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Effect of different supplementations on growth and yield of oyster mushroom

Sneha J. Mistry* and R.G. Parmar

Department of Plant Pathology, B.A.College of Agriculture, Anand Agricultural University, Anand-388 110- Gujarat
**Corresponding author;* Email: snehamihir@aau.in

Oyster mushroom is one of the very attractive crops successfully cultivated in most developing countries due to its easy cultivation technology. The most amazing point of mushroom cultivation is it is landless agriculture on useless lignocelluloses agricultural wastes. The oyster mushrooms have potentials to utilize various kinds of waste materials as substrate than any other mushrooms and in consequence convert them into valuable vegetable food at par with non vegetarian food in terms of nutritional attributes. Since these natural lignocelluloses contain limits of nutrient constituents, require supplementations in the form of chemical and biological supplements. Addition of the supplements with basal substrate has been as common practice to enhance the yield, nutritional and medicinal values (Fan *et al.,* 2000; Shah *et al.*, 2004). The present study comprised the detailed information in context of oyster mushroom cultivation, used multiple basal substrates and supplements (additives).

During present investigation, efficacies of different supplements were evaluated under in vivo conditions. The investigations on evaluation of different supplementations on growth and yield of oyster (*Pleurotus sajor kaju*) mushroom was carried out at Mushroom Laboratory, Department of Plant Pathology, B. A. College of Agriculture, Anand, Gujarat. The supplements evaluated were Wheat bran, Rice husk, Bajara flour, Gram flour, Soybean flour, Maize flour, Groundnut haulm and Chickpea haulm @ 2% of paddy straw as substrate for cultivation of oyster mushroom. The growth parameters viz; days required for spawn run, pin head formation and for first, second and third harvest while the yield parameters (fruit body observations) like pileus diameter, stipe length and size, average fruit body weight, number of fruits/kg dry substrate and average yield /kg dry substrate were studied in completely Randomized Design (CRD) design with three replications having three bags per treatment.

Effect of different supplements on days required for completion of spawn run

The time taken for spawn run due to different treatments varied from 15.83 to 22.83 days. It was revealed that the treatment T_7 Paddy straw+ 2% Groundnut haulm took minimum incubation period of 15.83 days among all the treatments which was at par with treatment T_2 Paddy straw+ 2% Rice husk (17 days), treatment T_8 Paddy straw + 2% chickpea haulm (17.33 days) and treatment T_1 Paddy straw + 2% Wheat bran (18.50 days) while the treatment T_6 Paddy straw+ 2% Maize flour took maximum days for spawn run (22.83).

Effect of different supplements on days required for pinhead formation

The observation on pinhead formation were recorded when the mushroom bags were fully colonized and the small pinhead (primodia) started

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emerging from bags. The data regarding days required for pinhead formation revealed that the treatment T_7 Paddy straw + 2% Groundnut haulm took minimum time of 6.67 days for pinhead formation which was at par with treatment T_8 Paddy straw + 2% chickpea haulm (7.17 days), T_2 Paddy straw + 2% Rice husk (7.33 days), and treatment T_1 Paddy straw + 2% Wheat bran (7.67 days), while maximum days (11.67days) for pinhead formation were observed in the treatment T_9 Paddy straw. Sivaprakasam and Ramraj (1991) reported, 25 to 27 days for appearance of pinhead in case of *Pleurotus sajor-caju* grown on wheat straw.

Effect of different supplements on days required for harvest of mushroom

The findings indicate that the treatment T7 (Paddy straw + 2% Groundnut haulm) consistently showed the shortest time to harvest across all three harvests. For the first harvest, T7 took 24.33 days, which was comparable to T2 (Paddy straw + 2% Rice husk) at 24.50 days, T8 (Paddy straw + 2% Chickpea haulm) at 25.33 days, and T1 (Paddy straw + 2% Wheat bran) at 26 days. T9 (Paddy straw alone) required the longest time, taking 34.83 days. For the second harvest, T8 took the fewest days at 33.33, similar to T7 at 34.17 days, T1 at 34.67 days, and T2 at 36.17 days, with T9 again taking the longest at 43.83 days. The third harvest showed T7 required 45.83 days, closely matched by T1 at 47.83 days, T2 at 48.17 days, and T8 at 48.50 days, while T9 took the maximum time at 58.83 days.

Effect of different supplements on number of fruiting bodies per bag

The results on number of fruiting bodies per bag varied from 58.00 to 72.33 due to different supplements. The data revealed that the treatment T_8 Paddy straw+ 2% chickpea haulm produced significantly higher number of fruiting bodies per bag (72.33) which was found at par with treatment T_7 Paddy straw+ 2% Groundnut haulm (71.67), T_1 Paddy straw+ 2% Wheat bran (70) and T_2 Paddy straw+ 2% rice husk (67.50).The minimum number of fruiting bodies were found in the treatment T_5 Paddy straw+ 2% Soybean flour (58.00).

