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Sustainable Management of Agricultural Wastes through Cultivation of *Pleurotus sajor caju*

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ABSTRACT

The consequences of global warming, environmental degradation, and waste disposal are being felt in the twenty-first century. To address the problem of waste disposal, the current study utilises *Pleurotus sajor-caju* growing on various waste materials. Various mixtures of these substrates are also used for cultivation. *Pleurotussajor-caju* is a remarkable organism that can biodegrade waste into protein and perform several other functions. Wheat straw (WS), paddy straw (PS), soybean straw (SS), and sugarcane baggage (SB) are some of the standard substrates employed in this study, used tea leaves (UTL), domestic waste (DW), saw dust (SD), and newspaper (NP) are examples of non-traditional substrates. The data make it very clear that, of the four test conventional substrates (WS, PS, SS, and SB), SS was the best substrate. It is recommended that trash be bioconverted to provide consumers with nutrients and medication in addition to proteinaceous food, since the growth of mushrooms on different agricultural wastes could be a helpful tool for agricultural entrepreneurship. Interestingly, bioremediation, carbon sequestration, metal reduction, and filth reduction are all engineered when rubbish is used to grow mushrooms.

Keywords: *Pleurotussajor-caju,* Agricultural Wastes, mushrooms, bioconvert

INTRODUCTION

41The climate in Sagar allows for the production of oyster mushrooms and an abundance of agricultural waste. Growing oyster mushrooms was suggested as a way to bioconvert lignocellulosic wastes into edible protein (Panday et al., 2008). One of the attractive features of oyster mushrooms is their capacity to use a variety of agricultural waste products and transform the lignocellulose biomass into high-quality food with flavor and nutritional value (Adebayoetal., 2015). Lignocellulose molecules, which are present in most agricultural waste, can be challenging to manage and get rid of. Sugarcane baggase, wheat straw, soybean straw,and paddy straw are the substrates of interest (Dehariya and Vyas, 2015; Akshaya et al., 2023). Lignocellulosic substrates have garnered a lot of attention lately because of their possible use in secondary fermentation processes for the production of food, fuel, and chemicals. because they are produced in large quantities and are rich in cellulose and lignin. Prior studies demonstrated the potential for bioconverting waste lignocellulose into valuable goods (Poppe, 2000; Philippoussis and Zervakis, 2000; Dehariya and Vyas, 2013). Because of their special ability to selectively delignify, which offers a sufficient enzymatic mechanism for the conversion of complex organic macromolecules into simple chemicals, oyster mushrooms have been employed as a method for the biodegradation of a variety of plant litter (Wang et al., 2019). Spent compost can be fed to cattle to improve their health and milk production, or it can be used as a soil conditioner to boost the yield of particular crops (Kumar et al., 2017).

The yield of three *Pleurotus* species cultivated on various lignocellulose byproducts was reported (Jain and Vyas, 2005). Several fungi were previously recovered from various lignocellulosic wastes (Vyas and Vyas, 2005). According to (Vyas et al., 2009; Dehariya and Jain, 2025), growing mushrooms on a variety of agricultural waste could be a useful tool for agricultural entrepreneurship. This bioconversion of waste not only provides consumers with proteinaceous food but also medicine and nutrients. It's interesting to note that using garbage to produce mushrooms also engineers a number of things, including bioremediation, carbon sequestration, filth reduction and metals (Dehariya et al., 2010).

MATERIALS AND METHODS

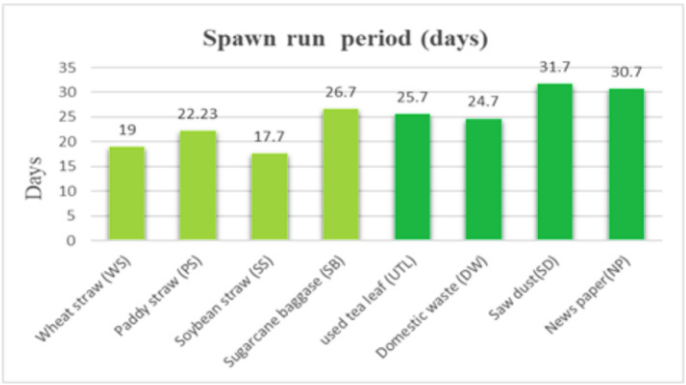
Wheat straw (WS), soybean straw (SS), paddy straw (PS), and sugarcane baggage (SB) are examples of typical substrates on which oyster mushrooms are produced; non-conventional substrates include used tea leaves (UTL), domestic waste (DW), saw dust (SD), and newspaper (NP). Each substrate was submerged in chemically treated water containing 500 parts per million formalin and 75 parts per million bavistin after being cleaned with fresh water. A 1:1 ratio was used to mix the substrates. After draining the excess water, the substrate was placed in 30 x 45 cm polythene bags. A multilayered spawning technique was used to inoculate the substrates. Spawn was supplied to the substrate at a rate of around 2-3% after being acquired from J. N. K. V. V. in Jabalpur. A few pinholes on the bags' bottoms allow for draining and aeration. The bags were incubated in the cropping room for the spawn run. The sacks were ripped

