

Effect of Different Growing Media on Growth and Yield of Oyster Mushrooms in Laghman Province, Afghanistan

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ABSTRACT

Mushroom cultivation is highly influenced by the choice of growing media, which affects both growth and yield. This study was conducted in Laghman Province, Afghanistan, to evaluate the performance of *Oyster mushroom* on different locally available growing media. Several agricultural materials were tested to determine their suitability for mushroom production under controlled conditions. Experiment was conducted at Laghman university and the design of experiment was CRD (Randomized complete design with three replications. Parameters such as mushroom height, mushroom stem diameter, weight of stem, and weight of stem per bags, were measured and compared across treatments. Result showed that, wheat straw was higher at height, stem number, weight and bags weight compare to all treatments (height 20 cm, number of stem 9, weight of stem 8 gr and weight per bags 58 gr). Results showed significant variation in growth and yield depending on the growing media type. Growing media with balanced nutrients and good moisture retention supported faster mycelial development and higher production, while less nutritious or compact growing media resulted in slower growth and reduced yield. The findings highlight the importance of selecting appropriate growing media for optimizing both quantitative and qualitative traits of *Oyster mushroom*. Utilizing low-cost agricultural residues as cultivation growing media not only enhances mushroom productivity but also provides an environmentally friendly approach to waste management and income generation in Laghman Province. These insights can guide local farmers and researchers in improving mushroom cultivation practices in Afghanistan. According to results and work, our future recommendation is to conduct the experiment under different growing media with different temperatures.

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INTRODUCTION

Mushrooms (*Oyster mushroom*) are edible fungi widely cultivated for their nutritional value, economic importance, and role in sustainable agriculture (Nguyen & Ranamukhaarachchi,

2020). Mushrooms are considered a good source of protein, vitamins, and minerals, and they provide high yields in a short period. Mushroom cultivation is regarded as an important alternative farming system due to its low land requirement, low cost, and rapid production, especially in countries with limited land and water resources. Mushrooms are used as relish in many countries like China, Ghana, and many others. they can be used to make very expensive sauces and soups in Asian countries such as China and Korea. Mushrooms are considered dietary fiber and proteins, most amino acids, minerals, and vitamins (Zied *et al.*, 2017; Yao *et al.*, 2019). Oyster mushroom constitutes of 25–30% protein, 2.50% fat, 17–44% sugar content, 7–38% mycocellulose, and approximately 8–12% mineral (potassium, phosphorus, calcium, and sodium). Furthermore, mushrooms contain a great quantity of dietary fiber and given their chemical structure, they show immunostimulator and anticancer activity (Cheung, 2013; Lemieszek and Rzeski, 2012). Other biological properties of the mushrooms are being antidiabetic, antioxidant, and antitumor (Meng *et al.*, 2016; Davila *et al.*, 2020). Cultivation of mushrooms has become a very portables commercial agribusiness in most developing and developed countries such as the USA, Great Britain, China, Asia, Japan, Europe South Africa, and Ghana with China as the biggest producer producing about 3,918,300 tons each year (Kortie *et al.*, 2018). China produces more than 85% of all Oyster mushroom mushrooms worldwide; however, 95% of the total China production is for domestic consumption (Patel and Goyal, 2012; Zhang *et al.*, 2014). The productivity of mushroom cultivation is strongly influenced by the choice of growth growing media, which provides essential nutrients and physical support for mycelial development and fruiting body formation (Sharifi *et al.*, 2025).

Different growing media, such as agricultural residues, grains for spawn production, and supplemented composted materials, vary in their chemical composition and structural properties, leading to significant differences in mushroom growth and yield (El-Sayed *et al.*, 2024). Previous studies have demonstrated that growing media composition can affect key growth parameters, including incubation period, pinhead formation, biological efficiency, and total yield (Afify *et al.*, 2022; Sardar *et al.*, 2020). The use of agro-industrial wastes and mixed growing media has also been shown to improve cultivation outcomes, offering a sustainable approach for enhancing mushroom production (Sharifi *et al.*, 2025; El-Sayed *et al.*, 2024).

Globally, mushrooms are recognized as an important alternative in agriculture due to their low capital requirements, minimal land use, rapid yield, and potential to provide income, nutrition, and employment (Nguyen & Ranamukhaarachchi, 2020). Despite these advantages, mushroom cultivation in Afghanistan has not yet been developed commercially or according to standard practices. Population growth, unemployment, and food security challenges underscore the need for low-cost, quick-yield agricultural systems. However, mushroom cultivation still receives limited attention from farmers, largely due to the inappropriate selection of suitable growth growing media (Sharifi *et al.*, 2025). In

Afghanistan, farmers and innovators often lack knowledge of scientifically validated growing media and cannot effectively compare the efficiency of different agricultural residues.

Research on mushroom cultivation consistently emphasizes the critical role of growth growing media, including growing media, spawn carriers, and supplements, in influencing mycelial development, yield, and biological efficiency. Various studies have investigated how different growing media components affect key growth parameters in *Pleurotus* species and other edible mushrooms. Several experiments have examined *Pleurotus ostreatus* growth on growing media derived from agricultural residues. Sharifi *et al.* (2025) evaluated combinations of wheat straw, corn Stover, rice straw, and sawdust supplemented with wheat bran and lime. Their results demonstrated that rice straw supplemented with 2% lime significantly enhanced stalk length, cap diameter, total yield, and biological efficiency, highlighting the crucial role of growing media composition in maximizing productivity (Sharifi *et al.*, 2025; Sardar *et al.*, 2020; Afify *et al.*, 2022).

