

EFFECTS OF COW MANURE RATE ON AVERAGE WEIGHT OF FRESH FRUIT, B.E (%) OF *PLEUROTUS CITRINOPLEATUS* ON RUBBER SAWDUST AND WASTE SUBSTRATE AFTER GROWING *GANODERMA LUCIDUM*

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Abstract: Currently in Vietnam, *Pleurotus citrinopileatus* is grown on cellulose-rich substrates. *Pleurotus citrinopileatus* was grown on a substrate of rubber sawdust and waste substrate after growing *Ganoderma lucidum*. The cultivation of *Pleurotus citrinopileatus* mushroom on the waste substrate after growing *Ganoderma lucidum* is to take advantage of agricultural waste and to create edible mushroom products for the market. These substrates were rich in cellulose and were supplemented with cow manure at different ratios of 0%, 2%, 4%, 6%, and 8% to obtain the average weight of fresh fruit bodies per plant embryo bag and biological efficiency B.E (%). This study is for surveying the effect of cow manure rate on the average weight of fresh fruit, B.E (%) of *Pleurotus citrinopileatus* on two substrates, including rubber sawdust and waste residue, after growing *Ganoderma lucidum*.

Keywords: Biological efficiency; cultivation; *Pleurotus citrinopileatus* mushroom; rubber sawdust; *Ganoderma lucidum*.

1. Introduction

The edible oyster mushroom genus *Pleurotus* is collected and cultivated in many countries. The fungus was able to grow at temperatures ranging from 15-35°C, with an optimal growth temperature of 25°C.

The optimum pH for mycelia growth was 7.0 [1]. Oyster mushrooms (*Pleurotus* spp.) comprise a major proportion of the edible mushrooms cultivated in the world [2]. In the present work, the oyster mushroom *Pleurotus citrinopileatus* was cultivated on different vegetable and agricultural wastes [3].

Pleurotus citrinopileatus were cultivated on various substrates [4]. To investigate the effect of cow manure on the biological productivity of *Pleurotus citrinopileatus* after growing *Ganoderma lucidum*, two types of substrates had been used, including rubber sawdust and waste substrate. This study is for surveying the effect of cow manure rate on the average weight of fresh fruit, B.E (%) of *Pleurotus citrinopileatus* on two substrates, including rubber sawdust and waste residue, after growing *Ganoderma lucidum*.

2. Materials and methods

Cow manure was used as a source of nutrients to add to the substrate at different rates of 0%, 2%, 4%, 6%, and 8%.

Rubber sawdust and *Ganoderma lucidum* mushroom waste were separated, sieved to remove impurities, then humidify (60-65%) with 1% lime water. The bottom must be lined, and the compost pile was surrounded by nylon. Each type of substrate was

then incubated separately for 24-48 hours. The compost pile is mixed during incubation. Rubber sawdust and waste substrate were poured into a nylon bag of about 300 g each before being marked for each treatment. The nylon bags were then put in the autoclave in 10 hours at 98°C, let cool after 24 hours and inoculate *Manihot* esculent into *Pleurotus citrinopileatus*. The mycelium is grown at room temperature.

After 7 days of culturing, the embryo sacs were transferred to the grower. When the mycelium of *Pleurotus citrinopileatus* begins to adapt to the culture nutrient composition, the mycelium spreads gradually until the embryo bag is sealed. The cotton button was then opened, and the embryo sacs were watered everyday to take care of the mushrooms.

The temperature for annealing *Pleurotus citrinopileatus* mycelium is 23-28°C, and the temperature for the fruiting body is 20-30°C.

The biological efficiency (yield of mushroom per kg substrate on a dry wt. basis) was calculated by the following formula, given by Chang *et al.*, (1981), as follows:

$$B.E (\%) = ((\text{Fresh weight of mushroom}) \times 100) / \text{Dry weight of substrate.}$$

For investigating the effect of cow manure ratio on biological productivity of *Pleurotus citrinopileatus* on different substrates after growing *Ganoderma lucidum*, five different test samples had been used, as represented in Table 1 and Table 2. The cow manure ratio was taken from 0% to 8%, while the substrate was taken at 100% for all the test samples.

Table 1: Experimental samples in case of rubber sawdust substrate

No.	Test samples	Cow manure (%)	Rubber sawdust substrate
1	DCA	0	100%
2	A1	2	
3	A2	4	
4	A 3	6	
5	A 4	8	

Table 2: Experimental samples in case of waste sawdust substrate

No.	Test samples	Cow manure (%)	Waste sawdust substrate
1	DCG	0	100%
2	G1	2	
3	G2	4	
4	G3	6	
5	G4	8	

The data processing was carried out on the software “Statgraphics Centurion XV”, commonly used in biological statistical analysis, including analysis of sample characteristics, comparison of means, proportions, analysis of variance, one-way and multi-dimensional regression...

