1989).

Completely randomized design (CRD) was followed for the experiment. The data were statistically analyzed. The critical difference (CD) was processed at the five per cent probability level.

All the bran supplemented sets showed early spawn run, primordial development and fruit bodies maturation than control which ranged from 17-20 days, 20-25 days and 24-30 days, respectively (Table.1). Among the bran used, rice bran took minimum time for this purpose (17, 20, 24 Days) followed by Pea bran (17, 21, 25 Days), Sorghum (18, 22, 25 Days), Pigeon pea bran and wheat bran (18, 22, 26 Days), barley bran (19, 23, 27 Days), maize bran (19, 24, 27 Days) and gram bran (20, 25, 29 Days). The unsupplemented sets took longer duration for the above stages (20, 25, 30 Days). This result is confirmative to the report of Naraian *et. al.* (2009) who stated that supplementation with organic nitrogenous substances hasten the production time.

A significant effect on mushroom yield was noticed in bran supplemented bags. Yield increase might be due to extra amino acids or proteins and / or easily degradable carbohydrate available to the mushroom mycelium (Royse, 2002) in form of bran. The organic nitrogenous sources also supply carbon, potassium and phosphorus to the mushroom mycelium. These can be easily used by fungi because the absorption of these molecules is more energetically efficient than synthesizing the molecules, which allow the fungi to obtain more energy to stimulate mycelia growth and increase the mushroom biomass (Kinugawa *et al.* 1994; Siddiqui and Khan, 1989). Supplementation of mushroom beds with extra nutrients has been invariably proved suitable for

Table 1. Effect of different bran supplementation on various parameters of mushroom production

Cereal, millet and legume bran	Spawn run (Days)	Primordial development (Days)	First harvest (Days)	Total yield from three flushes [g/500 g dry substrate]	Biological efficiency (%)	Average number of sporocarp	Weight per sporocarp (g)
Wheat bran (10%)	18	22	26	615	123	53	11.60
Rice bran (10%)	17	20	24	655	131	55	11.90
Maize bran (10%)	19	24	27	565	113	47	12.02
Barley bran (10%)	19	23	27	550	110	44	12.50
Sorghum bran (10%)	18	22	25	580	116	59	9.83
Pea bran (10%)	17	21	25	600	120	44	13.63
Gram bran (10%)	20	25	29	540	108	54	10.00
Pigeon pea bran (10%)	18	22	26	595	119	39	15.42
Control	20	25	30	545	109	48	11.35
SE	-	-	-	13.20	2.94	9.58	0.53
CD (P=0.05)	-	-	-	27.72	6.18	20.12	1.11

Average of three replications

better yield (Perry, 1987). Among the bran used, only wheat, rice, sorghum, pea and pigeon pea bran produced significant yield and biological efficiency of mushroom as compared to control. It was recorded maximum in rice bran (655 g, 131%) followed by wheat bran (615 g, 123%), pea bran (600 g, 120%), pigeon pea bran (595 g, 109%) and sorghum bran (580 g, 116%). Rice bran showed highest percentage yield increase over others (Table.2) which might be due to its chemical composition. It is well established fact that rice bran is naturally rich source of carbohydrate, vitamins and minerals. The nitrogen content of bran varies from 1-3% on dry weight basis. The largest part of rice bran nitrogen is protein nitrogen, therefore, the addition of rice bran as a supplement enhanced the nitrogen content of substrate thus increase mushroom productivity (Sangeetha *et. al.* 2011). The rice bran supplementation also improves the level of phosphorus absorption (Mateus Dias Nunes *et.al.* 2012).

The number of fruit bodies harvested varied among the treatments that ranged an average of 39-59 sporocarp/bag. These were at par among themselves while significant sporocarp weight was produced only from barley (12.50 g), pea (13.63 g) and pigeon pea bran (15.42 g) supplemented sets.

Table 2. Percentage yield increase (+) or decrease (-) from control

Name of bran	Percentage yield increase (+) or decrease (-) from control
Wheat bran (10%)	+12.84
Rice bran (10%)	+20.18
Maize bran (10%)	+3.66
Barley bran (10%)	+0.91
Sorghum bran (10%)	+6.42
Pea bran (10%)	+10.09
Gram bran (10%)	-0.91
Pigeon pea bran (10%)	+9.17

Our results are similar to the finding of previous workers (Bahukhandi, 1990a; Bahukhandi, 1990b; Srivastava and Singh,

Plate: Effect of different supplements on mushroom cropping

1999; Takahashi, 1976; Terashita and Kono, 1984) who reported better biomass production of oyster mushroom with addition of rice bran.

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