Journal of Agricultural Sciences (Agrosci)
e-ISSN 3047-2423
p-ISSN 3032-7547

Volvariella Volvacea Mushroom Production in Some Growing Media

Noertjahyani[*1], Harri Hanafi[2], Ai Komariah[1], Lia Amalia[1], Indriana Ulfah[1], R.Budiasih[1]
[1]Agriculture Faculty, Universitas Winaya Mukti
[2] Agrotechnology, graduate student, Agriculture Faculty, Universitas Winaya Mukti
***Corresponding author: noertjahyani@yahoo.com**

Abstract
Background. *Volvariella volvacea* (straw mushroom) is a high-demand agricultural commodity. Rice straw is used as a planting medium in this crop production. During the harvest season, this type of media is abundant. Other press must be used to produce straw mushrooms continuously.
Aims. This research aims to study the growth and yield of the mushroom *V. volvacea* on various growing media. Karawang regency hosted an experimental study.
Methods. The experimental design was a randomized complete block design with six treatments and four replications. The treatment of mushroom growing media in rice straw, rice husk, waste from textile fabric (cotton), and three other treatments was a 1:1 (v/v) mixture of these planting media.
Result. The findings revealed that different planting media had an impact on the growth and yield of straw mushrooms.
Conclusion. The highest mushroom production was obtained by combining the growing media ,straw and husk ,in a 1:1 ratio.
Implementation. Rice husk can be used as a substitute for straw as a growing medium.

Keywords: Straw mushroom; Rice straw; Waste Cotton; Husk

INTRODUCTION

Mushrooms are one of the most well-liked commodities within the mushroom group. People enjoy mushrooms because they are high in nutritional value and have a delightful taste. The mineral content of mushrooms is higher than that of beef and lamb (Chen & Buswell, 2004).

Furthermore, mushrooms contain selenium (15.2 g/100 g) and ergothioneine (53.73 mg/100 g), which are antioxidants that protect the body from free radicals and inflammation (Retno Wulansari & Karlina, 2020). Straw mushroom protein contains all the essential amino acids found in eggs, with a higher content of lysine and histidine (Kementerian Republik Indonesia, 2022).

The demand for straw mushrooms is increasing due to growing public awareness of their nutritional benefits. According to the findings, there is a 15-ton-per-day demand for edible mushrooms in certain cities of Indonesia, including Jakarta, Bandung, Bogor, Sukabumi, and their surrounding areas in West Java (Widyastuti, 2016). According to this, the prospects for developing this straw mushroom appear to be very promising. Depending on the cultivation technique, straw mushrooms can be harvested in as little as 1-3 months. As a result, the turnover of business capital can occur quickly. Furthermore, this straw mushroom grows on readily available media and does not require a large amount of land. The mushroom business is a job opportunity as part of an effort to improve the economy and farmers' standard of living.

Straw is a common medium for mushroom cultivation. As a result, mushroom cultivation is most common in rice-growing areas such as Karawang Regency and Indramayu. As the name implies, this mushroom grows well on straw and compost media. Straw from the rice harvest yields 1.4 times the amount and contains C 35.11%, N 1.86%, K2O 5.35%, and P2O5 0.21% (Indonesia Bertanam, 2012). The large amount of straw generated from rice waste is still insufficient to meet the demand for mushroom growing media. This condition is because straw is only available during the harvest season. Weather conditions also affect the availability of straw. Due to uncertainty in the weather during the rice harvest, mushroom farmers will refrain from using rice straw. This condition contributes to the insufficiency of straw stock as a growing medium. As a result, alternative media that can also positively impact the growth and yield of the straw mushroom are required.

Various types of mushroom growing media are being developed at the moment. Mushrooms flourish in composted paper waste, empty palm oil bunches, banana stem compost, cotton waste, husk charcoal, and biomass compost. Because it contains nutrients for mushroom growth, husk charcoal can be used as mixed or alternative media. Husk charcoal media is one medium that can be used for the growth of F1 straw mushroom and white oyster mushroom seeds. However, mycelium growth on cardboard media is superior to husk charcoal media (Bety Rahayu, 2016).