3. Results and discussion

3.1. Effect of cow manure ratio on average weight of fresh fruiting bodies and B.E (%) of *Pleurotus citrinopileatus* on rubber sawdust substrate after *Ganoderma lucidum* mushroom cultivation

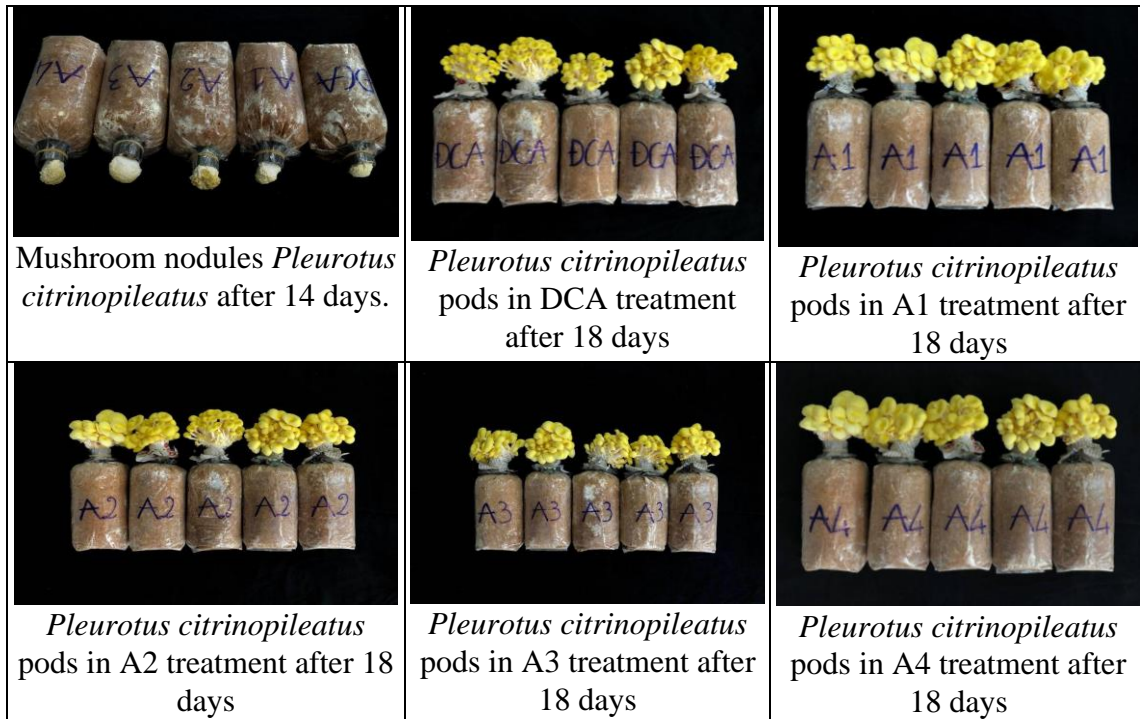


Figure 1: *Pleurotus citrinopileatus* fruiting bodies of the treatments on rubber sawdust substrate supplemented with cow manure after 18 days of inoculation

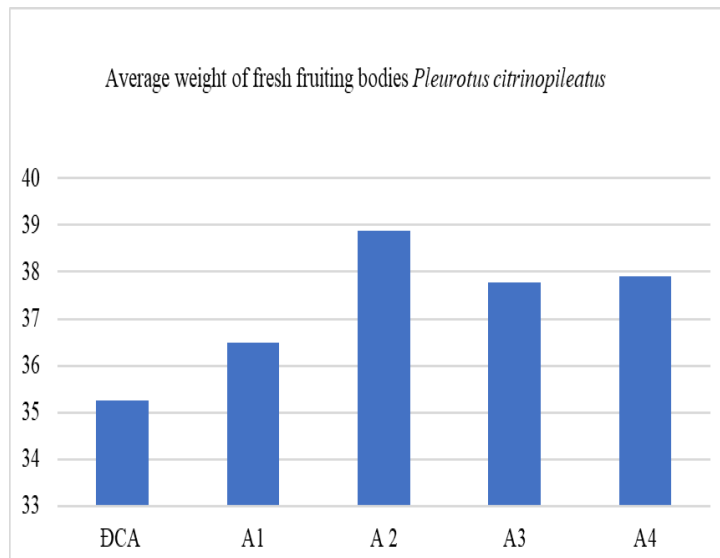


Figure 2: Average weight of fresh fruiting bodies of *Pleurotus citrinopileatus* on rubber sawdust substrate supplemented with cow manure at different ratios