The selection of spawn growing media also influences cultivation outcomes. Verma *et al.* (2023) compared traditional wheat grain spawn with alternative growing media such as wheat straw and liquid cultures. While wheat grain spawn generally produced higher yields, alternative spawn growing media affected morphological traits, including fruit body weight and diameter, suggesting that spawn carriers can impact growth characteristics (Verma *et al.*, 2023; Jamil *et al.*, 2019). Similarly, Slowe *et al.* (2024) reported that inoculation techniques using solid versus liquid culture growing media affected yield and quality parameters in *Pleurotus ostreatus*, reinforcing the importance of both growing media type and growing media preparation methods in cultivation efficiency.

Beyond conventional growing media and spawn carriers, supplemented and mixed growing media have been explored to optimize mushroom yield. Nguyen and Ranamukhaarachchi (2020) assessed various culture growing media, grain sources, and lignocellulose mixtures such as spent coffee grounds and cardboard combined with wheat straw. Their study revealed that specific combinations enhanced mycelial extension and primordia formation, demonstrating the potential of alternative waste materials in mushroom cultivation (Nguyen & Ranamukhaarachchi, 2020; Rehan *et al.*, 2016). Similarly, growing media mixtures such as paddy straw blended with banana leaves improved yield performance in multiple *Pleurotus* species, indicating that growing media diversity can positively affect biological efficiency and resource utilization (Gebbru *et al.*, 2024). However, around the world different growing media are using for the production of mushroom which was not clear that which growing media is in expansive and available for the production of mushroom. Besides, it remains unclear which growing media is most suitable under local conditions. Therefore, this study aims;

- to identify the most effective growth growing media for Oyster mushroom in Laghman Province, Afghanistan, by scientifically evaluating different agricultural residues to provide practical guidance for farmers, students, and policymakers.

METHODS AND MATERIALS

Research Design

The experiment was conducted at the Laghman University Research Farm during the 1403–1404 academic year to evaluate the effects of different growing media on the growth and yield performance of oyster mushrooms. A Completely Randomized Design (CRD) was employed for the experiment. Four types of growing media were evaluated as treatments: Maize cobs, wheat straw, sawdust, and poplar sawdust. Each treatment was replicated three times, with five cultivation bags included within each replication. Thus, the experiment consisted of 4 treatments $\times$ 3 replications $\times$ 5 cultivation bags, giving a total of 60 cultivation bags. The experimental bags were randomly arranged within the cultivation room to minimize the potential effects of differences in environmental position. All treatments were subjected to the same general cultivation and management conditions throughout the experimental period.

Experimental Treatments and Sample

Four growing media were used as experimental treatments. Each treatment was prepared using 7 kg of the respective growing media. The treatments were designated as follows:

- T₁: Maize cobs – 7 kg
- T₂: Wheat straw – 7 kg
- T₃: Sawdust – 7 kg
- T₄: Poplar sawdust – 7 kg

For each treatment, five cultivation bags were used per replication, resulting in 15 bags for each treatment across the three replications. The total number of cultivation bags used in the experiment was therefore 60. Gypsum and lime were incorporated into the growing media during growing media preparation. Oyster mushroom spawn was added to the prepared growing medias before the cultivation bags were transferred to the growing room.

Research Materials and Equipment's

The materials used in the experiment included Maize cobs, wheat straw, sawdust, poplar sawdust, oyster mushroom spawn, gypsum, lime, water, and plastic cultivation bags. The main equipment used included a weighing balance, measuring ruler, thermometer, humidity-monitoring equipment, containers for heat treatment, ventilation equipment, and a solar-powered lighting system. The cultivation room was thoroughly cleaned and disinfected before the experiment. Silver-colored plastic was placed over the windows to reduce direct exposure to sunlight. Ventilation equipment was used to facilitate air circulation within the room, while a solar-powered system was used to provide artificial light.

Preparation of Growing media

The four growing media were prepared separately according to their respective treatments. Each growing media was immersed in water and boiled for approximately 30 minutes as a

heat-treatment procedure intended to reduce contaminating microorganisms. Following heat treatment, the growing medias were placed in sealed plastic bags and kept for approximately 10 hours. After the heat-treatment period, gypsum and lime were thoroughly mixed with the respective growing media. The prepared growing medias were subsequently transferred into plastic cultivation bags. Oyster mushroom spawn was then introduced into each prepared bag. The same general preparation and spawning procedures were followed for all treatments to maintain uniformity among experimental units.

Cultivation and Environmental Management

Following preparation and spawning, the cultivation bags were arranged randomly within the cultivation room according to the experimental design. The room was maintained under the same general environmental conditions for all treatments. During the experimental period, the recorded temperature ranged from approximately **34 to 40°C**, while relative humidity was maintained at approximately **80–85%** during both daytime and nighttime. Ventilation equipment was used to improve air circulation within the cultivation room. Water was applied to the floor of the room every four days to assist in maintaining humidity. Direct sunlight was minimized by covering the windows with silver-colored plastic. A solar-powered lighting system was used to provide light within the cultivation room. Environmental conditions were monitored throughout the experiment to maintain relatively uniform conditions among treatments.

