

# Oyster Mushroom Cultivation

## Part I. Mushrooms

### Chapter 2

#### Mushroom Growing for a Living Worldwide

## MUSHROOM CULTIVATION TO MAKE LIVING IN NEPAL

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### A Short History of Mushroom Cultivation in Nepal



Figure 1. Nepal

Mushroom cultivation was initiated by the Division of Plant Pathology, Nepal Agricultural Research Council (NARC) in 1974. The growing technology for white button mushroom was developed during that early period and extended to general farmers starting in 1977. It utilized the synthetic media of paddy straw, which is harvested twice a year in Kathmandu. Of course, a few farmers grew mushrooms before the introduction of the technology but the number of button mushroom growers has increased year after year thanks to the spread of the technology.

The growing technology to grow oyster mushroom using chopped straw packets was introduced to the farmers in 1984, and since then mushroom cultivation has become more popular among farmers. These two kinds of mushroom cultivation systems have been employed by farmers in about 25 districts within Nepal. The Centre for Agricultural Technology (CAT) has recently introduced straw mushroom (*Volvariella volvacea*) cultivation in the Terai districts and shiitake in the hill districts and has been instructing farmers how to grow them since 2001.

### Oyster Mushroom Cultivation in Nepal

Oyster mushroom cultivation was introduced to Nepalese scientists in 1981. Research on the proper substrate and climatic conditions for oyster mushroom growing was carried out by the Division of Plant Pathology. Growing *Pleurotus sajor-caju* on stump and chopped paddy straw packets was successful in Kathmandu in 1982. The technology, which was distributed to farmers in 1984, was so simple, easy to adopt and suitable to the climate of Kathmandu valley that farmers could adopt it quickly. The cultivation practices, which produced quick returns, spread like wildfire. Poor farmers were willing to try mushroom growing on a small scale in order to augment their incomes. The growing of the species *P. ostreatus* was introduced later in 1998. These days farmers prefer *P. ostreatus* because it has higher productivity and can be grown during the winter in Kathmandu. Thanks to this

durability, local consumers can now obtain oyster mushrooms all the year round. These mushrooms have been grown recently in the Terai districts (a tropic area) during winter and also transported to markets in Kathmandu.

Oyster mushrooms are often grown without any environmental control. *P. sajor-caju* is cultivated for the summer crop at Kathmandu (25-30°C and 80%) and in the hills of Nepal while it is cultivated in the Terai regions during the winter season (22-26°C and 70%). *P. ostreatus* is grown during the winter season in Kathmandu and other cool places (5-20°C and 70%). Some mushroom growers try to grow these two species together. Of course, oyster mushrooms cannot be grown in Terai during the summer (30-40°C and 70%). The mid hills of Nepal are the most appropriate areas for oyster mushroom production and therefore the mushroom technology has been expanded widely in those villages.

### Cultivation Method Practiced in Nepal

The cultivation method for oyster mushroom production using paddy straw in Nepal is as follows. Paddy straw is selected from the field by choosing fresh, not old, clean and straight pieces, of good quality. These straws are manually chopped into small pieces (2-3 inches long) using the locally hand-made chopper (Fig. 2). Chopped straw is then soaked in water for 2-4 hours, or sometimes overnight, in a container or a small ditch specially made for this purpose (Fig. 3).



Figure 2. Straw chopping



Figure 3. Soaking the chopped straw



Figure 4. Cleaning the straw in clean water



Figure 5. Draining water on a wooden framed net

The soaked straw is cleansed in water (Fig. 4) 1-2 times in a plastic bucket or some other container. The water from the straw is drained off in sieve (Fig. 5). Most farmers drain the water off slowly by placing the cleansed straw on a sloped place, a procedure that takes 2-4 hours.

The drained straw is then steamed in a steamer. The local steamers are clay pots with a number of holes on the bottom. These steamers are put on top of a metallic vessel containing water (Fig. 6). The water is boiled using a kerosene stove. The mouth of the straw steamer is covered with thick plastic sheet (Fig. 7) and tied up by a string so as to make it tight. It takes about half an hour for the steam to reach the top of the steamer. Once the steam reaches to the top, steaming should be continued for about half an hour or more in order to sterilize the straw. The temperature in this process usually goes beyond 90°C.



Figure 6. Local steamer (earthen pot) on a metallic vessel containing water



Figure 7. Covering the steamer with plastic to pasteurize



Figure 8. Steaming the straw in a metallic drum

Instead of the clay pot steamer, a metallic drum (Fig. 8) can be used. In such cases the metallic drum is filled with water to about 6 inches from the bottom and a tripod stand is used to support the grate. The drum is then filled with straw and covered with a plastic sheet. The steaming method is then the same as with the clay pot steamer. The steamed straw is cooled down in the same container or transferred into a plastic sack to prevent contamination from outside.

The plastic bags used for making packets are of different sizes: 12×16" (small) and 18×26" (large). These bags are punched to make holes at a distance of 4 inches apart. Cooled straw is packed in the bags in layers up to 4 inches deep and grain spawn is sprinkled in layer by layer (Fig. 9). Once the bag is filled, the bag mouth is closed with a rubber band. Incubation proceeds at room temperature for 20-21 days (Fig. 10), until the mycelium spreads completely throughout inside the packets.



