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Short Communication

Yield performance of oyster mushroom in different substrate under cold arid conditions of Kargil Ladakh

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ABSTRACT

In response to the reluctance to cultivate oyster mushrooms in Ladakh due to the high cost of wheat/barley straw, a study was undertaken to explore the feasibility of cultivating oyster mushrooms using a combination of straw and leaves. The objective was to evaluate the performance of mushroom yields and associated parameters, thereby underscoring the significance of mushrooms in the region. The study was carried out at three selected mushroom growers' sites as part of an On-farm trial. The substrate quality of two distinct materials, namely willow leaves and wheat straw, as well as a combination of both (wheat straw + willow leaves in a 1:1 ratio) were evaluated for cultivating oyster mushrooms. The cultivated mushrooms were harvested in three flushes, with the yield data revealing that the highest fresh weight yield was achieved from wheat straw (315g, 327g, 359 g from different locations). Contrary to this, a combination of wheat straw and willow leaves (1:1 ratio) produced slightly lower yields (299g, 300g, 302g) and the lowest yields were obtained from willow leaves alone (249 g, 273g, 281g). In this study it was found that on willow leaves the yield was low but it was economically feasible as it is the cheapest substrate to grow oyster mushroom.

Key Words: Cold arid, Leaves, Mushroom,Wheat straw,Willow.

INTRODUCTION

Mushrooms have been recognized for their role as a vital food source, both nutritionally and medicinally, making them a prominent component of modern diets. In comparison to other foods like beef, wheat, and potatoes, mushrooms stand out with protein content ranging from 4-44%, surpassing proteins found in beef (16%) and wheat (1%). Moreover, mushrooms serve as an excellent source of essential vitamins such as niacin, riboflavin, and vitamin C. They also contain folic acid, a crucial vitamin for blood-building, countering pernicious anemia (Oei, 2003; Effiong *et al,* 2024). Mushrooms flourish during the rainy season on manure heaps and dump sites with an abundance of humus. Cultivating mushrooms locally requires meeting specific growth conditions, including adequate food and humidity.

Utilizing agricultural and industrial wastes as substrates involves processes such as boiling, pasteurization, and fermentation. Various studies have explored substrates like straw, paper, sawdust, logs, rice straw, and wheat straw for mushroom cultivation, each showing varying yields and growth characteristics (Kurtzman, 1975; Park *et al,* 1975; Khan *et al,* 1981; Khan and Ali, 1981; Mathew *et al*, 1996; Jiskani, 1999; Agba *et al,* 2021; Argaw *et al* ,2023). Given the hesitation of oyster mushrooms cultivation in Ladakh due to high cost of wheat/barley straw, a study was conducted to cultivate oyster mushrooms on straw and leaves.

MATERIAL AND METHODS

Study area and experimental materials

The study was conducted at three interested mushroom growers. The substrate

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quality of two different substrates namely, willow leaves, wheat straw, and wheat straw + willow leaves(1:1) were evaluated for growing oyster mushroom. Willow leaves was collected from the KVK, farm, wheat straw purchased from Department of Agriculture.

Pure culture preparation and production conditions

Mushroom culture was grown on Potato Dextrose Agar (PDA) medium for 7 d. 33 mg of PDA mixed with 1L of distilled water. Test tubes were corked, sterilized (at 121 °C, 1.5 p.s.i, for 30 min) and allowed to solidify in a slant position. To obtain pure culture, a piece (4 mm × 4 mm) of fleshy tissue (of the original *Pleurotus ostreatus* culture) was aseptically transferred to individual PDA slants under UV fitted inoculation chamber. The cultures were incubated at 25 °C until sufficient mycelial growth is observed and pure cultures were obtained by sub-culturing in PDA. The slant culture was transferred to petri-plates and incubated at 25 °C for 7 days. Once the mycelium fully invaded the agar medium, the culture was used for spawn preparation.

Grain spawn preparation

Wheat (*Triticum avestivum*) grain was used for spawn preparation. For this purpose, about 5 kg of grain was half-cooked,excess water drained off and allowed to cool down to room temperature. It was then spread uniformly over a surface sterilized (70 % ethanol) plastic sheet until optimum moisture (55–60%) is attained. The grain was then mixed with 0.5 % chalk (calcium carbonate), and 2 % gypsum (calcium sulfate) as nutrient supplement and the pH was adjusted to 9 (Romero, 2007). The mixture was then filled into 1kg autoclavable polythene bag, plugged and sterilized in an autoclave (at 121 °C, 15 p.s.i, for 1 h).Sterilized polythene were then allowed to cool and aseptically inoculated with a piece (5 mm × 5 mm) of mycelia culture (14 days old). The polythene bag were subsequently incubated at 24 ± 3 °C for 14 d until the mycelia fully invade the grains. After 15 d, the grain spawn was ready to use.