Data Collection Procedure

Data were collected at predetermined observation periods throughout the cultivation period. The same measurement procedures were applied to all treatments and replications. The following growth and production parameters were recorded:

- **Mushroom height (cm):** Mushroom height was measured using a ruler or measuring scale from the base of the stem to the uppermost point of the fruiting body.
- **Stem weight (g):** The weight of harvested mushroom stems was determined using a weighing balance.
- **Number of stems:** The number of mushroom stems produced in each cultivation bag was counted manually and used Vernier caliper.
- **Bag weight (g):** Mushroom production obtained from each cultivation bag was weighed using a weighing balance.

Observations were recorded separately for each treatment and replication at each observation date. The collected data were subsequently organized for statistical analysis.

Data Collection Instruments

The instruments used for data collection included a weighing balance, measuring ruler, thermometer, and humidity-monitoring device. The measuring ruler was used to determine mushroom height, whereas the weighing balance was used to measure stem weight and bag weight. The number of stems was determined by direct counting. Temperature and relative humidity were monitored using the relevant measuring instruments during the cultivation

period. The observations were recorded in structured data sheets containing the treatment, replication, observation date, and corresponding measurements for each parameter.

Data Analysis

The collected data were coded and entered into **SAS (Statistical Analysis System) software** for statistical analysis. Analysis of variance (ANOVA) was performed according to the Completely Randomized Design to determine the effect of growing media on mushroom growth and yield characteristics. The statistical model used for the analysis was:

$$Y_{ij} = \mu + T_i + \epsilon_{ij}$$

where:

- Y_{ij} = observed value of the dependent variable,
- μ = overall population mean,
- T_i = effect of the i th growing media treatment, and
- ϵ_{ij} = experimental error associated with the observation.

The dependent variables analyzed included mushroom height, stem weight, number of stems, and bag weight. Treatment means were calculated and compared to determine differences among the four growing media. Where significant differences among treatment means were detected by ANOVA, an appropriate mean comparison procedure was applied at the **5% significance level ($P < 0.05$)**. The results obtained from the SAS analysis were presented as treatment means, and the statistical differences among treatments were used to interpret the effects of growing media on oyster mushroom growth and production.



Figure 1. Shows preparation of different growing media (Maize cobs, wheat straw, sawdust, and poplar sawdust)

FINDINGS

Mushroom Height: Statistical analysis at $P < 0.05$ revealed significant differences among treatments (Figure 2). Result showed, at 20 DAP, the highest mean height was recorded in wheat straw (15 cm), followed by sawdust (13 cm), poplar sawdust (13 cm), and Maize cobs (12 cm). At 40 DAP, wheat straw maintained the highest height (17 cm), while sawdust and poplar sawdust both recorded 14 cm and 13 cm, respectively. Maize cobs showed minimal increase, reaching 13 cm. At 60 DAP, wheat straw produced the greatest height (20 cm), demonstrating a consistent increase over time. Sawdust and poplar sawdust both reached 15 cm. In contrast, Maize cobs showed no further increase beyond 40 DAP, remaining at 13 cm.

Overall, wheat straw supported the highest growth throughout the observation period, followed by sawdust and poplar sawdust, while Maize cobs resulted in the lowest height and showed minimal growth after 40 days.

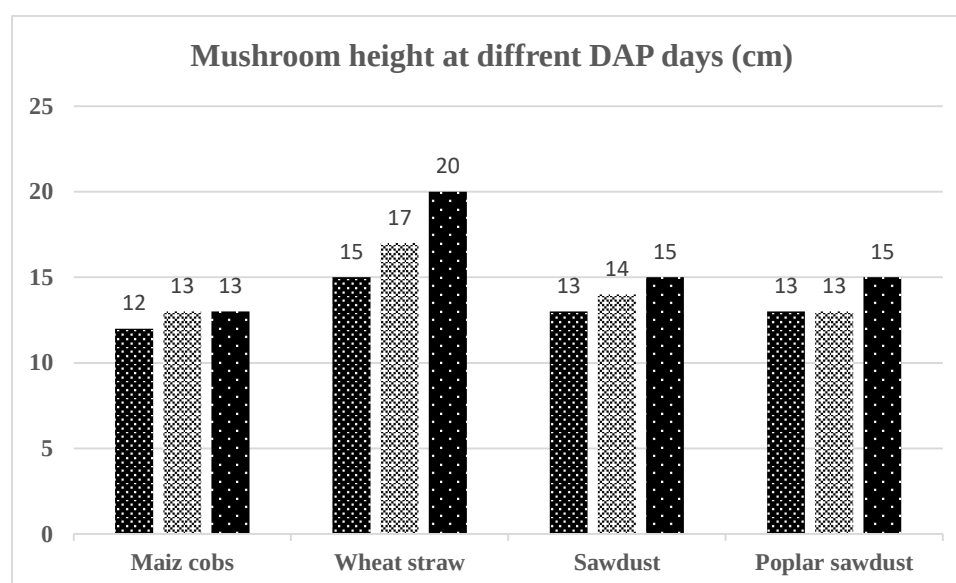


Figure 2: Shows the mushroom height at different days after planting

Number of Stems: Statistical analysis at $P < 0.05$ revealed significant differences among treatments (Table 1). At 20 days after planting (DAP), wheat straw recorded the highest stem number (6), followed by sawdust (4), Maize cobs (3), and poplar sawdust (3). At 40 DAP, wheat straw showed a slight increase to 7 stems, maintaining its leading position. Maize cobs increased to 4 stems, while sawdust declined to 3 stems. Poplar sawdust remained unchanged at 3 stems. By 60 DAP, wheat straw exhibited a substantial increase to 9 stems, representing the highest stem production among all growing media.

