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Full Research Article

Cultivation of Paddy straw Mushrooms (*Volvariella volvacea,)* in the Lateritic Zone of West Bengal-A Healthy food for Rural People

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Abstract

Paddy straw mushroom (Volvariella spp.) also called 'straw mushroom' is a fungus of the tropics and subtropics and has been cultivated for many years in India . This mushroom has several advantages like requirement of the tropical or sub-tropical climate, fast growth rate, easy cultivation technology and good acceptability at consumers' level. Paddy straw mushroom contains good amount of protein, crude fibres and ash, all make it a health diet along with superior composition of various elements and essential amino acids. West Bengal has tremendous potential of commercial cultivation of Volvariella volvacea due to the easy availability of paddy straw and good environmental conditions. This mushroom can easily be grown by the rural women which not only generate income for them but also helpful for meeting their daily protein requirements. An investigation was carried out at a mushroom farm of Bolpur, Birbhum ,W.B. during the season 2008-2010 to find out the suitability of cultivation of this mushroom under the agro-ecological condition of red and lateritic belt of West Bengal. Varous substrates i.e. paddy straw, paddy straw+Wheat straw 1:1 , banana leaf+paddy straw 1:1 , water hyacinth+paddy straw 1:1 , mustard straw+paddy straw 1:1 and maize straw+paddy straw 1:1 were taken to find out their suitability for cultivation of Volvariella volvacea. Different methods of cultivation i.e. bed method ,cage method ,spiral method and heap method were further tried to identify a suitable method of cultivation for the locality. Paddy straw was found to be most appropriate substrate in terms of yield and biological efficiency followed by maize straw+paddy straw 1:1 and banana leaf+paddy straw 1:1 which were exhibited 10.20, 9.8 and 8.5% biological efficiency respectively.While, mustard straw+paddy straw 1:1 substrate was found unsuitable for paddy straw mushroom cultivation.Among the various methods of cultivation,bed method of cultivation has showed its supremacy among all the treatments. The information will help the farmers for decision making for diversifying their cultivation as well generating extra income.

1. Introduction:

Cultivation of edible mushrooms is one of the most economically viable processes for the bioconversion of lingo-cellulosic wastes (Bano et al., 1993) straw mushroom(*Volvariella volvacea*), the fourth most important cultivated edible mushroom in the world (Chang, 1989). It was first cultivated in India in 1940; however, its systematic cultivation was first attempted by Thomas and his associates at Coimbatore, in 1943. Paddy straw mushroom is also known as "warm mushroom" as it grows at relatively high temperature. It is a fast growing mushroom and under favorable growing conditions total crop cycle is completed within 4-5 weeks time. This mushroom can use wide range of cellulosic materials and the C: N ratio needed is 40 to 60, quite high in comparison to other cultivated mushrooms. It can be grown quite quickly and easily on uncomposted substrates such as paddy straw and cotton waste or other cellulosic organic waste materials Ahlawat,O.P.(2011). Several species of *Volvariella* have reportedly been grown for food, but only three species of the straw mushroom i.e. *Volvariella volvacea, Volvariella esculanta* and *Volvariella diplasia* are cultivated artificially. Presently this mushroom is more popular in coastal states like Orissa, Andhra Pradesh, Tamil Nadu, Kerala and West Bengal, however, it can also be cultivated in most of the states, where agro climatic conditions suit and agro waste is available in plenty. Among the various mushrooms cultivated in the country, *Volvariella volvacea* holds a good promise and its cultivation has been

introduced as a cottage industry. This mushroom has several advantages like requirement of the tropical or sub-tropical climate, fast growth rate, easy cultivation technology and good acceptability at consumers' level. The raw materials required for its cultivation are also available in abundance in country at very nominal rates. Various substrates viz. grain substrate (wheat, sorghum) and straw substrates (saw dust ,rice bran, de oiled rice bran, paddy husk etc.) were tried by the several workers to raise the spawn of *Volvariella* species (Ramaswamy and Kandaswamy,1976; Pani and Naik 1998,). Outdoor cultivation of paddy straw mushroom (*Volvariella volvacea*) was experimented in maize based cropping system by Krishnamoorthy et al. (2005). West Bengal has a tremendous potential and scope for paddy straw mushroom cultivation due to the easy availability of basic substrate (paddy straw). The high temperature requirement for its cultivation also makes it a good choice for adoption in round the year cultivation of mushrooms in West Bengal. This mushroom can be successfully cultivated on several crop residues like paddy straw cotton waste wheat straw and sugarcane industrial waste. Minimum effort has been given to popularize the paddy straw mushroom in West Bengal. The excellent unique flavour and textural characteristics distinguish this mushroom from other edible mushrooms. It contains good amount of protein, crude fibres and ash, in comparison to other mushrooms, all make it a health diet along with superior composition of various elements and essential amino acids. Considering the above, an initiative was undertaken to popularize the paddy straw mushroom by cultivating it under the agro-ecological conditions of lateritic belt of West Bengal.

