Comparison of Mushroom Substrate from Para Rubber vs. Cashew Sawdust on Growth and Yields of Pleurotus Ostreatus

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A R T I C L E I N F O	A B S T R A C T
  	In Cambodia, para rubber sawdust is commonly used to cultivate oyster mushrooms due to its availability as a byproduct from wood factories, but country's significant cultivated cashew could be an alternative substrate. Hence, exploring new substrates becomes essential for farmers when there's a scarcity or price hike in para rubber. This study is in purpose of investigation the impact of para rubber vs. cashew sawdust and different mixture formulas on the growths and yields of *Pleurotus ostreatus*. The experiment was conduct in Factorial in CRD with two main factors: A) two different saw dusts which were para rubber sawdust and cashew sawdust and factor (B) was mushroom mixture formulas (B1 – B6). B4 of cashew sawdust displayed the highest efficiency at 32.24%, while B3 and B4 of para rubber sawdust showed efficiencies of 23.57% and 23.54%, respectively. In conclusion, based on this experiment, cashew proves more effective than para rubber for *Pleurotus ostreatus* production. Specifically, B4, consisting of 100kg of cashew sawdust, 8kg of rice bran, 1kg of calcium carbonate, 1kg of palm sugar, 1kg of sticky rice flour, and 0.2kg of magnesium sulfate, maximizes yields for *P. ostreatus* cultivation.

INTRODUCTION

Cambodia, situated in a tropical region, exhibits a climate characterized by tropical savanna conditions and monsoons (Buckley et al., 2010). This climate fosters the growth of numerous edible mushrooms, including straw mushrooms, oyster mushrooms, and jelly mushrooms. Among these species, the oyster mushroom (*Pleurotus* sp.) stands out as particularly favored by Cambodians due to its versatility in culinary applications, especially in dishes served during wedding ceremonies. Consequently, there exists a high demand for this mushroom type within the country.

While Cambodia hosts a diverse array of oyster mushroom species, the most commonly produced and sold varieties are *Pleurotus ostreatus* (Fr.) Kummer and *Pleurotus pulmonarius* (Phillips, 2006). Para rubber sawdust serves as the predominant substrate for oyster mushroom cultivation in Cambodia (Srey, 2019). This reliance stems from the abundance of para rubber cultivation in provinces such as Kampong Cham and Thbong Kmum, coupled with the presence of numerous wood processing factories that generate para rubber sawdust as a byproduct. However, alternative wood sawdust sources, such as *Mangifera indica* L. or *Anacardium occidentale* L., have also been explored for oyster mushroom cultivation in various regions. Additionally, materials like oil palm petiole, bagasse, or rice straw have been utilized as substrates (Lin et al., 2015; Aguilar-Rivera & Jesús-Merales, 2010; Yang et al., 2013). Thus, the choice of substrate often depends on the geographical location, with the potential for cost-effectiveness and higher yields.

The demand for para rubber sawdust in Cambodia is steadily increasing alongside the growing number of mushroom growers, leading to shortages in supply. Consequently, wood factories have encouraged growers to utilize cashew sawdust (*Anacardium occidentale* L.) as an alternative substrate, given the substantial plantation areas of this plant in Cambodia (Padwe, 2011). However, concerns have arisen regarding the use of cashew sawdust. Some growers have reported lower yields in oyster mushroom production when utilizing cashew sawdust, despite its price being equivalent to that of para rubber sawdust. In response to this issue, an experimental study was conducted to investigate and compare the growth and yields of *Pleurotus ostreatus* (Fr.) Kummer when utilizing both types of sawdust.

LITERATURE REVIEW

The oyster mushroom belongs to the genus *Pleurotus*, comprising approximately 25 species such as *P. columbinus*, *P. flabellatus*, *P. florida*, *P. ostreatus*, and *P. sajor-caju*, which thrive as decomposers. It grows well on decomposed wood, making it easy to cultivate as these mushrooms do not require any special conditions for growth (Khare et al., 2006). Oyster mushrooms have gained popularity worldwide for their appealing taste and nutritional richness, contributing to increased production annually (Galappaththi et al., 2024). They thrive on cellulose, present in substrates like rice straw, wood sawdust, dry grass, corn cobs, etc. (Jongman et al., 2018).