Table 1. Shows different stems at different DAP

Treatments	20 DAP	40 DAP	60 DAP
Maize cobs	3c	4b	4ba
Wheat straw	6a	7a	9a
Sawdust	4b	3c	4b
Poplar sawdust	3c	3c	4b

*Least Significant Difference, *: 5% Significance, based on LSD (5%) Means with the same letter in the same column are significantly different at $P \leq 0.05$ (LSD).*

Stem Weight: Statistical analysis at $P < 0.05$ revealed significant differences among treatments. Stem weight increased over time for most growing media (Figure 3). At 20 days after planting (DAP), wheat straw recorded the highest stem weight (5 g), followed by sawdust (3 g), poplar sawdust (3 g), and Maize cobs (2 g). By 40 DAP, stem weight increased in Maize cobs (4 g) and wheat straw (6 g), while sawdust and poplar sawdust remained constant at 3 g. At 60 DAP, wheat straw continued to show the highest stem weight (8 g), demonstrating a consistent upward trend throughout the experimental period. Maize cobs also exhibited progressive growth, reaching 5 g. In contrast, sawdust showed no change over time,

maintaining a constant stem weight of 3 g, while poplar sawdust showed a slight decline to 2 g at 60 DAP.

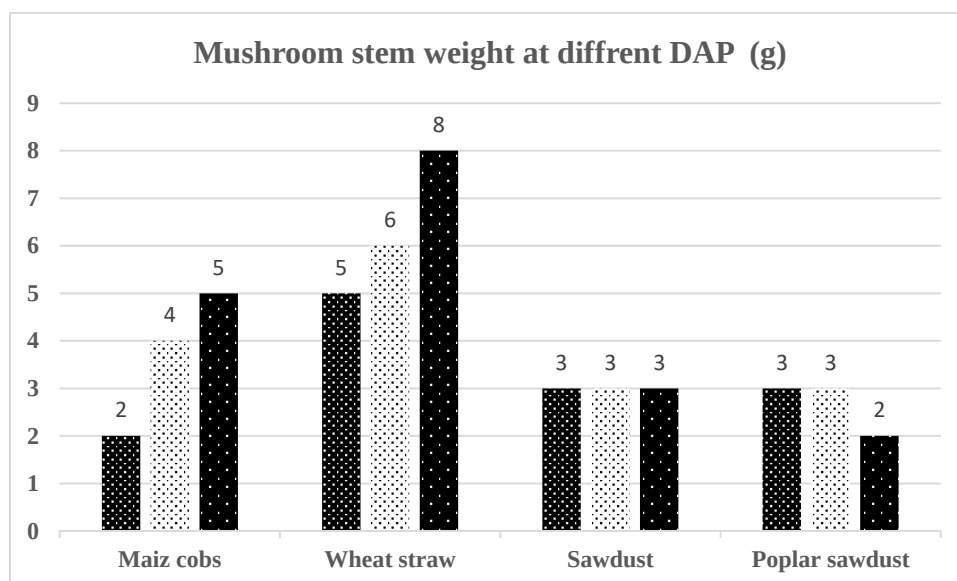


Figure 3. Shows mushroom stem weight at different days after planting.

Weight per Bag: There were significant different between treatments at 20 DAP, 40DAP and 60 DAP. At 20 days after planting, wheat straw produced 50 g per bag, Maize cobs 30 g, poplar sawdust 30 g, and sawdust 23 g. the highest weight per bag was recorded under Wheat straw. However, by 40 DAP, wheat straw increased to 55 g, sawdust 34 g, Maize cobs 32 g, and poplar sawdust 33 g. At 60 days after planting, wheat straw reached 58 g, sawdust 37 g, Maize cobs 34 g, and poplar sawdust 32 g. according to the figure number six the highest weight per bags was recording under Wheat Straw and the lowest were recorded under Maize cobs and Poplar sawdust. Sawdust was different at 60 days after planting with Maize cobs and Poplar sawdust (Figure 4).

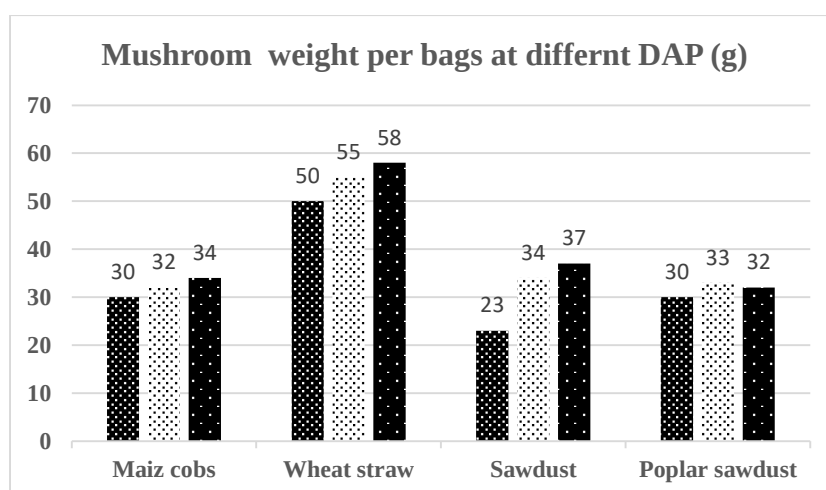


Figure 4. Shows mushroom weight per bag at different days after planting.