apart and sprinkled with water once or twice a day until the cropping was complete, after the straw had been completely impregnated with mycelium. The temperature was maintained between 25-30°C while the humidity was maintained between 70 and 80%. Days of spawn run, stipe length, first harvest yield, second harvest yield, and sporophore start were all noted during the growth phase.

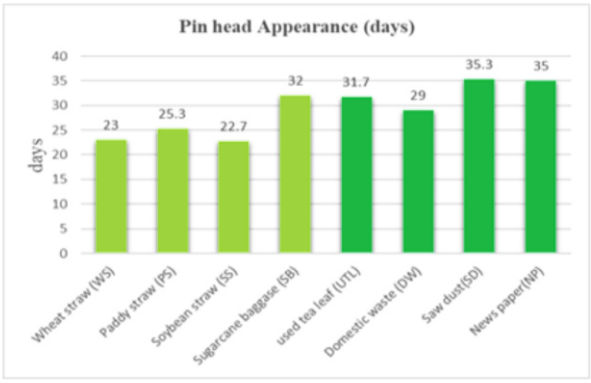
RESULTS AND DISCUSSION

Oyster mushrooms are grown in more suitable sub-tropical and monsoonic conditions because of their capacity to convert lignocelluloses waste into a potentially rich meal. We have been able to grow and understand the test mushroom species thanks to our current observations. *Pleurotus sajor-caju* can be grown on a variety of cellulytic plant sections. The development of *P. sajor caju* on several conventional and non-conventional substrates is demonstrated by the results found in Figure 1.Wheat straw (WS), paddy straw (PS), soybean straw (SS), and sugarcane baggage (SB) are some of the standard substrates employed in this study. used tea leaves (UTL), domestic waste (DW), sawdust (SD), and newspaper (NP) are examples of non-traditional substrates. The data make it very clear that, of the four test conventional substrates (WS, PS, SS, and SB), SS was the best substrate. This is not because the mycelium of oyster mushrooms took less time for spawn run and pin head appearance (17.7 and 22.7 days, respectively), but rather because it produced a good quantity of mushrooms (980g/Kg). WS was next to SS in terms of the amount of time needed for spawn run, pin head appearance, and yield g/kg; in this case, spawn run took 19 days, pin head took 22 days, and the total harvest yield was800g/kg. PS and SB produced fewer mushrooms and took longer to spawn run, and pinhead appearance.

Because it takes 24 days for the spawn run, 29 days for the pin head to grow, and a higher weight (685g/kg) was observed, DW determine that this substrate was the best among the non-conventional test substrates. On the other hand, SD was shown to be a poor substrate that required more time for spawn run and pin head appearance, as well as producing less 521g/kg. Other non-traditional substrates, like UTL and NP, needed less time than SD but more time than DW for spawn run and pinhead appearance similarly, a lower yield than DW but a higher yield than SD.

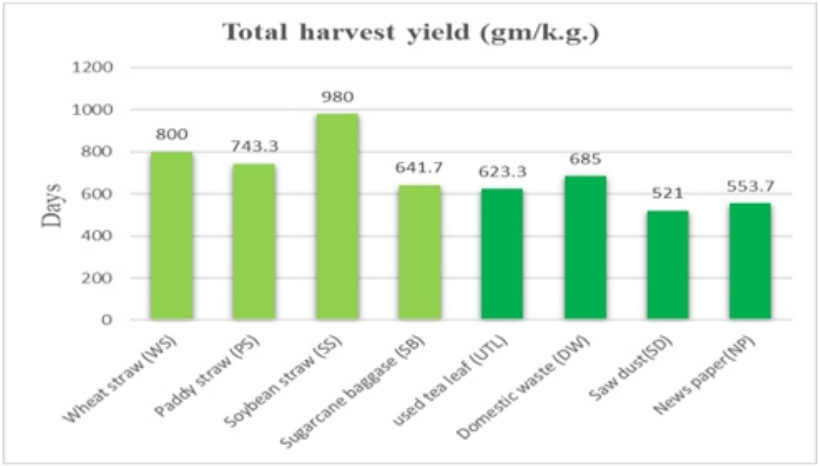


(A) Spawn running period for different substrates.