The study of cultivating oyster mushrooms began in 1917 with Falck, who described the cultivation of oyster mushrooms on wood and tree branches.

Subsequently, Kaufert & Etter (1929) conducted research on cultivating mycelium on artificial mediums of *Pleurotus corticalus* and *P. ostreatus* in laboratory settings. In 1959, Block et al. (1959) demonstrated the cultivation of mushrooms on wood sawdust, revealing that oyster mushrooms could thrive and yield better than other mushroom species. The initial industrial production of oyster mushrooms in Europe and America commenced in 1974 (Kalberer & Vogel, 1974). Currently, China holds the distinction of being the largest producer of oyster mushrooms. In 2020, China produced approximately 44 million tons of oyster mushrooms, surpassing Japan and America, which produced 52 and 40 million tons, respectively (Reportlinker, 2022).

METHODOLOGY
Experiment Process

This experiment was conducted in Factorial in CRD while factor A is represented two types of sawdust which was A1 = para rubber sawdust and A2 = cashew sawdust. Factor B is represented the type of mushroom substrate formula with the following details:

B1: 100kg of sawdust (Control)

B2: 100kg of sawdust, 5kg of rice bran, 1kg of $CaCO_3$, 2kg of gypsum and 0.2kg of $MgSO_4$ (Pitakthong, 2015)

B3: 100kg of sawdust, 7kg of rice bran, 1kg of broken rice, 1kg of $CaCO_3$, 0.5kg of gypsum, 0.2kg of $MgSO_4$ and pumice powder (Author's formula)

B4: 100kg of sawdust, 8kg of rice bran, 1kg of palm sugar, 1kg of sticky rice powder and 0.2kg of $MgSO_4$ (ESCAE Thailand, 2015)

B5: 100kg of sawdust, 6kg of rice bran, 1kg of $CaCO_3$, 0.5kg of gypsum and 0.2kg of $MgSO_4$ (ESCAE Thailand, 2015)

B6: B4: 100kg of sawdust, 5kg of rice bran, 1kg of caster sugar, 1kg of $CaCO_3$ and 0.2kg of $MgSO_4$ (ESCAE Thailand, 2015)

The pure culture of *Pleurotus ostreatus* (Fr.) Kummer was sourced from the Department of Agronomy at the Kampong Speu Institute of Technology (KSIT), Cambodia. The mushrooms were cultured on Potato Dextrose Agar (PDA) and maintained at 4°C in a refrigerator for subsequent subculturing onto rice grain. Para rubber and cashew sawdust were procured from a wood factory in Tbong Khmum province, while rice bran, broken rice, caster sugar, sticky rice powder, and palm sugar were acquired from farmers in Kampong Speu province. Magnesium sulphate salt, calcium carbonate, and gypsum powder were purchased from a vendor in Battambang province.

Following the acquisition of all ingredients, they were thoroughly mixed according to the specified formula while ensuring that the substrate's moisture content remained between 65% and 70%. Subsequently, the mixed substrate was packed into 4x14 inches plastic bags and subjected to 100°C hot steam for a duration of 4 hours. Afterward, the substrate bags were allowed to cool to ambient temperature before approximately 10g of mushroom spawn was introduced into each bag. The bags were then maintained at ambient temperature for a period of 30 days or until the mushroom mycelium colonized

the entire substrate within the bag. Throughout the incubation period, ambient temperatures were recorded at four intervals: 6:00 - 7:00 am, 12:00 - 13:00 pm, 16:00 - 17:00 pm, and 20:00 - 21:00 pm.

After the mycelium filled in, the mushroom spawn bags were transferred to the nursery and watered three times per day for 10 minutes each time using an automatic pump. During the fruiting period, ambient temperatures and moisture levels in the nursery were recorded at four intervals: 6:00 - 7:00 am, 12:00 - 13:00 pm, 16:00 - 17:00 pm, and 20:00 - 21:00 pm. Mushroom yields were collected for a period of 90 days following their placement in the nursery.

