AgriBio Innovations
(Published by Research Trend, Website: www.agribioinnovations.com)
ISSN NO. (Online): 3049-3862
Volume-2, Issue-1, Jan.-Dec., 2025 2(1): 59-62(2025)

Standardization of Composting Method for Cultivation of Paddy Straw Mushroom in Odisha Condition

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(Received: 02 March 2025; Revised: 27 May 2025; Accepted: 20 June 2025; Published: 07 July 2025)
(Published by Research Trend)

DOI: https://doi.org/10.65041/abi.18

ABSTRACT: Paddy straw mushroom *(Volvariella volvacea)* holds a significant place among edible mushroom and is widely cultivated in Odisha state using bundled paddy straws. It cultivated primarily in tropical and subtropical regions due to their rapid growth, high nutritional value and consumer preference. But now-a-days due to the mechanization farming the bundle paddy straws are not available. The study was conducted in Centre of Tropical Mushroom Research and Training (CTMRT), OUAT, Bhubaneswar, to investigate the potential of crumpled straw with the method of composting to enhance the biological efficiency of paddy straw mushrooms. Crumpled paddy straw with 20% rice bran, 2% calcium carbonate and 0.5% urea fertilizer composted for 6 days was found at par with the traditional method of cultivation as per yield is concerned.

Keywords: Paddy straw mushroom (*Volvariella volvacea*), cultivation, composting method.

INTRODUCTION

Paddy straw mushroom (*Volvariella volvacea*) is a popular edible mushroom known for its fast growth and high nutritional value. It is traditionally grown using agricultural waste material, with paddy straw being the most preferred due to its abundance, fibrous structure and ability to support rapid mycelia growth. With increasing mechanization of agriculture, paddy straw is now available in crumpled form instead of traditional bundles (Rath *et al.,* 2023). This crumpled straws lack the uniform structure and aeration provided by bundled straw, making them less ideal for direct use in mushroom cultivation (Sahoo *et al.,* 2012). To overcome this problem, semi- composting is needed which help to partial break down the straw, improve its structure and made it more suitable for mycelial colonization. This study focuses on determining the optimal duration required for effective semi-composting of crumpled paddy straw to enhance mushroom yield and quality. In the present study crumpled paddy straw was subjected to semi composting with different durations to make them suitable for paddy straw mushroom cultivation. Because the duration of composting of the substrate plays a significant role in shaping the physical attributes and nutritional content of the final products and these factors collectively impact mushroom productivity. The semi-compost method represents a novel approach to cultivating straw mushrooms using partially composted straw. This method is favored over the traditional one due to achieving higher productivity levels.

MATERIALS AND METHODS

This experiment was conducted in 2022 and 2023 at Center for Tropical Mushroom Research and Training (CTMRT), Department of Plant Pathology, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar. For this experiment the crumpled paddy straw was used as main component of substrate. Different substrate composition were taken as treatment and composted for different durations. The crumpled straw was employed as substrate in accordance with the semi-compost method and was subsequently compared to un-composted crumpled straw and traditional bundled paddy straw mushroom cultivation method.

The crumpled straw was spread out in a thin layer and kept moist by sprinkling water over it for 24

hours. After this 24 hour, all the components were combined, including 5% of chicken manure, 5% of wheat bran and 1.25% of neem cake or mustard cake, with the exception of calcium carbonate. Following the thorough mixing of all supplements, a heap measuring 1.5 m height and 1.5 m width was formed and covered with a transparent polythene sheet. On the second day, the turning was done and the heap was re-established. Then, on the fourth day, 2% of calcium carbonate was added with the substrate and the heap was re structured once more. The addition of calcium carbonate serves to mitigate the stickness of the compost, preventing anaerobic condition and maintaining the pH. At 6th, 8th and 10th day the heap was turned to ensure proper aeration. The temperature of the heap was consistently monitored, with temperatures reaching 60-65°C during the peak decomposition phase. After completion of the duration of semi-composting, the substrate was steamed for 2 hours. After cooling down to room temperature the substrate was transferred to the growing unit and the spawning process was initiated to create beds measuring 1.5x1.5 feet and 1.0 feet height. For T3, T4, T5, T6, T7 the composting duration was 6 days, for T8, T9, T10, T11, T12 the composting duration was 8 days and for T13, T14, T15, T16, T17 the composting duration was 10 days.

