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The Influence of Cultivation Techniques on Oyster Mushroom Production in Palangka Raya, Central Kalimantan Province, Indonesia

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Abstract. *Currently in Palangka Raya mushroom cultivation is increasing, and the more farmers are interested in doing so as the demand for mushroom products is still high and has not been met despite the decline from year to year. Differences in cultivation techniques at several stages will affect the yields of mushroom. The research was to determine the effect of cultivation techniques on oyster mushroom production at several mushroom farmers in Palangka Raya, it was carried out from March to April 2024. Observations and interviews were conducted to obtain information regarding data on land area, shelf mushrooms, humidity and temperature, watering, mushroom production, and other supporting data. Technical factors, technology for cultivating oyster mushrooms in Palangka Raya carried out by mushroom farmers are a). Providing additional nutrition once a week and watering the baglog will increase mushroom production one to two times than usual, b). Watering 2-3 times a day can reduce heat in the house and encourage mold growth. Strong motivation is one of the non-technical factors that can increase oyster mushroom production.*
Keywords: *cultivation technique, oyster mushroom, mushroom production, Palangka Raya*

1. INTRODUCTION

Oyster mushroom cultivation in Palangka Raya, Central Kalimantan Province, Indonesia is increasing currently, more and more farmers are interested in doing it, since it is a source of national income and helps alleviate poverty. Currently, there are more than 30 oyster mushroom farmers in Palangka Raya.

Mushroom cultivation and mushroom seedling in Palangka Raya were first initiated by Mr. Ir. Suharyoso around 2003, after that the mushroom business development was developed by Mr. Munari in 2006 and Mr. Budi Yanto in 2007 (Kalteng online, 2024). In 2024, the number of mushroom farmers in Palangka Raya increase even though according to statistical data the area and amount of production decreased from 2022-2023. The oyster mushroom harvest area in Palangka Raya is generally 1,470 m^2 in 2022 but decreased in 2023 to 1,360 m^2. Likewise, oyster mushroom production also decreased from 515 kg/kg in 2022 to 253 kg/kg in 2023 (BPS, 2024).

Mushroom cultivation techniques involve several different steps such as building mushroom houses, preparing seeds, preparing substrate, making baglogs, inoculating seeds in baglogs and maintaining baglogs and harvesting mushrooms (Sarita et al., 2023). Different techniques at several steps above will affect mushroom production. It is suspected that there are differences in techniques in the cultivation of oyster mushrooms carried out by mushroom farmers, so that there are differences in the amount of production which can be seen from statistical data that there has been a decrease in production results in the last year.

Optimizing the growth environment, which include light levels, humidity, and temperature, is one of the most critical elements for generating optimum yields. Maintain humidity by hanging jute sheets or coconut fiber mats along the walls and keeping them wet by watering them frequently during the planting phase in some traditional ways. During dry times there can be an increase in water loss because evaporation increases so that humidity decreases. The way to do this is by watering the floor or spreading sand on the floor (Sarita et al., 2023). This research aims to determine the effect of oyster mushroom cultivation techniques on oyster mushroom production in several mushroom farmers in Palangka Raya.

2. RESEARCH METHODS

Data was taken from five mushroom farmers in Palangka Raya. The farmers whose data was collected in this research were beginner farmers who had just received mushroom cultivation training at the end of 2023. The oyster mushroom cultivation training activity was carried out by experts from Palangka Raya University (UPR) and this activity was funded by the United Evangelical Mission (UEM) and the Central Palangka Raya GKE Resort assembly. The farmers started the mushroom business at the same time, in November 2023 until now. Making baglogs and inoculating mushroom seeds on baglogs is done at the same time and in the same way. In December 2023, each farmer was given baglog assistance in which 700 baglogs oyster mushroom seeds were planted.

Observation and interview are done to obtain information regarding land area data, mushroom shelf, humidity and temperature, watering, production data and other supporting data. Mushroom production data were taken from March-April 2024.

