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Cultivation Technology of *Pleurotus* Species Production in Bangladesh

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ABSTRACT: The importance and prospect of growing mushrooms commercially in Bangladesh has recently been outlined. From several experiments conducted with various methods of cultivation in the laboratory, it was found that oyster mushroom cultivation was most successful by employing the poly bag method, nylon net bag method and bed method. The optimum yield of *Pleurotus* spp. was obtained during the period from October to March and July to August. Sawdust and various agricultural wastes were used as substrates. Contamination of *Pleurotus* spp. substrate by fungal and bacterial spp. were observed. The biological efficiency was satisfactory.

1 INTRODUCTION

Pleurotus spp. are some of the choice edible mushrooms that can be cultivated in the tropics (Quimio *et al.* 1990). Recently, these mushrooms have become a common edible mushroom in Bangladesh. Their cultivation technology has gained popularity because: (a) prevalance of favorable agro-climatic conditions, (b) availability of many agricultural, forest, and household wastes at a low cost, (c) they can be grown in a variety of containers such as polethene bags, nylon nets, baskets, shelves, trays, etc. (Kapoor 1989), (d) they are relatively easy to cultivate, i.e. they require low capital investment with high yield even under natural rural conditions, and (e) after harvest, they can be dehydrated allowing the opportunity to store the product for longer periods compared with other edible mushrooms such as *Volvariella* spp.

The most popular species of oyster mushrooms for commercial

production in Bangladesh are *P. sajor-caju* and *P. citrinopileatus*. Problems and prospects of growing mushrooms in Bangladesh, like other countries of the world, have been described previously (Rahman and Zaman 1993). Both *P. sajor-caju* and *P. citrinopileatus* may be grown year-round using simple and low-cost technology. The best yield performance of oyster mushrooms was recorded in the period from October to March and July to August when temperatures range from 18 to 26C and 26 to 31C, respectively. The best and most luxuriant growth occurs, generally, in the winter season. *Pleurotus citrinopileatus* has more temperature tolerance than *P. sajor-caju*. The "best" substrates for growing oyster mushrooms are sawdust and wet straw. Experimental results have revealed that oyster mushrooms can be grown in bags or in beds of different configurations placed on the ground under shade.

2 MATERIALS AND METHODS

Pure cultures of the above mentioned species were obtained from the Mushroom Culture Centre, Dhaka (1987), India (1990) and the Philippines (1995). These isolates were subcultured on PDA slants for use during the period of investigation from 1987 to 1995. Sawdust spawn was produced for fruiting in bags and on beds. Many substrates, suitable for growth of oyster mushrooms, are abundantly available in the country. Both rice and wheat straw, sawdust (*Magnifera indica*), and wheat and rice bran were used throughout this study by following the methods as described below for cultivating *Pleurotus* spp.

In Bangladesh, a poly bag method (PBM) and a nylon net bag method (NNBM) (Chang and Quimio 1982, Kapoor 1989) have become very popular. Most commercial mushroom production in the country is now practiced using the NNBM (Nita 1984). At present, methods used in Bangladesh for growing oyster mushrooms are described below.

2.1 Poly bag method

Sawdust (500 g) mixed with wheat bran in the ratio of 4:1 was watered and placed into polypropylene bags measuring 25 cm x 20 cm. The substrate was sterilized at 121C for 15 minutes in an autoclave, then cooled at room temperature for 24 hours. The substrate was inoculated with one/two tablespoons spawn per bag. After inoculation the substrate was incubated for 15 to 25 days at room temperature. When the growth of mycelium was visible, the poly bags were punctured at the top sides for

facilitating the luxuriant growth of the mycelium. Five to 7 days later, punctures were made on the sides of the bag where mushrooms emerged and were harvested on a routine basis.

2.2 Nylon net bag method

Dry, chopped (2 cm) paddy straw (15 kg) was soaked in ordinary water for 12 to 24 hours, depending the straw's ability to absorb water. Excess water was drained from the substrate and it then is sterilized in an autoclave. The straw was cooled for 24 hr and then spawned. The spawned substrate was divided equally and filled and pressed compactly into two nylon net bags which then were placed inside polyethylene bags. The bags were closed at the top (leaving a small gap for gas exchange) and hung in a shady place. After 15 days of spawn growth, the plastic bag was removed and the surface was sprayed twice daily to maintain substrate surface wetness. Mushrooms began to form at day 18 after spawning and harvesting of mature basidiomes occured at day 20 to 24.