Bustamam's (2017) study found that a 75% husk and 25% straw mixture produced the best edible mushroom growth. The addition of 20% husk charcoal and 15% rice bran resulted in the best mycelial growth; however, the highest productivity was observed in the media containing 15% husk charcoal and 15% rice bran (Ali Yazid Muchsin, 2017). Straw mushroom farmers in Indramayu demonstrate that cotton has been widely used as a medium for straw mushrooms in addition to husk charcoal. According to research, cotton waste is the most suitable medium for straw mushroom production and growth (Jagapati, 2018).

Rice husk, which is agricultural trash, and cotton, which is textile industrial waste, are abundant and consistent. Furthermore, the usage of these wastes is inefficient. As a result, this study was conducted to investigate the effects of various media on the productivity of straw mushrooms and to determine the composition of the media that yielded the maximum output. It is expected that the usage of these two wastes will be employed as an alternative medium, allowing mushroom production to flourish.

RESEARCH METHOD

This study employs an experimental approach to verify its findings. In a mushroom planting medium, the experiment was conducted in Cikalong Village, Cilamaya Wetan District, Karawang Regency, West Java. The planting area is located at an elevation of 6 meters above sea level. Media-soaking tubs, plastic tarpaulin coverings, hooks, pasteurized furnaces, digital scale hygrometer thermometers, and writing instruments were used in this experiment. F3 mushroom seeds, straw, rice husks, cotton, and firewood were used in this experiment.

A Randomized Block Design (RBD) was used in the experimental design. The experimental treatment in mushroom media consisted of rice straw, rice husks, cotton, and three other treatments, which were a 1:1 (v/v) combination of these planting media. Each treatment was repeated four times, resulting in a total of 24 experimental plots. Each plot is 1 x 0.5 m in size. The previously used growing media was composted for seven days before being incorporated into the planting media according to the treatment plan. The medium thickness for each treatment was 15 cm. Furthermore, pasteurization at 70 °C was accomplished by introducing vapor into the planting media via a steam chimney (Figure 1).

DOI 10.62885/agrosci.v2i6.815

(a)

(b)

Figure 1: Mushroom culture activities (a) pasteurization of planting place and (b) research growing media

One day after pasteurization, F3 seeds were either injected or planted at a temperature of 30 °C. The F3 seeds used are ready-to-plant varieties. The seeds are equally distributed across the surface of the media. Each 0.5 m^2 media area received 100 g of mushroom seeds. The temperature of the planting site is maintained between 30 °C and 31 °C throughout the mycelium growth period. Mushrooms are harvested ten days after they are planted. Harvesting occurs in the morning around 6 a.m. on mushrooms that have reached the egg phase (oval-shaped).

The number of fruiting bodies, average fruit body weight, total weight per harvest period, and the length of the harvest period were collected as primary data. In this experiment, the harvest period was repeated twice. The overall production of straw mushrooms, the sum of the first and second harvests, was also observed. Temperature and humidity measurements were taken in the planting place and on the medium during the experiment.

RESULT AND DISCUSSION

Table 1 shows the temperature and humidity observations made during the experiment. There appear to be variances in the environmental conditions in the growing media. During the experiment, the temperature and humidity of the planting place met the parameters for mushroom growth and development, specifically 30 °C and 89% humidity. The ideal temperature and humidity for growing straw mushrooms are 30 °C-38 °C, with an optimal temperature of 35 °C and an optimal humidity of 80-90% (Bambang Sunandar, 2010; Wahyu Nurwijayo, 2021).

Table 1. Temperature and Humidity of Planting Place and Media during Experiment

Place and Time Measurement	Temperature (C)	Humidity (%)
Planting place:		
After seed inoculation until harvest, I	31	89
After inoculation of seeds until harvest II	30	89
Planting media at harvest I:		
Straw	27	89
Husk	32	88
Cotton	29	89
Straw: Husk (1:1 v/v)	30	89
Straw: Cotton (1:1 v/v)	27	89
Husk: Cotton (1:1 v/v)	26	90
Planting media at harvest II:		
Straw	27,5	89
Husk	30,5	80
Cotton	27,5	89
Straw: Husk (1:1 v/v)	29,5	89
Straw: Cotton (1:1 v/v)	27,5	89
Husk: Cotton (1:1 v/v)	26	89

According to the F test results (Table 2), different straw mushroom growth media affected straw mushroom yield and production, except for the average weight of the first harvested fruit and the length of the first harvest period.

