Journal of Life Sciences Research
ISSN : 2408-9184
Vol. 1, No. 2, 51-53, 2014
http://asianonlinejournals.com/index.php/Lifsc/index

Suitability of Various Substrates for Cultivation of *Pleurotus Pulmonarius* in Konkan Region of Maharashtra

Pramod Borkar[1] --- Anila Doshi[2] --- Makarand Joshi[3] --- Sudhir Navathe[4]

[1]Department of Plant Pathology, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India
[2]Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan
[3,4]Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Abstract

Mild tropical humid climate persists in Konkan region throughout the year within a range of 23 - 35 ^{0} C. This climate is conducive for the commercial cultivation of oyster mushroom. Locally available substrates such as paddy straw, arecanut husk, coconut husk, banana pseudostem, groundnut shells, sugarcane bagasse and wheat straw alone and in combination with rice bran and wheat bran were used. Maximum biological efficiency of *P. pulmonarius* was recorded on paddy straw (76.30%) followed by wheat straw (74. 53 %). In case of supplemented substrates, the maximum biological efficiency of the mushroom was recorded on paddy straw supplemented with wheat bran (85.40%). This was followed by paddy straw supplemented with rice bran (82.63%) and wheat straw supplemented with wheat bran (82.26).

Keywords: *Pleurotus pulmonarius,* Substrates, Konkan, Biological efficiency.

1. Introduction

The ability of mushrooms to grow on agricultural wastes in less area makes an attractive proposition for income generation. The added advantage is in improvement in dietary values leading to solution of malnutrition, abatement of pollution and diversification of agriculture. The natural advantages for oyster mushroom cultivation in India are the presence of seasonal variations enabling the cultivation of different species under natural conditions in the form of relay cropping in different seasons and abundance and easy as well as cheap availability of variety of agro wastes. Mild tropical humid climate persists in Konkan region throughout the year within a range of 23 - 35 ^{0} C. This climate is conducive for the commercial cultivation of oyster mushroom.

2. Materials and Methods

Seven locally available substrates viz. paddy straw, arecanut husk, groundnut shells, sugarcane bagasse, coconut husk, banana pseudo stem, and wheat straw were used to assess the biological efficiency of *P. pulmonarius* on these substrates. Paddy straw, wheat straw and sugarcane bagasse were cut into 5-8cm pieces. Areca nut husk, coconut husk and groundnut shells were crushed with a chaff cutter. One kg quantity of each substrate was weighed separately on an electronic balance. All the substrates were soaked overnight in fresh tap water. Excess water in the substrates was drained off by placing the substrates on a clean, cemented platform with desirable slope. All the substrates were immersed in hot water (80-90° C) for 2 hrs. After 2 hrs the excess water was drained off and the substrates were allowed to cool at room temperature. The moisture content of the hot water treated substrates was around 70 to 72 per cent. The substrates were then spawned @ 2 per cent on wet weight basis and filled in polypropylene bags of size, 53 X 35 cm so as to make cylindrical mushroom beds. Three replications were maintained for each substrate. These bags were then perforated by making about 25-30 pinholes on all sides including top and bottom. Mushroom beds thus prepared were then transferred to iron shelves in spawn run room. Complete darkness and 25±2 ^{0}C temperature was maintained in this room till completion of mycelial run. Beds with completely colonized substrate were transferred to the hanging bamboo shelves in cropping room and then the plastic cover was removed. The humidity in the cropping room was maintained within a range of 80-85 per cent with the help of mist blowers which were run for 5-10 minutes, 4-5 times a day. The experiment was laid in Completely Randomized Design. Three replications were maintained per treatment.

In case of supplemented substrates, each substrate was separately supplemented with 0.5 per cent rice bran and wheat bran on wet weight basis of the substrate. The weighed quantities of supplements were mixed thoroughly, with the substrate. Three replications were maintained per treatment in CRD.

3. Results and Discussion

3.1. Effect of Substrates on Biological Efficiency of *P. Pulmonarius*

It is observed from Table 1, that the minimum colonization period was recorded in banana pseudostem substrate (14 days) followed by paddy straw (20 days)and wheat straw (21)respectively. They were followed by sugarcane bagasse (22 days), areca nut husk and groundnut shells (26 days), and coconut husk(35 days). Early emergence of pin heads was recorded in paddy straw and wheat straw (4 days) followed by arecanut husk, groundnut shells, sugarcane bagasse and banana pseudostem (6 days). Delayed pin head formation was recorded only in coconut husk where pin heads appeared 50 days after spawning.