DISCUSSION

The present study demonstrated clear differences in the growth and productivity of oyster mushrooms among the growing media evaluated. Overall, wheat straw produced the most consistent and favorable results across the measured parameters, including mushroom height, stem weight, number of stems, and bag weight. In comparison, Maize cobs, sawdust, and poplar sawdust supported mushroom growth to varying degrees, but their performance was generally lower or less consistent than that of wheat straw. These differences indicate that the physical and chemical characteristics of the growing medium play an important role in mycelial development, fruiting body formation, biomass accumulation, and overall mushroom production. The superior performance of wheat straw may be related to its favorable physical structure and nutrient composition. Throughout the experimental period, wheat straw showed a continuous increase in mushroom growth and reached the highest recorded height at 60 days after planting (DAP). This consistent pattern suggests that wheat straw provided suitable conditions for mycelial colonization and subsequent fruiting body development. The relatively loose and porous structure of wheat straw may allow sufficient air circulation while retaining an adequate amount of moisture. Both moisture and aeration are important factors in oyster mushroom cultivation because excessive moisture can reduce oxygen availability, whereas insufficient moisture can restrict mycelial growth and fruiting. Therefore, the physical structure of wheat straw may have provided a favorable balance between moisture retention and aeration compared with the other growing media evaluated in this study.

The findings are generally consistent with previous reports identifying cereal straws, particularly wheat straw, as suitable growing medias for oyster mushroom cultivation. Chang and Miles (2004) and Sánchez (2010) reported that agricultural residues containing considerable amounts of cellulose and hemicellulose can provide suitable carbon sources for mushroom development. Wheat straw also has a structure that can be readily colonized by mushroom mycelium following appropriate preparation. Therefore, the continuous increase in growth observed in the present study may reflect the ability of oyster mushroom mycelia to efficiently utilize the available lignocellulosic components of wheat straw. In contrast, Maize cobs showed comparatively limited growth, particularly after 40 DAP. Although Maize cobs are also lignocellulosic agricultural residues containing cellulose, hemicellulose, and lignin, their physical structure differs considerably from that of wheat straw. The relatively compact and rigid nature of Maize cobs may reduce nutrient accessibility and restrict air movement within the growing medium. Farooq *et al.* (2025) similarly indicated that the structural characteristics of lignocellulosic materials can influence their suitability for mushroom cultivation. The slower growth observed on Maize cobs in the present study may therefore be related not only to their nutrient composition but also to the rate at which mushroom mycelia could physically access and degrade the growing media.

However, the relatively lower performance of Maize cobs does not necessarily indicate that this material is unsuitable for oyster mushroom cultivation. Its progressive increase in

stem weight and moderate stem production suggest that the mushroom was able to utilize the growing media to some extent. The lower performance may potentially be improved through appropriate pretreatment, reduction of particle size, moisture optimization, or supplementation with additional nutrients. Future experiments could therefore evaluate different preparation methods and proportions of Maize cobs in combination with other growing medias to determine whether their productivity can be improved. Such investigations would also be useful because Maize cobs are widely available agricultural residues and could provide an alternative growing media where wheat straw is limited. The results obtained for sawdust and poplar sawdust indicate that wood-based growing media can also support oyster mushroom production, although their performance was less pronounced than that of wheat straw. Both growing medias showed moderate growth, with mushroom height reaching approximately 15 cm at 60 DAP. However, this increase was not as consistent as the trend observed in wheat straw. One possible explanation is the relatively high lignin content of wood-based materials. Lignin is a complex structural polymer that is more difficult to decompose than cellulose and hemicellulose. Although oyster mushrooms possess ligninolytic enzymes that enable them to utilize woody materials, degradation can occur more slowly and may require a longer period before sufficient nutrients become available for fruiting body development (Sánchez, 2010; Afify *et al.*, 2022). Consequently, the lower growth observed in sawdust-based growing media may partly reflect slower nutrient release rather than complete unsuitability of these materials.

Stem weight provided additional evidence of differences among the growing media. Wheat straw showed a continuous increase from 5 g at 20 DAP to 8 g at 60 DAP, indicating progressive biomass accumulation throughout the experimental period. This increase may be associated with favorable moisture retention, aeration, and nutrient availability in the growing media. Efficient decomposition of cellulose and hemicellulose can make nutrients available for incorporation into mushroom biomass. Chang and Miles (2004) emphasized the importance of growing media composition in supporting mushroom biomass production, particularly when the growing media contains readily accessible structural carbohydrates. Maize cobs also showed a progressive increase in stem weight, reaching 5 g at 60 DAP. This suggests that Maize cobs were capable of supporting biomass production, although their performance remained below that of wheat straw. The gradual increase may indicate that the mushroom mycelium was able to colonize and degrade the Maize cob growing media over time, but possibly at a slower rate (Sardar *et al.*, 2020). This finding suggests that further processing, supplementation, or optimization of moisture and particle size may improve the utilization of Maize cobs.

