RESEARCH PAPER

AUTOMATED OYSTER MUSHROOM (Pleurotus oystreatus) PRODUCTION (AUTO-OMP): A COMPARATIVE STUDY

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ABSTRACT
The study was conducted to determine the production performance of oyster mushroom under both automated and conventional method. Its was conducted at the ISUFST-SEC. the study composed of two treatments where treatment A represents the automated method, while treatment B represents the conventional method. It was laid out in randomized complete blocked design (RCBD) with three replications, having 10 fruiting bags per replicate. Data such as weight of harvested mushroom fruits, temperature, and humidity were analyzed using ANOVA in RCBD, while significant results were subjected to DMRT. The findings demonstrate that IoT- based automation creates a more favorable microenvironment for mushroom production, as evidenced by significantly higher yields and trends toward more optimal temperature and humidity conditions. While temperature and humidity differences were not statistically significant, their combined effects likely enhanced fruit body growth and development, thereby contributing to the significantly higher production performance under the automated system.

Keywords: IoT-Based, oyster mushroom, conventional method, automated
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RATIONALE

Oyster mushroom (Pleurotus oystreatus) cultivation has emerged as a sustainable and profitable agricultural practice, offering high nutritional value, a rapid production cycle, and minimal space requirements. Traditional methods of mushroom farming typically involve manual monitoring and control of environmental factors, such as temperature and humidity, which are crucial for optimal growth.

These conventional approaches often utilize organic substrates like rice bran, wheat straw, and animal manures, with the entire process spanning from 10 days to 6 months post-spawning (Khaniya, S., Chaulagain, B. P., 2024).

Advancements in agricultural technology have introduced automated systems designed to optimize growing conditions, potentially enhancing efficiency and profitability. For instance, the integration of the Internet of Things (IoT) in mushroom farming allows for real-time monitoring and control of environmental parameters, leading to improved yields and reduced labor costs (Terrashroom, 2024). Additionally, automated harvesting systems have been shown to decrease labor expenses by 30% and increase harvest efficiency by 20% (Setukrite, 2024).

Understanding these factors will provide valuable insights into the effectiveness of each method in maximizing yield and economic returns. For example, economic analyses have demonstrated that mushroom cultivation can be a profitable venture, with studies reporting net returns and favorable benefit-cost ratios (Chitra, K. et al., 2018).

Thus, this study was conducted to evaluate oyster mushroom production under both conventional and automated methods.

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OBJECTIVES OF THE STUDY

This study aims to determine the production performance of oyster mushroom under both conventional and automated methods.

Specifically, it sought to:

1. Determine the production performance of oyster mushroom under both conventional and automated methods in terms of weight of harvested mushroom fruits; and
2. Determine the environmental condition of oyster mushroom under both conventional and automated methods in terms of temperature, and humidity; and

SIGNIFICANCE OF THE STUDY

This study on mushroom production using conventional and automated methods holds significant value for various stakeholders in the agricultural sector, particularly in sustainable farming and agribusiness. The findings of this research will contribute to the following areas:

Mushroom Growers and Farmers – The study will provide valuable insights into the efficiency of conventional versus automated methods in terms of yield, production cycles, and resource management. It will help farmers make informed decisions on adopting technology-driven approaches to maximize their production and profitability.

Agricultural Researchers and Academicians – The study will serve as a reference for future research on optimizing mushroom production techniques. It can contribute to the growing body of knowledge on precision agriculture and smart farming applications in mushroom cultivation.

Agribusiness and Investors – By analyzing the return on investment (ROI) of both methods, this study will help agripreneurs and investors assess the economic feasibility of integrating automation in mushroom farming. It will also highlight potential business opportunities in the mushroom industry.

Policy Makers and Agricultural Agencies – The results can aid government institutions and agricultural organizations in formulating policies and support programs that promote sustainable and profitable mushroom farming. This may include incentives for farmers adopting modern technologies and training programs for enhanced productivity.

