

Strengthening Oyster Mushroom Cultivation Based On Good Agricultural Practices (Increasing Productivity Through Improved Spores and Contamination Control In The Growth Chambers)

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Abstract:

Oyster mushroom (*Pleurotus ostreatus*) cultivation shows promise as a productive community enterprise, but its success is influenced by the quality of the spawn, contamination and the microclimate conditions within the growing house. This community engagement activity aims to strengthen growers' knowledge and skills through the application of Good Agricultural Practices (GAP), with a focus on improving spawn quality, controlling contamination, and managing the microclimate of the growing house. The activity was carried out at the Jember Oyster Mushroom Home Industry in Jember Regency, involving 15 participants. The methods used included awareness-raising sessions, training, discussions, demonstrations, practical sessions, mentoring, and evaluation via pre-tests and post-tests, each comprising 10 questions. The material covered the identification of cultivation problems, the selection and handling of healthy spawn, the prevention and control of contamination through sanitation and the use of botanical pesticides, the management of temperature, humidity and air circulation, as well as the drafting of Standard Operating Procedures (SOPs) and production monitoring. The results of the activity showed that participants took part enthusiastically and were active in discussions and practical sessions. The average pre-test score ranged from 40 to 60, whilst the average post-test score rose to 100. This improvement indicates that the training programme successfully enhanced participants' understanding of the principles and practices of GAP-based oyster mushroom cultivation. This initiative serves as a first step towards strengthening cultivation practices that are more targeted, hygienic and standardised. Further support is required to assess the impact of GAP implementation on contamination levels, the success rate of baglogs, productivity and the continuity of harvests..

Keywords: Oyster mushrooms, Good Agricultural Practices, spawn, contamination, microclimate, community outreach

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Introduction

Oyster mushrooms (*Pleurotus ostreatus*) are an agricultural commodity with potential for development as a productive household-scale economic enterprise. Oyster mushroom cultivation also has the potential to support community economic self-reliance through the utilisation of resources and the development of mushroom-based products (Sugianto, 2023). Jember Regency has the potential for oyster mushroom development, supported by the availability of raw materials for growing media, such as sawdust and agricultural waste, as well as public demand for fresh oyster mushrooms. Based on the data included in the proposal, oyster mushroom production in

Jember Regency increased from 6,173 quintals in 2022 to 9,410 quintals in 2023. This trend indicates that oyster mushrooms have the potential to be further developed as part of a local resource-based agro-industry (Sugianto, 2023; Wardhana et al., 2025).

The partner for this community service initiative is the Jember Oyster Mushroom Home Industry, located in Langsepan Hamlet, Keranjingan Village, Summersari Sub-district, Jember Regency. The business has been operating since 2014 and is managed by a team of five workers. The partner has one cultivation shed with a capacity of around 10,000 baglogs per production cycle and is capable of producing around 25–50 kg of fresh oyster mushrooms per day, with a continuous daily harvest. More than a decade of business experience, coupled with the availability of local raw materials, constitutes a key asset in the development of the oyster mushroom business.

Despite having considerable production potential, the partners still face several challenges in terms of cultivation. These issues include pest and disease infestations, a high risk of baglog failure, sub-optimal selection of spawn, and temperature and humidity management in the cultivation rooms that is not yet optimally controlled. Over a single production cycle lasting 3–4 months, the baglog failure rate is reported to be around 10 per cent. Furthermore, the partners do not yet have standard operating procedures (SOPs) for oyster mushroom cultivation that can serve as guidelines for consistent production practices. Issues regarding production quality and the need to improve cultivation processes are also a concern in oyster mushroom grower empowerment programmes at other locations (Casban et al., 2024).



Figure 1. Baglog infested with wireworms

These issues highlight the need to strengthen cultivation practices that are not only focused on increasing production but also on the application of Good Agricultural Practices (GAP). In the context of oyster mushroom cultivation, GAP focuses on the use of high-quality materials and spawn, the implementation of sanitation and hygiene measures, the prevention of contamination, the management of the growing environment, and the standardised execution of cultivation stages. Efforts to improve the quality of the production process through mentoring and the application of technology have also proven to be a relevant approach in empowering oyster mushroom grower groups (Casban et al., 2024). Previous activity proposals have also stipulated that the selection of high-quality spawn, pest and disease control, and the management of the microclimate within the growing houses are important components of technical training in oyster mushroom cultivation.

