Scope
Volume 14 Number 04 December 2024

Effect of Different Manure Compost on the Growth, Yield and Nutritional Composition of Pleurotus Florida

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Abstract: Oyster mushrooms, belonging to the Pleurotus genus within the Class Basidiomycetes and Family Agaricaceae, are known for their ability to thrive on decomposing organic matter. The fruiting bodies of these mushrooms typically exhibit a shell- or spatula-shaped appearance and can vary in color, ranging from white, cream, and grey to yellow, pink, or light brown, depending on the species.A study was conducted to evaluate the effects of various manure-based composts on the growth, yield, and nutritional composition of Pleurotus florida. The mushrooms were cultivated on different substrates, including rice straw mixed with cow dung compost (1:1) (T2), sheep dung compost (1:1) (T3), poultry manure compost (1:1) (T1), cow urine compost (1:1) (T5), silkworm dung compost (1:1) (T4), and panchakavya compost (1:1) (T6). Compost preparation involved a mix of rice straw (60%), rice bran (5.5%), chicken manure (31%), urea (0.5%), and gypsum (3%).The results revealed significant variations in growth, yield, biological efficiency, and the nutritional profile of the mushrooms across the different substrate formulations. Notably, substrates without compost supplementation demonstrated superior performance in terms of yield and biological efficiency. Among the compost treatments, the temperature of the substrates rose from an initially low level to peak values on the fourth day, reaching 69°C (T1), 59°C (T2), 54°C (T3), 61°C (T4), 65°C (T5), and 63°C (T6). The highest yield of Pleurotus florida was recorded at 443 grams.

Key Words: Panchakavya, formulations, Pleurotus florida, compost.

Introduction

Mushrooms are the visible reproductive structures of edible fungi belonging to the Basidiomycotina or Ascomycotina divisions. Essential nutrients for their growth include carbon, nitrogen, and inorganic compounds, with cellulose, hemicellulose, and lignin serving as primary carbon sources. Oyster mushrooms, specifically, require higher carbon and lower nitrogen levels. Substrates like rice and wheat straw, cottonseed hulls, corncob, sugarcane bagasse, sawdust, waste paper, and leaves provide the necessary components for their cultivation. This study evaluates the effectiveness of manure composts combined with rice straw in improving the growth and nutritional quality of Pleurotus florida.

Globally, about 80 mushroom species are widely or experimentally cultivated, with specific varieties dominating India's production. In 2008, India's mushroom output was approximately 100,000 tons, primarily comprising Agaricus bisporus (white button mushroom), Volvariella spp. (paddy straw mushroom), and Pleurotus spp. (oyster mushroom). White button mushrooms account for 85% of India's total production, with oyster and paddy straw mushrooms following.

Oyster mushrooms are increasingly popular in South India, particularly Tamil Nadu, where they are seasonally cultivated under controlled conditions, contributing to 90% of India's total oyster mushroom production. Rich in protein, essential minerals (P, Ca, Fe, K, Na), and vitamins (thiamine, riboflavin, folic acid, niacin), Pleurotus species also offer medicinal benefits, particularly in diabetes management and cancer therapy. This dual nutritional and therapeutic value enhances their significance in both agriculture and healthcare.

Materials and Methods:

Preparation of Spawn:

After sterilization, the bags were rested for 12 hours to stabilize and reabsorb any condensed water droplets. Subsequently, sorghum grains in the sterilized bags were inoculated with 10- to 15-day-old mother spawn of Pleurotus florida. The inoculated bags were then maintained at a temperature of 25 ± 1 °C for 10 to 15 days to facilitate the spawn run.

