

## Effect of supplementation of substrate with brans and oil cakes on yield of oyster mushroom (*Pleurotus* spp.)

J.P. SHARMA and S. KUMAR

Horticulture and Agro-forestry Research Programme, ICAR Research Complex for Eastern Region, Ranchi 834 010

**ABSTRACT:** Straw based substrate requires supplementation of brans or oil cakes for optimization of CN ratio which help in increasing productivity of mushroom. Accordingly, experiment was conducted on three oyster mushrooms viz; *Pleurotus florida*, *P. sajor-caju* and *P. ostreatus* with supplementation of brans (wheat and rice), oil cakes [Indian beech (karanj) *Deris indica* and de-oiled soybean flour (*Glycine max*)] in the paddy straw substrate. Use of supplements in the substrate resulted into significant increase in yields of fruiting bodies of all the three species of *Pleurotus*. Supplementation with wheat bran @2% enhanced the yield significantly in *P. florida* (48.3%), *P. sajor-caju* (44.9%) and in *P. ostreatus* (48.1%) over control. The yield of *P.ostreatus* was higher (52.9%) at 4% wheat bran supplementation but this increase was statistically at par with that of 2% level. Similar trend was obtained with 2% rice bran supplementation Use of de-oiled soybean supplements *P.florida* showed 31.3% decrease in yield. Similarly < 10% yield decline was noted in *P.sajor caju* with the use of karanj cake. Combination of all supplements was most beneficial to increase yield in *P. ostreatus* 54.7%. Thus the wheat bran @2% (w/w) supplementation was found beneficial in increasing the yield.

**Key words:** *Pleurotus*, supplementation of substrate, wheat bran, oil cake

Mushrooms are very delicious and an important food protein supplement has a great potential for reducing malnutrition, job generation in rural people particularly the women, due to increasing awareness of its dietary values its production is exponentially increasing. Oyster mushroom includes several species of genus *Pleurotus*. Its cultivation is becoming popular because of its wide adaptation to temperature, its easily available substrates and simple cultivation techniques, grows on a wide variety of substrates. Thirty-nine species of *Pleurotus* have been recorded (Garcha *et al.*, 1997), of which 9 have been grown commercially world wide. China alone accounts for 80% of the total world produce of *Pleurotus* spp. In India 95% mushroom production is of white button mushroom (*Agaricus bisporus*) and remaining 5% is shared by *Pleurotus* spp. and *Volvariella* spp. (Verma, 1997). Presently mushroom production consists of 80% of *A.bisporus*, 15% of *Pleurotus* and 5% of *Lentinula* (Chang, 2007). Cereal straws are the most preferred

substrate for cultivation of *Pleurotus* species. Addition of organic and inorganic supplements to the substrates during cultivation is little known to influence the yield of various species of mushroom (Dubey and Das, 1997; Patra *et al.*, 1997 and Kaur, *et al.*; 1997). Therefore, an experiment with brans and oil-cakes as organic supplements in different combination and quantities was conducted in order to find out better and cheaper supplements to increase the yield of oyster mushroom and the results are reported hereunder.

### MATERIALS AND METHODS

The culture of *Pleurotus* spp. viz; *P. florida*, *P. sajor-caju* and *P. ostreatus* were obtained from National Research Centre for Mushroom, Solan (HP). The spawn of all the species was raised on wheat grain following method of Shivaprakasam and Kandaswamy (1983). The experiment was conducted for two years (2003 and 2004) in temperature ranges from 24 to 27°C, RH from 86 to 95 % (September), temperature ranges from 21 to

\*Corresponding author: jaibina\_05 yahoo.co.in

26°C, RH ranges from 72 to 95 % (October ) and temperature ranges from 18 to 23°C, RH from 74 to 90 % (November), respectively with nine treatments Experiment on *P.ostreatus* was conducted in 2003 only .The following supplements were used (i) Wheat bran, rice bran (ii) oil cakes of Indian beech (karanj) *Deris indica* and soybean (*Glycine max*) separately (iii) combination of brans and cakes and (iv) unsupplemented control. Two concentrations viz., 2% and 4% of brans and cakes were used except in case of de-oiled soybean. The de-oiled soybean was prepared by extracting the water soaked soybean over night, dried the extract, powdered and used as supplements. Substrate was soaked overnight in 0.01% bavistin (50% carbendazim) and 0.05% formalin solution after soaking and excess moisture was shade dried up to 65 %moisture level. The four kg substrates in each bag were layer wise filled in polypropylene bags (size 50 x45 cm). Four replications of each treatment were taken in the study. Spawning was done @ 2% of wet straw. The yield data was recorded and calculated on the basis of fresh mushroom per kg dry straw from each bag and biological efficient (BE) was mentioned. The benefit cost ratios (B:C) was calculated with 30 man hour @ Rs 6.25/hr, karanj cake @ Rs 4.00/ kg, wheat bran @ Rs 5.50/kg, rice bran @ Rs 5.00/kg, Soybean @ Rs 12.00/ kg and spawn @Rs 10.00 / 200g pkt. The sale price of mushroom

@ Rs40.00/ kg and cost of cultivation @ Rs 20.25 / bag.