Sawdust maintained a relatively constant stem weight of 3 g, while poplar sawdust showed a slight decline at the final observation. The limited increase in sawdust-based treatments may indicate slower conversion of the growing medium into mushroom biomass. Poplar sawdust, in particular, may have been affected by differences in the chemical composition of the wood, including lignin and other extractive compounds. Some wood

species may contain compounds that temporarily inhibit fungal growth or require additional time for degradation or detoxification. Sánchez (2010) noted that the composition of lignocellulosic growing medias can strongly influence their suitability for mushroom production. Therefore, pretreatment or supplementation may potentially improve the nutritional availability of these wood-based materials. The number of stems followed a pattern similar to the other growth measurements. Wheat straw consistently produced the highest number of stems, increasing from 6 at 20 DAP to 9 at 60 DAP. A greater number of fruiting bodies generally indicates that the growing medium provided suitable conditions for primordia initiation and subsequent development. Moisture, aeration, growing media composition, and nutrient availability can all influence fruiting body formation. Royse and Tan (2017) reported that growing media composition is an important factor affecting primordia formation and fruiting body development in oyster mushrooms. The higher stem count observed in wheat straw may therefore be associated with its favorable physical and nutritional characteristics.

Maize cobs showed moderate improvement in stem production before becoming relatively stable, whereas sawdust and poplar sawdust showed only minor fluctuations. Such variation may be associated with differences in growing media decomposition and nutrient release over time. A growing media that releases nutrients gradually may initially support slower growth but continue to provide resources over a longer period. In contrast, a growing media that is more readily accessible to fungal enzymes may support faster initial development. Therefore, differences in stem number should be interpreted together with the other growth and yield measurements rather than being considered an isolated indicator of growing media suitability. Bag weight, which provides an overall indication of production performance, further demonstrated the favorable performance of wheat straw. Wheat straw produced the highest bag weight throughout the experimental period and reached 58 g at 60 DAP. This result supports the growth and stem measurements and indicates that the favorable performance of wheat straw was reflected not only in individual mushroom characteristics but also in overall biomass production. The finding agrees with previous studies describing wheat straw as a suitable growing media for oyster mushroom production because of its physical structure, moisture retention, and availability of cellulose and hemicellulose (Chang & Miles, 2004; Sánchez, 2010).

Interestingly, sawdust showed considerable improvement over time and reached 37 g at 60 DAP, making it the second-highest medium at the final observation. This suggests that sawdust may have potential for sustained mushroom production when appropriate cultivation conditions are provided. Its slower performance during the earlier stages may be related to the slower degradation of lignin-rich material. With sufficient cultivation time, oyster mushroom mycelia may gradually break down the growing media and utilize its available nutrients. This observation highlights the importance of considering cultivation duration when evaluating alternative growing media. The comparatively lower performance of poplar sawdust may have resulted from differences in its physical and chemical

characteristics. Its slight decline at the final stage could indicate nutrient depletion, reduced moisture retention, structural changes in the medium, or a combination of these factors. However, because the present experiment did not directly measure growing media moisture, lignin degradation, nutrient concentration, or enzyme activity, these explanations should be regarded as possible interpretations rather than confirmed causes. This represents an important limitation of the present study because the observed growth differences cannot be directly linked to specific chemical characteristics of the growing media. Future research should therefore include measurements of pH, moisture content, cellulose, hemicellulose, lignin, and carbon-to-nitrogen ratio before and after cultivation. Such analyses would provide stronger evidence for explaining the mechanisms responsible for differences in mushroom growth and production.

Another limitation is that the experiment evaluated only four growing media under the environmental conditions used during the study. Different temperature, humidity, ventilation, and light conditions may produce different growth and yield responses. In particular, temperature was not included as an experimental treatment, meaning that the interaction between growing media type and temperature could not be determined. Future studies should therefore evaluate the performance of these growing medias under different temperature regimes and, where possible, investigate the interaction between growing media and temperature. Such experiments could help identify the environmental conditions under which each growing medium performs most effectively. The study also evaluated growth and production parameters over a period of up to 60 DAP. Although this period provided useful information about mushroom development, a longer cultivation period could provide additional information regarding later flushes, total yield, production duration, and the long-term performance of each medium. Future experiments should therefore consider multiple flushes and longer observation periods. Biological efficiency should also be included as an important production indicator because it provides a more comprehensive measure of how efficiently mushrooms convert the growing media into harvestable biomass.

The limited number of growing media evaluated also suggests the need for further comparative research. Future studies could examine combinations of wheat straw, Maize cobs, sawdust, and poplar sawdust at different ratios rather than using each medium separately. Growing media supplementation could also be investigated, particularly for Maize cobs and wood-based growing media that showed lower performance in the present study. Different pretreatment methods, particle sizes, moisture levels, and supplementation rates could be evaluated to determine whether the productivity of these growing medias can be improved. Such research would be particularly valuable for identifying locally available and low-cost materials for oyster mushroom production. From a practical perspective, the findings suggest that wheat straw has considerable potential as a growing medium for oyster mushroom production under the conditions of this study. However, growing media selection should not be based solely on mushroom growth because availability, preparation requirements, cost, and local accessibility are also important considerations. Although

sawdust showed lower performance during some observation periods, its relatively high final bag weight indicates that it may still have potential when sufficient cultivation time and appropriate preparation are provided. Similarly, the moderate performance of Maize cobs suggests that further optimization may allow this agricultural residue to be used more effectively.