Compost:

1. Poultry Manure Compost
2. Cow dung Compost
3. Goat dung Compost
4. Silkworm dung Compost
5. Cow Urine Compost
6. Panchakavya Compost

Compost Preparation(Wakchaure et al., 2013)

Table 1: Formulation of Manure Based Compost		
1.Poultry manure compost (T1)	**2.Cow dung compost (T2)**	**3.Goat dung compost**
Paddy straw - 1800g	Paddy straw - 1800g	Paddy straw - 1800g
Rice bran - 165g	Rice bran - 165g	Rice bran - 165g

Urea - 15g	Urea - 15g	Urea - 15g
Gypsum - 90g	Gypsum - 90g	Gypsum - 90g
Poultry manure - 930g	Cow dung - 930g	Goat dung - 930g
4.Silkworm dung compost (T4)	**5.Cow urine compost (T5)**	**6.Panchakavya compost (T6)**
Paddy straw - 1800g	Paddy straw - 1800g	Paddy straw - 1800g
Rice bran - 165g	Rice bran - 165g	Rice bran - 165g
Urea - 15g	Urea - 15g	Urea - 15g
Gypsum - 90g	Gypsum - 90g	Gypsum - 90g
Silkworm dung - 930g	Cow urine - 930g	Panchakavya - 930g

The Short or Pasteurization Method

The composting process was divided into two distinct stages:

Stage 1: Rice straw was initially moistened and arranged into a pile. The pile was turned every two days, with gypsum added after the first turning. After the fourth turning, the compost was transferred to a pasteurization tank.

Stage 2: The temperature inside the pasteurization tank was maintained at 48–50°C for 2–3 days. Steam was then applied, raising the temperature to 58–60°C for 6 hours. Ventilation was introduced to allow fresh air to cool the compost to 25–28°C. The entire composting process was completed in 19–20 days.

The Long Method

For the long composting method:

Rice straw was spread across the composting yard in a layer 8–10 inches thick.Water was sprinkled on the straw 2–3 times daily for two days to ensure thorough wetting.Various organic materials—such as cow dung, sheep dung, poultry manure, cow urine, silkworm dung, and panchakavya—along with urea and wheat bran, were separately mixed.These mixtures were combined with the pre-wetted straw and heaped into a pile for further composting.

Physico-Chemical Analysis of Substrate

Estimation of nitrogen (Association of Official Analytical Chemists procedures method, 1990).

- 100ml of conical flask was used to hold 1g of the sample.
- Added 3ml of salicylic acid of 3.2% concentrated sulphuric acid and a pinch of sodium thiosulphate to the above.
- After adding 5ml of hydrogen peroxide digestion was done on a hot plate until the digest becomes colourless. Simultaneously, a blank was also run.

- Then by addition of sodium hydroxide the contents were neutralized and transferred to a 100ml volumetric flask.
- Added 1ml of 10% sodium potassium tartrate and 1ml of Nessler's reagent to the above.
- Using distilledwaterit was made upto the mark and at 420nm the absorbance was measured.
- Ammoniacal nitrogen (ammonium sulphate) was used as the standard.

Moisture content (Usha and Suguna 2014)

The weight of the substrate was measured when fresh and air- drying for 48 hours, and the moisture content was calculatedusing the below equation:

Moisture content (%) = ((Fresh weight- Dry weight) ÷ Fresh weight) ×100

Cultivation of Pleurotus florida

The straws were dried under the sun, and to about 4 cm lengths chopped and dipped in water for overnight They were used as substrate after draining the excess water.

Nutritional Analysis of Pleurotus florida

Moisture content (Usha and Suguna 2014)

The fresh mushroom was initially weighed, then subjected to drying in an oven at 80°C for 48 hours, followed by cooling. This process of heating and cooling was iterated until a consistent weight was attained. The determination was carried out using the following equation:

Moisture content (%) = ((Fresh weight- Dry weight) ÷ Fresh weight) ×100

Ash content (Usha and Suguna 2014)

The mushroom sample in powdered form underwent ashing in a muffle furnace at 550°C for 6 hours, followed by cooling. The calculation of ash content was performed using the following equation:

Ash content (%) = (weight of ash % weight of sample) ×100

Lipid content (Usha and Suguna 2014)

Five grams of ground mushroom were suspended in a mixture of Chloroform: Methanol (2:1) at a ratio of 50ml, thoroughly mixed, and allowed to stand for 3 days. The solution underwent filtration and centrifugation at 1000 rpm. Subsequently, it was transferred to a pre-weighed bottle, and the upper methanol layer was evaporated by heating. The dried extracts were then weighed, and the estimation of total lipids was determined by subtracting the initial weight from the final weight. The quantity of total lipids was assessed based on the difference between the two weights.