Table 3: Average weight of fresh fruiting bodies and (B.E%) of *Pleurotus citrinopileatus* on rubber sawdust substrate
a, b, c... are statistical differences, P value <0.05

Treatments	DCA	A1	A 2	A3	A4
Average weight of fresh fruiting bodies	35.25 ± 0.75^a	36.50 ± 0.75^{ab}	38.87 ± 0.75^c	37.78 ± 0.75^{bc}	37.92 ± 0.75^{bc}
B.E (%)	16.08	20.28	21.59	20.99	21.06

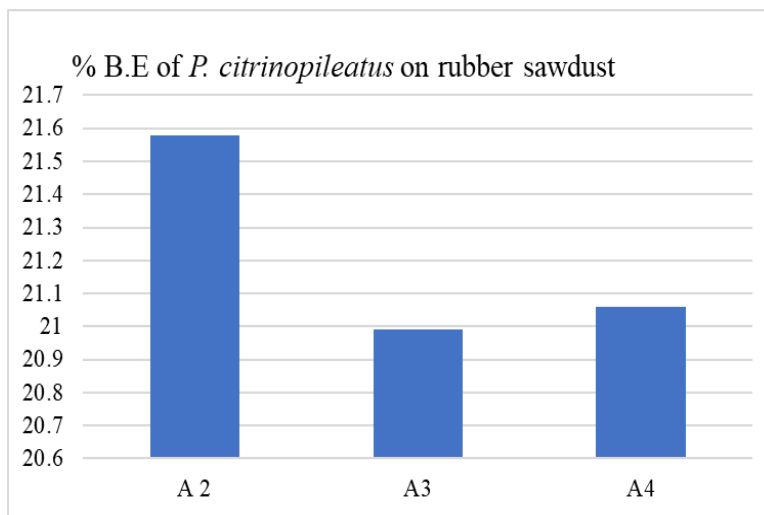


Figure 3: B.E (%) of *Pleurotus citrinopileatus* on rubber sawdust substrate supplemented with cow manure at different ratios

- Average weight of fresh fruit body:

According to Table 3, Figure 1, and Figure 2, in the first 4 days after inoculation of the tertiary seed of *Pleurotus citrinopileatus*, the mycelium started to get used to the substrate and started spreading the embryo sac on day 11. The average weight of fresh fruit body of DCA treatment was recorded as the lowest (35.25 ± 0.75^a), which is 37.92 ± 0.75^{bc} ; 36.50 ± 0.75^{ab} ; 37.78 ± 0.75^{bc} ; 38.87 ± 0.75^c in case of treatment A4, A1, A3 and A2, respectively. The results indicate that treatment A2 gives the highest average weight of fresh fruiting bodies of *Pleurotus citrinopileatus*.

- B.E (%) of *Pleurotus citrinopileatus*:

The results, which is represented in Table 3 and Figure 3, indicate that treatment A2 gives the highest B.E. (21.59%), which is recorded 20.99%; 21.06%; 16.08%; 20.28% in case of treatment A3, A4, DCA, A1, respectively. So, treatment A2 had the highest biological yield of 21.59% when 4% cow manure was added to rubber sawdust substrate.

3.2. Effect of cow manure ratio on average weight of fresh fruiting bodies and B.E (%) of *Pleurotus citrinopileatus* on waste substrate after *Ganoderma lucidum* mushroom cultivation.