In light of these circumstances, this community engagement initiative is aimed at strengthening the partners' capacity to implement Good Agricultural Practice (GAP)-based oyster mushroom cultivation through three key areas of focus: improving the selection and use of spawn;

controlling contamination through a safer approach utilising botanical pesticides; and managing the microclimate within the mushroom houses. The training and technical mentoring approach is in line with oyster mushroom empowerment initiatives that prioritise improvements to production processes as a key strategy for enhancing partners' capacity (Casban et al., 2024; Chasanah et al., 2025). The initiative is expected to enhance partners' understanding and skills so that the cultivation process can be carried out in a more targeted, hygienic and consistent manner. Furthermore the GAP-based is the utilisation of local resources and the application of environmentally friendly cultivation techniques are key elements in the development of a sustainable mushroom business. Kalista et al. (2023) demonstrate that agricultural waste, such as maize cobs, can be utilised as a substrate for mushroom cultivation whilst simultaneously enhancing the economic value of previously underutilised resources. Training and mentoring activities have also proven vital in enhancing the community's knowledge and skills regarding substrate formulation, substrate preparation, and mushroom cultivation techniques. In line with this approach, Legawati et al. (2018) emphasised the importance of utilising natural materials as an alternative for pest control to reduce reliance on chemicals and maintain environmental balance. This principle is relevant to the implementation of Good Agricultural Practices (GAP) in oyster mushroom cultivation, particularly through the use of safe materials, preventative contamination control, management of the growing environment, and capacity building for growers.

Method

The community service activities were carried out at the Jember Oyster Mushroom Home Industry in Langsepan Hamlet, Keranjingan Village, Summersari Sub-district, Jember Regency. The implementation method utilised a participatory approach based on the partners' needs. This approach positions the partners as active participants in the activities, from the identification of problems, through the delivery of training and practical sessions, to the evaluation stage. This participatory approach is in line with the method outlined in the proposal, namely to ensure that the solutions provided are practical, easy to adopt, and can be continued independently by the partners.

The activity was attended by 15 participants. Knowledge assessment was carried out using a pre-test and a post-test, each comprising 10 questions. The pre-test was administered before the material was presented to assess the participants' prior knowledge, whilst the post-test was administered after the activity to assess changes in the participants' understanding of the material presented. The training material was designed based on the requirements of GAP-based oyster mushroom cultivation, with the aim of enabling participants to identify the main problems in cultivation, understand GAP principles, select and handle spawn correctly, understand the prevention and control of contamination, manage the temperature, humidity and air circulation in the growing house, and carry out record-keeping, monitoring and evaluation of production. The material also covered the identification of upstream issues, improving the quality of spawn, contamination, microclimate management, pests and diseases, natural control, the drafting of GAP-based cultivation SOPs, critical control points in the SOPs, and the group's follow-up plan. The stages of the programme include awareness-raising, training, practical application of technology and standard operating procedures (SOPs) for cultivation, mentoring, and evaluation. In the initial stage, awareness-raising sessions are held to explain the programme's objectives, the cultivation challenges faced, and the benefits of implementing Good Agricultural Practices (GAP)

in the oyster mushroom business. This stage is carried out through discussions with partners to explore their experiences and the actual challenges encountered during the production process.

The next stage is technical training in cultivation. The training material focuses on three main aspects. Firstly, spawn improvement, which includes understanding the characteristics of good spawn, selecting healthy spawn, and the importance of using high-quality spawn to reduce the risk of growth failure. Improving seedling quality and the production process are crucial to enhancing the quality of the oyster mushroom business, as demonstrated in empowerment activities through the provision of sterilisation equipment and improvements to the baglog production process (Casban et al., 2024). Spore improvement is identified as a key component because the proposal identifies inappropriate spore selection as one of the factors increasing the risk of disease and baglog failure.

The training on seed improvement emphasised the use of seeds from reliable and healthy sources; characteristics of good seeds include white mycelium, even growth, good vigour, no unusual odour, and freedom from contamination. Participants were also provided with an understanding of the age and condition of spawn, hygienic storage and transport, the segregation of spawn suspected of being contaminated, and batch or date labelling to facilitate the tracing of any issues.