2. Materials and Methods

The experiments were carried out at a mushroom farm of Bolpur, Birbhum, W.B. during the season 2008-2010. A well-ventilated room with a cemented floor and wall was used as cropping room. Spawn of paddy straw mushroom was prepared from fresh fruiting body in the laboratory. Varous substrates i.e. paddy straw, paddy straw+Wheat straw 1:1, banana leaf+paddy straw 1:1, water hyacinth+paddy straw 1:1, mustard straw+paddy straw 1:1 and maize straw+paddy straw 1:1 were taken to find out their suitability for cultivation of *Volvariella volvacea*. Different methods of cultivation i.e. bed method, cage method, spiral method and heap method were further tried to identify a suitable method of cultivation for the locality. Spawning @ 2% (dry weight basis) was done through layering method. Paddy straw was soaked in water for 18 hours and 72-75% moisture content of the straw was maintained at the time of spawning. Bed method of cultivation was followed and 24-30°C temperature and 90% relative humidity was maintained in cropping room. A unit of 10 kg substrate was taken for each replication and four replications was maintained in each treatment. The Biological Efficiency was calculated from the sum of total weight of all flushes harvested from dry substrate.. It is always expressed in term of percentage.

$$\text{Biological Efficiency \%} = \frac{\text{Fresh weight of mushroom}}{\text{Air-dried}} \times 100$$

Details of the cultivation technique followed for paddy straw mushroom are given in plate -1&2.

3. Results and discussion:

4.1. *Evaluation of substrates for cultivation of Paddy Straw Mushroom (Volvariella volvacea)*

To increase the biological efficiency of Paddy Straw Mushroom (*Volvariella volvacea*),various combination of paddy straw i.e. Paddy straw+Wheat straw (1:1) ,+Paddy straw Banana leaf (1:1) , Paddy straw +Water hyacinth (1:1), Paddy straw +Mustard straw (1:1) and Paddy straw+Maize straw (1:1) were tested along with paddy straw (served as control) The data obtained on various parameters have been presented in table-1. It was evident from the table that, paddy straw alone and its various combinations produced fair quantity of yield of *Volvariella volvacea* and differ significantly among each other. Maximum yield was obtained from paddy straw followed by maize straw+paddy straw 1:1 and banana leaf+paddy straw 1:1 which were exhibited 10.20 , 9.8 and 8.5 % biological efficiency respectively. Paddy straw spawned substrate has taken minimum time (12 days) for completing the spawn run followed by 1:1combination of paddy straw with maize straw, banana leaf and wheat straw (13 days).While, mustard straw+paddy straw 1:1 substrate was found unsuitable for paddy straw mushroom cultivation. However, no correlation was exist between rates of spawning and number of sporophores. Compactness of mushroom bed provides vital role in paddy straw mushroom production as it can not supply ambient temperature and fresh air between the layers results in poor mycelium development .This finding further confirming the reports of Saeed *et al*., (1994).

4.2. *Evaluation of different methods of cultivation for higher biological efficiency of Paddy Straw Mushroom* .

To find out a suitable technique for cultivation of paddy straw mushroom under the agro-ecological condition of lateritic belt of West Bengal, four methods i.e, bed method ,cage method ,spiral method and heap method were evaluated during the cropping season and the data obtained on different parameters have been presented in table-2.

