Research in
ISSN : P-2409-0603, E-2409-9325
AGRICULTURE, LIVESTOCK and FISHERIES
An Open Access Peer-Reviewed International Journal

Article Code: 0356/2022/RALF
Article Type: Research Article

Res. Agric. Livest. Fish.
Vol. 9, No. 1, April 2022: 11-16.

EFFECTS OF DIFFERENT SUBSTRATES ON PRODUCTION OF OYSTER MUSHROOM IN WALLING OF SYANGJA, NEPAL

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ARTICLE INFO

Received
09 April, 2022

Revised
24 April, 2022

Accepted
26 April, 2022

Online
30 April, 2022

Key words:
Mushroom
Spawn
Finger-millet
Yield

ABSTRACT

This research was conducted in Agriculture Development Resource Center, Syangja to determine the effectiveness of substrate for the production of oyster mushroom (*Pleurotus ostreatus*). Completely Randomization Design was used for this research with three replications in which five treatments (substrate) were used i.e.; rice straw, finger-millet straw, saw dust, maize straw and maize cob. Days required for full colonization, first fruiting, harvesting time, total mushroom production, mushroom pileus diameter, and stipe length were observed by taking 5 sample randomly from each treatment. Among the investigated substrate compositions, maize cob required the fewest days (19 days) to complete spawn running, followed by finger-millet straw (21 days), while saw dust required the most days (38 days) to complete spawn running. Finger-millet straw indicated the shortest time (28 days) harvesting, and the maximum yield was found in finger-millet straw (1.05 kg) and highest stipe length (5.3cm) was found in saw dust followed by rice straw (4.8 cm). Among various used substrate finger-millet straw was found to be the best for mushroom production at least in Waling, Syangja.

To cite this article: Regmi S. and C. Puri, 2022. Effects of different substrates on production of oyster mushroom in walling of syangja, Nepal. Res. Agric. Livest. Fish., 9 (1): 11-16.

INTRODUCTION

Mushroom are higher level fungi that grow at different substrates. Approximately 14000 species of the estimated millions of fungus on the planet produce fruiting bodies large enough to be classified as mushrooms (Kriak et al, 2008).Mushrooms are edible saprophytic fungus that grow on dead organic matter of vegetative origin and belong to the genus *Pleurotus*, which belongs to the Basidiomycetes class (Mondal et al.,2010) The name "mushroom" refers to fungi with a stem (stipe), cap (pileus), hymenium (lamellae), and spores on the cap's underside (Masarirambi et al., 2011). Chlorophyll pigment is absent in mushroom so, they have heterotrophic mode of nutrition.

In Nepal, there are almost 110 mushroom species are edible (Poudel and Bajracharya, 2011). In fiscal year 2016/17 fresh mushroom production was 10850 MT, similarly in fiscal year 2017/18 production was 10500 MT and in fiscal year 2018/19 production was reached to 11255 MT (MoAD, 2077). Bioactive chemicals found in oyster mushrooms have been shown to have anti-protozoal, anti-helmintic, phytotoxic, and brine shrimp lethality characteristics. Because oyster mushrooms have antioxidant, antibacterial, anti-hypersensitive, anti-inflammatory, anticancer, and food additive qualities, they have a wide range of industrial and medical applications (Chang, 2007). Dried oyster mushrooms have a significant nutritional value, with protein (25-50%), fat (2-5%), carbohydrates (17-47%), mycocellulose (7-38%), and minerals (potassium, phosphorus, calcium, sodium) ranging from 8 to 12 percent (Stanley, 2011). Niacin, riboflavin, vitamin D, C, B_1, B_5, and B_6 are all vitamins found in edible mushrooms (Ahmed et al., 2009)

Oyster mushrooms have a cap spanning diameter of 5 to 25 cm, stipe length 3-10, and stipe diameter 2-5 cm, according to Gunde and Cinerman(1995). Because of their ability to manufacture lignocellulosic enzyme, most Pleurotus spp. can utilise cellulose, hemicellulose, and lignin (Yehia, 2012).This area lies in Mid-Hilly region of Nepal so, here is high production of used substrate. To utilize the produced materials in mushroom production we used this substrates