Data Collection
Chemical Properties of Mushroom Substrate

The pH value of the mushroom substrate was determined following the method outlined by Geffert et al. (2019). Approximately 0.2g of substrate was weighed and placed into a 100ml beaker, to which 40ml of distilled water was added. The mixture was thoroughly mixed and left at ambient temperature for 24 hours. Subsequently, the solution was filtered using Whatman No.1 filter paper and measured using a pH meter (Benchtop pH Meter PHS-25CW PHS-3BW PH-210, Biobase, China).

Total organic carbon (TOC) content was assessed according to the procedure described by Walkey & Black (1934). Approximately 0.05g of substrate was weighed and placed into a 125ml Erlenmeyer flask. Then, 10ml of 1.0 N potassium dichromate solution ($K_2Cr_2O_7$) was added, followed by thorough mixing. Next, 20ml of concentrated sulfuric acid (H_2SO_4) was poured into the flask, and the mixture was shaken for 1 – 2 minutes before being left at ambient temperature for 30 minutes. Subsequently, 40ml of distilled water was added, and 2 or 3 drops of O-phenanthroline indicator were introduced. The solution was titrated with Ferrous sulfate ($FeSO_4$): 0.5 until the endpoint was reached. A blank was prepared following the same procedure, excluding the substrate. Upon recording the results, the TOC content was calculated as follows:

$$\text{TOC (\%)} = (\text{me. } K_2Cr_2O_7 - \text{me.FeSO}_4) \times (0.003 \times 100 \times 1.33)/ W \quad (1)$$

Information:
TOC = Total organic carbon
%Organic Matter (OM) = TOC x 1.72
me = Conc. (N) x volume (ml)
W = Weight of mushroom substrate

The total nitrogen content was determined using the Kjeldahl method (AOAC, 1995). One gram of mushroom substrate was weighed and placed into a Kjeldahl flask (n = 3), to which 0.3055g of glycine and 2 Kjeltabs 3.5 Cu were added. Subsequently, 15ml of H_2SO_4 was poured into the flask, and the mixture was digested in a digestion machine at 420°C for 120 minutes. After cooling, the solution was treated with 50ml of 4% boric acid and 3 drops of methyl red indicator. The solution was then distilled with 40% NaOH and titrated with standard 0.1 N H_2SO_4. The nitrogen content was calculated as follows:

$$TNC\ (\%) = (V1 – V2) \times N \times 0.014 \times 6.25 \times 100 / W \qquad (2)$$

Informations:

TNC = Total Nitrogen Content

V1   = Volume of H_2SO_4 0.1 N Standard titration

V2   = Volume of H_2SO_4 0.1 N Standard Blank

N   = Concentration of standard acid (N)

W   = Weight of mushroom substrate (g)

Mushroom Growth and Yields

The mushroom mycelium growth rate (mm/day) was measured at 20 days after inoculation with mushroom spawn. Both sides of the bag were measured, combined, and then divided by 2. The length of mycelium growth was divided by 20 to observe the growth rate in millimeters per day. The sample consisted of 10 replications, with one bag per replication. The number of days until the mushroom mycelium filled the entire bag (days) was recorded, with 10 replications, and one bag per replication.

The mushroom fruiting bodies were collected and weighed daily for 90 days after transfer to the nursery to observe fresh weight or yield per bag. The dry weight was determined by placing the mushroom fruiting bodies in a hot air oven at 70°C for 72 hours. The sample comprised 10 replications, with one bag per replication.

The biological efficiency (%BE) was calculated by weighing the dry weight of the mushroom fruiting bodies and dividing by the dried substrate per bag as follows (Girmay et al., 2016):

$$BE\ (\%) = DW\ of\ MFB \times 100 / DW\ of\ S1B \qquad (3)$$

Informations: BE = Biological efficiency

DW   = Dry weight

MFB = Mashroom fruiting body

S1B = Substrate in one bag

Data Analysis

The data were recorded in Microsoft Excel and subjected to analysis of variance (ANOVA) at a significance level of 95%. Treatments that exhibited significant differences were further analyzed using Duncan's Multiple Range Test.