Overall, the findings confirm that growing medium type plays an important role in oyster mushroom growth, biomass accumulation, stem production, and overall yield. Wheat straw consistently showed favorable performance across the measured parameters, whereas Maize cobs, sawdust, and poplar sawdust showed varying degrees of suitability. The differences observed among the treatments are likely related to variation in the physical structure, moisture retention, nutrient availability, and decomposition characteristics of the growing media. Nevertheless, because these growing media characteristics were not directly measured in the present study, the proposed mechanisms should be interpreted cautiously. Further research involving different growing media, temperature regimes, growing media combinations, pretreatment methods, and detailed chemical analyses would provide a stronger basis for optimizing oyster mushroom production and identifying sustainable, locally available growing media.

CONCLUSION

Growing media significantly influences mushroom growth, and yield. Among the four growing media evaluated, wheat straw consistently outperformed the others across all parameters, including Mushroom height, stem weight, number of stems, and bag weight. Sawdust showed moderate performance, Maize cobs provided limited growth after 40 DAP, and poplar sawdust was the least effective. These results indicate that wheat straw is the most suitable growing media for *Oyster mushroom* cultivation under the conditions of Laghman Province, Afghanistan.

Authors' contributions

- Shahidullah Niazi conducted the field study collected the raw data and wrote the manuscript.
- Hafizullah Niazy reviewed the manuscript and help at Data analysis.
- Ajmal Amini, Zia Ur Rahman Rasikh, Rasool khan and Shakirullah Niazi reviewed the manuscript and help during research work.
- All author's reviewed and approved the final version.

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Conflict of interest statement

The authors declare that they have no conflict of interest.

Data availability statement

Data are available upon request from the corresponding author, subject to approval of the relevant ethics committee.

REFERENCES

- Afify, A. H., El-Sawah, A. M., Ali, M. S., & Abd El-Rahman, N. K. (2022). Effect of different agro-industrial wastes on the growth and yield of edible mushrooms (*Pleurotus florida*). *Journal of Agricultural Chemistry and Biotechnology*, 13(2), 25-28. <https://doi.org/10.21608/jacb.2022.120892.1020>.
- Miles, P. G., & Chang, S. T. (2004). *Mushrooms: cultivation, nutritional value, medicinal effect, and environmental impact*. CRC press. <https://doi.org/10.1201/9780203492086>.
- Cheung, P. C. (2013). Mini-review on edible mushrooms as source of dietary fiber: Preparation and health benefits. *Food Science and Human Wellness*, 2(3-4), 162-166. DOI: 10.1016/j.fshw.2013.08.001.
- Dávila, G. L. R., Murillo, A. W., Zambrano, F. C. J., Suárez, M. H., & Méndez, A. J. J. (2020). *Evaluation of nutritional values of wild mushrooms and spent growing media of *Lentinus crinitus* (L.) Fr. Heliyon 6: e03502*. DOI: 10.1016/j.heliyon. 2020.e03502
- El-Sayed, O., Bardisi, E. A., Zyada, H. G., & Arisha, M. H. (2024). Using different grain growing media for spawn production and maximization of Oyster mushroom (*Pleurotus florida*) production. *Zagazig Journal of Agricultural Research*, 51(2), 151-156. DOI link: <https://doi.org/10.21608/zjar.2024.353637>
- Farooq, T. N., Hussain, M., Zeeshan, M., Khan, A. U., & Majeed, A. (2025). Comparative Analysis of Growth Growing media for Enhancing Yield and Development of Oyster Mushroom. *Journal of Asian Development Studies*, 14(2), 1219-1228. DOI link: <https://doi.org/10.62345/jads.2025.14.2.96>
- Gebru, H., Belete, T., & Faye, G. (2024). Growth and yield performance of *Pleurotus ostreatus* cultivated on agricultural residues. *Mycobiology*, 52(6), 388-397. DOI link: <https://doi.org/10.1080/12298093.2024.2399353>.
- Hoa, C.-L. Wang, and C.-H. Wang (2015). the effect of different growing media on the growth, yield, and nutritional composition of two Oyster mushroom mushrooms

