
Effect of substrate soaking period and bed dimension on productivity of straw mushroom, *Volvariella volvacea*

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Paddy straw mushroom (*Volvariella volvacea*) is the most popular mushroom of Odisha. Owing to its short crop cycle and excellent taste, it has gained the status of a cottage industry in the coastal agro-ecological situation of Odisha. However, biological efficiency is poor (10 %) under conventional method of cultivation as an intercrop in the coconut plantations in outdoor situation. Hence, an investigation was taken up to evaluate the performance of varied pre-soaking periods of the substrate as well as bed dimension in terms of mushroom productivity. It was observed that pre-soaking of substrate for 6 h gave significantly highest yield of 1028.75 g/bed with a corresponding biological efficiency of 14.69 % among six soaking periods evaluated. Further, square beds (2' x 2' x 1'9'') or the modified forms were superior in comparison to large sized rectangular beds (4' x 2' x 1'9'') or round compact beds (18'' height and 3'8'' diameter) in realization of higher biological efficiency (10.26-10.93 %) in straw mushroom during the rainy season.

Key words: *Volvariella volvacea*, substrate soaking period, bed dimension, biological efficiency.

INTRODUCTION

Paddy straw mushroom (*Volvariella volvacea*) is an edible mushroom of tropics and sub-tropics. Straw mushroom cultivation is confined to the coastal states like Odisha, Andhra Pradesh, Tamil Nadu, Kerala and West Bengal (Ahlawat and Tewari, 2007). It is popular owing to its excellent taste and flavour, short crop cycle, simple and easy method of cultivation and availability of production inputs relatively at cheaper rates. Straw mushroom grows well in the temperature range of 30-35°C and relative humidity 75-85 % (Quimio *et al.*, 1990). Therefore, cultivation is confined within the months of March to October in the coastal belts of Odisha. Straw mushroom is traditionally grown in beds prepared out of non-pasteurized paddy straw as an intercrop in coconut plantations. At present, Odisha

produces 8000 metric tonnes of straw mushroom per annum contributing to 66 % of the total mushroom production of the state (Thakur and Mohapatra, 2013). However, the yield is unstable and low with an average biological efficiency (BE) of 10 %. Literature reveals that manipulation of crop culture could lead to improved yield of straw mushroom. Keeping this in view, the present studies have been undertaken to evaluate the pre-soaking period of the substrate and bed dimension in improving the yield of straw mushroom.

MATERIALS AND METHODS

Substrate soaking period

Good quality paddy straw bundles were collected, made to 1.5' length by trimming both the ends and soaked in clean and cold water for 2, 4, 6, 8,

10 and 12 h. Bundles were taken out, excess water drained out to 65 % substrate moisture. The experiment was laid out in randomized block design with six replications in each treatment. Beds were raised (1.5' x 1.5' x 1.5') with three layers each of 5'' thickness and the cover layer of 3'' thickness. For each bed 7.0 kg of dry straw was required. Spawning was done at 3 % of dry substrate in three layers, first two layers at the periphery only with a spacing of 3'' between spawn segments and all over the third layer with the same spacing. The beds were supplemented with gram flour at 3 % of the dry substrate. Beds were covered with transparent polythene sheets till mycelial run was over and then withdrawn. Beds were moistened appropriately. Fruits of the first flush were harvested followed by providing the polythene cover once again. Then the second harvest from second flush was recorded. Observations on days taken for emergence of pin head, number of fruit bodies, weight of fruit bodies were recorded and the corresponding biological efficiency was calculated using the following formula:

Bed dimension

$$\text{Per cent biological efficiency (BE)} = \frac{\text{Dry weight of substrate}}{\text{Fresh weight of mushroom}} \times 100$$

The experiment on evaluation of bed dimension was raised with six treatments including square bed (2' x 2' x 1'9''), rectangular bed (4' x 2' x 1'9''), square with cross bundle (2' x 2' x 1'9'), square without cross bundle (2' x 2' x 1'9''), round compact bed (18'' height and 3'8'' diameter) and bag method (80 cm x 40 cm). Six replications were maintained in each treatment in randomized block design. Beds were prepared adopting standard procedure as described earlier. Care was taken to maintain suitable temperature and humidity in the growing room. Observations on days taken for emergence of pin heads, number of fruit bodies and weight of fruit bodies were recorded and biological efficiency calculated treatment wise.

