Feasibility Study on Growing Abalone and Oyster (*Pleurotus sp)* Mushrooms on Agricultural Residue

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Abstract

Mushrooms are the fruiting bodies of edible macro fungi belonging to the class Basidiomycetes and genus Pleurotus. It is an excellent source of high quality plant protein, vitamins and minerals. There is an increasing demand for mushroom in the local market and currently the production is far less than the demand. Abalone and oyster mushrooms (Pleurotus sp.) are locally available and famous for their unique flavor. At present saw dust is used as the growth media. Among the bio-conversion processes of agricultural residue, mushroom cultivation is an appropriate technology in managing crop residue. The objective of the study was to evaluate the yield performance of Abalone and Oyster (Pleurotus sp.) mushroom grown on two different agricultural residue; Bagasse and Durian husk. The pilot study was conducted in a well-constructed mushroom-house recommended by the Department of Agriculture in Kegalle, Sri Lanka during 2021-2022. The saw dust rreplacement proportions of 0 (control), 0.25, 0.50, 0.75 and 1.0 were tested using 08 replicates each. Overall time required for spawning/mycelial running, pin-head formation, and maturation of fruiting bodies, and number of fruiting bodies formed were assessed. Biological efficiency was compared for all media compositions tested. A rapid mycelial growth was observed in Oyster (30 days) compared to Abalone (46, 50 days) in all media proportions tested. Biological efficiency of 50-51% was recorded in the control experiments in which both mushroom types were grown on saw dust media. Both Oyster and abalone mushroom grown on replacement proportion of 0.75 bagasse showed improvement in biological efficiency. Out of the two residue studied bagasse perform better compared to Durian husk. Oyster and Abalone mushrooms can be productively grown on sugarcane bagasse. Even though Durian husk can be used to grow Abalone with the same biological efficiency as saw dust, further studies are encouraged on adjusted particle sizes of the growing media.

Keywords: *Mushroom, Oyster, Abalone, Bagasse, Durian*

INTRODUCTION

Mushrooms are the fruiting bodies of macro-fungi and edible fungi belonging to the class Basidiomycetes and genus Pleurotus. It is an excellent source of high quality plant protein, vitamins and minerals (Thanuejah, *et al.*, 2013). A high nutritional value of dried oyster mushrooms has been reported with protein (25-50%), fat (2-5%), sugars (17-47%), micro-cellulose (7-38%) and minerals (potassium, phosphorus, calcium, sodium) of about 8-12%. Edible mushrooms are rich in vitamins of niacin, riboflavin, vitamin D, C, B1, B5 and B6 (Ahmed *et al.*, 2009). Different species of *Pleurotus* normally grow within a temperature range of 15-25°C and on various agricultural waste materials as substrate (Hasan *et al*., 2010). Abalone and oyster mushrooms (*Pleurotus sp.*) are usually available in the local market and famous for their unique flavour and has become one of the major protein sources in vegetarian diets.

A major portion of the organic matter produced during the crop production is non-edible and becomes a source of environmental pollution. Among the bio-conversion processes of agricultural residue, mushroom cultivation is an appropriate technology for the management of agricultural and agro-industrial residue. Several studies have been conducted to evaluate the possibility of using plant residues as a substrate for mushroom cultivation (Gayathiri *et al*., 2008; Basnayake *et al*., 2008; Tarko & Sirna, 2018).

There is an increasing demand for mushroom in the local market and currently the production is far less than the demand. Because of the high cost of production, the market price is kept around Rs. 800-1600/kg for the past few years. At present saw dust is used as the growth media. Thanuejah, *et al.*, (2013) has done a comprehensive review on 'Potential for Oyster Mushroom Cultivation in Sri Lanka'. Even though attempts have been made to increase the production of mushroom, still there is a gap between production and the market demand. Limited availability and the cost of media preparation lead to increased cost of production. Therefore, it would be beneficial in finding alternate growth media for mushroom cultivation by utilizing freely available agricultural residue; bagasse, durian husk, bare corn cob, cowpea and green gram pod hull. This is an ongoing research and

the results obtained on bagasse and Durian husk are presented in this extended abstract. The objective of the study was to evaluate the yield performance of Abalone and Oyster (Pleurotus sp.) mushroom grown on two different agricultural residue; Bagasse and Durian husk.

METHODOLOGY

The pilot study was conducted in a well-constructed mushroom-house recommended by the Department of Agriculture in Pitihuma Grama Niladhari Division, Kegalle, Sri Lanka in 2021-2022. Bagasse and Durian husk were collected from Monaragala and Gampaha respectively. Pure cultures of Abalone and Oyster (*Pleurotus sp)* were collected from the Department of Agriculture Mushroom-Laboratory, Wagolla.

In the normal process of grow bag preparation (50-55 bags), 20 kg of saw dust, 2 kg of rice bran, 400 g of lime and soybean powder and 40 g of Magnesium Sulphate is used. Replacement proportions of saw dust were made according to the Table 1 and 08 replicates were prepared for each replacement proportion. Saw dust, dried Durian husk and bagasse were machine chopped before use (Figure 1). The machine mixed substrate/media (0.9-1.0 kg) was fed into the polythene (150-200 gauge) grow bags. The tightly packed grow bags were autoclaved at 121˚C, 1 atm pressure and allowed to cool. A day after sterilization, the grow bags were inoculated with 10 g of pure culture of Abalone and Oyster under aseptic condition. The grow bags were kept in a dark room at 25- 30°C and 90% relative humidity for 20 days. The humidity of grow bags was maintained by spraying water using misters. When the growth media/substrate was fully covered by the mushroom mycelia, bags were opened and kept for fructification.