Fat Content (Teklit 2015)

Using an extraction apparatus, approximately 10g of mushroom sample was weighed and subjected to extraction with petroleum ether for approximately 16 hours. Subsequently, it underwent drying, chilling in desiccators, and reweighing, with the mass duly recorded. The calculation of the fat content was carried out using the following equation:

Fat content (%) = (100 (Weight of Soxhlet flask with extracted fat - Weight of empty Soxhlet flask) ÷ Weight of sample)

Protein content (Usha and Suguna 2014)

Taking five grams of ground mushroom, 50ml of 0.1N NaOH was added to it, followed by boiling for 30 minutes. After cooling to room temperature, the solution underwent centrifugation at 1000 rpm, and the supernatant was gathered. The measurement of total protein was conducted using the Lowry's method.

Results and Discussion

Composting

It was completed at outdoor for about 28 days with 7-8 turnings. During composting temperature plays a vital role for determination of the microbial activity in all the six different compost. In that obtain a maximum temperature in poultry manure compost. It showed that poultry manure contain a huge amount of microorganisms which plays a major role in degradation.In all the compost prepared initially it was low and during the 4th day the temperature has raised for maximum, with 69°, 57°, 54°, 61°, 65° and 63°C respectively for the poultry manure compost, cow dung compost, sheep dung compost, silkworm dung compost, cow urine compost and panchakavya compost.

The similar result has been reported by Wakchaureet al,using poultry manure compost.

During composting, in poultry manure compost, cow urine compost and panchakavya compost strong ammonia smell was observed during 2, 3, 4 and 5th turning. In cow dung compost, sheep dung compost and silkworm dung compost strong ammonia smell was observed during 2, 3, 4, 5 and 6th turning. In poultry manure compost, cow urine compost and panchakavya compost after 5th turning reduction in ammonia smell was observed. In cow dung compost, sheep dung compost and silkworm dung compost after 6th turning reduction in ammonia smell was observed. In poultry manure compost, cow urine compost and panchakavya compost after 7th turning no ammonia smell was observed.

Physico-Chemical Analysis of Substrate

The amount of nitrogen was found to be 2.30% using 1800 grams of paddy straw with the moisture content of 3.2%. similarly the moisture content of poultry manure was

16.95%. the rice bran has 2.9% moisture content to yield nitrogen of 2.30% as shown in table 3. There was no moisture content for urea and gypsum and this was consistent with the results of Baysalet al., 2007usingchicken manure compost substrate.

Table 2: Physico-Chemical Analysis of Substrate

Formula	Ingredients	Fresh weight (g)	Moisture (%)	Dry weight (g)	Nitrogen (%)	Nitrogen (g)	Percentage Nitrogen	Temperature on 26th day (in degree Celsius)
T1	Paddy straw	1860	3.2	1800	0.67	12.06	**2.30**	
	Poultry manure	1120	16.95	930	2.8	26.04		
	Rice bran	175	2.9	165	2.53	4.17		**42**
	Urea	15	0	15	43.97	6.59		
	Gypsum	90	0	90	0.07	0.063		
	Total			**3000**		**48.93**		
T2	Paddy straw	1860	3.2	1800	0.67	12.06	**2.18**	
	Cow dung	1350	31.1	930	2.424	22.54		
	Rice bran	175	2.9	165	2.53	4.17		**38**
	Urea	15	0	15	43.97	6.59		
	Gypsum	90	0	90	0.07	0.063		
	Total			**3000**		**45.44**		
T3	Paddy straw	1860	3.2	1800	0.67	12.06	**2.23**	
	Goat dung	1130	17.69	930	2.57	23.90		
	Rice bran	175	2.9	165	2.53	4.17		**35**
	Urea	15	0	15	43.97	6.59		
	Gypsum	90	0	90	0.07	0.063		
	Total			**3000**		**46.79**		
T4	Paddy straw	1860	3.2	1800	0.67	12.06	**2.34**	
	Silkworm	1075	13.48	930	2.92	27.15		