(B) Pin head appearance for different substrates





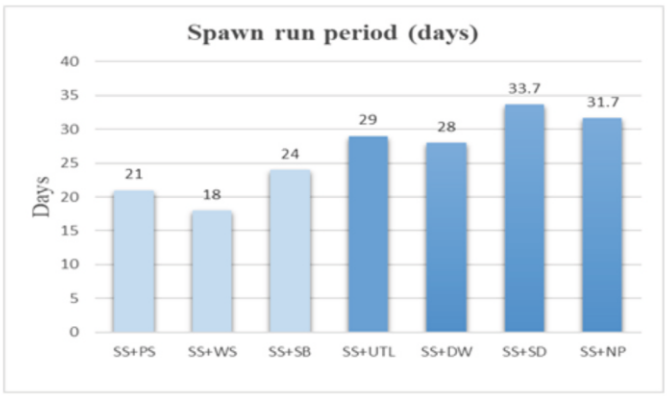
(C) Mushroom yield in different substrates

Figure 1. Pleurotus sajor-caju cultivated on different conventional and non-conventional substrates.

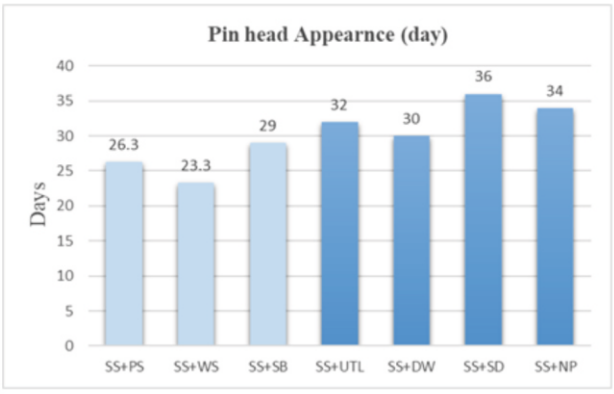
Conventional sources are superior to non-conventional sources, according to the findings. Based on the afore mentioned results, the following experiment was carried out, using SS as the primary substrate and the remaining standard substrates, PS, WS, and SB, in combination.

Combinations included SS+PS, SS+WS, and SS+SB. Figure 2. data make it abundantly clear that the best combination was discovered among the three combinations. SS+WS produces a significant quantity of mushrooms (873.3g/kg), however, it took a shorter time for the spawn run and pin head appearance (18 and 23.3 days, respectively) due to the mycelium of oyster mushrooms. SS+PS was next to SS+WS in terms of the time needed for spawn run, pin head appearance, and yield g/kg; in this case, spawn run took 21days, pinhead took 26.3 days, and total harvest yield was 800g/kg. In addition to producing fewer mushrooms, PS and SB took longer to spawn, run and pin head appearance.

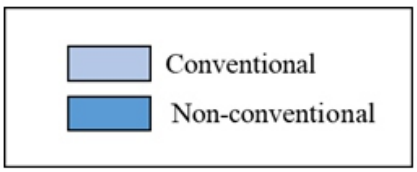
SS+DW was shown to be the best substrate among the combinations of SS and non-conventional substrates because it takes 28 days for the spawn run, 30 days for the pin head to form, and a higher weight of 826.7 g/kg was recorded. However, SS+SD was shown to be a bad substrate in terms of producing less than 570g/kg as well as requiring more time for spawn run and pin head appearance.