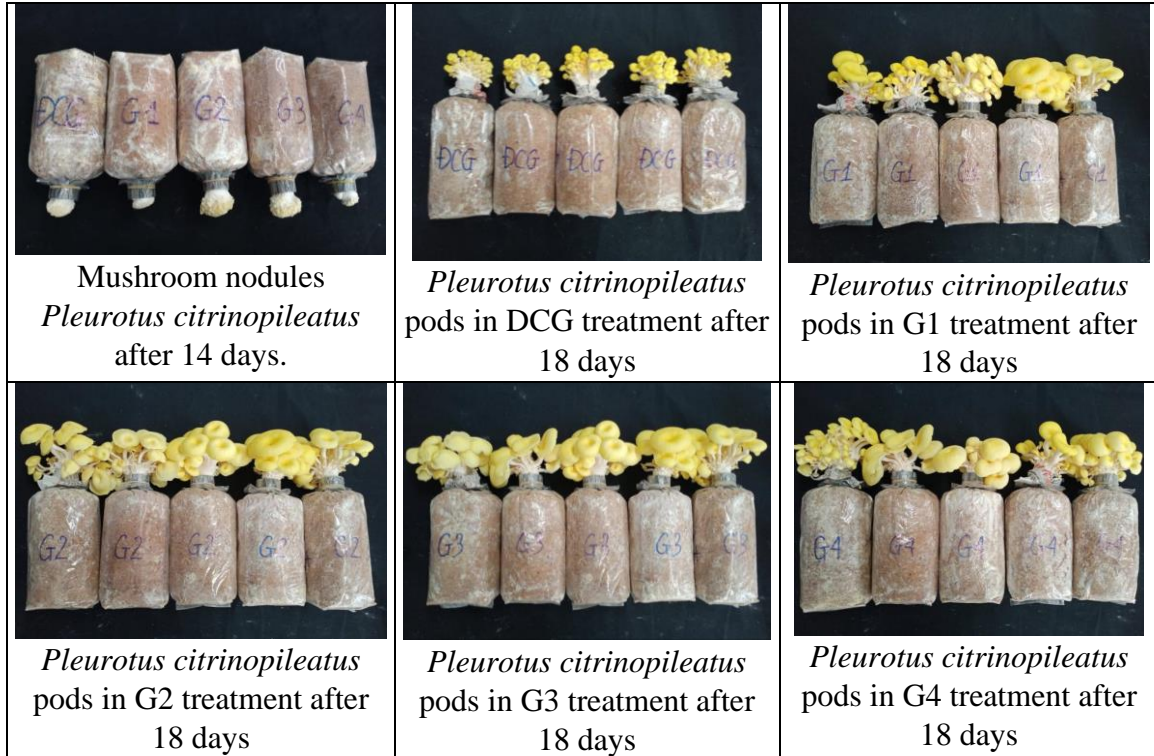


Figure 4: Fruiting bodies of *Pleurotus citrinopileatus* on waste substrate after growing *Ganoderma lucidum* supplemented with cow manure after 18 days of inoculation

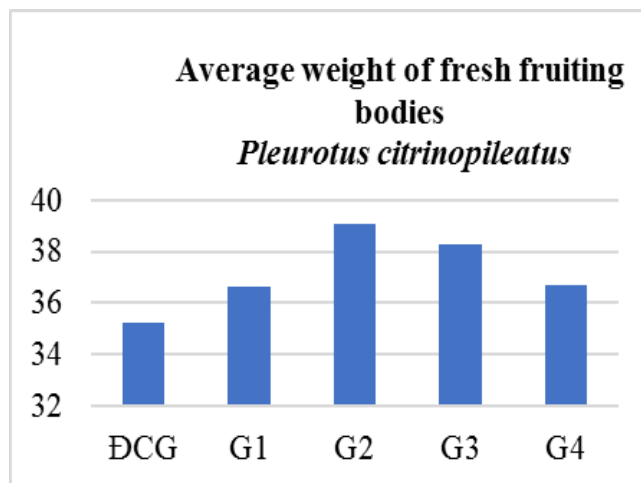


Figure 5: Average fresh fruiting bodies weight of *Pleurotus citrinopileatus* on waste substrate after *Ganoderma lucidum* mushroom cultivation, supplemented with cow manure with different ratios

Table 4: The average weight of fresh fruit and (B.E%) of *Pleurotus citrinopileatus* on the waste substrate after *Ganoderma lucidum* mushroom cultivation.

a, b, c... are statistical differences, P value <0.05

Treatments	DCG	G1	G2	G3	G4
Average weight of fresh fruiting bodies	35.24 ± 0.68 ^a	36.61 ± 0.68 ^{ab}	39.05 ± 0.68 ^c	38.31 ± 0.68 ^{bc}	36.67 ± 0.68 ^{ab}
B.E. (%)	16.32	20.34	21.69	21.28	20.37

