International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 14, 2019, pp.-8804-8806.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

PRODUCTION OF STRAW MUSHROOM FROM SEMI-COMPOSTED SUBSTRATES- A POTENTIAL GAME CHANGER FOR FUTURE MUSHROOM INDUSTRY OF ODISHA

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Received: July 15, 2019; Revised: July 24, 2019; Accepted: July 26, 2019; Published: July 30, 2019

Abstract: An experiment was conducted to evaluate paddy straw and other locally available substrates for production of straw mushroom (*Volvariella volvacea*) in Odisha under semi-compost method. Paddy straw (uncrumpled / hand threshed / bundled), when semi-composted, sustained significantly higher mushroom yield (15.63% BE) compared to the yield (11.50 % BE) obtained from its un-decomposed state in traditional method of cultivation. When other wastes such as cotton waste, banana leaves and water hyacinth were mixed with un-crumpled straw, the biological efficiency increased further (16.06 -19.29 % BE). Paddy straw mixed with cotton waste (3:1, w/w) sustained the highest yield potential (19.29 % BE). It was also recorded that semi composted crumpled/ cattle threshed paddy straw (12.0 % BE) was statistically at par with the non-composted uncrupmled/ hand threshed paddy straw (11.50 % BE) in supporting the mushroom yield. The results can be highly rewarding considering that these were traditionally been poor mushroom substrates and there is a rising accumulation of cut pieces of straw due to the increasing use of combined harvester in paddy crop in recent times.

Keywords: *Mushroom yield, Straw Mushroom, Semi-Composted Substrates*

Citation: Hota S. and Pani B.K. (2019) Production of Straw Mushroom from Semi-Composted Substrates- A Potential Game Changer for Future Mushroom Industry of Odisha. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 14, pp.- 8804-8806.

Academic Editor / Reviewer: Dr Lakshman Chandra De

Introduction

Paddy straw is the main substrate used for straw mushroom cultivation in Odisha and elsewhere. The low biological efficiency (10-15 %) and inconsistent yield are the major limiting factors for higher commercial success of the crop. Moreover, the crumpled straw generated from bullock/ tractor-driven threshing or from harvesting by combined harvesters is reported to be unsuitable for mushroom cultivation [1,2]. It is reported that higher and more stable yield (30-40% BE) could be obtained through adoption of indoor method of farming [3] using cotton waste as substrate. When a combination of rice straw and cotton waste was used, it sustained a biological efficiency of 21.8 to 27 % [4]. As cotton wastes are not available in Odisha and collecting them from outside would add heavily to the cost of production, it was thought imperative to evaluate paddy straw and other locally available substrates under semi-compost method for production of straw mushroom (*Volvariella volvacea*) in Odisha. It is imperative to note that the production of bundled straw has been constantly on the decline after introduction of combined harvesters in rice farming which generate crumpled straw instead of bundled straw. The broader objective of the present study was to compare semi-compost method with traditional method for straw mushroom production from bundled straw and to find suitability of crumpled straw as a substrate for mushroom cultivation.

Materials and Methods

The study was undertaken at the Centre of Tropical Mushroom Research and Training, Orissa University of Agriculture and Technology. This growing room was provided with concrete racks with provision of introducing live steam in to the room. This was accomplished by allowing the steam from an improvised boiler which was evenly distributed through pipes with small holes. There was also the provision of exhaust fans to remove the hot air whenever required. The concrete floor was covered with 6" thick sand which was kept wet throughout the cropping period for maintenance of adequate humidity. Wet gunny bags were also used in the windows to increase inside humidity. In the semi-compost method of straw mushroom cultivation, the bundled paddy straw was used as substrate (chopped paddy straw- 300 Kg, wheat bran @ 6 % or 18 Kg, chicken manure @ 1.5 % or 4.5 Kg, calcium carbonate @ 2% or 6 Kg) unless otherwise stated. Paddy straw was chopped into 2-3 inches. The cut pieces were spread in a thin layer and kept wet for 24 hours by sprinkling water. Care was taken so as to maintain 7- to 80 % moisture in the wet straw. All the ingredients were mixed with the wet straw except calcium carbonate and a heap of 1.5m ×1.5m×1.5 m was made It was covered by a thin polythene sheet. A turning was given on the second day and the heap was restored. The second turning was given on the 3rd or 4th day, calcium carbonate was mixed thoroughly and heap was restored again. Calcium carbonate removed the stickiness of compost to avoid anaerobic condition and increases the pH. Compost was ready on the 6th day. Temperature of the heap was checked regularly. It was 68-70°C during the composting process. Then it was transferred to the growing unit and compost beds of 15 cm height were prepared on wet paddy straw bundles. Length and width of the beds were 2 m and 0.5m, respectively. The beds were exposed to live steam for about 1hour. After the temperature of the room was brought down to room temperature (about 35-380 C), spawn bits were applied on the beds @ 0.4% of the wet weight of the compost, and then covered another thin layer (2 inch) of semi compost. The beds thus prepared were covered with polythene sheets till the pin heads appear. The room temperature was maintained at 32-34°C during spawn run. The beds started fruiting in about 9-10 days. In the above semi-composting method, both crumpled and un-crumpled paddy straw were used separately. Paddy straw bundles were also used in combination with banana leaves, cotton waste and water hyacinth in 3:1 proportion (w/w). In another combination paddy straw bundles, banana leaves and water hyacinth were used in 2:1:1 proportion (w/w).