In all the substrates, maximum yield was obtained from the first harvest. The loose texture of banana pseudostem might be the reason for speedy colonization. Softening of the substrate was observed in all the other substrates after soaking in cold water followed by hot water treatment but the coconut husk fibres remained hard and tough. This may be due the presence of more amount of lignin in coconut fibres. The *Pleurotus* species are able to grow on a wide spectrum of lingo-cellulosic waste material due to their ability to secrete an array of degrading enzymes. The activity these enzymes vary according to the composition of the substrate and the species or strain of the mushroom [1]. Maximum biological efficiency (76.30 %) of *P. pulmonarius* was recorded on paddy followed by wheat straw 74.53).These results are in conformity with those reported by earlier workers [2-4]. Geetha and Sivaprakasam [5] reported that the paddy straw used for cultivation of *Pleurotus* species showed higher reduction in cellulose content indicating the preference of the mushrooms to the substrates rich in cellulose. Both paddy and wheat straw contain good amount of cellulose but perhaps the amount lignin in wheat straw is more than that in paddy straw. The reason for low biological efficiency in areca nut substrate may be attributed to the lignin content of the substrate. Though the biological efficiency was less as compared to straw substrates, this substrate needs to tried more number of times for this mushroom as the biological efficiency is nearly 50 per cent. Groundnut shell substrate was the poorest performer among the 7 substrates under study. It recorded only 14.47 per cent biological efficiency. High moisture holding capacity of this substrate resulted in less availability of free air in the substrate during spawn run. This ultimately had adverse effect on substrate colonization and fruit body formation. The present findings are in concurrence with the results of Mane, et al. [6] and Veena and Savalgi [7].

The biological efficiency in sugarcane bagasse was nearly sixty per cent and it proved to be a better substrate for cultivation of the mushroom under study. Iqubal, et al. [8] also reported similar results. Coconut husk was significantly superior to groundnut shells but inferior to other substrates. Perisamy and Natarajan [1] reported that some strains of *P. djamor* were cable of degrading the lignin polymers in coconut coir and therefore recorded better yield on coconut coir pith substrate while others failed to do so. Banana pseudostem ranked fifth in terms of biological efficiency. This substrate contains more amount water than dry matter. The low yield on this substrate may be attributed to maximum utilization of available nutrients during colonization.

3.2. Effect of Substrate Supplementation on Biological Efficiency of *P. Pulmonarius*

The maximum biological efficiency of the mushroom was recorded on paddy straw supplemented with wheat bran (85.40%) which was followed by paddy straw supplemented with rice bran (82.63%) and wheat straw supplemented with wheat bran (82.26). Latter two treatments were statistically at par with each other. Among the remaining treatments, in treatment the T_{13}, where wheat straw was supplemented with rice bran, the biological efficiency was nearly 80 per cent. This was followed by sugarcane bagasse. The biological efficiency on sugarcane bagasse supplemented with wheat bran and rice bran was 63.03 and 61.06 respectively. Both these treatments were statistically at par with each other. The biological efficiency of arecanut husk with wheat bran supplementation was 51.70 per cent and with rice bran it was 49.23 per cent and the difference among these two treatments was statistically significant.

Biological efficiency on banana pseudostem supplemented with wheat bran and rice bran was 37.80 and 37.70 per cent respectively and both these treatments were statistically at par. Moreover, the biological efficiency on coconut husk supplemented with both the supplements was statistically at par. Supplementation of ground nut shells with both the supplements did not yield mushrooms. This indicated that the supplementation was not effective in case of this substrate. Seven of the 14 treatments, recorded more than 50 per cent biological efficiency and wheat bran supplementation recorded higher yield than rice bran. Though, both supplements were ineffective with groundnut shell substrate.

Colonization period in all the supplemented substrates was less as compared to that required to colonize the same substrate without supplementation. Biological efficiency on all the supplanted substrates except groundnut shells was more than on non-supplemented substrates. Maximum biological efficiency was recorded in paddy straw supplemented with wheat bran followed by paddy straw supplemented with rice bran and wheat straw supplemented with wheat bran. Similar results were reported by many workers [9-11]. Ground nut shell substrate retains more amount of moisture which results in poor mycelial run. Due to incorporation of supplements in this substrate, the bed was so compact that there was very little scope for proliferation of mushroom mycelium. This condition did not allow the primary mycelium to form tertiary mycelium which aggregates to form fruit bodies of mushroom fungi.