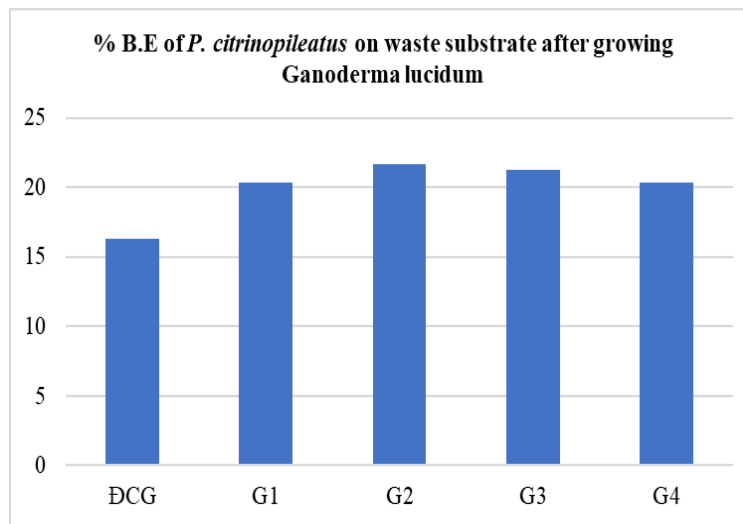


Figure 6: B.E (%) of *Pleurotus citrinopileatus* on waste substrate after growing *Ganoderma lucidum*, supplemented with cow manure in different proportions

- Average weight of fresh fruiting bodies:

As shown in Table 4, Figure 4, and Figure 5, during the first 4 days after inoculation of the tertiary seed of *Pleurotus citrinopileatus*, the mycelium began to get used to the substrate and began to spread the embryo sac on day 11. The average weight of fresh fruiting bodies of *Pleurotus citrinopileatus* were recorded lowest in case of DCG treatment (35.24 ± 0.68^a), which is 36.67 ± 0.68^{ab}; 36.61 ± 0.68^{ab}; 38.31 ± 0.68^{bc}; 39.05 ± 0.68^c in case of treatment G4, G1, G3 and G2, respectively. The results indicate that treatment G2 gives the highest average weight of fresh fruiting bodies of *Pleurotus citrinopileatus*.

- B.E (%) *Pleurotus citrinopileatus*:

According to Table 4 and Figure 6, the highest biological efficiency was recorded in case of treatment G2 (21.69%). It is respectively 21.28%; 20.37%; 16.32%; 20.34% in case of treatment G3, G4, DCG and G1. So, G2 gives the highest biological yield while the lowest B.E. was recorded in case of DCG treatment.

4. Conclusion

Pleurotus citrinopileatus grown on rubber sawdust substrate had the highest average weight in case of treatment A2 of 38.87 g and biological efficiency of 21.59%. Thus, 4% is the most suitable rate of cow manure when growing *Pleurotus citrinopileatus* on rubber sawdust substrate.

Pleurotus citrinopileatus grow on the waste substrate had the highest average weight in case of treatment G2 of 39.05 g and biological efficiency was recorded 21.69%. Thus, 4% is also the optimum cow manure rate when growing *Pleurotus citrinopileatus* on the waste substrate.

Above conclusions show that 4% is the optimum rate of cow manure when growing *Pleurotus citrinopileatus* on different substrate after growing *Ganoderma lucidum*.

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SUMMARY

ẢNH HƯỞNG TỶ LỆ PHÂN BÒ ĐẾN HIỆU SUẤT SINH HỌC CỦA *Pleurotus citrinopileatus* TRÊN MÙN CỬA CAO SU VÀ BÃ THẢI SAU KHI TRỒNG NẤM LINH CHI

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Tóm tắt: Hiện nay ở Việt Nam, nấm bào ngư vàng *Pleurotus citrinopileatus* được trồng trên cơ chất giàu cellulose. *Pleurotus citrinopileatus* được trồng trên cơ chất mùn cửa cao su và cơ chất bã thải sau khi trồng nấm linh chi. Việc trồng nấm *Pleurotus citrinopileatus* trên cơ chất bã thải sau khi trồng nấm linh chi nhằm tận dụng lại nguồn phế thải nông nghiệp đồng thời góp phần làm giảm ô nhiễm môi trường từ cơ chất này, tạo ra sản phẩm nấm ăn để cung cấp cho thị trường. Các cơ chất này giàu cellulose và được bổ sung phân bò ở các tỷ lệ khác nhau 0%, 2%, 4%, 6%, 8% để xác định khối lượng trung bình quả thể tươi trên mỗi bịch phôi 300 g và hiệu suất sinh học của nấm bào ngư vàng. Nghiên cứu này đã khảo sát tỷ lệ phân bò ảnh hưởng lên khối lượng trung bình quả thể tươi, hiệu suất sinh học của *Pleurotus citrinopileatus* trên hai cơ chất mùn cửa cao su và bã thải sau khi trồng nấm linh chi.

Keywords: Nấm hoàng kim; nấm bào ngư vàng; nấm sò vàng; năng suất sinh học của nấm.