For each treatment 3 beds were prepared as 3 replication. For each bed 200 g of spawn were used. The semi-composted crumpled straw substrate was initially spread in a 4 inch thick layer. A quarter of the 200 g spawn, each piece being thumb-sized, was placed in a single row, positioned 4 inches from the edge, equidistant from each other. The central section was left vacant. Subsequently, a quarter of the 200 g of chickpea flour was evenly sprinkled over it. The second layer, also 4 inches thick, was constructed in a similar manner as the first layer. Again, thumb sized spawn bits were placed in a single line, 4 inches from the edge on all four sides, followed by a sprinkling of chickpea flour. The third layer of 4 inches thickness was arranged over the 2nd layer, with the remaining composted substrate, spawn and pulse powder evenly distributed across the entire surface. Each bed had an average dry weight of 7kg. The beds were covered with clear polythene up to the point of pinhead emergence. Throughout the cropping seasons, suitable condition for temperature, light, humidity and ventilation were carefully maintained. Various yield parameters were documented over the course of the 3-week cropping cycle. Mushrooms were harvested in the egg stage from two successive flushes and their fresh weights were recorded. The fresh weight of fruiting bodies was measured right after harvesting. Observations were made regarding several yield-related characteristics, including the number of days for pinhead initiation, the time for the first harvest, the weight of harvested fruiting bodies, the count of sporophores, and the average weight of sporophores. The biological efficiency (BE) of *Volvariella volvacea* was also documented. All data pertaining to yield were analyzed using statistical methods. A critical difference (CD) was computed for yield and average no. of fruiting bodies data at a 5% significance level.

RESULT

From the above experiment it was recorded that the shortest duration of pinhead formation was in traditional method of mushroom cultivation with bundled paddy straw (T1) i.e. 9 days. However, the lowest duration of pinhead formation i.e. ten days was recorded in T3, T4, T6, T7. The maximum days to pinhead formation i.e. 14 days was recorded in T2. In T8, T9, T12, T13, T14, T17 the pinheads were formed in 12 days but in T10, T11, T15, T16 the pinheads were formed in 13 days.

The lowest days to 1st harvest i.e. 14 days was observed in T1 (paddy straw bundle) with maximum no. of fruiting bodies (58.3%) as well as highest average weight of fruiting bodies (8.9 g) leading to highest yield (761g). However, the days to 1st harvest in T3, T4, T6 and T7 was 16 days but in T5, T8, T9, T10, T11, T12, T13, T14, T15, T16 and T17 the days to 1st harvest was 17 days. The maximum days to 1st harvest was observed in T2 (crumpled paddy straw) *i.e.* 19 days.

The highest number of fruiting bodies were found in T13 which was 76.3 which was significantly higher than the other treatments. However T12 and T7 were statistically at par with T13 with 74.7 and 72.6 average number of fruiting bodies respectively. The next higher numbers of fruiting bodies were found in T8 (63.3) and T3 (61.8) which were statistically at par with each other. The lowest average number of fruiting bodies was 36.7 in T4.

The highest yield was recorded in T1 (761g) followed by T7 i.e. 718 grams. However T12, T8, T13 and T3 were the next best treatment after T7 recorded with 706g, 701g, 687g and 681g yield respectively and were statistically at par with T7. At T17 the yield was 620g. The lowest yield was recorded at T2 *i.e.* 387g.

The biological efficiency was calculated on basis of yield compared with substrate used. The highest biological efficiency was recorded in T1 *i.e.* 10.41% and the lowest was recorded in T14 *i.e*. 5.19%. However the biological efficiency recorded in T8 was 8.72%, T13 was 8.54%, in T3 was 8.47% and T12 was 8.18% which are statistically at par.

Table 1: Assessment of the production capacity of crumpled paddy straw with varying compositions and duration of semi-composting.