Figure 9. Making packets and spawning



Figure 10. Incubation of packets at farmer's house

When the spawn run is completed, the bag is removed by cutting the plastic (Fig. 11). The packets are arranged in a row on the floor using a brick or two underneath (Fig. 12). The spacing between the packets is 6 inches, with 2 feet between the rows. Watering is done every morning and evening using a sprayer. In the dry season, one

more spraying of water should be done. Primordia appear after 4-5 days (Fig. 13) and develop into a full size mushroom within an additional 2-3 days (Fig. 14).



Figure 11. Packets after opening the plastic bags



Figure 12. Packets are arranged in a row with bricks underneath



Figure 13. Primordia formation



Figure 14. Fruiting bodies

### Infrastructure and Investment on Oyster Mushroom Production

Nepalese farmers grow mushrooms in a thatched house (Fig. 15) or a plastic tunnel. The thatched house is made up of wheat straw, bamboo and wooden support (Fig. 16). Plastic cover is used whenever it is necessary.

The plastic tunnels (Fig. 17, 18, 19) are constructed of thick plastic sheets with bamboo support. The size of tunnel is 40 feet long, 15 feet wide and 8 feet high.

The investment cost for oyster mushroom production is quite low. Most of the total cost is for the construction of a mushroom house, which is made of local and easily available materials. Skilled construction labor is available in most villages. The raw materials for mushroom cultivation are agricultural wastes and are usually available at the farmer's door.



Figure 15. Thatched house



Figure 16. Inside a thatched house



Figure 17. Plastic house (tunnel)



Figure 18. Inside the tunnel



Figure 19. Plastic tunnel covered with straw

### Cost and Benefit of Oyster Mushroom Production in Average (for 2 months)\*

• **Total Production Cost = NPR\*\*5,150.00 (USD69.26)**

Item	Quantity	Cost in NPR
Straw for 100 packets	300kg	1,200.00 (USD16.13)
Plastic bags (18 × 26")	100 pcs	400.00 (USD5.37)
Spawn (250g/bottle)	50 bottles	1,200.00 (24 per bottle)
Rent	2 months	1,000.00 (500/month)
Chemicals		150.00 (USD2.02)
Labor		1,200.00 (USD16.13)

• **Total Income**

= NPR18,000.00-27,000.00 (USD242.09-363.14)

Price	Volume	Value in NPR
90.00 per kg	200-300jg (2-3kg/pack)	18,000.00-27,000.00

\* It takes one month growing and another month for harvest.

\*\* NPR (Nepalese Rupee, NPR1 = USD0.0134 in Feb 2004)

• **NET PROFIT = Total Income - Total Production Cost**

- ▶ Maximum NPR21,850.00 (USD270.00)
- ▶ Minimum NPR12,850.00 (USD160.00)

One oyster mushroom grower produces 5 tons a year on average. The estimated productivity is 800-900kg of oyster mushrooms from 1,000kg of paddy straw. A farmer can grow about 4-5 crops per year and produce the income of NPR200,000-300,000 (USD2,689.9-4,034.99) per year.

### **Mushroom Growers, Spawn Supply and Product Marketing**

There are about 5,000 mushroom growers within Kathmandu valley and 6,000 growers in other districts in total, including growers of other mushrooms. Balambu, with a long history of mushroom growing, has approximately 100 commercial growers and some 100 seasonal growers. They produce 2,000-3,000kg per day during the summer season and about 300-400kg per day during winter season. There are four or five distributors who collect the product from farmers to supply the markets. These same distributors also deliver spawn to the farmers. Some growers purchase directly from the spawn suppliers and sell their products to the market by themselves, and at present this is the system adopted in most of the villages for mushroom marketing and production.

There are about five spawn producers at Kathmandu. They supply spawn to farmers as well as the distributors. Some suppliers deliver spawn to remote places through courier transport services. In most of the other districts, mushroom growing is initiated by the Agriculture Department offices of HMG (His Majesty's Governments of Nepal). There are extension programs of mushroom production of HMG in the country, but most spawn production and mushroom marketing is done by private agencies.

There are no good marketing systems and no stable market price for mushrooms in Nepal. The market price fluctuates according to the demand and supply. The growers in Kathmandu get NPR40.00-60.00 (USD0.54-0.80) per kg during pick production season. However the price ranges from NPR80.00-90.00 (USD1.07-1.20) per kg most of the other times. During the off-season growers get NPR150-200 (USD2.01-2.68) per kg.

### **Conclusion**



Figure 20. Training women farmers

Oyster mushroom production is a most appropriate technology for the poor landless farmers and women farmers in Nepal. Mushrooms can be grown in the small space of a farmers' own house for small scale production and generate income that aids in the family support. Mushroom cultivation is a most popular activity for development programs targeting income generation among women in Nepal because it is suitable for the women's life style.

As the women's responsibility is mainly to take care of the household work and children, they can accommodate mushroom cultivation in between their main work. The product is highly nutritive and a good food for their children and old parents, and because of its high value they can also derive some income from the production. The farmers of many districts of Nepal have grown oyster mushrooms in a small scale and have benefited highly. They have managed to adopt the technology in a simple way whereby they can afford to invest on a small scale. They are mainly utilizing the agricultural waste of wheat and paddy straw, and thus mushroom cultivation has improved the living conditions of many poor farmers in Nepal.