Secondly, the control of contamination, pests and diseases. Training was provided through explanations of the sources of contamination, the importance of production environment sanitation, the identification of symptoms of infestation, and control using more environmentally friendly approaches. During this activity, the use of botanical pesticides was introduced as one alternative control method. Practical sessions were designed to help participants understand the principles of using plant-based materials, application methods, and the importance of maintaining the cleanliness of the coop environment as part of contamination prevention.

In the session on contamination, participants were introduced to the signs of contamination, including a change in colour to green, black, yellow or orange, the appearance of slime, or an abnormal odour. Sources of contamination may include raw materials, equipment, the workspace, workers, water or the inoculation process. The control principles emphasised were prevention, early detection, isolation and sanitation. For natural control, plant-based materials such as neem extract were introduced as part of an integrated control strategy. The module also emphasised the precautionary principle, namely that pesticides should not be sprayed directly onto fruit or baglogs without safety testing and clear procedures, and that it is essential to identify the organism, select appropriate measures, conduct small-scale trials, and evaluate effectiveness.

The training method involved a combination of lectures, discussions, demonstrations and hands-on practice. Follow-up support was provided after the training to ensure participants could apply the material to their cultivation activities. Evaluation was carried out through observation, assessing participants' engagement during discussions and practical sessions, their ability to identify cultivation issues, and their ability to explain the principles of seedling improvement, contamination control and microclimate management. This mentoring and evaluation framework is based on the activity design outlined in the proposal, which emphasises monitoring, periodic evaluation, and the refinement of strategies based on constraints identified in the field.

In addition to evaluation through observation, changes in participants' knowledge were analysed descriptively by comparing the average pre-test and post-test scores.

Results and discussions

1. Participants' Enthusiasm and Participation

The event, attended by 15 participants, received a positive response. The participants took part enthusiastically and actively throughout the presentation of the material, discussions, demonstrations and practical sessions. This enthusiasm was evident in the participants' engagement in asking questions and discussing the issues they had encountered in the oyster mushroom cultivation process.

This indicates that the material presented is directly relevant to the participants' needs. The issues discussed are real-life problems faced by partner businesses, particularly regarding seedling quality, contamination and the environmental conditions of the greenhouses. A participatory approach is important as it enables participants to relate the material to their previous farming experiences.



Figure 2. Participants of Jember Oyster Mushroom Home Industry

Previous community engagement activities were also designed on the principle that partners are not merely the objects of the activities, but act as active participants involved in identifying problems, implementing solutions and carrying out evaluations. Consequently, the participants' enthusiasm serves as an early indicator that the empowerment approach adopted is well-received by the partners. The improvement in participants' knowledge and skills following the activity demonstrates that a training and mentoring approach is a key strategy in strengthening growers' capacity. This is in line with Kalista et al. (2023), who identify changes in the community's knowledge and skills regarding substrate formulation, substrate preparation and cultivation techniques as one of the indicators of the success of community engagement activities centred on mushroom cultivation.

2. Improving Understanding of Seed Improvement

One of the key outcomes of the activity was an increased understanding amongst participants of the importance of using good-quality spawn in oyster mushroom cultivation. Participants understood that the quality of spawn is one of the initial factors determining the success of mycelium growth and mushroom production. The evaluation results showed that participants' average pre-test scores were still in the range of 40–50 out of 10 questions, whilst after the training their average post-test scores reached 90. This increase in scores indicates an improvement in knowledge retention after participants had received the theoretical and practical training.