Biological efficiency in paddy straw supplemented with wheat bran was nearly 6.5 per cent more than that in sole paddy straw. This indicates that protein rich supplements such as wheat and rice bran have positive effect on colonization and biological efficiency of oyster mushrooms. It can be concluded on the basis of the results of present study that, incorporation proper supplements not only reduce the colonization period but also increases the biological efficiency of *P. pulmonarius*

Table-1. Effect of Substrates on biological efficiency of *P. pulmonarius.*

Tr.No.	Treatments	Spawn run Period (days)	Pinhead Formation(days)	Average Yield (g)	B.E. (%)
T_1	Paddy straw	20	4	763.00	76.30
T_2	Arecanut Husk	26	6	476.33	47.63
T_3	Groundnut shells	26	6	144.67	14.47
T_4	Sugarcane bagasse	22	6	593.33	59.33
T_5	Coconut husk	35	15	209.67	20.97
T_6	Banana pseudostem	14	6	374.33	37.43
T_7	Wheat straw	21	4	745.33	74.53
		CD at 5 %	33.94		
		CD at 1%	47.11		
		CV %	4.10		

Table-2. Effect of substrate supplementation on biological efficiency of *P. pulmonarius*

Tr. No.	Treatments	Spawn run Period (days)	Pinhead Formation (days)	Average Yield (g)	B.E. (%)
T_1	P+ RB	17	5	826.33	82.63
T_2	P+ WB	16	5	854.00	85.40
T_3	A+ RB	22	7	492.33	49.23
T_4	A+ WB	20	5	517.00	51.70
T_5	G+ RB	24	-	0	0
T_6	G+ WB	24	-	0	0
T_7	S+ RB	20	7	610.67	61.07
T_8	S+ WB	19	6	630.33	63.03
T_9	C+ RB	31	13	210.00	21.00
T_{10}	C+ WB	30	12	211.00	21.10
T_{11}	B+ RB	11	5	377.00	37.70
T_{12}	B+ WB	11	4	378.00	37.80
T_{13}	W + RB	17	4	799.67	79.97
T_{14}	W+ WB	17	5	822.67	82.27
	CD at 5%			14.16	
	CD at 1 %			19.11	
	CV			1.76	

References

[1] K. Perisamy and K. Natarajan, "Role of lignocellulosic enzymes during basidiomata production by pleurotus djamor var. Roseus," *Indian J. Biotechnol.*, vol. 3, pp. 577-583, 2004.

[2] D. K. Hazarika, "Effect of substrates and supplements on yield of oyster mushroom (Pleurotus Sajor-caju)," *Mushroom Res.*, vol. 7, pp. 47-48, 1998.

[3] R. Zhang, X. Li, and J. G. Fadel, "Oyster mushroom cultivation with rice and wheat straw," *Bioresource Technology*, vol. 82, pp. 277-284, 2002.

[4] J. W. Kimenju, G. O. M. Odero, W. E. Mutitu, P. M. Wachira, R. D. Narla, and W. M. Muiru, "Suitability of locally available substrates for oyster mushroom (Pleurotus Ostreatus) cultivation in Kenya," *Asian J. Plant Sci.*, vol. 8, pp. 510-514, 2009.

[5] D. Geetha and K. Sivaprakasam, "Enzyme and sporophore production potential of oyster mushroom (P. spp.)," *Mushroom Res.*, vol. 7, pp. 39-42, 1998.

[6] V. P. Mane, S. S. Patil, A. A. Syed, and M. M. V. Baig, "Bio-conservation of low quality lignocellusic agricultural waste into edible protein by pleurotus sajor-caju (Fr.)," *Singer. J. Zhegiang Univ. Sci. B.*, vol. 8, pp. 745-751, 2007.

[7] S. V. Veena and V. P. Savalgi, "Studies on cultivation of oyster mushroom on different farm substrates in Karnataka," *Proc.Nat.Mush.Symp.Thiruananthapuram,Kerala*, pp. 109-112, 1991.

[8] S. M. Iqubal, C. A. Rauf, and M. I. Sheikh, "Yield performance of oyster mushroom on different substrates," *Int. J. Agri. Biol.*, vol. 7, pp. 900-903, 2005.

[9] K. B. Khare, J. M. Mutuku, O. S. Achwania, and D. O. Otaye, "Studies on oyster mushroom production and economic profitability in Kenya," *Mushroom Research*, vol. 16, pp. 69-74, 2007.

[10] S. M. Ruhul Amin, N. C. Sarker, A. Khair, and N. Alam, "Detection of novel supplements of paddy straw substrate on oyster mushroom cultivation," *Bangladesh J. Mushroom*, vol. 1, pp. 33-37, 2007.

[11] K. K. Patil, R. V. Kulkarni, and D. N. Gupta, "Enhancing yield and biological efficiency in oyster mushroom by supplementation," *Acad. J. Plant Sci.*, vol. 4, pp. 41-44, 2011.