## RESULTS AND DISCUSSION

It is revealed from table 1 that there was a significant effect of supplementation on yield of fruiting bodies of the three species of *Pleurotus* in both the years (2003 and 2004) as well as mean. The mean data revealed that the maximum yield (1781.8g / bag, 1585.2g / bag of *P.florida* and *P.sajor caju* and 1336 g /bag in *P.ostreatus*) was obtained in 2% wheat bran supplementation in the substrate. The supplementation of 2% wheat bran resulted 48.3% higher yield in *P.florida* (Fig 1), 44.9% in *P.sajor caju* and 48.1% in *P. ostreatus* over the respective control. Similar trend was obtained with 2% rice bran supplementation but maximum yield increase was noted in *P.ostreatus* (48.3%). The yields of *P.ostreatus* and *P. sajor-caju* were higher (53.0 %and 39.44%) at 4% wheat bran supplementation also (Table1) but these were statistically at par with those at 2% supplementation level. Similarly < 10% yield decline was noted in *P.sajor-caju* with the use of karanj cake however, the combination of supplements was most beneficial to *P.ostreatus* (54.7%).

Supplementation of karanj cake in the substrates resulted at par reduction in yield of *P. sajor-caju* with control in both the concentrations

**Table 1.** Influence of different supplementation on yield and benefit/cost ratio in *Pleurotus* spp.

Treatments	<i>P. florida</i>				<i>P. sajor caju</i>				<i>P. ostreatus</i>	
	Yield (g)			B:C ratio	Yield (g)			B:C ratio	Yield (g)	B:C ratio
	2003	2004	Mean		2003	2004	Mean			
T <sub>1</sub> Karanj cake (2%)	1556.6	1312.6	1434.6	2.82	999.4	1029.3	1014.3	1.99	992.9	1.95
T <sub>1</sub> Karanj cake (4%)	985.7	1176.0	1080.9	2.11	1001.4	994.3	997.8	1.95	1028.2	2.01
T <sub>3</sub> Wheat bran (2%)	1810.0	1753.6	1781.8	3.5	1597.8	1572.6	1585.2	3.11	1293.4	2.54
T <sub>4</sub> Wheat bran (4%)	1563.3	1533.3	1548.3	3.02	1662.9	1385.3	1524.5	3.0	1336.0	2.64
T <sub>5</sub> Rice bran (2%)	1457.9	1414.6	1436.3	2.82	1462.5	1323.3	1392.8	2.73	1295.0	2.16
T <sub>6</sub> Rice bran (4%)	1391.0	1222.0	1306.5	2.55	1444.2	1146.6	1295.3	2.53	1100.0	2.15
T <sub>7</sub> De-oiled soybean (2%)	627.4	1046.6	837.0	1.63	1290.4	1226.6	1258.4	2.45	1029.6	2.08
T <sub>8</sub> (T <sub>1</sub> +T <sub>3</sub> +T <sub>5</sub> +T <sub>7</sub> )	1554.9	1072.0	1313.5	2.53	1573.2	1122.0	1347.6	2.15	1351.0	2.6
T <sub>9</sub> Check	1382.2	1020.6	1201.4	2.37	1132.1	1054.6	1093.3	2.15	873.2	1.7
CD. (P0.05)	322.1	250.4	449.2		223.7	274.1	263.1		253.6	
CV (%)	13.6	11.3	14.72		9.6	13.2	8.94		12.8	