Effect of different supplements on average fruit body weight

The data on the average fruit body weight (g) ranged from 8.13 to 12.05 g per fruit. The treatment T_7 Paddy straw+ 2% chickpea haulm had significantly highest average fruit body weight (12.05 g) which was found to be at par with treatment T_1 Paddy straw + 2% Wheat bran (11.68 g), T_2 Paddy straw+ 2% rice husk(11.65 g) and T_8 Paddy straw+ 2% chickpea haulm (11.54 g). While, lowest average fruit body weight (8.13 g) recorded by treatment T_5 Paddy straw+ 2% Maize flour.

Effect of different supplements on morphological characters

The data revealed that the maximum pileus diameter was recorded by the treatment T_7 Paddy straw+ 2% groundnut haulm (6.98 cm) which was found to be at par with T_8 Paddy straw+ 2% chickpea haulm (6.45 cm) and T_1 Paddy straw+ 2% wheat bran (6.40 cm). While the minimum pileus diameter was observed in treatment T_3 paddy straw +2% Bajara flour (4.13 cm).

The data on the stipe length revealed that the treatment T_8 Paddy straw+ 2% groundnut haulm recorded maximum stipe length (4.21 cm) which was at par with treatment T_1 Paddy straw+ 2% wheat bran (4.04 cm) ,T_7 Paddy straw+ 2% groundnut haulm (3.91 cm) and T_2 Paddy straw+ 2% rice husk(3.67 cm). While the maximum stipe length was observed in treatment T_3 paddy straw +2% Bajara flour (2.60 cm). *Stipe size:* The maximum stipe size

Table 1. Effect of different supplements on days required for spawn run, pinhead formation and harvest of oyster mushroom

Tr. No.	Treatment	Days required for Spawn run*	Days required for pinhead formation*	Days required for 1st harvest*	Days required for 2nd harvest*	Days required for 3rd harvest*
1	Paddy straw+ 2% Wheat bran	18.50^{bcd}	7.67^{cd}	26.00^{d}	34.67^{ef}	47.83^{c}
2	Paddy straw+ 2% Rice husk	17.00^{d}	7.33^{d}	24.50^{d}	36.17^{de}	48.17^{c}
3	Paddy straw+ 2% Bajara flour	21.33^{ab}	10.33^{ab}	29.17^{c}	38.17^{cd}	53.17^{b}
4	Paddy straw+ 2% Gram flour	22.00^{ab}	10.33^{ab}	30.00^{bc}	39.00^{bc}	54.00^{b}
5	Paddy straw+ 2% Soybean flour	20.67^{abc}	9.00^{bc}	29.17^{c}	38.17^{cd}	53.17^{b}
6	Paddy straw+ 2% Maize flour	22.83^{a}	9.17^{bc}	32.00^{b}	41.00^{b}	56.00^{ab}
7	Paddy straw+ 2% Groundnut haulm	15.83^{d}	6.67^{d}	24.33^{d}	34.17^{ef}	45.83^{c}
8	Paddy straw+ 2% Chickpea haulm	17.33^{cd}	7.17^{d}	25.33^{d}	33.33^{f}	48.50^{c}
9	Paddy straw	22.17^{ab}	11.67^{a}	34.83^{a}	43.83^{a}	58.83^{a}
	S.Em. ±	1.12	0.64	0.31	0.38	0.29
	C.D. 5%	Sig.	Sig.	Sig.	Sig.	Sig.
	C.V.%	6.28	11.80	5.68	5.29	2.95

Note: 1. * Mean of three repetitions; 2. Treatment mean(s) with the letter(s) in common are not significant by DNMRT at 5% level of significance

Table 2. Effect of different supplements on No. of fruiting bodies per bag of oyster mushroom (pooled of two cycles)