After harvesting the first flush of mushrooms, the substrates contained in NNB were covered with plastic bags for 7 days. The bags then were removed, the substrate was watered twice daily and mushrooms begin to appear after 3 days. Each successive flush was treated in the same manner as described above. This process yielded one kg of mushooms in 4 flushes.

2.3 Bed method

Mushroom beds were prepared with wire net (1.75 cm mesh) at a minimum height of 75 cm with a length of 1.5 m and a width of 1.2 m. Dry, chopped (2 cm length) paddy straw (20 kg at 10 kg/m2) was soaked for 12 to 24 h depending on the ability of the straw to absorb water. The straw then was drained and divided into 4 equal lots. One lot was spread uniformly on the bed and 2 packets of spawn were layered uniformly over the bed. This process was repeated with the other 3 lots so that the beds were spawned in 4 layers. The beds then were wrapped with a polyethylene sheet by applying pressure and bound tightly with a nylon rope. After 15 days of spawn growth, the plastic sheet was removed and water was spayed at least twice daily to maintain proper substrate surface moisture. Mushrooms began to appear three days later and were harvested beginning the 21st day after spawning. Once the first flush was harvested, the beds were wrapped with plastic sheets for 7 days and the process was repeated as above. This process can be completed in 4 flushes with a yield of 13 kg per bed.

3 RESULTS

After inoculation (20 to 30 days) mushrooms were found to grow vigorously. The best performance of oyster mushrooms were recorded in the period from mid October to mid March and July to August when temperatures range from 18 to 26 C and 26 to 31 C, respectively. The production, however, during the rest of the year fluctuated because of changes in temperature, humidity and other environmental parameters. *Pleurotus sajor-caju* was grown throughout the year but it's optimum and most luxuriant growth took place, generally in the winter and during rainy seasons (Table 1). *Pleurotus citrinopileatus*, *P. cystidiosus* and *Pleurotus* sp. were more temperature tolerant than *P. sajor-caju*. Sawdust mixed with rice/wheat bran for production with the PBM was suitable for both summer and winter seasons. On the other hand, rice/wheat straw compost used in the NNBM/BM were adequate for winter production. Contaminants were observed during times of the year when both humidity and temperature are elevated (May to September). Species of *Trichoderma*, *Penicillium*, *Aspergillus* and *Rhizopus* may infest compost packets, mushroom beds, and basidiomes. *Coprinus* spp. frequently are observed in mushroom beds during this period and may reduce substrate productivity.

Table 1. Average monthly production (kg) of *P. sajor-caju, P. citrinopileatus* and *P. cystidiosus* from 1987-1995.

Month	*Pleurotus sajor-caju*	*Pleurotus citrinopileatus*	*Pleurotus cystidiosis*
Jan	80	0	0
Feb	100	0	100
March	50	0	70
April	70	0	0
May	90	170	160
June	130	240	200
July	160	290	280
August	160	300	290
Sept	100	180	190
Oct	200	150	220
Nov	300	0	150
Dec	320	0	0

4 DISCUSSION

The NNBM and BM of *Pleurotus* mushroom cultivation utilizing simply-treated, unsupplemented rice straw as the main substrate is comparatively simpler than the PBM. The NNBM and BM offers an alternative way to cultivate this mushroom for growers that have limited access to sawdust. Likewise, they require less capital inputs than the PBM and the technology is less complicated. *Magnifera indica* is the main sawdust used by growers with the PBM. It was found that oyster mushroom cultivation was successful by employing the PBM in the summer period when temperatures remain high and by using the NNBM in the winter season when much more favorable temperatures exist. The PBM appears convenient for domestic production, on a small scale farming basis. On the other hand, as commercial technology for mushroom production in the country, NNBM has replaced the BM. The BM consists of arranging the shelves in tiers made of either wood or steel structures and thereby exploits the use of greater overhead space minimizing the need for greater land space.

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