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Substitution of plant residues of medicinal importance for production of oyster mushroom

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Abstract

Mushrooms are highly nutritious, a store house of proteins, and have pharmaceutical value. In that way, paddy straw or wheat straw substrate is usually practiced to cultivate mushrooms. Due to the great demand for these substrates and the interest of utilizing medicinal plant wastes, the present study was undertaken with garlic peel and vetiver straw substrates for substitution and paddy straw to cultivate oyster mushrooms. The results revealed that the spawn running was completed within 16.5 to 18.5 days in all the substrates; however, earlier spawn running (17 days) was observed in garlic peel along with other substrates. However, the pinhead formation was earlier in paddy straw alone substrate (21 days), followed by vetiver + paddy straw and garlic peel + paddy straw. Moreover, the highest yield of *P. florida* was noticed in paddy straw substrate combined with vetiver straw which is also on par with paddy straw substrate alone. This study infers that both vetiver and garlic peel could be used as substrate and paddy straw to cultivate oyster mushroom.

1. Introduction

In our country, the oyster mushroom (*Pleurotus* spp.) cultivation is practiced by utilizing paddy straw or wheat straw as substrate. Currently, the cultivable area under crops especially paddy straw/ wheat straw is shrinking due to failure of monsoon, fragmentation of land holdings and urbanization. Moreover, due to an acute shortage of paddy straw, the cost of available paddy straw substrate is too high, so partial substitution with suitable agrowastes will attract the farming community. In this context, a preliminary study was conducted at the Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore where the plant residues of medicinal importance, the vetiver (*Chrysopogon zizanioides*) straw and garlic (*Allium sativum*) peel waste was tried alone and in combination with paddy straw for cultivation of oyster mushroom, *Pleurotus florida*. Earlier, Thiribhuvanamala *et al.* (2018) reported that oyster mushroom could be cultivated in substrate combination with paddy straw and vetiver with bioefficiency of 113.7 % as compared with the paddy straw substrate (120% bioefficiency). Agricultural waste peels as lignocellulosic biomass-rich materials have encouraged new gateways for producing renewable, low cost and sustainable adsorbents for water treatment applications (Bhatnagar *et al.*, 2015). The mesoporous biowaste carbon from garlic peel waste was used as a carbon framework for sulfur encapsulating in Li-S batteries (Lee *et al.*, 2021). Moreover, reports show that garlic peel could be reused for cadmium adsorption from the effluents and have great hope for bioremediation of polluted cadmium soils. So, an idea of using garlic peel for mushroom cultivation emanated, and the present study was focused on utilizing the garlic peel and vetiver straw substrate to produce organic mushrooms.

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2. Materials and Methods

The garlic peel waste, vetiver straw and paddy straw were used as substrates to cultivate oyster mushroom, *Pleurotus florida* var. PF. The vetiver straw and paddy straw were chopped in to small bits and soaked in cold water for 4 h and steamed for 1 h. The garlic peel waste was soaked in cold water for 10 min and steamed for 1 h. After steaming, the substrates were dried until 60% moisture and used for cultivation purpose. About 300 g of respective substrate were filled in polypropylene bottles and spawned with *P. florida* @ 100 g/350 g substrate. Likewise, the PP bags of 14 x 5 inches were filled with spawn of *P. florida* @ 100 g/350 g substrate and incubated at 28°C for 15 days. Combination of paddy straw + vetiver and paddy straw + garlic peel substrate (1:1) were also used. After a complete spawn run, the bags were placed in cropping houses at 25°C with relative humidity of 80%. Observations on days for spawn run, days for pin head formation, days for first harvest and total yield were recorded. Bioefficiency (%) was calculated.

3. Results

The spawn running was completed within 16.5 to 18.5 days in all the substrates; however, spawn run was longer in garlic peel alone substrate (18.5 days). But, when garlic peel was combined with paddy straw, the spawn running was earlier (17 days). The pinheads appeared earlier in paddy straw (21 days), followed by vetiver + paddy straw and garlic peel + paddy straw (20.83 and 20.83 days, respectively). However, the sporophores were ready for harvest on 21st day in paddy straw followed by vetiver straw + paddy straw substrate (22.33 days). All the substrates yielded three flushes in 42 to 45 days cropping cycle, whereas garlic peel substrate

yielded in two harvests within 38 days. The vetiver straw yielded 360 g/350 g dry straw weight (bioefficiency of 108.6%) of *P. florida* mushrooms with benefit cost ratio B:C of 3.0. The paddy straw and vetiver combined as substrate recorded 398.3 g/350 g dry straw weight with B:C of 3.2 (bioefficiency of 113.7 %). However, paddy straw yielded 400.0 g/350 g dry straw with B:C of 3.2 (bio-efficiency of 114.2 %). The results revealed that the vetiver straw can be best utilized as substrate in alone or in combination with paddy straw for the cultivation of oyster mushrooms which fits suitably in vetiver integrated farming system in Cuddalore and Sivaganga parts of Tamil Nadu (Table 1; Figure 1a). Garlic peel waste having medicinal value can be recommended for utilization alone or in combination with paddy straw to produce organic mushrooms (Table 1; Figure 1b).