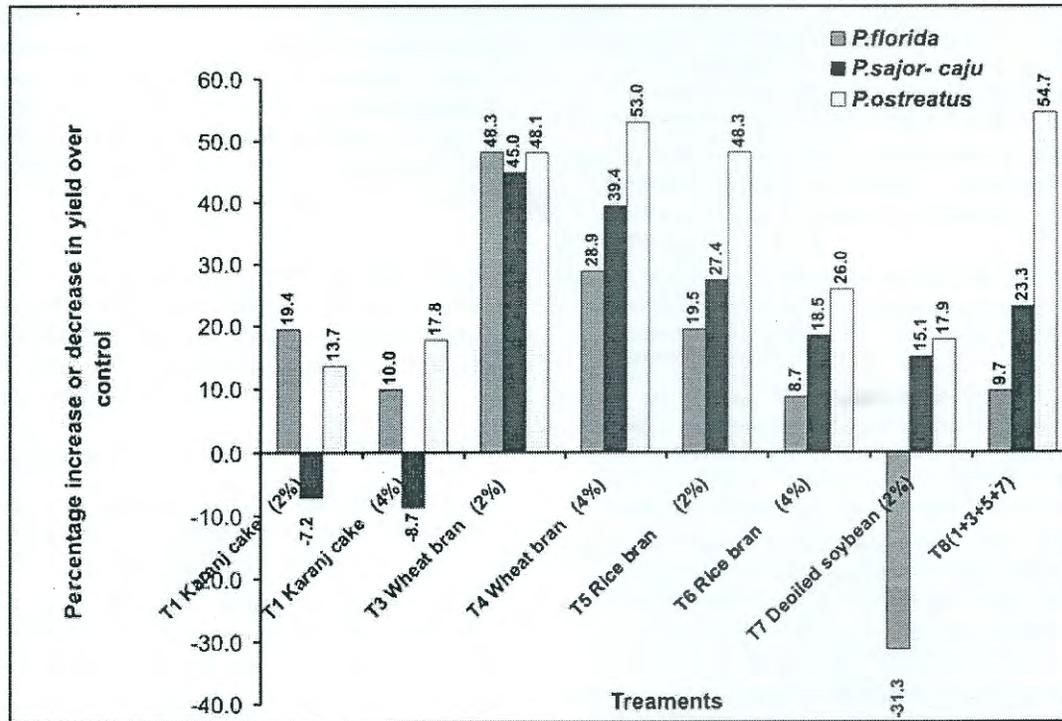


Fig. 1. Effect of supplementation on yield of *Pleurotus* species

used. (Fig 1). The de-oiled soybean supplementation in the substrates resulted in reduction (31.33%) in yield in case of *P.florida* (Fig .1) and had no effect in the other two species. The mixture of all the supplementation @ 2% also resulted in yield at par with control in *P. florida*, effect in *P.ostreatus*, where it gave the highest and significant yield increase.

The benefit cost ratio was found to be maximum in *P. florida* (3.50 and 3.02) with wheat bran supplementation @2% and 4% levels respectively as compared to control (2.37) whereas in case of *P.sajor caju* the B:C worked out to be 3.11 and 2.97 in 2% and 4%, respectively over control (2.15). In case of *P. ostreatus* also, the B: C was (2.54 & 2.64, respectively) were much higher than those with control 1.72. The Table 1 revealed 1.13 times additional benefit with use of 2% wheat bran supplement in case of *P.florida* and 0.96 times in *P.sajor caju*. However, in case of *P. ostreatus* the additional benefit was 1.82 & 1.42 times more over control in 2% & 4%, respectively.

Contrary to the above result (Dubey *et al.*, 1997; Patra *et al.*, 1997) reported that wheat bran and rice bran inhibited the yield whereas pigeon pea gram dal powder and Karanj cake enhanced the yield of above species. However, the experiment conducted under AICMR at different centres viz; Udaipur, Raipur, Solan, Ranchi, and Pantnagar, reported 2% of wheat bran beneficial for growing oyster mushroom (Anonymous, 2003-04, Anonymous, 2004-05). Whereas Kumar *et al.* (1997) obtained maximum yield with bengal gram powder and wheat bran @ 100g /kg with 155% biological efficiency in *P. sajor caju* .

Chital and Champawat (1997) reported that oil cake supplementation in wheat straw substrate @2% cotton cake, castor cake, mustard cake and sesame cake resulted in significant increase in yield of *P.sajor-caju* except mustard cake in comparison to control. Highest yield was obtained with sesame cake. However, neem cake @2% and 4% supplementation recorded higher yield of *P.florida* and *P.sajor caju* at Pune centre (Anonymous, 2004-05) while neem cake @5%

recorded the highest yield at Coimbatore (Anonymous, 2001-02) in *P.florida*, however, in the present investigation Karanj (*Denis indica*) cake @ 2% was at par with control. Singh and Shandilya (2004) reported that supplementation of cotton seed meal; cotton seed cake and soybean meal increased the yield of button mushroom (*Agaricus bisporus*).

Thus, use of sterilized wheat bran @ 2 % in the paddy straw substrate is recommended for getting higher yield of *Pleurotus* species which is cheaper than the other supplement tested in oyster mushroom production.

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