Consumers and the Food Industry – An increased understanding of efficient mushroom production can lead to improved supply, better quality produce, and more affordable mushrooms in the market. This benefits consumers and supports the food industry by ensuring a stable supply of mushrooms for various culinary and medicinal uses.

Overall, this study aims to contribute to the advancement of mushroom production technologies, bridging the gap between traditional farming practices and modern agricultural innovations.

SCOPE AND LIMITATIONS OF THE STUDY

This study was limited to the production performance of oyster mushroom (Pleurotus oystreatus) under both conventional and automated methods in terms of weight of harvested fruits, temperature, and humidity. A total of two (2) treatment was randomly distributed in the experimental area. The study was laid out in Randomized Complete Block Design (RCBD). The treatments were the Automated Method (A) and the Conventional Method (B). Each treatment will be replicated three times using random sampling method in RCBD. There were ten (10) fruiting bags per treatment with a total of sixty (60) experimental fruiting bags. This study was conducted at ISUFST-SEC, from June 2025 to August 2025.

Data collected were analyzed using Analysis of Variance (ANOVA) in RCBD while significant result was subjected further to Duncan's Multiple Range Test (DMRT).

METHODOLOGY

Materials

The following materials used in the study: oyster mushroom, rice straw, sawdust, IoT system.

Methods

Methods used during the conduct of the study includes the experimental treatment and design, management practices and procedures, instrument of data collection, methods of collecting data and statistical tools and analysis.

Experimental Treatments and Design. The experimental design used was Randomized Complete Block Design (RCBD). The treatments were Automated Method (A) and the Conventional Method (B). Each treatment was replicated three times using random sampling method in RCBD. There will be ten (10) fruiting bags

per treatment with a total of sixty (60) experimental fruiting bags. The experimental lay-out is shown in Figure 1.

Management Practices and Procedures. The management practices and procedures was also discussed in this section. This includes the location, preparation of substrates and fruiting bags, and application of experimental treatments.

Location. The experimentation was conducted at the ISUFST-San Enrique Campus Research Area. The study was conducted in a controlled mushroom cultivation facility. Two production setups were established: Automated Method (A): Manual monitoring and adjustment of environmental conditions such as humidity, temperature, and misting. Conventional Method (B): Use of automated systems (e.g., humidity and temperature sensors, automated misting, and environmental control devices) to optimize growing conditions.

Preparation of Substrate and Fruiting Bags. The substrate for oyster mushroom cultivation was a combination of rice straw and sawdust. For substrate pasteurization, the prepared substrate was pasteurized using the hot water or steam method to eliminate contaminants. For bagging and inoculation, the sterilized substrate was packed into polypropylene fruiting bags and inoculated with oyster mushroom spawn under sterile conditions. For incubation, the inoculated bags were placed in a dark incubation room at 25–28°C for 2–3 weeks until complete mycelial colonization is achieved.

Application of Experimental Treatments. The experiment has two treatment groups, with a three replications per treatment. For Automated Method (A), mushrooms were grown in a manually controlled growing house where humidity is maintained by manual misting, and ventilation is adjusted by opening or closing plastic sheeting or windows. For Conventional Method (B), mushrooms were grown under an automated system with humidity and temperature sensors, an automated misting system, and controlled ventilation.

RESULTS AND DISCUSSION

Weight of Mushroom Fruit Harvested (g). The yield performance of mushrooms under the two production systems is summarized in Table 1. Results revealed that fruiting bags placed inside the automated mushroom house exhibited significantly higher fresh weights

compared to those cultivated under the conventional method. In Month 1, the automated system recorded a mean yield of
151.88 g per bag, which was statistically greater ($p < 0.05$) than the 125.97 g obtained from the conventional system. A similar trend was observed in Month 2, with yields of 129.30 g in the automated setup versus 100.73 g in the conventional.

The cumulative yield across both months reached 281.18 g in the automated system, outperforming the 226.70 g recorded under conventional conditions.

Analysis of variance confirmed significant treatment effects, indicating that automation with IoT-based control optimizes environmental conditions and subsequently enhances mushroom productivity.