Table 2. The test results for the diversity of yield components and the production of straw mushrooms on different growing media

No.	Response variable	F value count	$F_{.05}$
1.	Number of harvested fruits I	3,15 *	
2.	Number of fruits harvested II	52,33 *	
3.	Average body weight of harvested fruit I	$1{,}98^{ns}$	
4.	Average body weight of harvested fruit II	6,15*	2,90
5.	Yield I	6,52*	
6.	Yield II	4,95*	
7.	The harvest period I	$1{,}45^{ns}$	
8.	Harvest period II	25,05*	
9.	Production (yield I and harvest II)	11,50*	

*Significant; ^{ns} not significant

The growing media contains various nutrients, minerals, and other chemicals, contributing to diversity. According to Asanti (2019), the composition of growth media influences nutrient availability. Furthermore, the water-holding capacity of the growing media varies, causing environmental variables such as temperature and humidity to fluctuate, which in turn affects the ability to grow and form mycelium and fruiting bodies.

According to the F test results (Table 2), different straw mushroom growth media affected straw mushroom yield and production, except for the average weight of the first harvested fruit and the length of the first harvest period. The growing media contains various nutrients, minerals, and other chemicals, contributing to diversity. According to Asanti (2019), the composition of growth media influences nutrient availability. Furthermore, the water-holding capacity of the growing media varies, causing environmental variables such as temperature and humidity to fluctuate, which in turn affects the ability to grow and form mycelium and fruiting bodies.

The combination of straw, husk charcoal, cotton, or a mixture of these materials influences the average fruit bodyweight of straw mushrooms, as shown in the second harvest (Table 1). Fruiting body weights were more significant in straw and husk medium (1:1 v/v) but not statistically different from rice husk media (Table 3). Straw media has enough nutrients and minerals to support the growth of mycelia and mushroom fruiting bodies.

Table 3. Average Body Weight of Straw Mushrooms on Different Growing Media

Growing medium	Average weight per fruit (g) on	
	Harvest I	Harvest II
Straw	21,55 a	22,32 b
Husk	22,12 a	22,65 bc
Cotton	22,77 a	21,67 a
Straw and husk (1:1 v/v)	23,02 a	22,90 c
Straw and cotton (1:1 v/v)	22,25 a	22,22 b
Husk and cotton (1:1 v/v)	21,02 a	22,25 b

Remark: Numbers followed by the same letter in each column indicate that they are not Significantly different according to Duncan's test at the 5% level.

Rice husk media generates an environment that promotes the metabolic process of mushrooms. According to the findings of supporting observations, the temperature and humidity of the media on the husks were 30.5 °C and 80%, respectively, which were ideal circumstances for the growth and production of edible mushrooms. According to Setiyono (2018), rice husks have sufficient water storage capacity to maintain the media's humidity at a constant level.

The plant media applied affected the number of fruits collected I and II (Table 2). The number of fruits harvested in the first harvest was nearly identical for both those who used straw and those who used alternative media. Although the nutrient and mineral content of each medium varied as shown in the first harvest, the nutrient supply contained in each medium was still sufficient for mycelia growth and fruiting body formation (the level of intraspecies competition was still low or had not yet occurred), yielding nearly the same number of fruits (Table 4). Unlike the second harvest, the media had a substantial impact on the number of fruits. This condition was because of the limited cellulose availability in each medium. This condition led to intraspecific competition and variation in the number of fruits produced in each medium. Intraspecific or interspecific competition occurs when organisms compete for nutrients, food, water, space, or other ecological factors.

Table 4. Average number of fruiting bodies in the first and second harvests of straw mushrooms grown on various growing media.

Growing media	Average Number of Fruiting Bodies	
	Harvest 1	Harvest II
Straw	18,75 ab	24,00 c
Husk	36,25 a	45,00 a
Cotton	24,25 a	24,50 c
Straw and husk (1:1 v/v)	19,50 ab	30,75 b
Straw and cotton (1:1 v/v)	20,75 ab	26,50 bc
Husk and cotton (1:1 v/v)	11,00 b	11,75 d

Remark: Numbers followed by the same letter in each column indicate that they are not significantly different according to Duncan's test at the 5% level.