	dung							
	Rice bran	175	2.9	165	2.53	4.17		**41**
	Urea	15	0	15	43.97	6.59		
	Gypsum	90	0	90	0.07	0.063		
	Total			**3000**		**50.05**		
T5	Paddy straw	1860	3.2	1800	0.67	12.06	**1.53**	
	Cow urine	930	-	930	0.314	2.92		
	Rice bran	175	2.9	165	2.53	4.17		**46**
	Urea	15	0	15	43.97	6.59		
	Gypsum	90	0	90	0.07	0.063		
	Total			**3000**		**25.81**		
T6	Paddy straw	1860	3.2	1800	0.67	12.06	**1.54**	
	Panchakavya	930	-	930	0.306	2.85		
	Rice bran	175	2.9	165	2.53	4.17		**44**
	Urea	15	0	15	43.97	6.59		
	Gypsum	90	0	90	0.07	0.063		
	Total			**3000**		**25.73**		

Cultivation of Pleurotus florida

Rate was recorded on paddy straw + cow dung compost (T2), paddy straw + goat dung compost (T3) and paddy straw + silkworm dung compost (T4).

Fig 1: Cultivation Of *Pleurotus florida*

Total yield in the bed containing different compost varied significantly. Maximum yield (680.9 g) was obtained from rice straw and the minimum yield of (140.05g) was obtained from rice straw and goat dung compost (1:1). Average yield was observed in poultry manurecompost (367.72g), silkworm compost (372.31g), cow urine compost(443.43g) and panchakavya compost (419.87g). Lowest yield was observed in cow dung compost (193.1g) and sheep dung compost (140.05g). The superior yield on rice straw seemed to result from the relatively higher availability of nitrogen, carbon and minerals from this substrate.The highest biological efficiency was observed in control (45.39%) and the lowest biological efficiency was observed in T3 (9.33%).Similarly the biological efficiency of T1, T2, T3, T4, T5 and T6 is 45.39%, 24.51%, 12.89%, 9.33%, 24.82%, 29.53%, 27.99%. In T2 and T3 yield very low biological efficiency because of it cannot be suitable for the cultivation of Pleurotus florida and also it take higher time for the spawn run and primordial initiation as shown in table3.

Nutritional Analysis of Pleurotus Florida

Moisture Content

The moisture content of Pleurotus florida grown was found 89.58%, 88.29%, 85.07%, 88.31%, 83.14%, 88.36%, 88.91% as shown in table 4.4. Highest moisture content (89.58%) was present in control. Lowest moisture content of about (83.14%) was found present in paddy straw + silkworm dung compost.

Ash Content

In Pleurotus florida, the ash contentwas found to be 0.68%, 0.67%, 0.34%, 0.56%, 0.68%, 0.63% and 0.78% for control, poultry manure compost, cow dung compost, sheep dung compost, silkworm dung compost, cow urine compost and panchakavya compost respectively. The highest ash content of about 0.78% was found in panchakavya compost. The lowest ash content of about 0.34% in cow dung compost as shown in table 3.

Lipid content

The lipid content of Pleurotus florida grown in different compost range 0.12% to 0.24%. Highest lipid content (0.24%) present in control. Lowest lipid content (0.12%) present in T1. Lipid content present in different samples Control, T1-T6 were found to be 0.24%, 0.12%, 0.22%, 0.18%, 0.15%, 0.17%, 0.14% respectively. Based on the observation then compare to control the S1, S2, S3, S4, S5 and S6 contain low lipid content, because of it test samples are used as a dietary food. By supplement the substrate along with the different compost gives a better result, compared to the lipid content from control to test samples.