RESULTS
Chemical Properties of Mushroom Substrate

The formula B1 represents pure sawdust without any supplemented nutrients. The pH values of para rubber and cashew sawdust were 7.73 and 7.08, respectively. The total organic carbon (TOC) content of para rubber sawdust was 39.41%, which was lower than that of cashew sawdust at 48.63%. Additionally, the total nitrogen content of para rubber sawdust was twice as

high as that of cashew sawdust, with values of 0.23% and 0.16%, respectively, leading to differences in the C:N ratio. Para rubber sawdust exhibited a lower C:N ratio compared to cashew sawdust, with values of 174.17 and 303.04, respectively (Table 1).

Table 1. Chemical Properties of Mushroom Substrate

Sawdust	Substrate formula	pH	Total Organic Carbon (%)	Organic Matter (%)	Total N (%)	C:N Ratio
Para rubber	B1	7.73	39.41	67.78	0.23	174.17
	B2	7.61	41.82	71.93	0.37	112.58
	B3	7.99	43.07	74.08	0.30	141.53
	B4	7.21	45.81	78.80	0.35	129.09
	B5	8.14	41.47	71.33	0.36	114.60
	B6	7.36	45.67	78.55	0.32	142.13
Cashew	B1	7.08	48.63	61.76	0.16	303.04
	B2	6.21	45.79	58.15	0.24	187.33
	B3	6.33	43.85	55.69	0.26	170.69
	B4	6.39	47.63	60.49	0.36	132.80
	B5	6.99	45.22	57.43	0.30	152.58
	B6	5.61	44.10	56.01	0.32	139.28

Formulas B2 to B6 represent sawdust mixed with supplemental nutrients. Para rubber sawdust, after being mixed with nutrients, maintained its pH value except for formula B5, which increased the pH from 7.73 to 8.14. Conversely, cashew sawdust exhibited a decrease in pH value after mixing with mushroom nutrients, albeit within acceptable limits, except for formula B6, which resulted in a more acidity. Following the addition of mushroom nutrients, para rubber sawdust showed a decrease in the C:N ratio, ranging from 112.58 to 142.13. Notably, mixing cashew sawdust increased the total nitrogen content, resulting in a decrease in the C:N ratio, which ranged from 132.8 to 182.33. Although this ratio was higher than that of para rubber sawdust, it still demonstrated the most suitable C:N ratio for growing oyster mushrooms (Table 1).

Mycelium Growth

After inoculated with mushroom spawn, the bags have been incubated in a nursery, roof with galvanized iron and cover the wall by sun shade net which allow air could go in and out coupled with protect rain. The nursery temperature has been recorded 4 times per days. The averages temperature was 22.91°C, 30.57°C, 26.45°C, 24.52°C for the morning, noon, afternoon and at night respectively. Para rubber sawdust showed the best mycelium growth rate and could fill mushroom spawn bag than cashew sawdust which were 8.44mm/day and 29.97 days respectively.

Table 2. Mycelium Growth and Number of Days to Growing Full in Mushroom Spawn Bag

Sawdust		Mycelium growth rate (mm/days)	Mycelium growth full the bag (days)
rubber	Para	8.44[a]	29.97[a]
	Cashew	7.13[b]	36.78[b]
Substrate formulas			
Para rubber	B1	9.18[a]	27.70[a]
	B2	9.47[a]	27.00[a]
	B3	7.72[b]	31.70[bc]
	B4	6.93[cd]	37.30[e]
	B5	9.32[a]	27.00[a]
	B6	8.01[b]	29.10[ab]
Cashew	B1	7.29[bc]	36.90[de]
	B2	7.79[b]	34.30[cd]
	B3	6.87[cd]	37.30[e]
	B4	7.58[bc]	33.00[c]
	B5	6.87[cd]	38.40[ef]
	B6	6.38[d]	40.80[f]

[a, b, c/] In the same row column with different alphabet showed the significant different $P<0.05$

The mycelium growth rates induced by para rubber sawdust in formulas B1, B2, and B3 exhibited the highest rates at 9.18mm, 9.47mm, and 9.32mm per day, respectively. Conversely, all formulations utilizing cashew sawdust yielded lower mycelium growth rates, with formula B6 displaying the lowest rate at only 6.38mm per day.