MATERIALS AND METHODS

This research is conducted in the farm of Agriculture Development Resource Center at Walling -1, Syangja during 10 August to 22 November 2021. The experiment was conducted in completely randomized design (CRD) with 5 treatments and 3 replications. Thus, there were altogether 15 bags each of 5kg and variety used was *Pleurotus ostreatus.*

The treatments consisted of rice straw, finger-millet straw, saw dust, maize straw and Maize cob as substrates. These substrates were chopped into small pieces of 1-2 2.5 5 cm except sawdust, overnight soaked, thoroughly washed with clean water and excess water was allowed to drain down so that water did not ooze out when squeezed with hand. Then the substrates were individually sterilized by steam using metallic drum for 2 to 3 hrs and were allowed to cool to normal temperature. After that each subtract were filled into plastic bags of size 40.64 X 60.69 cm making 5-6 layer each of 5 kg. The spawn was spread at periphery layer with some spawn at the base. Then the bags were tied at the mouth and few holes were made for aeration around the periphery plastic bag and were incubated in dark with ventilated room at around 22-25°C.

The plastics were removed when the substrates were fully colonized with mycelium, and each ball was placed on a wooden platform in a scattered light environment to develop mushrooms. Watering was done 2-3 times a day, depending on the substrate and temperature, and after 7-10 days, fruiting bodies formed, ready for harvest in another 3-5 days. The second and third harvests were taken in a similar fashion. The number of days it took for full colonization, first fruiting, harvesting time, total mushroom production, mushroom pileus diameter, and stipe length were observed. Observed data were then analyzed by R- Studio and Microsoft-excel. Analysis of variance (ANOVA) was used to test differences among the treatments and means were separated using Duncan's multiple range test (DMRT) at the 5 % level of significance (Gomez and Gomez, 1984).

RESULTS

Days required for complete colonization, primordia formation and harvesting

In terms of colonization length, first fruiting duration, and first harvest duration, analysis of variance (ANOVA) demonstrated highly significant findings (($p \leq 0.05$)) across the studied substrates. On various substrates, days required to achieve colonization ranged from 19 to 38 days. Maize cob required the fewest days (19 days) to complete spawn running, followed by finger-millet straw(21 days) and rice straw (28.33 days) to complete spawn running whereas, saw dust took the highest time (38 days) to complete colonization (Table 1).Data of fruiting duration was found statistically significant due to the different substrates Significantly lowest time (28 days) for first fruiting initiation was recorded on finger-millet straw followed by rice straw (33 days) while the highest time (44 days) for first fruiting initiation was found in saw dust .

Table 1. Effect of different substrates on days required for complete colonization, primordia formation and harvesting of oyster mushroom

Substrates	1stcolonization duration(days)	1stfruiting duration(days)	1stharvesting duration (days)
Saw dust	38.66^{a}	44.67^{a}	57^{a}
Maize stover	29.66^{b}	36.00^{bc}	41.66^{b}
Rice straw	28.33^{b}	33.66^{cd}	38.66^{b}
Finger-millet straw	21.33^{c}	28.00^{d}	38.33^{b}
Maize cob	19.00^{c}	42.00^{ab}	57^{a}
Grand mean	27.4	38.86	46.53
CD	4.6	7.44	3.4
CV%	9.28	11.09	4.07
F-Test	***	**	***

** = Significant at 1% level, Mean values within the same column that bear different superscript letters are significantly different ($\alpha < 0.05$), CV=Coefficient of variation and CD= Critical difference.

The harvesting duration was found statistically significant to the different substrates (Table 1). The lowest time (38 days) for harvesting was recorded from rice straw and finger-millet straw followed by maize Stover while the highest day for harvesting was recorded on saw dust (57 days) (Table 1).

Effect on yield due to various substrates

After the analysis of yield data with respect to different substrata it was found highly significant. The yield was measured during each harvest and the total yield was calculated finally. It was found highest from finger-millet straw (1.05 kg) followed by rice straw (1.01 kg) while the lowest yield was observed in saw dust (0.13 kg).