Fat Content:

The fat content of Pleurotus florida grown in different compost range 0.8% to 3.2%. Highest fat content (3.2%) present in control. Lowest lipid content (0.8%) present in S5 and S6. Lipid content present in different samples Control, S1- S6 were found to be 3.2%, 1.6%, 1.6%, 1.2%, 2.0%, 0.8%, 0.8%. By supplement the substrate along with the different compost gives a better result, compared to the fat content from control to test samples.The presence of unsaturated fatty acids is crucial in our diet, while high levels of saturated fatty acids, commonly found in animal fats, could potentially pose health risks. The discovery of a substantial proportion of unsaturated fatty acids, including a high percentage of linoleic acid in these mushrooms, contributes significantly to considering mushrooms as a health-promoting food.

Table 3: Nutritional analysis, Yield, Biological Efficiency of Pleurotus florida

Content	Moisture content (%)	Ash content (%)	Lipid content (%)	Fat content (%)	Protein content(%)
C	89.58	0.68	0.24	3.2	19.75
T1	88.29	0.67	0.12	1.6	22.89
T2	85.07	0.34	0.22	1.6	25.15
T3	88.31	0.56	0.18	1.2	21.89
T4	83.14	0.68	0.15	2.0	25.83
T5	88.36	0.63	0.17	0.8	23.43
T6	88.91	0.78	0.14	0.8	29.74
Yield And Biological Efficiency of Pleurotus florida					
Content	**Bud formation**	**Bud Number**	**Harvesting Period (Day)**	**Total Yield (g)**	**Biological Efficiency (%)**

C	21&29	5	23&33	680.9	45.39
T1	26&38	3	28&40	367.72	24.51
T2	31	2	33	193.1	12.87
T3	34	2	36	140.05	9.33
T4	33&43	5	35&45	372.31	24.82
T5	24&35	5	26&37	443	29.53
T6	23&42	5	25&44	419.87	27.99

Protein Content

The Protein content of Pleurotus florida grown in different compost range 19.75% to 29.74%. Highest protein content (29.74%) present in S6. Lowest lipid content (19.75%) present in Control. Protein content present in different samples Control, S1- S6 were found to be 19.75%, 22.89%, 25.15%, 21.89%, 25.83%, 23.43%, 29.74%. The protein content of mushrooms exhibits notable variability attributed to factors such as species strain, tissue type, developmental stage, substrate, and analytical method. Generally, mushroom protein surpasses that of green vegetables and fruits. Reported variations in mushroom protein content stem from differences in genetic structure among species and physical and chemical distinctions in the growing medium.Based on the increase in protein content present in the mushroom was increased.

Conclusion

Oyster mushroom (Pleurotus florida) was successfully grown in the different compost with an optimum temperature. During cultivation, we observe some parameters to that gives a difference between the mushrooms grown in a different substrate.

Based on that we observe the highest yield in rice straw without supplement of manure compost and rice with the supplement of manure compost gives a lesser yield then compare to control, because the Oyster mushroom (Pleurotus florida) takes higher time to consume nutrients through compost. Based on the biological efficiency also shows the similar result to yield respectively.

Based on the nutritional quality, the rice straw with supplement of manure compost gives a high nutritional value. The rice straw without supplement of manure compost gives a less nutritional value then compare to the rice straw with supplement of manure compost.

Due to the observation and analysis of Oyster mushroom (Pleurotus florida), the rice straw with supplement of cow urine and panchakavya shows a better result.

The rice straw with supplement of cow urine (T5) and panchakavya (T6) is the suitable substrate for growing of Oyster mushroom (Pleurotus florida).

Acknowledgments:

Our sincere appreciation goes toK.S.Rangasamy college of Technology, Tiruchengode for providing the necessary laboratory facilities, equipment and resources that were vital for carrying out the research effectively. The expertise and guidance provided by Dr.M.Nithya (Assistant Professor – Department of Biotechnology, KSRCT) were instrumental in shaping the direction of our study and refining our research methodologies.

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