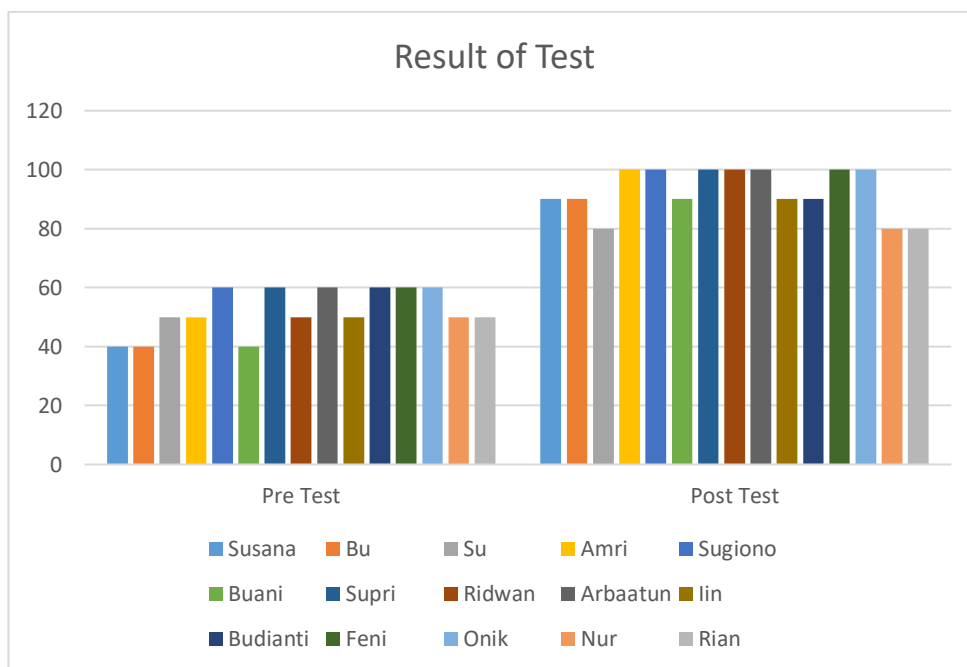


Figure 3. The Comparasion Result of Post and Pre Test

Prior to the activity, the issue of spawn selection had been identified as one of the factors contributing to the high risk of disease and the failure of cultivation bags. Consequently, the training on spawn improvement was designed to enhance participants' ability to recognise the characteristics of suitable spawn and to understand the importance of maintaining spawn quality throughout the spawn preparation and incubation processes.

This understanding is a crucial part of implementing Good Agricultural Practice (GAP), as the success of cultivation is not solely determined by the maintenance stage after the baglogs have been placed in the cultivation house, but begins with the selection of production inputs. The stages of oyster mushroom cultivation, from substrate preparation to incubation, are crucial to the success of the production process (Sugianto, 2023). With high-quality spawn and a more controlled propagation process, the likelihood of uniform mycelium growth can be increased and the risk of production failure can be minimised.

These results are consistent with the proposed solution outlined in the proposal, which incorporates the selection of high-quality spawn as part of the standard operating procedure (SOP) for oyster mushroom cultivation. The importance of improving the production process and the quality of the baglogs is also highlighted by Casban et al. (2024), whilst Sugianto (2023) demonstrates that oyster mushroom cultivation practices encompass stages ranging from substrate preparation to the incubation process. The SOP covers spawn selection, sterilisation, incubation, house maintenance, and harvesting.

3. Understanding Contamination Control using Botanical Pesticides

The results of the activity showed that participants were able to understand the principles of contamination and pest and disease control using a safer approach through the use of plant-based pesticides. Participants gained knowledge regarding the importance of preventing contamination through sanitation and hygiene in production environments, as well as the use of control agents derived from plant sources. This improved understanding is reflected in the average post-test score of 90, compared to the average pre-test score, which ranged from 40 to 50.

Contamination control is a relevant issue because the partners' initial conditions indicate the presence of disease and pest problems that could lead to significant production losses. The proposal states that an infestation of the gurem pest has previously caused losses of up to 5,000 baglogs. Furthermore, the burem disease was previously managed using rudimentary methods involving petrol and rat glue, posing risks to safety and production management.



Figure 4. The Participants make the botanical pesticides

An introduction to botanical pesticides provides participants with alternative knowledge for managing pests and diseases using an approach that places greater emphasis on environmental safety. This approach to pest management and the improvement of production processes forms part of efforts to enhance the quality of oyster mushroom cultivation through empowerment and mentoring activities (Casban et al., 2024; Chasanah et al., 2025). However, their application must still be carried out with care, taking into account the type of material, concentration, frequency of application and location of application, so as not to disrupt oyster mushroom growth or leave residues that could potentially affect product safety.

From the perspective of GAP implementation, contamination control should not rely solely on the use of control agents. Prevention through sanitation, the cleanliness of equipment and growing houses, the selection of healthy spawn, the sterilisation of baglogs, and environmental management must form an integrated whole. Thus, botanical pesticides are positioned as part of an integrated control strategy and not as the sole control method.