The rate of mycelium growth directly influences the speed at which the mushroom mycelium fills the spawn bag. This growth rate closely correlates with the time required for the mushroom mycelium to completely fill the spawn bag. Spawn bags utilizing para rubber sawdust in formulas B1, B2, B5, and B6 achieved complete filling in 27.7, 27.0, 27.0, and 29.1 days, respectively. Conversely, substrates utilizing cashew sawdust required a longer duration to fill the mushroom spawn bag, with formula B6 exhibiting the longest time of 40.7 days to achieve complete filling (Table 2).

Mushroom Yields

Overall, mushroom substrates derived from cashew sawdust yielded the highest fresh weight of mushroom fruiting bodies, totaling 212.18g per bag, which significantly differed from those obtained from para rubber sawdust, which averaged 192.44g per bag. The dry weight of mushrooms and biological efficiency exhibited a correlation with fresh weight.

Among the mushroom substrate formulas utilizing cashew sawdust, formula B4 produced a significant fresh weight of 322.4g, differing significantly from formulas B3 and B4 derived from para rubber sawdust, which yielded 235.67g and 236.37g, respectively. Conversely, the lowest fresh weight of

mushrooms was observed in formula B1 for both types of sawdust, resulting in only 117.78g and 101.52g, respectively. The dry weight of mushroom fruiting bodies correlated with the fresh weight, with formula B4 using cashew sawdust yielding the highest dry weight at 29.46g, followed by formulas B3 and B4 using para rubber sawdust, which yielded 23.84g each.

Biological efficiency (BE%) of the mushroom substrate exhibited a similar correlation with fresh and dry weight, with formula B4 using cashew sawdust yielding the highest biological efficiency, followed by formulas B3 and B4 using para rubber sawdust (refer to Table 3).

Table 3. Fresh Weight, Dry Weight and Biological Efficiency of Mushroom Yields

Sawdust		Mushroom fresh weight (g)	Mushroom dry weight (g)	BE%
Para rubber		192.44[b]	18.89[b]	19.24[b]
Cashew		212.18[a]	23.28[a]	21.22[a]
	Substrate formulas			
	B1	117.78[d]	11.44[f]	11.78[e]
	B2	182.36[cd]	17.65[de]	18.24[cd]
Para	B3	235.67[b]	23.84[b]	23.57[b]
rubber	B4	236.37[b]	23.84[b]	23.64[b]
	B5	198.82[bcd]	19.09[cde]	19.88[bcd]
	B6	183.64[cd]	17.48[de]	18.36[cd]
	B1	101.52[d]	9.22[f]	10.15[e]
	B2	222.19[bc]	19.56[bcde]	22.22[bc]
	B3	224.18[bc]	22.51[bc]	22.42[bc]
Cashew	B4	322.40[a]	29.46[a]	32.24[a]
	B5	227.79[bc]	21.93[bcd]	22.78[bc]
	B6	174.99[c]	16.98[e]	17.50[d]