The experiment was laid out in randomized complete block design and a control with 08 replications for each treatments (replacement proportion). The time taken for the completion of spawn running/mycelium growth, pin-head formation, and maturation of fruiting bodies was recorded. The average number of fruiting bodies, mean weight of fresh mushroom were recorded and the biological efficiency (BE) was calculated using the equation 01 (Peng *et al*., 2000). Four rounds of mushroom harvests (flushes) were made across all growth media/substrates during the course of experiment. The data was analyzed using SPSS (Version 20). Analysis of variance was used to indicate significant mean differences at 95% confidence interval.

$$BE = \frac{Weight\ of\ fresh\ mushroom\ harvested\ per\ bag}{Weight\ of\ dry\ substrate\ per\ bag\ before\ innoculation} \times 100\% \qquad \textit{(Equation 01)}$$

Table 1: Sample preparation plan

Growth Media		Replacement Proportions of **Band Saw Dust*** in the Growth Media			
		0.25 (1)	**0.50 (2)**	**0.75 (3)**	**1.0 (4)**
Bagasse (B)	Oyster (O)	BO1	BO2	BO3	BO4
Durian husk (D)		DO1	DO2	DO3	DO4
Saw dust (C)		CO			
Bagasse (B)	Abalone (A)	BA1	BA2	BA3	BA4
Durian husk (D)		DA1	DA2	DA3	DA4
Saw dust (C)		CA			

(a) (b) (c)

Figure 1. Substrates/growth media (Dried ground Durian husk (a); Dry bagasse (b) and Saw dust (c))

RESULTS AND DISCUSSION

Table 2 presents the summary of the results including average time taken for spawning/mycelial growth, pin-head formation, fruiting body formation and maturation of fruiting body bodies, and number of fruiting bodies. Mycelial running is the extension and colonization of fungal hyphae throughout the substrate and it was comparatively faster in Oyster (30 days) than Abalone (46-50 days) in all the substrates tested including the controls. Pin-head formation took 3-6 days in both Oyster and Abalone mushrooms while fruiting bodies formed within 3-5 days after pin head formation and there was no significant difference in the time spent for pin-head formation and fruiting body formation among different substrates tested. Figure 2 shows the fruiting body formation in different substrate/growth media. Mean weight of fresh mushrooms harvested and biological efficiency of the substrate calculated over 03 consecutive flushes are listed in the Table 3. Biological efficiency of 50-51% was recorded in the control experiments in which both mushroom types were grown on saw dust media. Oyster mushroom grown on replacement -ratio of 0.75 bagasse showed significant biological efficiency compared to the control. Oyster mushroom did not perform well on Durian husk and the biological efficiency was less than the saw dust media. The reason could be higher bulk density of Durian husk. The bulk density of Durian husk of 10 mm particles was calculated to be 214 kg/m^3.

Table 2: Summary of the results- Time taken for the completion of spawning, pin-head formation and fruiting body formation, and average number of fruiting bodies

Growth media (Table 1)	Completion of spawn/mycelial running (Days)	Pin-head formation (Days)	Fruiting body formation (Days)	Average number of fruiting bodies
BO1	30	3	3	22
BO2	30	4	4	26
BO3	30	3	3	23
BO4	30	5	5	23
DO1	30	4	4	23
DO2	30	4	4	24
DO3	30	3	3	23
DO4	30	3	3	23
CO	30	3	3	22
BA1	50	5	4	13
BA2	50	5	4	14
BA3	50	6	5	14
BA4	50	6	5	13
DA1	46	4	4	13
DA2	46	4	4	12
DA3	46	4	4	14
DA4	46	4	4	13
CA	50	5	4	14

Table 3: Mean weight of harvested mushroom and biological efficiency (BE) of substrate in 03 consecutive flushes

Growth media (Table 1)	Mean Weight (g)	Biological Efficiency (%)
BO1	230	46.0
BO2	140	28.0
BO3	343	68.6
BO4	153	30.6
DO1	153	30.6
DO2	130	26.0
DO3	152	30.4
DO4	195	39.0
CO	255	51.0
BA1	355	71.0
BA2	300	60.0
BA3	400	80.0
BA4	340	68.0
DA1	255	51.0
DA2	260	52.0
DA3	257	51.4
DA4	260	52.0
CA	250	50.0

Figure 2: Formation of fruiting bodies of Oyster and Abalone mushroom in different substrate

Abalone mushroom grown on bagasse showed significant increase in biological efficiency in all the replacement proportions compared to the control. The fibrous nature and low bulk density (100 kg/m^3) of sugarcane bagasse make it more suitable for growing mushroom. Abalone showed no improvement, yet equal biological efficiency compared to the control when grown on Durian husk, yet further evaluation is need on optimization of particle size.

CONCLUSION

Oyster and Abalone mushrooms can be productively grown on sugarcane bagasse. Out of the two residue studied bagasse perform better compared to Durian husk in all replacement proportions tested. Abalone performed best on bagasse, hence it can be recommended as a substitute for saw dust. Even though Durian husk can be used to grow Abalone with the same biological efficiency as saw dust, further studies are encouraged on adjusted particle size of the growing media.

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