Among the various methods of cultivation ,bed method of cultivation had showed its supremacy among all the treatments exhibited 11.20% Biological Efficiency followed by 10.30%

Steps involved in Paddy Straw Mushroom Spawn Preparation

Medium for isolation of pure culture

Inoculation of mushroom tissue for pure culture

Pure culture of volveriella volvaceae in culture tube

Inoculation of master culture for spawn preparation

Master culture/stock culture in wheat grains

Grain spawn in polythene bags

Plate 1: Methods involved in spawn preparation

Table 1: Evaluation of various substrates for Paddy Straw cultivation

Sl. No.	Substrates	Total yield from 10 kg substrate g	B.E %	No. of fruit bodies/per bed	Spawn run period in Days
1.	Paddy straw	1020	10.20	420	12
2.	Maize straw+Paddy straw 1:1	980	9.8	527	13
3.	Banana leaf+Paddy straw 1:1	850	8.50	332	13
4.	Water hyacinth+Paddy straw 1:1	730	7.30	410	15
5.	Paddy straw+Wheat straw 1:1	910	9.10	520	13
6.	Mustard straw+Paddy straw 1:1	530	5.30	581	16
SE(mean)		9.50		7.73	0.67
CD (p=0.05)		28.28		22.99	2.00

and 9.15% from spiral and cage method respectively. Bed method and heap method of cultivations were taken 14 days for completing the spawn run followed by cage method (15 days)and spiral method 16(days) fig-2. No correlations were exist among the spawn run periods of cultivation methods. However heap method of cultivation was found unsuitable due to its poor performance in terms of yield. Cage method of cultivation has an extra advantage over the other methods, as it

Cultivation of Paddy Straw Mushroom

Preparation of substrate

Spawning on substrate

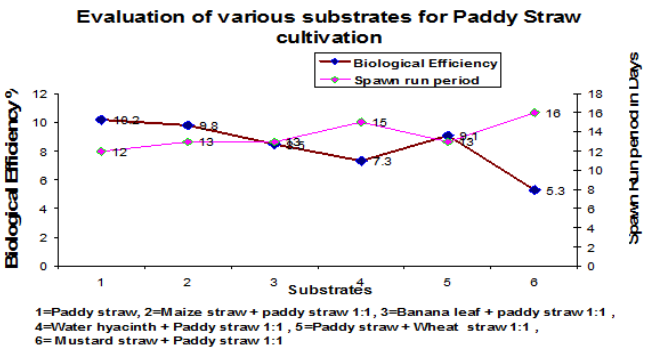
Spawned substrate

Initiation of pinheads

Developing pinheads

Full grown paddy straw mushroom

Plate 2: Methods involved in cultivation



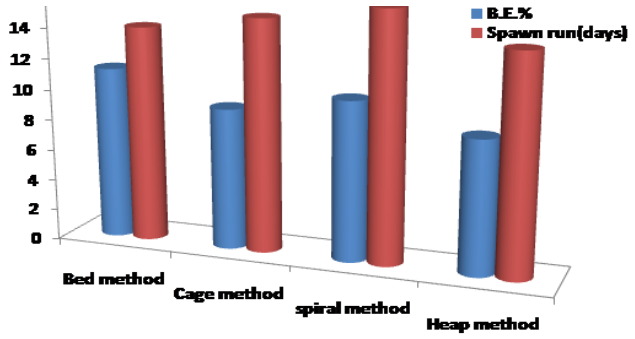


Table-2: Evaluation of various method of cultivation

Sl. No.	Supplementation	Total yield from 10 kg substrate (g)	B.E. %	No. of fruit bod-ies/ per bed	Spawn run period in Days
1.	Bed method	1120	11.20	622	14
2.	Cage method	915	9.15	727	15
3.	spiral method	1030	10.30	632	16
4.	Heap method	860	8.60	682	14
	SE(treatment me-an) CD (p=0.05)	22.77 56.48		15.49 46.04	1.31 3.89

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4.	Heap method	860	8.60	682	14
	SE(treatment mean)	22.77		15.49	1.31
	CD (p=0.05)	56.48		46.04	3.89

maintains proper temperature and aeration inside the bed due to proper shape and size, which enable the mushroom mycelium to grow faster than the others. The above mentioned fact could be one of the reason of higher biological efficiency of paddy straw mushroom in cage method of cultivation.Similar results with cage method of cultivation were also reported by Jiskani et al (2004).

4. Conclution:

Successful cultivation of paddy straw mushroom can be done with paddy straw and its combination with maize straw and wheat straw the lateritic belt of West Bengal and 10.2% Biological Efficiency can easily be obtained through indoor cultivation. Bed method of cultivation was found to be most suitable for cultivation of paddy straw mushroom followed by spiral method Heap method of cultivation was found unsuitable due to its poor performance in terms of yield. The reports of investigation may provide useful information to the farmers for crop diversification and decision making which will generate extra income and also include valuable protein and essential amino acid in their daily diet.

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