Sr. No.	Treatment details	Days to pinhead formation	Days to first harvest	Average no. of fruiting bodies	Yield (g/bed)	B.E. (%)
T1	Paddy straw bundles (control)	9	14	58.3	761	10.57
T2	Crumpled paddy straw	14	19	46.7	387	5.38
T3	Crumpled paddy straw + wheat bran 5% + chicken manure 5% + calcium carbonate 2% (composted for 6 days)	10	16	61.8	681	8.47
T4	Crumpled paddy straw + mustard oilcake 5% + chicken manure 5% + calcium carbonate 2% (composted for 6 days)	10	16	36.7	496	6.17
T5	Crumpled paddy straw + wheat bran 1.25% + mustard oil cake 1.25% + neem cake 1.25% + chicken manure 5% + calcium carbonate 2% (composted for 6 days)	11	17	53.3	450	5.66
T6	Crumpled paddy straw + sugarcane bagasse (composted for 6 days)	10	16	32.7	396	5.50
T7	Crumpled paddy straw + rice bran 20% + calcium carbonate 2% + urea fertilizer 0.5% (composted for 6 days)	10	16	72.6	718	8.31
T8	Crumpled paddy straw + wheat bran 5% + chicken manure 5% + calcium carbonate 2% (composted for 8 days)	12	17	63.3	701	8.72
T9	Crumpled paddy straw + mustard oilcake 5% + chicken manure 5% + calcium carbonate 2%(composted for 8 days)	12	17	49.0	506	6.29
T10	Crumpled paddy straw + wheat bran 1.25% + mustard oil cake 1.25% + neem cake 1.25% + chicken manure 5% + calcium carbonate 2% (composted for 8 days)	13	17	53.3	450	5.66
T11	Crumpled paddy straw + sugarcane bagasse (composted for 8 days)	13	17	59.3	405	5.63
T12	Crumpled paddy straw + rice bran 20% + calcium carbonate 2% + urea fertilizer 0.5% (composted for 8 days)	12	17	74.7	706	8.18
T13	Crumpled paddy straw +wheat bran 5% + chicken manure 5% + calcium carbonate 2% (composted for 10 days)	12	17	76.3	687	8.54
T14	Crumpled paddy straw + mustard oilcake 5% + chicken manure 5% + calcium carbonate 2% (composted for 10 days)	12	17	50.7	417	5.19
T15	Crumpled paddy straw + wheat bran 1.25% + mustard oil cake 1.25% + neem cake 1.25% + chicken manure 5% + calcium carbonate 2% (composted for 10 days)	13	17	51.3	414	5.21
T16	Crumpled paddy straw + sugarcane bagasse (composted for 10 days)	13	17	59.0	506	7.03
T17	Crumpled paddy straw + rice bran 20% + calcium carbonate 2% + urea fertilizer 0.5% (composted for 10 days)	12	17	61.0	620	7.18
	SEM(±)			1.097	13.274	0.287
	CD			3.38	40.92	0.826

DISCUSSION

The exploratory trial, which involved various semi-compost crumpled straw substrate, demonstrate their diverse potential in enhancing paddy straw mushroom productivity compared to the non-composted crumpled straw and traditional method i.e. use of bundled paddy straw. The difference in production potential among these substrate may be due to variation in their physical properties, water retention capacity, pore space availability and nutritional composition (Pani, 2011; Ranasingh *et al.,* 2020). Semi-composted crumpled paddy straw with urea for 6 days exhibited better performance to crumpled paddy straw in terms of yield. However, when crumpled paddy straws semi-composted for 8 days were used, its yield was significantly at par with the yield of Semi-composted crumpled paddy straw with urea for 6 days. By increasing the composting duration from 6 days to 8 days led to an improvement in biological efficiency, which increased to 8.72% but further increasing the duration of composting to 10 days decreasing the yield which may be due to over decomposition of substrates. The significance of the semi-

composting method in boosting straw mushroom yield has been acknowledged by various researchers such as Ahlawat *et al.* (2009); Ahlawat and Tiwari (2007); Thakur and Yadav (2006). Decomposed and fermented waste materials are believed to be richer in nutrients compared to unfermented ones, which likely contributes to increased yield, as supported by Stametes (1993); Quimio *et al.* (1990). Maurya *et al.* (2016) also reported that the highest fruiting bodies yield resulted from a substrate composed of chicken manure and wheat bran, followed by chicken manure in comparison to chicken manure with rice bran or neem cake. Pani and Naik (1998) reported better yields with bundled paddy straw than with crumpled paddy straw, possibly due to the better percolation of light, proper aeration and superior water holding capacity of beds prepared from bundled straw. Light and oxygen levels are crucial factors for the growth and development of paddy straw mushroom, which is why early production of mushroom pinheads was observed in bundled straw compared to semi-composted crumpled straw. A similar observation was also made by Hota and Pani (2019).

CONCLUSIONS

Based on the experimental results, it was observed that semi-composted crumpled straw, when combined with 20% rice bran, 2% calcium carbonate, 0.5% urea fertilizer and composted for 6 days, produced a higher yield of 718 g compared to other combination involving crumpled straw. Additionally increasing the composting duration from 6 days to 8 days led to an improvement in biological efficiency, which increased to 8.72%. The investigation revealed that the semi-composted crumpled paddy straw method for 6 days was statistically comparable to the traditional method involving bundled paddy straw as far as yield is concerned.

Acknowledgements. The authors are highly grateful to the Department of Plant Pathology, Odisha University of Agriculture and Technology for providing the facilities required for this study.

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How to cite this article: Sagarika Giri and Anita Priyadarsini (2025). Standardization of Composting Method for Cultivation of Paddy Straw Mushroom in Odisha Condition. *AgriBio Innovations, 2*(1): 59-62.