This suggests that the integration of automated management contributes to improved physiological responses and fruit body development, leading to greater biomass accumulation.

Temperature (°C). Environmental monitoring revealed that the IoT-based mushroom house consistently maintained lower ambient temperatures compared to the conventional setup. Mean values ranged from 26.84°C to 27.12°C in the automated system, whereas the conventional house reached higher temperatures of 30.07°C and 29.87°C in Months 1 and 2, respectively.

Although the differences were not statistically significant ($p > 0.05$), the relatively lower and more stable temperature profile within the automated house reflects its capacity to regulate microclimatic conditions closer to the optimal thermal range for Pleurotus spp. growth. Stable temperatures are critical for enzymatic activity and substrate colonization, and while not statistically significant, the trend suggests potential long-term benefits for sustained fruiting performance under automated management.

Relative Humidity (%). Relative humidity levels were consistently higher in the IoT-based mushroom house across both months of production. Recorded values reached 78.67% and 66.37% for Months 1 and 2, respectively, compared with only 65.34% and 33.39% under the conventional system.

Despite the lack of significant differences ($p > 0.05$), the higher humidity maintained in the automated house is physiologically advantageous for mushroom primordia initiation and fruit body expansion. High relative humidity reduces water stress, minimizes cap cracking, and ensures uniform development of fruiting bodies. Thus, while statistical tests indicated no significant variation, the consistently higher humidity levels under automation likely contributed to the observed increase in yield.

CONCLUSION

1. oyster mushroom production performed better under the automated method compared to the conventional method.
2. In terms of yield, the automated mushroom house produced significantly heavier mushroom fruit weights across production months, indicating a clear advantage of automation in enhancing productivity.

RECOMMENDATIONS

1. Mushroom growers are encouraged to adopt IoT-based automation to improve yield and production efficiency, particularly in areas where maintaining stable environmental conditions is challenging.
2. Further refinement of temperature and humidity control settings in automated systems is advised to maximize their potential in providing ideal growing conditions for oyster mushrooms.
3. Further studies should incorporate longer experimental periods and continuous monitoring of environmental parameters to better capture fluctuations and their effects on yield.
4. Similar studies should be conducted on different mushroom species to validate the effectiveness of automated systems across a wider range of fungal crops.

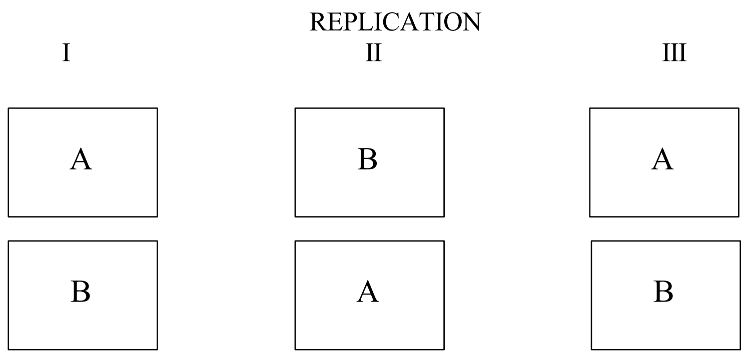

Figure 1. Experimental layout arranged in a Randomized Complete Block Design.

Legend:
A–Automated Method
B–Conventional Method

Table 1. Summary of the Production performance of mushroom

PARAMETERS	TREATMENT		Sig.	CV
	A	B		
Weight of mushroom fruit harvested (g)				
Month 1	151.88[a]	125.97[b]	*	0.93
Month 2	129.30[a]	100.73[b]	*	6.83
Total	281.18	226.70		
Temperature (^{O}C)				
Month 1	26.84	30.07	ns	5.25
Month 2	27.12	29.87	ns	5.93
Humidity (%)				
Month 1	78.67	65.34	ns	16.21
Month 2	66.37	33.39	ns	30.55

abc - Means with the same letter superscript are not significantly different
*- Significant at 5% level of probability
ns- not significant at 5% level

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