Resources are required for survival and growth (Kusumawati, 2018). The rice husk media produced the most fruits, while the rice husk and cotton combination media produced the fewest (Table 4). Rice husk media has a high protein content (8.77%) (Syahrir, 2018), supported by suitable media conditions, such as a 30 ℃ temperature and a high humidity level, which are ideal for mycelia development and fruiting body production.

The kind of media affected the first, second, and third yields and mushroom output (Table 2). Table 5 shows the outcomes of further investigation. The husk media produced larger yields in the first, second, and third harvests. Higher fruit bodyweight and quantity of fruiting bodies confirm this. Furthermore, the husk media includes more balanced nutrients and constant temperature and humidity conditions, resulting in improved growth, yields, and production.

Table 5. Total Weight of First, Second Harvest, and Production of Straw Mushrooms on Different Growing Media

Growing media	Yield (kg)		Total weight (production) (kg/0,5 m^2)
	Harvest I	Harvest II	
Straw	0,41 b	0,56 b	0,96 b
Husk	0,76 a	0,86 a	1,62 a
Cotton	0,41 b	0,61 ab	1,02 b
Husk and Straw (1:1 v/v)	0,44 b	0,62 ab	1,05 b
Straw and Cotton (1:1 v/v)	0,47 b	0,46 bc	0,92 b
Husk and Cotton (1:1 v/v)	0,24 b	0,26 c	0,51 c

Remark: According to Duncan's test, numbers in each column that are followed by the same letter indicate that they are not substantially different at the 5% level

Only the second harvest was affected by the length of the harvest period due to the usage of different media (Table 6). Because nutrients and minerals were not growth factors that were competed by straw mushrooms in the media, the length of the initial harvest period was not significantly different due to different media. The availability of nutrients in the media reduces as time passes and the mushroom population grows. The availability of nutrients will influence mycelium growth. Cotton has the most cellulose (93%) of the three types of media (Sitorus, 2018), followed by rice husk with 50% and rice straw with 34% (Sitorus, 2018). (Syahrir, 2018). According to Chen and Buswell (2004), the higher the availability of nutrients, the faster the mushrooms grow and develop, and the longer the harvest period. The combination of husk: cotton media produced the second shortest harvest duration in this experiment (Table 6). During the growth and development of straw mushrooms, the temperature in this medium averaged 26°C (low) with 89 % humidity (Table 2). This temperature will prevent fruit bodies from forming and reduce the harvest period.

Table 6. Length of Harvest Period of Straw Mushroom on Different Growing Media

Growing Media	Harvest period (days)			
	Harvest I		Harvest II	
Husk	5,00	a	6,25	a
Straw	4,75	a	7,25	a
Cotton	4,00	a	6,50	a
Husk and straw (1:1 v/v)	4,50	a	6,50	a
Husk and cotton (1:1 v/v)	4,00	a	6,25	a
Straw and cotton (1:1 v/v)	3,75	a	3,50	b

Remark: Numbers following the same letter in each column suggest no significant difference in DMRT at the 5% level.

CONCLUSION

The growing medium has an impact on mushroom yield. The most effective growing medium was rice husk (1.62 kg/0.5m2). As an alternative to rice straw, rice husk can be used.

BIBLIOGRAPHY

Ali Yazid Muchsin, Wisnu Eko Murdiono, dan Moch Dawam Maghfoer. 2017. Pengaruh Penambahan Sekam Padi dan Bekatul terhadap Pertumbuhan dan Hasil Jamur Tiram Putih Pleurotus Ostreatus. Plantropica Journal of Agricultural Science, 2(1): 30-38

Asanti, V.A. 2019. Pengaruh Suplement Organik Tanaman terhadap Pertumbuhan dan Perkembangan Jamur Merang (Volvariella volvaceae). *J. Floratek*. vol 3. pp. 11–18.

Badrut Tamam, MH. 2016. Kompetisi Intra spesies dan Interspesies dalam Ekosistem dalam https://generasibiologi.com/2016/10/kompetisi-intraspesies-dan-interspe-sies.html.