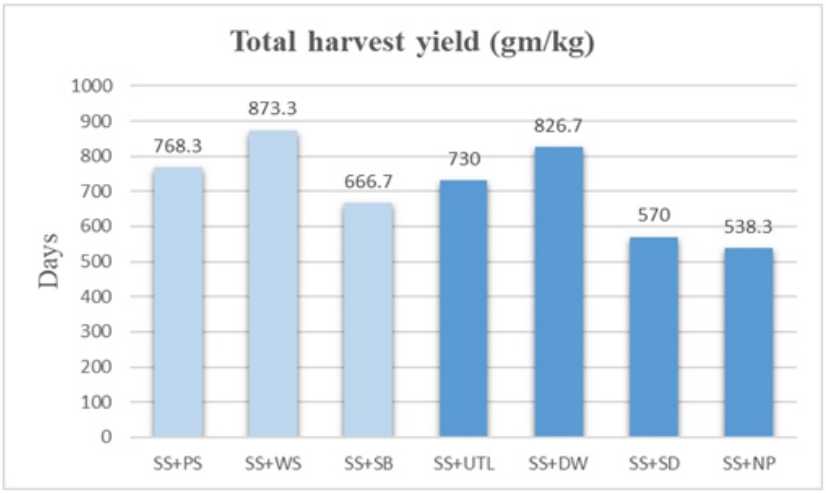


(A) Spawn running period for different substrates.



(B) Pinhead appearance for different substrates



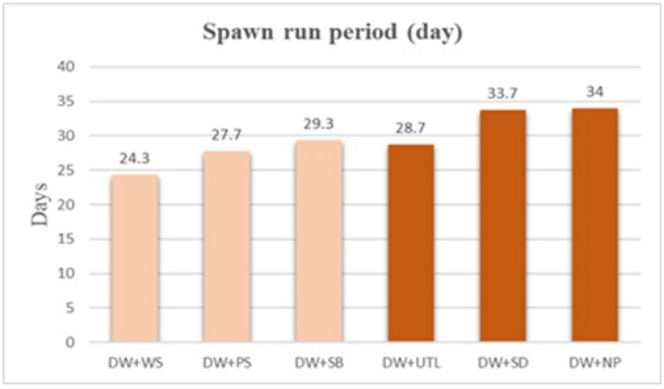


(C) Mushroom yield in different substrates

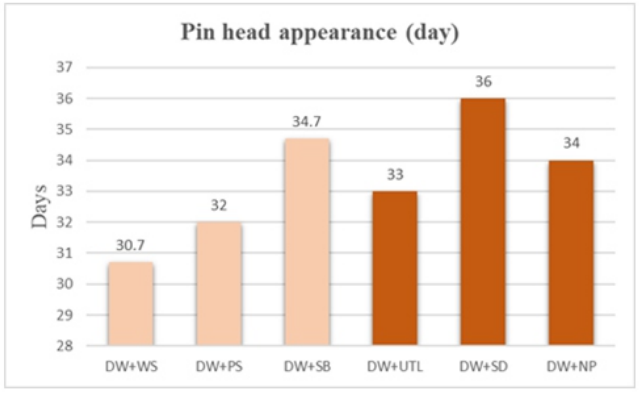
Figure 2. Combination of soybean straw with different conventional and non-conventional substrates.

P. sajor caju grows on various combinations of DW with other conventional and non-traditional substrates, according to the data found in figure 3. DW+WS, DW+PS, and DW+SB are three common combinations used in this study. The data clearly shows that DW+WS was the best combination out of the three, not because the mycelium of oyster mushrooms took less time for spawn run and pin head appearance (24.3 and 30.7 days, respectively), but also because it produced a good amount of mushrooms (775 g/Kg). DW+PS was next to DW+WS in terms of the time needed for spawn run, pin head appearance, and yield g/kg; in this case, spawn run took 27.7days, pinhead took 32days, and total harvest yieldwas715g/kg. DW+SB produces fewer mushrooms and takes longer to spawn, run, and pinhead appearance.