Tr. No.	Treatment	No. of fruiting bodies per	Average fruit body weight (g)* bag*	Pileus diameter (cm)*	Stipe length (cm)*	Stipe size (cm)*	Total yield (g) per kg substrate*
1	Paddy straw+ 2% Wheat bran	70^{ab}	11.68	6.40^{a}	4.04^{a}	3.16^{ab}	790^{a}
2	Paddy straw+ 2% Rice husk	67.50^{abc}	11.65	6.72^{a}	3.67^{abc}	3.33^{a}	831^{a}
3	Paddy straw+ 2% Bajara flour	58.50^{d}	10.52	4.13^{c}	2.79^{ef}	2.58^{c}	643^{b}
4	Paddy straw+ 2% Gram flour	58.00^{d}	10.58	5.39^{b}	3.20^{cde}	2.61^{c}	630^{b}
5	Paddy straw+ 2% Soybean flour	60.83^{cd}	8.50	5.48^{b}	3.07^{def}	2.87^{bc}	605^{b}
6	Paddy straw+ 2% Maize flour	62.17^{cd}	8.13	4.89^{b}	2.60^{f}	2.43^{c}	610^{b}
7	Paddy straw+ 2% Groundnut haulm	71.67^{a}	12.05	6.98^{a}	3.91^{ab}	3.54^{a}	871^{a}
8	Paddy straw+ 2% Chickpea haulm	72.33^{a}	11.58	6.45^{a}	4.21^{a}	3.46^{a}	844^{a}
9	Paddy straw	63.67^{bcd}	10.10	5.55^{b}	3.43^{bcd}	2.86^{bc}	663^{b}
	S.Em. ±	1.01	0.12	0.11	0.17	0.14	11.04
	C.D. 5%	Sig.	Sig.	Sig.	0.49	Sig.	74.088
	C.V.%	8.11	5.92	10.18	11.53	11.05	7.96

Note: 1. *Mean of three repetitions; 2. Treatment mean(s) with the letter(s) in common are not significant by DNMRT at 5% level of significance

Table 3. Economics of supplements for growth of mushroom

Trt. No.	Treatments	Quantity of supplements required kg/q	Price of supplement/ kg	Cost of substrate for quintal	Labour cost (Rs./kg)	Total cost of cultivation per quintal substrate	Fruit yield (kg/ substrate)	Gross income	Net income	BCR
1	2	3	4	5	6	7	8	9	10	11
1	Paddy straw+ 2% Wheat bran	6	15	200	12430.20	13220	79	18953	5740	1.43
2	Paddy straw+ 2% Rice husk	6	2.5	200	12430.20	13145	83	19942	6775	1.52
3	Paddy straw+ 2% Bajara flour	6	50	200	12430.20	13430	64	15439	1930	1.15
4	Paddy straw+ 2% Gram flour	6	50	200	12430.20	13430	63	15115	1690	1.13
5	Paddy straw+ 2% Soybean flour	6	50	200	12430.20	13430	60	14515	970	1.08
6	Paddy straw+ 2% Maize flour	6	25	200	12430.20	13280	61	14645	1360	1.10
7	Paddy straw+ 2% Groundnut haulm	6	2.5	200	12430.20	13145	87	20911	7735	1.59
8	Paddy straw+ 2% Chickpea haulm	6	2.5	200	12430.20	13145	84	20249	7015	1.54
9	Paddy straw	0	-	200	12430.20	13130	66	15907	2710	1.21

Note: 1. Labour charges @ ¹ **.** 380.3 for 60 half days and 2 days for bag filling, 2. Price of mushroom = Rs**.**. 240/kg

(3.54 cm) was recorded in treatment T_7 Paddy straw+ 2% groundnut haulm which was at par with T_8 Paddy straw+ 2% chickpea haulm (3.46 cm), T_2 Paddy straw+ 2% rice husk(3.33cm) and T_1 Paddy straw+ 2% wheat bran (3.16 cm). The minimum stipe size was observed in treatment T_6 paddy straw +2% Bajara flour (2.43 cm).

Effect of different supplements on yield

It was revealed that treatment T_7 Paddy straw+ 2% groundnut haulm recorded maximum yield (871 g/kg dry substrate) which was at par with treatment T_8 Paddy straw+ 2% chickpea haulm(844 g/kg dry substrate), T_2 Paddy straw+ 2% rice husk(831g/kg dry substrate) and T_1 Paddy straw+ 2% wheat bran(790 g/kg dry substrate). The lowest yield was recorded (605 g/kg dry substrate) in treatment T_4 Paddy straw+ 2% Soybean flour.

Economics

The data presented in Table 3 revealed that the treatment of Paddy straw+ 2% Groundnut haulm registered the highest (1:59) BCR followed by Paddy straw+ 2% chickpea haulm (1.54), Paddy straw+ 2% Rice husk (1:52), and Paddy straw+ 2% Wheat bran (1:43).

CONCLUSION

The study revealed that treatment T7, which involved a 2% supplement of groundnut haulm (60g/kg dry substrate), required the fewest days for spawn run (15.83 days) and pinhead development (6.67 days). It also produced the highest average weight of the fruit body (12.05g) and the highest fruit yield (871g/kg dry substrate). This performance was comparable to treatment T8 (2% supplement of chickpea haulm, 60g/kg dry substrate) and treatment T2 (2% supplement of rice husk, 60g/kg dry substrate), which yielded 844g/kg dry substrate and 833g/kg dry substrate, respectively, with minimal disease incidence.

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