RESULTS AND DISCUSSION

The data indicated that pre-soaking of substrate for 6 h gave significantly highest yield of 1028.75 g per bed with a corresponding biological efficiency of 14.69 %. The same treatment produced maximum fruit bodies per bed (49.25) and the days to appearance of pin heads was numerically lowest

(8.5 d). Further, pre-soaking for a period of 4 h yielded 872.5 g of fruit bodies which was statistically at par with pre-soaking for 8 h (875 g) and pre-soaking for 10 h (855 g) with the realized biological efficiencies of 12.46, 12.50 and 12.21 % respectively. It was also found that soaking for 2 h and 12 h were inferior in yield performance having yielded 630 g and 600 g per bed respectively. The yield level in the trial varied in between 600-1028.75 g per bed (Table 1). Substrate soaking period has a tremendous bearing on mushroom productivity. Longer period of soaking facilitates decomposition of straw resulting in decreased C/N ratio which is unfavourable for *V. volvacea*. Hence, lengthy soaking periods up to 12 h reduced the biological efficiency of the substrate. This finding was in agreement with the findings of Bhavani Devi (1982) and Mohapatra *et al.* (2010). Belewu and Belewu (2005) reported that pre-soaking of substrate even for a period of 4 h could give better yields in paddy straw mushroom. Ahlawat and Tewari (2007) were of the view that soaking straw for a period of 12-14 h was necessary to obtain good yields under conventional method of cultivation. However, this study ascertained that 4-8 h of soaking was optimum to obtain a good crop of straw mushroom in outdoor situation. Quality of straw pre-soaked for longer periods would lead to deterioration of yield and quality of mushrooms.

It was indicated from Table 2 that pin head emergence was earlier (7d) in T₃ (square with cross bundle) and T₄ (square without cross bundle). It took 8 days in other bed types except the cylindrical one (bag method) in which pin head emerged in 14 days. The rectangular bed (4' x 2' x 1'9'') and round compact bed (18'' height and 3'8'' diameter) yielded well, but with low biological efficiency and therefore, were uneconomic. Similarly, the bag method (80 cm x 40 cm) had low yields, but with high biological efficiency. However, this method might not be acceptable for large scale cultivation owing to the complicated preparation procedure of bags. Square bed (2' x 2' x 1'9'') and square beds with little modification (T₁, T₃ and T₄) gave good yields with acceptable biological efficiency (>10 %). Square bed (2' x 2' x 1'9'') and square without cross bundle gave equal yields 1092.5 g and biological efficiency of 10.93 % respectively closely followed by square with cross bundle giving yield of 1026.25 g and biological efficiency of 10.26 %.

Table 1 : Effect of substrate soaking period on mushroom productivity

Treatment	Days to appearance of pin head	Number of fruit bodies	Yield (g) per bed	Biological efficiency (%)
T ₁ Soaking for two hours	10.50	31.25	630.00	9.00
T ₂ Soaking for four hours	8.75	42.75	872.50	12.46
T ₃ Soaking for six hours	8.50	49.25	1028.75	14.69
T ₄ Soaking for eight hours	9.00	42.00	875.00	12.50
T ₅ Soaking for 10 hours	8.75	41.50	855.00	12.21
T ₆ Soaking for 12 hours	11.75	35.50	600.00	8.57
C.D.(0.05)	0.69	3.70	32.72	-
C.V. (%)	4.78	6.08	2.68	-

Hence, square beds or modified square beds (2' x 2' x 1'9'') might be the appropriate type of obtaining better productivity during rainy season. Percolation of good amounts of light and air into the smaller beds especially during the mushroom development stage might be attributed for realiza-

tion of 2' x 2' x 1' was superior in realization of sporophore yield. Agarwala (1973) found that a bed size of 2' x 2' x 4' was superior in respect of mushroom productivity which was in agreement with the finding of Singh (1976). However, standard bed types for different seasons could be

Table 2 : Effect of bed dimension on mushroom productivity

Treatment	Days taken for emergence of pin head	Number of fruit bodies	Weight of fruit bodies (g) per bed	* Biological efficiency (%)
T ₁ Square bed (2' x 2' x 1'9'')	8.00	98.75	1092.50	10.93
T ₂ Rectangular bed (4' x 2' x 1'9'')	8.25	132.50	1600.00	8.00
T ₃ Square with cross bundle (2' x 2' x 1'9'')	7.00	145.00	1026.25	10.26
T ₄ Square without cross bundle (2' x 2' x 1'9'')	7.00	73.50	1092.50	10.93
T ₅ Round compact bed (18" height and 3'8" diameter)	8.00	170.75	1537.50	3.62
T ₆ Bag method (80 cm x 40 cm)	14.00	9.75	162.50	10.86
C.D.(0.05)	0.74	24.60	217.24	-
C.V. (%)	5.65	15.55	13.29	-

tion of better yields. Workers opined differently on the effect of bed dimension on mushroom productivity. Gupta *et al.* (1970) observed that a bed di-

worked out through a series of on-farm trials to improve productivity of straw mushroom which at present is hovering in between 10-15 %.

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