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Effects of Supplements in Rice Straw on Oyster Mushroom (*Pleurotus florida*) Production

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ABSTRACT
Rice straw treated with four different organic additives (rice bran, wheat bran, gram flour and crushed maize cobs) as nutrient supplements was evaluated for the cultivation of Oyster mushroom (Pleurotus florida).The best results were obtained with wheat bran supplemented rice straw. P. florida grown in wheat bran supplemented straw showed an accelerated growth as evident by least days required to colonise the substrate and also least days taken for sprouting. Apart from this, contamination was absent and the fruiting bodies were larger sized with snow white colour indicating healthy and luxurious growth. The total increment in yield in wheat bran supplemented rice straw was 495g (46% higher) in 2kg dry weight of rice straw .The yield increment was found significantly higher at 1% level of significance. The second best additive was found to be rice bran for which the yield increment was 202.5g (19% higher) for 2kg dry weight of substrate (significant at 5%).Supplementing crushed maize cobs to rice straw didn't increase the yield significantly. Addition of gram flour showed negative effect on total yield because of severe contamination by the saprophyte Trichoderma.
Keywords: *Oyster mushroom (Pleurotus spps.), additives, substrate, fruiting bodies, saprophyte, Trichoderma.*

INTRODUCTION

Pleurotus spps are among the widely cultivated mushrooms throughout the world. The popularity of *Pleurotus* is mainly due to its ease of cultivation and nutritional and medicinal value. It is an ideal food for diabetic and heart patients due to its low calorie, high protein and high fibre value. It also has anti-hypertensive and anti- hypercholestrolemic property (Gunde Cimerman N. 1999).Being loaded with vitamins (mainly B complex and C) and anti-oxidants the mushroom shows anti-tumour properties (Geraldine et al.2009). The methanol extract from fruiting bodies of *P. florida* shows OH^- radical scavenging and lipid peroxidation inhibiting activities (Janardhanan et.al 2007, V. Achal 2009).

Pleurotus can be grown in cultivation media of any ligno-cellulosic material such as rice straw, wheat stover, sawdust, sugarcane bagasse, maize cobs and aquatic weeds with varying yield and performance (Badshah et.al. 1992). However, rice straw is the commonly used substrate for mushroom cultivation in Nepal. Rice straw is also used as feed for livestock. This has been causing a hike up in the price of rice straw during recent years, adversely affecting the economy of mushroom production. There is no doubt that straw quality not only affects yield but also affect overall performance during cultivation. Therefore quality straw is a prerequisite for successful *Pleurotus* industry. This experiment is to evaluate the effects of supplementing the rice straw with different organic additives which can be easily available to mushroom growers.

MATERIALS AND METHODS

Rice straw of Sabitri variety was obtained from Agronomy Farm of Agriculture and Forestry University, Rampur, Chitwan. Twenty eight days old spawn of *P. florida* was obtained from District Agriculture Development Office (DADO), Chitwan.

Additives used for supplementing were obtained as below:

Wheat Bran and Rice Bran: Rice Mill, Rampur, Chitwan

Maize Cobs of variety Rampur Composite: National Maize Research Program (NMRP), Rampur

Gram Flour: Rampur

Research design

Five treatments with different additives with four replications each were arranged in Completely Randomised Design (CRD). The Treatments are- T_1: Rice Straw Only (Control); T_2: Rice Straw + Wheat Bran (10:1 dws*); T_3: Rice Straw + Rice Bran (20:1 dws); T_4: Rice Straw + Gram Flour (25:1 dws); T_5: Rice Straw + Maize Cob (10:1 dws)

*dws = dry weight of substrate

Cultivation of the mushroom

Rice Straw was stripped overnight and chopped into pieces of 2 to 3 inches size the following morning. The chopped straw was steamed in a big metal drum where the temperature of steam coming out from the top of drum was reported 95^0 C continuously for 4 hours so as to get rid of most fungal and bacterial spores. The sterilised substrate was allowed to cool overnight in airtight condition. The substrate was packed in white polythene bags at the rate of 500 g per bag. Spawning was done after every 2 inch thick layer of substrate at the rate of 40 g spawn per bag. The bags were incubated in a dark room. The temperature variation in the room was observed between 20^0C to 29^0C during the month of January. Observations regarding time taken to colonise the substrate, time taken for sprouting, extent of saprophyte contamination and fresh weight of fruiting bodies were recorded periodically.