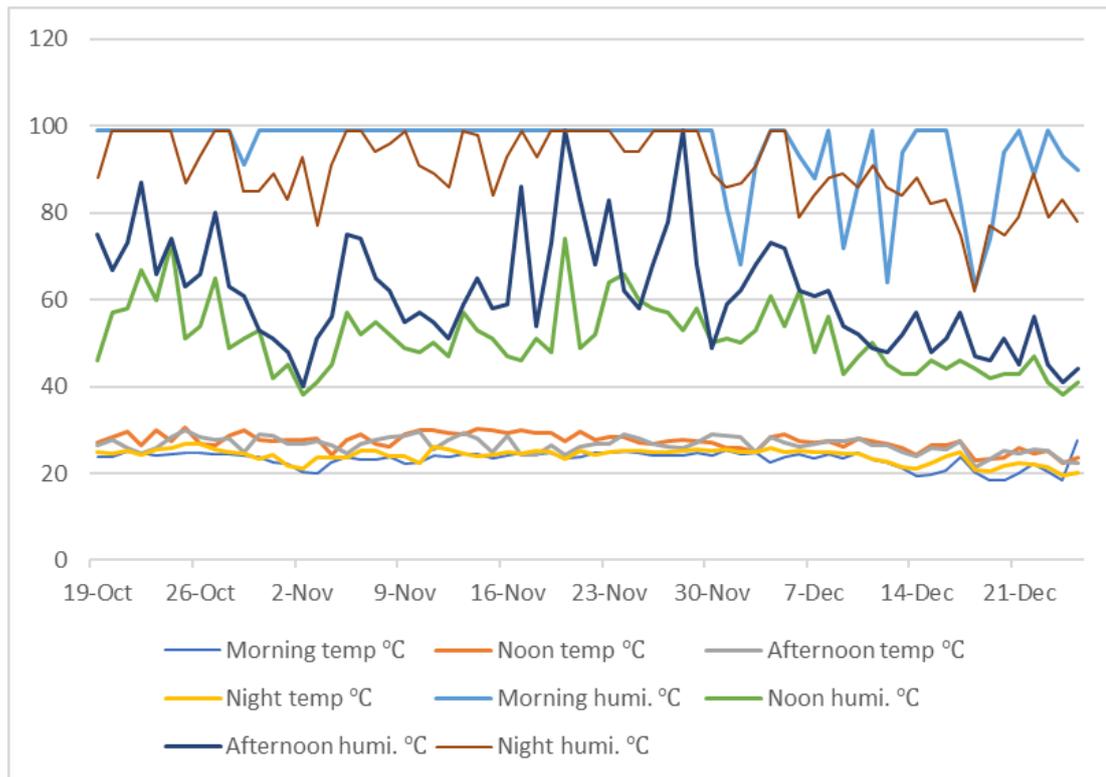[a, b, c]/ In the same row column with different alphabet showed the significant different $P < 0.05$

Figure 1. Temperature and Humidity in Nursery Use Induce Growing of Fruiting Body of Oyster Mushroom (Morning temp = 6:00 – 7:00am; Noon = 12:00 – 13:00; Afternoon = 16:00 – 17:00; Night = 20:00 -21:00)

DISCUSSION

When focusing on sawdust without supplementation with mushroom nutrients, the pH of para rubber and cashew sawdust was measured at 7.73 and 7.07, respectively, which falls within the appropriate range for mushroom cultivation. This aligns with the findings of Wajidkhan et al. (2016), who established that the optimal pH range for oyster mushroom substrate is between 6.0 and 8.0. The total organic carbon (TOC) content of cashew sawdust surpassed that of para rubber sawdust, with values of 61.76% and 50.05%, respectively. However, the total nitrogen content of cashew sawdust was notably lower at 0.16%, compared to 0.23% for para rubber sawdust. The lower nitrogen content in cashew sawdust resulted in a higher C:N ratio, rendering it less suitable for oyster mushroom cultivation. Oyster mushrooms require nitrogen as an energy source for the breakdown of lignin, cellulose, and hemicellulose present in sawdust (Cueva et al., 2016). Di Lonardo et al. (2020) demonstrated that a deficiency of nitrogen in the mushroom substrate forces mushrooms to expend more energy in acquiring nitrogen from the substrate, thus affecting their growth.

Incorporating mushroom nutrients into sawdust has the potential to augment the total nitrogen content. Supplementation with mushroom nutrients led to an increase in the total nitrogen content of cashew sawdust substrate, ranging from 187:1 to 133:1, rendering it suitable for oyster mushroom cultivation. This observation is supported by Osunde et al. (2019), who

demonstrated that a substrate composed of corn cob with a C:N ratio of 120:1 yielded optimal growth conditions for *Pleurotus pulmonarius*, surpassing those of wood sawdust (C:N ratio of 325:1) and old paper (C:N ratio of 400:1).

The substrate derived from para rubber exhibited significantly faster growth rates compared to cashew sawdust, with the highest observed rate reaching 9.47 mm/day, while the fastest mycelium growth rate recorded for cashew sawdust was 7.79 mm/day. Nonetheless, the growth rate of mycelium on cashew substrate remained within the normal range when compared to the findings of Bhattacharjya et al. (2014). In their study, utilizing *Albizia saman*, *Swietenia mahagoni*, *Leucaena leucocephala*, and *Eucalyptus citriodora* as substrates for oyster mushroom cultivation, the mycelium growth rates were reported as 5.8, 6.6, 7.0, 6.2, and 5.9 mm/day, respectively. Similarly, Khan et al. (2012) investigated the growth of *Pleurotus ostreatus* on four different types of wood sawdust, *Acacia nilotica*, *Mangifera indica*, *Bombax cieba*, and *Pinus wallichiana*. The recorded mycelium growth rates were 2.78, 3.37, 2.50, and 3.50 mm/day, respectively.