- (*Pleurotus ostreatus* and *Pleurotus cystidiosus*)," *Mycobiology*, vol. 43, no. 4, pp. 423–434. DOI: 10.5941/MYCO.2015.43.4.423
- Jamil, F., Yaqoob, A., Mehmood, Z., Hamid, A., Shah, Z., Imtiaz, M., ... & Ijaz, R. (2019). Comparative study for growth and yield performance of Oyster mushroom mushroom (*Pleurotus* spp.) on different growing media under temperate condition. *Journal of Environmental & Agricultural Sciences*, 19, 10-22.
https://jeas.agropublishers.com/2026/03/comparative-study-for-growth-and-yield-performance-of-oyster-mushroom-pleurotus-spp-on-different-growing-medias-under-temperate-condition/?utm_source=chatgpt.com
- Kortei, N. K., Odamtten, G. T., Obodai, M., Wiafe-Kwagyan, M., & Prempeh, J. (2018). Survey of mushroom consumption and the possible use of gamma irradiation for sterilization of compost for its cultivation in Southern Ghana. *Agriculture & Food Security*, 7(1), 83. DOI link: <https://doi.org/10.1186/s40066-018-0235-8>
- Lemieszek, M., & Rzeski, W. (2012). Anticancer properties of polysaccharides isolated from fungi of the Basidiomycetes class. *Contemporary Oncology/Współczesna Onkologia*, 16(4), 285-289. DOI: 10.5114/wo.2012.30055
- Meng, X., Liang, H., & Luo, L. (2016). Antitumor polysaccharides from mushrooms: a review on the structural characteristics, antitumor mechanisms and immunomodulating activities. *Carbohydrate research*, 424, 30-41. DOI link: <https://doi.org/10.1016/j.carres.2016.02.008>
- Muswati, C., Simango, K., Tapfumaneyi, L., Mutetwa, M., & Ngezimana, W. (2021). The effects of different growing media combinations on growth and yield of Oyster mushroom (*Pleurotus ostreatus*). *International Journal of Agronomy*, 2021(1), 9962285. DOI link: <https://doi.org/10.1155/2021/9962285>
- Nguyen, T. M., & Ranamukhaarachchi, S. L. (2020). Effect of different culture growing media, grain sources and alternate growing media on the mycelial growth of *Pleurotus eryngii* and *Pleurotus ostreatus*. *Pakistan Journal of Biological Sciences*, 23(3), 223–230. DOI link: <https://doi.org/10.3923/pjbs.2020.223.230>
- Patel, S., & Goyal, A. (2012). Recent developments in mushrooms as anti-cancer therapeutics: a review. *3 Biotech*, 2(1), 1-15. DOI: 10.1007/s13205-011-0036-2
- Rehman, M. K., Ali, M. A., Hussain, A., Khan, W. A., & Khan, A. M. (2016). Effect of different casing materials on the production of button mushroom (Oyster mushroom L.). *J Environ Agric Sci*, 7, 55-61. https://jeas.agropublishers.com/2016/03/effect-of-different-casing-materials-on-the-production-of-button-mushroom-agaricus-bisporous/?utm_source=chatgpt.com
- Royse, D. J., Baars, J., & Tan, Q. (2017). Current overview of mushroom production in the world. *Edible and medicinal mushrooms: technology and applications*, 5-13. DOI link: <https://doi.org/10.1002/9781119149446.ch2>

- Sánchez, C. (2010). Cultivation of *Pleurotus ostreatus* and other edible mushrooms. *Applied Microbiology and Biotechnology*, 85(5), 1321–1337. <https://doi.org/10.1007/s00253-009-2343-7>.
- Sardar, H., Anjum, M. A., Nawaz, A., Naz, S., Ejaz, S., Ali, S., & Haider, S. T. (2020). Effect of different agro-wastes, casing materials and supplements on the growth, yield and nutrition of milky mushroom (*Calocybe indica*). *Folia Horti*, 32(1), 115–24. DOI link: <https://doi.org/10.2478/fhort-2020-0011>
- Sharifi, A., Durani, A., Safi, S., Khalili, A., & Noor, N. A. (2025). Effects of different growing media growing media and supplements on growth and yield of mushroom (*Pleurotus ostreatus*). *Nangarhar University International Journal of Biosciences*, 4(02), 16–24. DOI link: <https://doi.org/10.70436/nuijb.v4i02.396>
- Slowe, S., Seecharan, D., Ansari, A. A., Jaikishun, S., & Latchman, K. (2024). Effect of solid and liquid growing media inoculations of spawn on yield and quality parameters of Oyster mushroom mushrooms (*Pleurotus ostreatus*) grown on different growing media. *Mushroom Research*, 33(1), 31–38. DOI link: <https://doi.org/10.36036/MR.33.1.2024.152104>
- Verma, P., Nath, M., Sharma, A., Barh, A., Kamal, S., Sharma, V. P., & Kumar, A. (2023). Comparative evaluation of different spawn growing media on the growth and yield of Oyster mushroom. *Mushroom Research*, 32(1), 41–49. DOI link: <https://doi.org/10.36036/MR.32.1.2023.137484>.
- Yao, H., Liu, Y., Ma, Z. F., Zhang, H., Fu, T., Li, Z., ... & Zhang, X. (2019). Analysis of nutritional quality of black fungus cultivated with corn stalks. *Journal of Food Quality*, 2019(1), 9590251. DOI link: <https://doi.org/10.1155/2019/9590251>
- Zhang, Y., Geng, W., Shen, Y., Wang, Y., & Dai, Y. C. (2014). Edible mushroom cultivation for food security and rural development in China: bio-innovation, technological dissemination and marketing. *Sustainability*, 6(5), 2961–2973. DOI link: <https://doi.org/10.3390/su6052961>
- Zied, D. C., Pardo, J. E., Tomaz, R. S., Miasaki, C. T., & Pardo-Giménez, A. (2017). Mycochemical characterization of *Agaricus subrufescens* considering their morphological and physiological stage of maturity on the traceability process. *BioMed Research International*, 2017(1), 2713742. DOI link: <https://doi.org/10.1155/2017/2713742>