Effect of different substrates on cap and stipe diameters and stipe length of oyster mushroom

After ANOVA analysis stipe length was found that significant result among the tested substrates ($p \leq 0.05$). The stipe length was measured as an average of five samples taken randomly from each treatment. In case of stipe length, it was found highest from rice straw (5.03 cm) followed by saw dust (4.8cm) while, lowest stipe length was observed in finger-millet straw (3.76cm).Similarly, stipe diameter was also found significant. In case of stipe diameter, it was found highest from finger-millet (1.1 cm) followed by Maize straw (0.9cm) while, lowest stipe diameter was observed in saw-dust (0.76cm).Similarly, Cap diameter was also found highly significant. In case of cap diameter, it was found highest from saw dust (4.9 cm) followed by rice straw (4.85cm) while, lowest cap diameter was observed in finger-millet straw(3.51cm).

Table 2. Effect of different substrates on yield of oyster mushroom

Substrates	Yield (kg)
Finger-millet straw	1.05[a]
Rice straw	1.01[ab]
Maize straw	0.82[b]
Maize cob	0.21[c]
Saw dust	0.13[c]
Grand mean	0.6
CD	0.19
CV%	16.77
F-Test	***

*** = highly Significant at 0.1% level, Mean values within the same column that bear different superscript letters are significantly different (p≤0.05), CV=Coefficient of variation and CD= Critical difference.

Table 3. Effect of different substrates on cap and stipe diameters and stipe length of oyster mushroom

Substrates	stipe diameter(cm)	Cap diameter(cm)	Stipe length(cm)
Saw dust	0.76[b]	4.9[a]	5.03[a]
Maize straw	0.9[ab]	4.83[a]	4.66[ab]
Rice straw	0.76[b]	4.85[a]	4.8[a]
Finger-millet straw	1.1[a]	3.51[b]	3.76[c]
Maize cob	0.853[b]	4.71[a]	3.85[bc]
Grand mean	0.87	4.47	4.46
CD	0.21	0.35	0.85
CV%	13.52	4.21	10.61
F-Test	*	***	*

*** = highly Significant at 0.1% level, Mean values within the same column that bear different superscript letters are significantly different (p≤0.05), CV=Coefficient of variation and CD= Critical difference

DISCUSSION

The days it took for oyster mushrooms to colonize different substrates were recorded and found to be significantly different. This could be owing to differences in chemical composition and C:N ratio, as reported by Bhatti et al (1987). The findings of this study accord with those of Bugarski et al. (1994), who discovered that the first fruiting happened on different days depending on the substrates. However, the finding of this study showed highest day of colonization in case of saw dust but opposite result was found in the literature of Samuel & Eugene TL (2012).In our study higher yield was found in finger-millet straw, similar result was also reported by Fufa et al (2021). The number of caps per cluster was found to have a strong influence on pileus diameter. The diameter grew bigger as the number of them decreased. Furthermore, the amount of aeration and light influenced the size of the caps and the site (Kivaisi et al., 2003).The results of this study agree with those of Habib et al. (2005), who discovered that pileus diameters ranged from 4.85-8.95 cm.The substrates with the longest stipe length had the lowest yield, which was also verified by Zadrazil (1978), who stated that the quality of oyster mushrooms is determined by the length of the stalk, with the longer the stalk, the worse the quality of the mushroom. The pileus diameter and yield were found to have a favorable connection. Changes in stipe length, pileusbreadth, and overall yield of mushrooms growing in different farm substrates could be due to the varied types of agricultural wastes, single or mixed agricultural wastes utilized in the preparation of the farm substrates. Chukwurah (2013) discovered a similar outcome .Stalk height, stalk diameter, and cap size in mushrooms are also affected by significant ecological elements such as temperature, humidity, fresh air, and compact material (AMGA, 2004).

CONCLUSION

Form this research, it can be concluded that, the oyster mushroom (*Pleurotus ostreatus*) can grow on different substrate, among them higher production was found on finger-millet straw followed by rice-straw. The production in saw-dust is very low. This research also shows that, rice straw and finger-millet substrate produces mushroom in short period of time compare to other substrate.

ACKNOWLEDGMENTS

The authors would like to express sincere gratitude to Mrs Basu Dev Regmi, Chief of Directorate of Agriculture Development, Pokhara for the continuous support.

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