

## Part II Mushroom for Better Life

## Chapter 8

Mushroom for a Living**SMALL SCALE OYSTER MUSHROOM CULTIVATION IN EGYPT**

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**Introduction**

Figure 1. Map of Egypt

Many parts of the world, particularly developing countries, have a problem in producing sufficient food, and poverty is increasing rapidly in these areas. There is a great need for tools to alleviate this poverty, and one of these tools is the growing of mushrooms. This poverty alleviation tool is particularly appropriate in countries that have large amounts of agricultural wastes. According to the mushroom growing guide published by the ministry of agriculture in 2003, Egypt is one of those countries having large unused agricultural wastes, and produces over 30 million tons of agricultural wastes every year. These wastes include rice straw, wheat hay, maize and cotton refuse, sawdust, vegetable residuals (mainly potato, tomato, and peanut), sugarcane trash, industrial food wastes, and water hyacinths.

Mushroom cultivation turns this refuse into a food source rich in minerals, protein, carbohydrates, and other healthy compounds. The material that remains after mushroom cultivation can be used as animal

fodder. Mushroom cultivation also offers employment to youth in rural regions. Mushroom cultivation provides an inexpensive protein source. While meat as a protein source is expensive (EGP<sup>1</sup>28-30/kg, USD4.48-4.8) for those who have a limited income, oyster mushrooms are so inexpensive (EGP9-12/kg, USD1.44-1.92), that they are called "Poor Man's Meat." Current dietary habits in Egypt do not include the consumption of mushrooms. For the promoted consumption of mushrooms, considerable efforts are required.

Mushroom cultivation is a suitable activity for the climate in northern Egypt where the temperature is 15-20°C in winter and 25-35°C in summer. Potential mushroom cultivation substrates are abundant in the countryside, where rice, wheat, maize, and cotton are commonly cultivated in the Delta provinces. Most parts of Egypt, except southern Egypt with hot and dry climate, have a climate appropriate for the cultivation of mushrooms.

The effort to promote mushroom cultivation among small farmers requires only simple kits and treatments, and all of the basic components needed to establish a mushroom cultivation industry are in place. Mushroom cultivation activity is beginning to increase, but is still far from being a mature industry.

Oyster mushrooms are the most commonly cultivated type of mushrooms in the areas where rice straw can be obtained for free from farmers. These rice farmers otherwise burn any excess rice straw in the fields at the end of summer in order to clear the fields for the next crop. The climate from September to April is suitable for cultivating oyster mushrooms. Many people grow oyster mushrooms in home kitchens in areas where the mushrooms are not available in the local markets.

<sup>1</sup> EGP(Egyptian Pound, USD1 = EGP6.25 in March, 2005)

### Short history of mushroom cultivation in Egypt

Mushrooms were known more than three thousand years ago by the ancient Egyptians. They were considered a luxury food, were eaten only by the nobility, and known as the food of the gods. In the 1940's some European foreigners living in Egypt cultivated mushrooms on a very small scale and collected wild mushrooms during the winters. In the 1980's the mushroom cultivation farms were established in Tanta and Faqous could not satisfy the demand from the hotels, tourists, and local residents.



**Figure 2.** Oyster mushroom in growing house  
(Photo courtesy by Dr. Amira Ali El-Fallal)

Studies on mushroom cultivation began in 1984 at the Fungi Identification and Preservation Laboratory in the College of Agriculture at Ein-Shams University. This organization concerns itself with the identification of wild mushrooms in Egypt and the cultivation of *Pleurotus* species such as *Pleurotus ostreatus*. They also do research on the use of agricultural wastes such as cereal straw, cotton and maize waste, wood, and sawdust. The study on commercial cultivation began in 1988, when several universities and food technology institutes established research units that are responsible for training growers in mushroom cultivation and marketing. These agencies provide low cost cultivation kits and spawn, and marketing assistance for growers. Today information about mushroom cultivation (especially oyster mushrooms) is available to small farmers through the agriculture directorates of all of the provinces in Egypt.

### Oyster Mushroom Cultivation in Egypt

#### How to cultivate

There are three main methods used in Egypt for cultivating oyster mushrooms commercially and one other method used in house kitchens as a hobby. The most frequently used substrate material is cereal straw, although rice strow costs the least.

The clean and dry straw is selected from the field and then cut into smaller pieces (although some farmers do not cut the straw because many rice species in Egypt have short stems), packed in plastic bags, soaked overnight, then let stand for 10-15 hours in order that the excess water can drain off. Then the substrate is boiled or steamed in a metallic drum using a heating source such as kerosene, firewood, or gas cylinders. The heating is continued until the temperature reaches 100°C. This process takes one or two hours. Some additives are applied to before or after pasteurization, these additives usually include 5% wheat bran and 5% lime, although some growers use gypsum.



**Figure 3.** Soaking straw  
(Photo courtesy by Dr. Amira Ali El-Fallal)

The temperature and humidity level of substrate are 25-30°C and 70-80%. Growers commonly pack the substrate in polyethylene bags, plastic vegetable netting, or rigid plastic cylinders

The polyethylene bag method is one of the easiest methods, and is especially appropriate for beginners. The bags are about 50cm wide and 80cm tall. Substrate and spawn are added in alternate layers, with the substrate layer being 10-15cm thick and the spawn layer sprinkled on top and concentrated near the outside edge. The bags are then closed and arranged on top of bricks placed on the floor. The inoculated bags are then incubated.