3. RESULTS AND DISCUSSION

The active baglog received by farmers for cultivation is around 700 baglogs, but the productive baglogs are almost the same, around 450 baglogs (some of the baglogs were not productive as the seeds were not good) except for farmer E who only used around 300 baglogs because many baglogs were left in the barn for too long, which temperature was very hot and unmaintained.

Farmers A and Farmers B's cultivation locations more benefit because their oyster mushroom cultivation locations are located above the Kahayan River, so the temperature in the 'kumbung' (mushroom house) is cooler than those cultivated on the ground, as well as the humidity being more humid (Table 1, Fig 2). To overcome high temperatures and to make the environment of the 'kumbung' more humid, watering is done more frequently, namely once every 2-3 days depending on the increase in temperature. Baglogs that were watered more frequently produced more than those that were watered less (Table 1, Fig. 1). Saputera et al. (20220) reported, the best treatment in accelerating the growth time of oyster mushroom shoots and the increase in wet weight of oyster mushrooms is four times the frequency of watering per day. This is in accordance with Ladli (2020) which states that oyster mushrooms can grow at moderate temperatures ranging from 20 to 30 °C and humidity 55-70%, but more optimal at require high moistness (70-85%) during fruiting.

The main ingredients in making baglog used by all farmers are the same, with the same nutrition, namely a mixture of 100 kg sawdust as a planting medium, 15 kg bran as an additional food source for mushroom growth and 2 kg lime and 1 kg gypsum (Ghofur, 2024). Even though the initial nutrition is the same when making baglog, there are differences in the provision of nutrition after the mushrooms grow on the baglog. Baglog which is given additional nutrition when watering will increase the

weight of the oyster mushroom fruit bodies (Tabel 1, Fig. 1, Fig 3).

Tabel 1. Technical and non-technical data regarding mushroom cultivation by beginner mushroom farmers in Palangka Raya

Information	Farmer				
	A	B	C	D	E
Location	Over the river	Over the river	On the land	On the land	On the land
Width kumbung	length 6 m, width 4 m	length 8 m, width 1.5 m	length 6 m, width 5 m	length 10 m, width 8 m	length 10 m, width 2 m
Kumbung height	2.5 m	4 m	3 m	4 m	6 m
Material of kumbung	Wall-wood, zink; roofing material-zinc	Wall-leaves of sago palm, screen plastick; roofing material: zinc	Wall-sement wall; roofing material: zinc	Wall-wood, zinc, screen plastic; roofing material: zinc	Wall-plastic,cement; roofing material-zinc
Material of shelves	Wood	Wood	Wood	Wood	Wood
Height of rack	2.5 m	2.5 m	2.5 m	2.5 m	2.5 m
Watering	2-3 times a day	2-3 times a day	2-3 times a day	2-3 times a day	once a day
Addition nutrient	JURAGAN (brand), give once in a week from March to April	NUTRISI NATURAL (brand), give every week from April	NUTRISI NATURAL (brand), give every week from April	NUTRISI NATURAL (brand), give every week from April	Nothing
Average of humidity	60%	65%	60%	65%	50%
Average of temperature	28 °C	27 °C	28 °C	28 °C	30 °C
Motivation for bussiness	strong	Strong	strong	Strong	weak
Learn cultivation from	UPR staff, youtube, other farmers	UPR staff, other farmers	UPR staff, other farmers	UPR staff, other farmers	UPR staff
Future plan	Increasing mushroom baglog amount	Increasing mushroom baglog amount and widen the area of kumbung	Increasing mushroom baglog amount	Increasing mushroom baglog amount	Nothing