Statistical Analysis The data was worked out for means, standard deviation and Coefficient of Variation. Variation was analysed by Analysis of variance (ANOVA) Method and treatment means were evaluated by

RESULTS AND DISCUSSION

Tables 1 and 2 show the results of the experiment.

Table 1

Treatments	Days to colonise	Days to sprouting	Saprophyte contamination
Rice Straw	27.500 ±1.80	33.50 ±1.12	Absent
RS + Wheat Bran	21.75 ±1.48	29.25 ±1.08	Absent
RS + Rice Bran	23.25 ±1.48	30.50 ±1.12	Mild*
RS + Gram Flour	23.00 ±1.22	32.25 ±1.48	Severe**
RS + Maize Cob	31.50 ±2.30	36.00 ±1.58	Absent

Mean ± Standard deviation

*mild = less than 50% area

**Severe = more than 50% area

Time taken to colonise the substrate was found to be least (29.75 days) in wheat bran supplemented straw and longest time (31.50 days) was recorded in maize cob added substrate. It was also observed that adding supplements significantly decreased the time taken to colonise the substrate. It is obviously due to enhancement of growth rate by supplementing nutrients by the additives. Maize cob being high in lignin slowed the initial growth rate of mycelium therefore taking longest time to colonise. This explanation also holds true for time taken for sprouting.

Most severe contamination by saprophyte (*Trichoderma)* was recorded in gram flour supplemented bags whereas mild contamination was seen in bags treated with rice bran. The reason behind this finding can be attributed to the higher percentage composition of easily soluble nutrients in the supplements which is favourable for saprophyte growth. Treatments with wheat bran, maize cob and control were devoid of any contamination. Fast growth of mycelium was helpful to avoid the attack by saprophyte in wheat bran supplemented samples.

Table No 2. Fresh Weights (in grams) of Harvested Mushroom (Total of first 3 pickings)

Treatments/ Replications	R_1	R_2	R_3	R_4	Treatment total(grams)
T_1: Rice Straw (Control)	281.30	259.31	240.78	290.67	1072.06
T_2: RS + Wheat Bran	334.12	445.73	377.56	409.63	1567.04
T_3: RS + Rice Bran	360.95	298.76	334.13	280.75	1274.59
T_4: RS + Gram flour	278.25	253.88	260.39	200.02	992.54
T_5: RS + Maize Cob	271.82	255.55	264.75	299.19	1091.31

Grand Total: 5997.54

Grand Mean: 299.87

CV = 11.09%

F calculated: TMSS/EMSS= 11.95^{**}

**significant at 1% level of significance.

Comparison Between Treatment Means:

$LSD_{0.05}$ = 50.11
$LSD_{0.01}$ =69.30

Treatments	Treatment means	Remark
T_2	391.76	**
T_3	318.65	*
T_5	272.83	Ns
T_1	268.01	Control
T_4	248.13	ns

**significant difference by $LSD_{0.01}$
*significant difference by $LSD_{0.05}$
ns = non- significant

TableNo.3. Efficiency of Production

Treatments	BE*	EE*
T_1 RS	0.536	1.34
T_2 RS + Wheat bran	0.712	1.78
T_3 RS + Rice Bran	0.606	1.55
T_4 RS + Gram Flour	0.486	1.17
T_5 RS + Maize Cob	0.496	1.35

*BE (Biological efficiency) = Fresh Weight of Yield / Dry Weight of Substrate
*EE (Economic efficiency) = Returns at market price / Total Cost at MP

CONCLUSION

Supplementing rice straw with wheat bran or rice bran increased the yield and improved the performance without posing any risk of contamination. Among the supplements added to the rice straw, wheat bran was found to be the best for increasing yield significantly and also minimizing the contamination at the same time. It was followed by rice bran both in terms of yield and performance. Maize cob didn't show significant increment in yield whereas gram flour showed negative results because of severe contamination by the saprophyte *Trichoderma*.

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