Typically, oyster mushrooms thrive within specific temperature and relative humidity ranges, namely 20°C to 30°C and 55% to 88%, respectively (Chitra et al., 2021). Additionally, Islam et al. (2016) asserted that oyster mushrooms can produce fruiting bodies within a relative humidity range of 80% to 90%, with the optimum temperature for cultivation being 28°C (Gorai & Sharma, 2018; Wang, 2015). In the present experiment, the temperature ranged between 24°C and 28°C (see Figure 1), falling within the suitable range for mushroom cultivation. However, the relative humidity conducive to mushroom growth was only observed in the morning and at night, ranging from 93% to 98%. Conversely, during the noon and afternoon periods, the relative humidity dropped to levels between 53% and 66%, falling below the optimal range for mushroom cultivation. This presents a significant challenge for mushroom growers in Cambodia who lack access to advanced nursery technologies for controlling temperature and humidity, resulting in decreased yields, poor quality, and weight loss (Mahajan & Oliveira, 2008).

In terms of mushroom yields, it was surprising to find that cashew sawdust overall produced higher yields than para rubber sawdust. However, formulas B3 and B4 emerged as the most effective formulations for oyster mushroom cultivation, regardless of whether para rubber or cashew sawdust was used as the substrate. In formula B3, the nutrient supplementation included pumice sulfate and broken rice, whereas formula B4 incorporated palmy sugar and sticky rice powder. The pumice sulphate utilized in this experiment consisted of 50% sulfate, 7% calcium, 12% phosphoric acid, 0.2% magnesium, 0.01% iron, and 0.0005% zinc (Namjitr, 2022). Pumice sulfate, a volcanic stone ground into powder, exhibits a porous microstructure. Typically employed to enhance soil structure, it possesses the capacity to retain water, oxygen, and plant nutrients beneficial for crop growth (Sahin & Anapali, 2006). Thus, incorporating pumice sulfate into the mushroom substrate facilitates the absorption of nutrients and water by the mushroom mycelium. Palmy sugar, rich in nutrients conducive to mushroom growth, contains approximately

91.04% sucrose, 24.12% sodium, 688.45 mg potassium, and 1.99 mg iron per 100g, along with various vitamins (Le et al., 2020). Broken rice and sticky rice powder serve as sources of carbon and carbohydrates for mushroom cultivation. Consequently, formulas B3 and B4 emerge as optimal formulations for oyster mushroom production.

CONCLUSIONS AND RECOMMENDATIONS

Para rubber sawdust contains a higher total nitrogen content than cashew sawdust, resulting in a lower C:N ratio. Supplementing both sawdust types with mushroom nutrients can adjust their C:N ratios to levels appropriate for oyster mushroom cultivation. Interestingly, para rubber sawdust as a substrate for mushrooms induces faster mycelium growth than cashew sawdust. Surprisingly, however, cashew sawdust yields more mushroom fruiting bodies, particularly with formula B4, which involves mixing 100 kg of sawdust with 8 kg of rice bran, 1 kg of palmy sugar, 1 kg of sticky rice powder, 1 kg of calcium carbonate, and 0.2 kg of magnesium sulfate.

Nevertheless, researchers advise farmers to choose between para rubber and cashew sawdust based on price and availability. Although formula B4 is deemed the most effective, formula B3 is also a viable option for growers to consider.

FURTHER STUDY

Cambodia has cultivated various crops suitable for oyster mushroom cultivation, including mango, rice, and oil palm. It is intriguing to explore the potential of utilizing these crop residues as substrates for oyster mushroom cultivation. Subsequent experiments could investigate the feasibility of using additional agricultural waste products for cultivating oyster mushrooms.

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