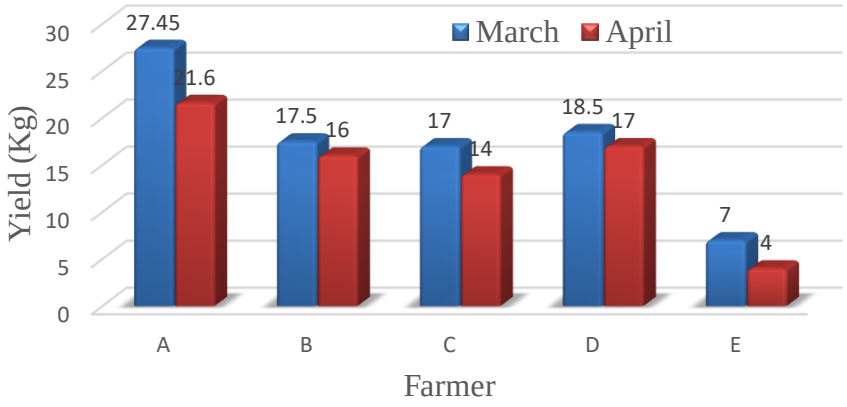

Figure. 1. Yield of oyster mushroom since March to April 2024 from five beginner mushroom farmers

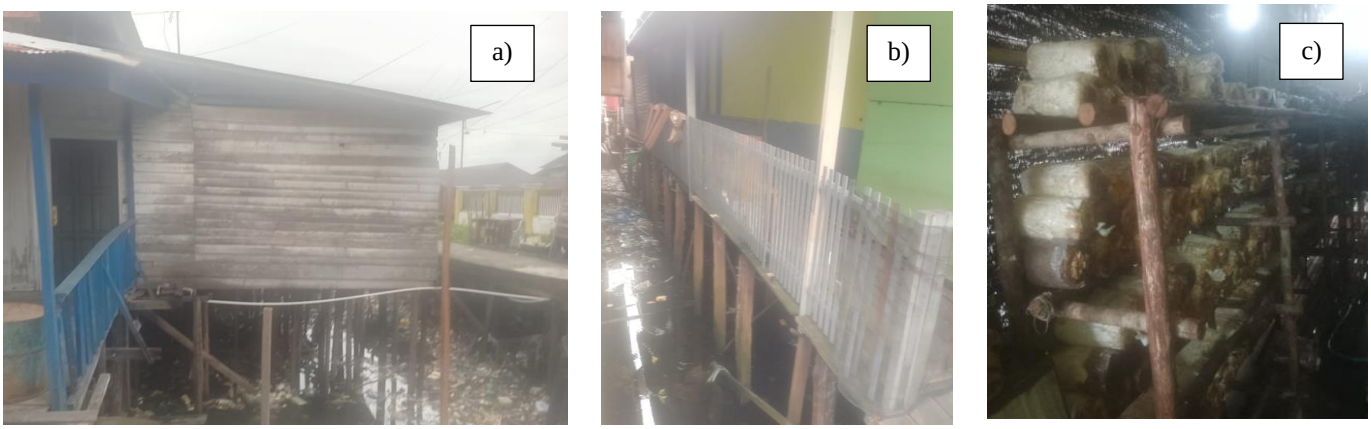

Figure 2. Kumbung is located above the river. a). A Farmer kumbung, b). B Farmer kumbung, c). Rack of oyster mushroom at B farmer

Figure 3. Kumbung is located on the ground. a). growth of oyster mushroom, b). Oyster mushroom racks and the condition of mushroom cultivation in D farmer

The highest mushroom production was obtained by mushroom farmer A, he used additional mushroom nutrition when watering, by adding 30 mL of nutrition namely Juragan to 17 liters of water which was sprayed once a week (Tabel 1, Fig 1). Juragan brand nutrition contains growth hormones such as gibberellin acid, indole acetic acid, kinetin, and zeatin. Ramachela & Sihlangu (2016) reported their research that hormones had significant effect on cap size and style length of oyster mushroom ($p \leq 0.05$). Cap sizes were; auxins: 13.42 cm, cytokinins: 9.9 cm and gibberellins: 7.13 cm and style lengths were: 6.93, 8.83 and 11.03 cm respectively.