Substrate processing and spawning

The substrates underwent a ten-day sun-drying process, during which their air dry weight changes were meticulously monitored by daily weighing over a consecutive five-days period. Following this, one kilogram of air-dried substrate was placed into individual polypropylene bags (55 cm × 50 cm). Each bag was securely tied at the opening and immersed in distilled and sterilized tap water overnight. After soaking, excess water was drained, and the substrates were exposed to full sunlight, with periodic weighing continuing until the moisture content reached 65–70% (Islam *et al,* 2014). Once the desired moisture level was achieved, the substrates were sterilized in an autoclave and allowed to cool to room temperature over several hours. Subsequently, these sterilized substrates, enclosed in separate bags, were transferred to polythene bags (65 cm in length and 45 cm in width) that had undergone surface sterilization. Each bag, containing 1 kg of substrate, was then inoculated with 80 g of spawn. Aseptic conditions were maintained throughout the process, ensuring the uniform distribution of the inoculum thorough mixing of spawn and substrates. To facilitate cross-sectional ventilation, 6–8 holes were punctured on the sides of each plastic bag. In total, eight polythene bags for each substrate type were inoculated with spawn, and the entire experiment was conducted.

Cultivation conditions and cropping system

Once mycelia growth within the bags reached a substantial level, and pinheads began to emerge, sections of the bags were selectively cut to create perforations, facilitating the development of fruiting bodies. Subsequently, the fully colonized substrates were transferred to a growth room and positioned on racks constructed from wood and nylon rope, with a spacing of 15–20 cm between each bag. Adequate ventilation in the growth room was ensured by periodically opening the door every 2–3 days.

To maintain the required moisture levels for mycelia growth, the inoculated bags were watered 2–3 times daily. Monitoring and control of relative

Table1. Yield of *Pleorotus ostreatus (g)* on different substrate at different locations.

Sr. No.	Location	Wheat straw	Wheat straw +Willow leaves	Willow leaves
1.	Wakha	315	299	249
2.	Titichumik	327	300	273
3.	KVK, Kargil-I	359	302	281

Table 2. Effect of substrates on yield and biological efficiency per flush.

		Yield (g)			Biological efficiency (%)		
Sr. No.	Treatment	F_1	F_2	F_3	F_1	F_2	F_3
1.	Wheat straw (T_1)	123.67	119.33	115.67	12.36	11.93	11.56
2.	Wheat straw +Willow leaves(T_2)	103.03	100.20	99.11	10.30	10.02	9.91
3.	Willow leaves (T_3)	97.33	93.33	90.67	9.73	9.33	9.06

humidity (RH) and room temperature were conducted using a thermo-hygrometer. The RH was consistently maintained between 60 and 65% by occasionally spraying a fine mist of water. This meticulous environmental control aimed to create optimal conditions for the successful cultivation of fruiting bodies. The treatments were $T_{1=}$Wheat Straw, $T_{2=}$ Wheat Straw+ Willow Leaves (1:1) and $T_{3=}$Willow Leaves.

Harvesting and Cropping of Mushroom

Mature mushrooms were carefully harvested by hand to avoid any damage to the substrates. The total yield of mushrooms was determined by measuring the combined weight of all harvested fruiting bodies from each flush. Furthermore, the biological efficiency (B.E.) was calculated in accordance with the method (Familoni *et al*, 2018). The *Pleorotus ostreatus* were grown at different area of the district *viz.,* Wakha, Titichumik and KVK, Kargil-I, in triplicates and data were recorded periodically for three flush (1^{st}F, 2^{nd}F and 3^{rd}F).

RESULTS AND DISSCUSSION

The cultivated mushroom were harvested in 3 flushes and the yield data of fresh mushroom revealed that the maximum yield on fresh weight basis was obtained from wheat straw (315g, 327g, 359 g from different location), followed by wheat straw + willow leaves (1:1) (299g, 300g, 302g) and least was obtained willow leaves (249 g, 273g, 281g), almost same result was observed by Agraw *et al* (2023), Shah and Ashraf (2004) on waste leaves. Getachew and Chawaka (2019) found that wheat was the best straw to grow oyster mushroom but in Ladakh due to scarcity and high cost of straw it was not possible to grow on wheat /barley straw, so this study was conducted and found that on willow leaves the yield was low but was economically feasible as it is the cheapest substrate to grow oyster mushroom.