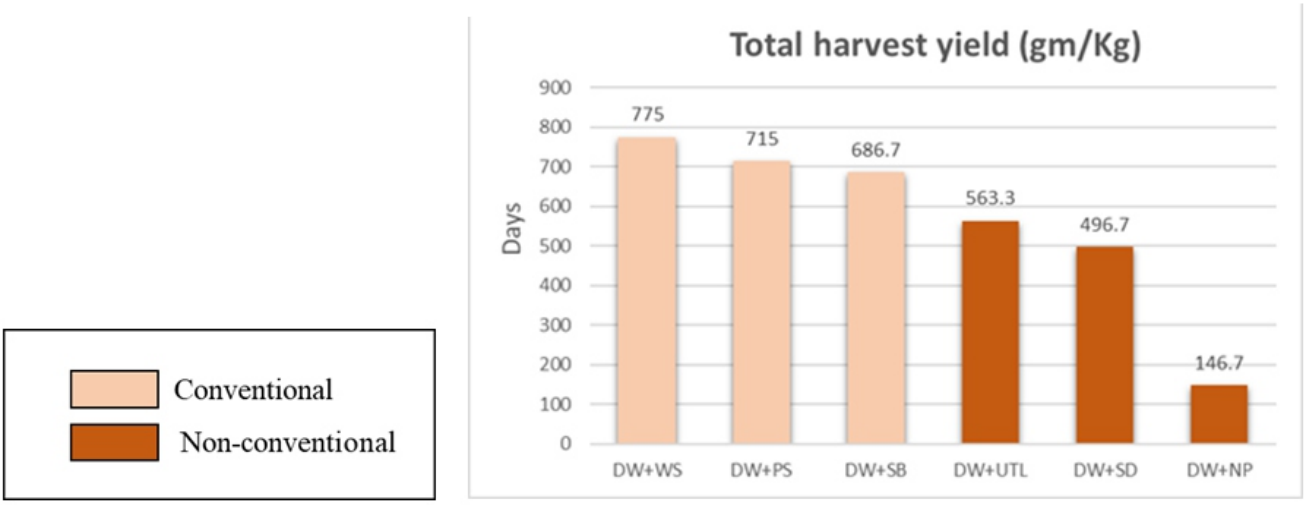
DW+UTL was found to be the best substrate among the combinations of DW and non- conventional substrates because it took 28.7 days for spawn run, 33 days for pinheadappearance, and had a higher weight of 563.3 g/kg. However, DW+NP was shown to be a poor substrate in terms of producing less 146.7g/kg as well as requiring a longer spawn run and a pin head appearance.



(A) Spawn running period for different substrates.



(B) Pinhead appearance for different substrates.



(C) Mushroom yield in different substrates

Figure 3. Combination of Domestic waste with different conventional and non-conventional substrates.

Wheat straw is the main substrate used to produce *Pleurotus* mushrooms. Wheat straw is the main substrate used to produce *Pleurotus* mushrooms. *Pleurotus sp*. was successfully cultivated on traditional substrates, according to (Kumar et al.,2004) and (Chandra et al., 1998). According to (Jain and Vyas, 2005), sugarcane and wheat straw make excellent substrates for growing oyster mushrooms. *Pleurotus sajor-caju* was reported to be suitable for spawn run, yield, and biological efficiency, and to utilize all agricultural wastes. The literature states that the mycelium growth period for another type of mushroom, *Pleurotus*, is three weeks (Akter et al., 2022). Singh and associates in 2007 documented *Pleurotus* species' extracellular enzymatic activity on vegetable wastes. Cellulose activity in various *Pleurotus* species during solid fermentation of a barley straw-based substrate was studied (Madhusudhan et al., 2002). Additionally, (Thakur, 2024) reported the superiority of paddy and wheat straw. Additionally, they stated that paddy straw has the highest biological efficiency and produces the greatest number of sporophores. Low lignolytic and cellulytic activity may be the cause of many agricultural wastes' poorer performance and yield (Pathak and Goel, 1988). However, the potential to use locally available substrates for *Plerotus sajor caju* production is ensured by the high and noteworthy performance of alternative substrates (Brinti, 2014).

Conclusion

Sagar is one of the largest producers of soybeans; hence, soybean straw (SS) is easily accessible. As a result, the cost of producing mushrooms is reduced when oyster mushrooms are

grown on soybean straw (SS). Wheat straw (WS), paddy straw (PS), soybean straw (SS), and sugarcane baggage (SB) are some of the standard substrates employed in this study. Used tea leaves (UTL), domestic waste (DW), sawdust (SD), and newspaper (NP) are examples of non-traditional substrates. The data make it very clear that, of the four test conventional substrates (WS, PS, SS, and SB), SS wasthe best substrate. DW+WS, DW+PS, and DW+SB are three common combinations used in this study. The data clearly shows that DW+WS was the best combination out of the three, not because the mycelium of oyster mushrooms took less time for spawn run and pinhead appearance (24.3 and 30.7 days, respectively), but also because it produced a good amount of mushrooms (775g/Kg). DW+PS was next to DW+WS in terms of the time needed for spawn run, pinhead appearance, and yield g/kg; in this case, spawn run took 27.7 days, pinhead took 32 days, and total harvest yield was 715 g/kg. DW+SB produces fewer mushrooms and takes longer to spawn, run, and pinhead appearance. In the end, using more soybean straw (SS) will help us reduce environmental problems. Specifically, increases in humus serve as carbon sequesters and store carbon. Growing mushrooms reduces problems with metal sequestration and absorbs nutrients. Ultimately, farm house hold waste was also used to bioremediation.

Acknowledgments

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