Gibberellin acid is a plant growth regulator and an important hormone to encourage plant growth and development. It can increase cell and stem elongation, leaf expansion, parthenocarpy, fruit growth, break seed dormancy, change the ratio of male and female flowers, influence flowering time, and reduce flower and fruit loss. Indole 3 Acetic Acid IAA is a plant growth regulator, its working mechanism is to promote cell division, elongation and expansion, induce tissue differentiation, promote RNA synthesis, increase cell membrane permeability, relax cell walls, and accelerate protoplasm flow. Kinetin is part of a group of compounds known as cytokinin, a class of growth regulators in plants. In plants, kinetin promotes cell division and is active in the processes of cell growth and differentiation (Zhengzhou Delong Chemical Co, 2024). The zeatin hormone belongs to the cytokinin hormone group, a plant hormone which function is to accelerate and increase the process of cell division (Saburu *et al.*, 2016).

The second highest production is from mushroom farmers B, C and D, they almost have the same production as that they added additional fertilizer, namely Natural Nutrition brand just in April (Tabel 1, Fig. 1, Fig 3). The Natural nutritional contains 273 ppm Zn, 8.37% organic C, 0.24% Mg, 0.53% Ca, 34 ppm Fe, HA hormone, Zeatin hormone, and GA7 hormone. These nutrients and growth hormones cause higher oyster mushroom production compared to farmer E. This is in line with Mardiana et al. (2021) statement that to stimulate growth of oyster mushroom, it needs additional nutrients containing element C, N, P and K. The element Mg is an activator that acts as an energy transport for several enzymes in plants. Calcium plays a role in cell growth, strengthening and aintaining cell walls. Ca content in mushroom cultivation media also functions as a source of nutrition to affect growth of mushrooms wet weight (Mardiana et al., 2023).

Farmer E's cultivation technique is a bit different from others. He is not adding additional fertilizer to the baglogs, and the 'kumbung' environment is hotter than others, and watering is done only once a day, as a result the oyster mushroom production is lower than it should be (Tabel 1, Fig. 1, Fig 4).

An understanding of production technology is needed to increase the productivity of oyster mushrooms, such as favorable environmental conditions, in this case providing good space, appropriate aeration, adequate temperatures, relatively humid humidity, and satisfy nutrition (Sarita et al., 2023).

A non-technical factor that can increase oyster mushroom production is strong motivation from farmers. Strong motivation to develop a more developed business will encourage farmers to enthusiastically seek information on cultivation techniques and encourage the production of new innovations to increase mushroom production. Mushroom farmers A, B, C and D have innovated by adding nutrients when watering the baglogs. Apart from that, they also have a plan and have added new baglogs oyster mushrooms to further increase mushroom production. Low motivation causes no new innovations in cultivation, which indirectly causes lower mushroom production as well (Table 1, Fig 1).

Development of sustainable oyster mushroom agribusiness is an important issue currently, considering that oyster mushrooms have good opportunities and potential. The supporting facilities aspect is the most important aspect of the criteria that must be considered. Factors considered are the mushroom media or substrate, return on investment (financial), public perceptions and attitudes in consuming oyster mushrooms (sociocultural), capital (institutional), availability of labor (human resources), readiness for adoption (technology), and market (supporting facilities) and the main sub-criteria is market demand (Kusrini et al., 2019).

4. CONCLUSION

1.) Technical factors, technology for cultivating oyster mushrooms in Palangka Raya carried out by mushroom farmers are:
   a). Providing additional nutrition once a week and watering the baglog will increase mushroom production one to two times higher than usual.
   b). Watering 2-3 times a day can reduce the heat in the mushroom house and encourage fungal growth.

2). Strong motivation is one of the non-technical factors that can increase oyster mushroom production.

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