4. Understanding the Management of the Cultivation Chamber Microclimate

Participants also gained an understanding of the importance of managing the microclimate within the mushroom house, particularly temperature and humidity. The microclimate is an environmental factor that influences the growth and productivity of oyster mushrooms. The importance of improving cultivation techniques and applying appropriate technologies to support oyster mushroom productivity was also reported by Chasanah et al. (2025). The material presented emphasised that temperature, humidity, light and air circulation need to be managed in an integrated manner and monitored regularly. The participants' improved understanding of these aspects was reflected in the difference in evaluation scores, which rose from a pre-test average of 40–50 to a post-test average of 90.

Initially, the partners had not been optimally controlling the temperature and humidity in the greenhouses. Consequently, the activity aimed to raise awareness of the importance of regularly monitoring greenhouse conditions and adjusting environmental management in line with actual conditions. The activity proposal also aimed to implement greenhouse management practices in accordance with cultivation standards and to increase crop productivity by ≥ 15 per cent.

An understanding of the microclimate is essential because the success of oyster mushroom cultivation depends on the interaction between the quality of the spawn, the growing medium, hygiene and the growing environment. Improvements in one aspect without corresponding improvements in the others may result in sub-optimal yields. Therefore, microclimate management must be carried out in an integrated manner with the implementation of standard operating procedures (SOPs) for cultivation.

5. The Implementation of GAP as an Integrated Approach

The results of the activities showed that participants not only gained knowledge of specific techniques, but also began to understand the relationships between the various components of cultivation. Seedling improvement, contamination control and microclimate management are three interrelated aspects that contribute to greater production success. An integrated approach involving community participation, mentoring and the application of appropriate technology has also been reported to support capacity building in oyster mushroom cultivation (Chasanah et al., 2025).

The implementation of GAP in oyster mushroom cultivation can begin with the use of high-quality inputs, the proper execution of sterilisation, maintaining hygiene during spawn preparation and incubation, carrying out appropriate pest and disease control, and maintaining suitable environmental conditions in the growing house. In the proposal, this approach is set out through the development and implementation of standard operating procedures (SOPs) for cultivation, covering the selection of high-quality spawn, sterilisation, incubation, house maintenance, and harvesting.

Consequently, community engagement activities are not only focused on the transfer of knowledge, but also on changing farming practices. The participants' enthusiasm and their ability to understand the material form the foundation for the programme's sustainability. The next stage should focus on providing support for the routine implementation of these practices and the recording of production indicators, so that the impact of applying Good Agricultural Practices (GAP) can be measured more objectively.

The improvement in knowledge assessment results reinforces these findings. Out of the 10 questions set, participants' average score rose from a range of 40–50 in the pre-test to 90 in the post-test. Descriptively, these results indicate that the training material was well received and understood by the participants. However, the improvement in knowledge scores cannot yet be directly interpreted as an increase in productivity, as measurements of production output following the implementation of GAP were not carried out as part of this evaluation. Therefore, further monitoring should cover contamination levels, the number of successful baglogs, harvest productivity, and the temperature and humidity conditions in the mushroom houses..

Conclusion

The community outreach activity, which focused on strengthening oyster mushroom cultivation based on Good Agricultural Practices, was attended by 15 participants and received a positive response. Participants showed enthusiasm in taking part in the presentation of the

material, discussions, demonstrations and practical sessions. The evaluation results showed an increase in the average knowledge score from 40–50 in the pre-test to 90 in the post-test, which consisted of 10 questions. These results indicate that participants were able to understand the material on the improvement and handling of spawn, the prevention and control of contamination using botanical pesticides, and the management of the microclimate within the mushroom houses.

These three aspects must be implemented in an integrated and sustainable manner through standard operating procedures (SOPs) covering cultivation, sanitation, pest and disease control, and the monitoring of temperature and humidity levels in the mushroom houses. Ongoing support is required to ensure that the knowledge acquired can be applied consistently and that its impact on baglog success rates, productivity and harvest continuity can subsequently be measured. Thus, the strengthening of GAP is expected to support increased productivity whilst ensuring the sustainability of the partner oyster mushroom businesses.

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