Table 1: Performance of oyster mushroom, *Pleurotus florida* (PF) in vetiver straw substrate

Treatments	DFSR	DFPF	DFFH	Yield (g/350 g dry straw)			Total yield (g/350 g dry straw)	Total cropping cycle	Bio efficiency (%)	B:C ratio
				I	II	III				
Vetiver straw + paddy straw (1:1)	16.50	20.83	22.33	203.3	130.0	65.0	398.3	45 days	113.7	3.2:1
Garlic peel + paddy straw (1:1)	17.00	20.83	23.63	200.5	120.5	45.0	366.0	42 days	104.5	2.8:1
Vetiver alone	17.50	22.67	24.67	150.0	120.0	90.0	360.0	45 days	108.6	3.0:1
Garlic peel waste alone	18.50	21.47	24.67	190.0	160.0	-	350.0	38 days	100.0	2.7:1
Paddy straw alone	16.67	19.00	21.00	200.0	140.0	60	400.0	42 days	114.2	3.2:1
CD (p=0.05)	0.77	0.79	0.79	-	-	-	17.45			

DFSR: Days for spawn run, DFPF: Days for pinhead formation, DFFH: Days for first harvest

Figure 1(a): Vetiver straw for production of oyster mushrooms.

Figure 1(b): Garlic peel substrate for production of oyster mushrooms.

4. Discussion

In accordance with our study, the vetiver straw substrate enhanced the growth of *P. eous, P. salmano stramineus* and *P. platypus* with bioefficiency ranging from 70 to 80 per cent was reported by Balasubrananiam and Krishnamoorthy (1996). However, there are supporting evidence by several workers. Garlic peel residue in combination with paddy straw for production of *P. florida* yielded 366 g/350 g substrate with bioefficiency of 104.5% with B:C ratio of 2.9. Garlic peel waste alone yielded 350 g/350 g substrate (100 % bioefficiency) with B:C ratio of 2.7. However, several workers have exploited various crop residues as a substrate utilization for commercial production of oyster mushroom, *viz.,* maize cobs and banana waste (Bonatti *et al.,* 2004), Vetiver straw, paddy straw and their combinations (Thiribhuvanamala *et al.*,2017), straw teak leaf litter and teak leaf litter + paddy straw substrate and paddy straw + combination of substrates (Balasubramani *et al.,* 2017).

It is interesting to note that garlic is well known for antimicrobial properties with allicin content, but the garlic peel did not interfere with mycelial colonization of *P. florida*. Garlic peel is reported to contain carbohydrates, lipids and phenyl propanoid. The results imply that vetiver straw alone, garlic peel alone, or paddy straw can be best utilized for cultivation of oyster mushroom on commercial cultivation and suitably fit in organic farming systems. This process not only reduces cost of production but also recycles agrowaste and reduces environmental pollution. The spent mushroom substrate can be used to prepare compost that can further enrich the soil organic matter and increase the beneficial rhizomicrobiome of crops. Further, studies are directed towards identification of nutritional and antioxidant values in mushrooms yielded from garlic peel and vetiver substituted substrates.

5. Conclusion

With the increase in the cultivation area of medicinal plants due to increased scientific and commercial attention, the wastes from these plants are left unutilized or burnt in the field itself. This study offers scope for utilization of medicinal plant wastes to cultivate mushrooms, which can add additional income to the farmer and fit in organic farming technology.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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References

Balasubramani, N.; Poovendhan, M.; Thiribhuvanamala, G.; Tilak, M.; Revathi, M. and Parthiban, K.T. (2017). Bioconversion of agroforest residues for production of oyster mushrooms. Int. J. Env., Agricul. and Biotechnol., **2**(5):2659-2667.

Balasubramanyan, S. and Krishnamoorthy, A.S. (1996). Vetiver (*Vetiveria zizanidies*) straw for the cultivation of oyster mushroom (*Pleurotus spp*). In vetiver: A miracle grass, Chiang Rai (Thailand), pp:4-8.

Bhatnagar, A., Sillanpaa, M. and Witek-Krowiak, A. (2015). Agricultural waste peels as versatile biomass for water purification: A review. Chem. Eng. J., **270**:244-271.

Lee, S.Y., Choi, Y., Kim, J.K., Lee, S.J., Bae, J.S. and Jeong, E.D. (2021). Biomass-garlic-peel-derived porous carbon framework as a sulfur host for lithium-sulfur batteries. J. Indust. Eng. Chem., **94**:272-328.

Thiribhuvanamala, G., Raja, M.B., Amirtham, D. and Rajamani, K. (2018). Exploitation of vetiver (*Chrysopogon zizanioides* L.) shoot biomass for production of oyster mushrooms. Med. Plan. Int. J. Phytomed. Relat. Indust., **10**(2):133-137.

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