Bambang Sunandar. 2010 Budidaya Jamur Merang. Ed. Susi Mindarti, Sri Murtiani dan Anna Sinaga. Balai Pengkajian Teknologi Pertanian Jawa Barat. Balai Besar Pengkajian dan Pengembangan Teknologi Pertanian, Badan Penelitian dan Pengembangan Pertanian, Kementerian Pertanian. 19 Hal. https://jabar.litbang.pertanian.go.id/images/stories/FEATI/jukjamur_2010.pdf

Bety Rahayu, 2016. Pertumbuhan Miselium Bibit F1 Jamur Tiram Putih dan Jamur Merang pada Media Kardus dan Arang Sekam dengan Bekatul sebagai Campuran Media Skripsi Fakultas Keguruan dan Ilmu Pendidikan Universitas Muhammadiyah Surakarta. http://eprints.ums.ac.id/42849/1/NASKAH%20PUBLIKASI.pdf

Bustamam, A. 2017. Pertumbuhan Jamur Merang (Volvariella volvacea) pada Media Tanam Jerami dan Limbah Sekam. http://jim.unsyiah.ac.id/pendidikan-biologi/article/view/4965

Chen, S., Ge, W. and Buswell, J. A. 2004. Biochemical and molecular characterization of a laccase from the edible straw mushroom, Volvariella volvacea. *Eur J. Biochem*, 328(271), pp. 318–328. doi: 10.1046/j.1432-1033.2003.03930.x.

Indonesia Bertanam. 2012. Kandungan Hara Kompos Jerami Padi. https://indonesiabertanam.com/2012/03/26/kandungan-hara-kompos-jerami-padi/ : Jerami yang dihasilkan setiap kali panen padi adalah 1,4 x dari hasil panen. Kandungan kompos Jerami padi C 35,11%, N 1,86%, K2O5,35% ,P2O5 0,21%

Irawati. 2017. Produktivitas Jamur Merang (*Volvariella volvaceae*) pada Media Campuran Sekam dan Jerami yang di Tanam dalam Baglog dan Keranjang. https://core.ac.uk/download/pdf/148615134.pdf

Jagapati.com. 2018. Mengulas si Jamur Merang. https://www.jagapati.com/artikel /Mengulas-si-Jamur-Merang

Kementerian Republik Indonesia, 2022. Prospek Bisnis Jamur di Tengah Pandemi Covid 19. https://www.Pertanian.go.id

Kusumawati, Dian Eka 2018. Pengaruh Kompetisi Intraspesifik dan Interspesifik terhadap Pertumbuhan Tanaman Jagung (Zea mays) dan Kacang hijau (Vigna radiata). Agroradix Vol. 1 No.2 (2018) Hal. 28-33 . ISSN : 2621-0665. DOI: https://doi.org/10.52166/ agroteknologi. v1i2.923. dari https://core.ac.uk/download/pdf/229348095.pdf

Retno Wulansari dan Karlina, L. 2020. Manfaat Jamur Merang Berdasarkan Kandungan Nutrisinya. https://www.sehatq.com/artikel/manfaat-jamur-merang-berdasarkan-kandungan-nutrisinya 12 mey 2020

Sitorus, C., Sukeksi, L. dan Sidabudatar, J. 2018. Ekstraksi Kalium Dari Kulit Buah Kapuk (Ceiba Petandra). *Jurnal Teknik Kimia USU*. Vol 7(2). pp. 17–22.

Syahrir, S. 2018. Nilai Nutrisi Pakan Berbahan Jerami Padi, Gamal Dan Urea Mineral Molases Liquid (UMML) Dengan Preparasi Yang Berbeda. *Buletin Nutrisi dan makanan Ternak*, 2, pp. 78–84.

Wahyu Nurwijayo. 2021. Cara Budidaya Jamur Merang untuk Pemula Modal, Murah dan Mudah. https://gdm.id/cara-budidaya-jamur-merang/

Widyastuti, B. 2016. Budidaya Jamur Kompos : Jamur Merang, Jamur Kancing (Champignon). Jakarta: Penebar Swadaya.