Table-1 *Evaluation of different substrates for production of Volvariella volvacea under semi-compost method*

Treatments / Substrates	Days for pinhead appearance	Days for 1st harvest	Number of fruiting bodies	Yield (g)	Weight of fruiting body (g)	B E (%)
T1: Paddy straw(uncrumpled)	9	14	132.00	2345.66	17.77	15.63**
T2: Paddy straw (crumpled)	13	16	107.48	1801.50	16.76	12.01**
T3:Paddy straw+ Banana leaves (3:1, w/w)	10	15	148.34	2455.10	16.55	16.36**
T4: Paddy straw+ Cotton waste (3:1, w/w)	8	13	160.68	2894.25	18.07	19.29**
T5: Paddy straw+ Water hyacinth (3:1, w/w)	11	15	137.40	2410.00	17.54	16.06**
T6: Paddy straw + Banana leaves +Water hyacinth (2:1:1, w/w)	10	15	157.81	2506.14	15.88	16.70**
T7: Traditional method (without composting)	10	14	43.67	805.00	18.43	11.50*
CD(0.05)						1.34
SE(m)±						0.43

*Each observation was the average from three replications. *Calculated from wet weight of compost, **Calculated from dry weight of paddy straw*

All the substrates except cotton waste were chopped into 2 to 3-inch pieces and soaked in water for 6 to 8 hours. Cotton waste was used as such. Spawning @ 3% of dry weight of substrate was done. Incubation of semi-compost beds and their maintenance were followed as per stated procedure. Fruiting bodies were harvested from a total of two flushes at egg stage and fresh weights were immediately recorded. The experiment was conducted in Randomised Block Design (RBD) with three replications for each substrate. Standard yield parameters were recorded and yield data were analysed statistically. The yields obtained from these composted substrates were compared with the yield obtained from traditional method of cultivation using un-decomposed paddy straw bundles.

Results

Data presented in [Table-1] revealed that the substrates possessed varied yield potential vis-a-vis the traditional method of straw mushroom production using non-composted paddy straw (bundled). Paddy straw (uncrumpled / hand threshed / bundled), when used as semi-composted substrates, was a better substrate for straw mushroom cultivation (15.63% BE) than when used un-decomposed in traditional method (11.50 % BE). When other wastes such as cotton waste, banana leaves and water hyacinth were mixed with un-crumpled straw, the biological efficiency was found to increase further (16.06 -19.29 % BE). Paddy straw mixed with cotton waste (3:1, w/w) sustained the highest yield potential (19.29 % BE). It was also recorded during the investigation that, semi composted crumpled/ cattle threshed paddy straw was statistically at par with the non-composted uncrupmled/ hand threshed paddy straw in supporting the sporophore production. This can be highly rewarding considering the fact that these were traditionally been poor mushroom substrates and there is a rising accumulation of cut pieces of straw due to the increasing use of combined harvester in paddy crop now-a-days.

Discussion

This is a new method of production of straw mushroom from semi-composted straw. It is preferred over the traditional method as the productivity in this method was found to be higher than the traditional method. Paddy straw (uncrumpled / hand threshed / bundled), when semi-composted, was a better substrate for straw mushroom cultivation than when used un-decomposed in traditional method. This might have been due to variations in their physical properties, bulk density, water retention capacity, availability of pore space and nutritional composition [5]. The importance of semi-composted paddy straw in promoting higher yield of straw mushroom has been reported by various workers [3, 6,7,8]. However, Sahoo [2] could achieve only 7.36 to 7.51% BE of straw mushroom using partially composted paddy straw substrate. This could have been due to the difference in substrate composition. Mixing of cotton waste banana leaf and water hyacinth with paddy straw, either alone or in combinations, was required to boost up mushroom yield subjected to their availability and taking in to account the cost benefit ratio. Water hyacinth is a cellulose rich weed plant which is abundantly available free of cost in many parts of the country. Dried banana leaves are also available in the commercial banana plantations in few pockets of the state. The use of cotton waste [9], banana leaf [10] and water hyacinth [11] as substrates have been demonstrated in other cultivated mushrooms. Moreover, the SMS (Spent Mushroom Substrate) generated from this method can directly be used as a source of manure in the crop fields. Minimum incidence of diseases and pests was also found which could be due to high temperature generated during composting and further subjecting the semi compost to steam pasteurization. Though the results of the present investigation were quite encouraging, there is need to further standardize the substrate composition for further increase in the mushroom yield.

Fig-1 Fruiting in paddy straw + cotton waste (3:1, w/w) substrate

Fig-2 Fruiting in un-crumpled paddy straw substrate

Conclusion

The traditional method of straw mushroom production, more often associated with low and erratic yield, should substituted with new semi-compost method of production to achieve higher and stable mushroom yield. Moreover, the uncrumpled straw, hitherto considered as a poor substrate, can be successfully used for growing mushroom in the new semi-composting method. Depending upon their availability and cost factor, cotton waste, banana leaves and water hyacinth may be mixed with straw during the process of semi composting to increase the biological efficiency of straw mushroom further.

Application of research: The findings of the present investigation are quite useful for the commercial mushroom growers of Odisha or elsewhere in the country to switch over to semi-composting method of straw mushroom farming.

Research category: Mushroom Research
Abbreviations: BE- Biological Efficiency

Acknowledgement / Funding: Authors are thankful to Centre of Tropical Mushroom Research and Training, Department of Plant Pathology, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar, 751 003, Odisha, India

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Research project name or number: MSc Thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Centre of Tropical Mushroom Research and Training, OUAT, Bhubaneswar, 751 003, Odisha, India

Cultivar / Variety / Breed name: Mushroom

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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