CONCLUSION

The study concluded that wheat straw was the effective substrate for cultivating oyster mushrooms, producing the highest fresh weight yields. A mixture of wheat straw and willow leaves (1:1) also performed well. Although wheat straw is the best substrate for oyster mushroom cultivation, its scarcity and high cost in Ladakh make it an impractical choice. Consequently, while willow leaves resulted in lower yields, they were identified as the most economically viable substrate for oyster mushroom cultivation in the region due to their availability and low cost.

REFERENCES

Agba M O, Markson A A and Oni J O (2021). Growth and yield impact of oyster mushroom *Pleurotus ostreatus* (Jacq P. Kumm) cultivated on diferent agricultural wastes. *J Biosci and Agri Res* **27** (1): 2225–2233.

Argaw B, Tesfay T, Godifey T and Asres N (2023). Growth and yield performance of oyster mushroom (P. ostreatus (Jacq.: Fr.) Kummer) using waste leaves and sawdust. *Hindawi Int J Agrony* **2023** , Article ID 8013491, 7 pages https://doi.org/10.1155/2023/8013491

Effiong M E, Umeokwochi C P, Afolabi I S and Chinedu S N (2024). Assessing, the nutritional quality of *Pleurotus ostreatus* (oyster mushroom). *Front in Nutri* **10**:2023. https://doi.org/10.3389/fnut.2023.1279208

Familoni T V, Ogidi C O, Akinyele B J and Onifade A K (2018). Evaluation of yield, biological efficiency and proximate composition of *Pleurotus* species cultivated on different wood dusts. *Czech Mycology* **70**(1): 33-45.

Getachew A, Keneni A and Chawaka M (2019). Production of oyster mushroom (*Pleurotus ostreatus*) on substrate composed from wheat straw, waste paper and cotton seed waste. *Int J Microbiol and Biotechnol* **4**(2): 38-44. https://doi.org/10.1155/2023/8013491

Jiskani M M, Pathan M A and Wagan K H (1999). Yield performance of oyster mushroom *Pleurotus florida* (strain PK, 401) on different substrates. *Pakistan J Agric Engg and Vety Sci* **15**: 26-9.

Khan S M and Ali M A (1981). Cultivation of oyster mushroom (*Pleurotus* spp.) on cotton boll locules. *In Proceedings of the Eleventh International Scientific Congress on the Cultivation of Edible Fungi, Australia, 1981/edited by NG Nair, AD Clift*.

Khan S M Kausar A G and Ali M A (1981). Yield performance of different strains of oyster mushrooms (*Pleurotus* spp.) on paddy straw in Pakistan. *In Proceedings of the Eleventh International Scientific Congress on the Cultivation of Edible Fungi, Australia, 1981/edited by NG Nair, AD Clift.*

Kurtzman Jr R H (1975). Summary of mushroom culture. *In Proceedings of seminar on mushroom research and production ARC, Printing Corporation of Pakistan Press, Karachi pp. 23-42*.

Mathew A V, Mathai G and Suharban M (1996). Performance evaluation of five species of *Pleurtotus* (Oyster Mushroom) in Kerala. *Mush Res* **5**: 9-12.

Oei P (2003). Mushroom cultivation, appropriate technology for mushroom growers. *Backhugs Publishers, Leiden. The Netherlands*

Park Y H, Go S J and Kim D S (1975). Studies on cultivation of oyster mushroom (*P. ostreatus*) using rice straw as substrate. *Research report of the office of Rural Development, Soil Science, Fertilizer, Plant Protection and Mycology* 17: 103-7.

Shah Z S and Ashraf M A (2004). Comparative study on cultivation and yield performance of oyster mushroom (*Pleurotus ostreatus*) on diferent substrates (wheat straw, leaves, sawdust). *Pakistan J Nutri* **3**(3):158–160.

Waqar Islam A R Zaynab M and Wu Z (2016). Efcacy ofdiferent weeds and agricultural substrates for cultivation of *Pleurotus ostreatus* (JACQ. FR.). *Asian J Agri Biol* **4**(4): 108–113.

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