When using the plastic vegetable netting method, a cylindrical skeleton constructed of metal wire or bamboo is prepared to hold open the netting. The netting has a radius of 30cm and pieces 70-80cm in height are used. The substrate and spawn are arranged in layers as in the polyethylene bag

method. The resulting blocks are covered with plastic and incubated.

The method that uses plastic cylinders makes use of pieces of Simi hard plastic that are closed to make cylinders of 35-40cm radius and 1.5-2m in height. The prepared substrate is mixed with spawn on a clean plastic sheet, the cylinders filled with spawned substrate, and then they are covered with a plastic sheet and incubated.

For all the three methods (bag, block, and cylinder) the inoculated substrate is arranged in a warm dark place. The incubating material is protected from insects and wild animals and aged for 2-3 weeks depending on the season and temperature, incubating until the substrate is coated with a white mycelia. Holes are made in the plastic sheets cover to allow venti-

lation and permit excess water to drain away. In the subsequent production stage, optimum conditions include a temperature in the range of 18-20 °C and relative humidity above 90%. Good ventilation should also be maintained.

In the common kitchen method plastic boxes are arranged in stable columns. In each box a substrate layer 10-15cm deep is packed, then spawn is sprinkled on the surface, followed by another 5-10cm deep substrate layer. The columns of plastic boxes are then covered with plastic and incubated.



**Figure 4.** Oyster mushroom in the bag  
(Photo courtesy by Dr. Amira Ali El-Fallal)

### Mushroom growers; spawn supply, and production marketing

There is no exact number of oyster mushroom producers recorded because most of them are seasonal. Growers are mostly located in the provinces of Giza, El-Sharqiya, El-Gharbiya, and Kafr El-sheikh. Rice and wheat cultivation is most common in El-Gharbiya and Kafr El-Sheikh provinces. None of the growers produces their own spawn. Companies that sell mushroom growing kits do not produce their spawn on agar plates because they don't have the required technical laboratories. The spawn producers merely inoculate grains from another grain spawn, using grain to grain transfer, usually on wheat grains. Spawn from PDA or PDYA media is only found at the universities and research institutes laboratories such as the Food Technology Research Institute, Alexandria University, Minufiya University, and Ein-shams University. Ein-shams University works with strains imported from German, Italian, and Dutch laboratories such as those on the list below:



**Figure 5.** Spawn in the bottle and bag  
(Photo courtesy by Dr. Amira Ali El-Fallal)

- |                                 |  |
|---------------------------------|--|
| 1. <i>Pleurotus ostreatus</i>   | 7. <i>Pleurotus eryngii</i>                |
| 2. <i>Pleurotus florida</i>     | 8. <i>Pleurotus flabellatus</i>            |
| 3. <i>Pleurotus colombinus</i>  | 9. <i>Pleurotus michigan</i>               |
| 4. <i>Pleurotus sajor-caju</i>  | 10. <i>Pleurotus saca</i>                  |
| 5. <i>Pleurotus pulmonarius</i> | 11. <i>Pleurotus salmoneo – stramineus</i> |
| 6. <i>Pleurotus cornucopia</i>  | 12. <i>Pleurotus sapidus</i>               |

The demand for oyster mushroom is high from September to April because of Christian fasting practices. People favor oyster mushrooms as a cheap vegetarian protein source rich in amino acids during their fasting. The main customers are normally hotels, supermarkets, and restaurants. Growers do not generally sell the mushrooms themselves. The growers sell their crops to marketing companies, and it is these companies that provide growing kits and spawn for the growers.

### Costs and Benefits from Oyster Mushroom Production

The main initial costs in the mushroom cultivation business are the building expenses. Egyptian growers use garages, store-rooms, or other locations that have a solid floor, walls, and a roof. Growers in Egypt rarely use greenhouses or similar structures.

The economic benefits of oyster mushroom cultivation should include a calculation for production rental expenses. One ton substrate needs about 25m<sup>2</sup> and the farmer may cultivate it himself or they may use one worker (Table 1). The average mushroom production is about 20-25% of the prepared substrate dry weight. Every 1kg spawn can result in 5kg of fruiting bodies. From 3 tons of substrate a farmer may harvest 600-750kg of mushrooms over a three month period. The price per kg is EGP6 or marketing companies. Farmer income from mushroom sales is EGP3,600-4,500 (USD576-720).

**Table 1.** Total expenses for 3 months

No	Expense Contents	Quantity	Amount(EGP)
1	Substrate; one ton hay, moisturized and pasteurized so it becomes three tons		200
2	Spawn; from mushroom unit, Ein-shams University, add with 5%	150kg ×EGP6	900
3	Containers; bags, nets, boxes, or cylinders (depreciation rate)		150
4	Place (if rented)	EGP100 ×3 months	300
5	Laborer (one)	EGP150 ×3 months	450
6	Disinfectants		50
7	Water and electricity		50
8	Packing and transportation for marketing		100
Total expenses			EGP2,200 (USD352)

Total profit = total income – total expenses

= 3,600-2,200 = EGP1,400 (USD224 at minimum) or = 4,500-2,200 = EGP2,300 (USD368 at maximum)

This profit can be maximized if place and substrate are free.

## Conclusion

Cultivating oyster mushrooms in Egypt is an effective method to alleviate poverty. Spawn and production materials are available in free and low cost arrangements. Substrates such as rice straw and cotton wool are often free for the taking. Good quality spawn is supplied by Mushroom Laboratory under the Egyptian Ministry of Agriculture at low cost, and during governmental projects the spawn is supplied for free. The weather in Egypt from September to May is suitable for oyster mushroom production and the temperature is easily controlled. During the hot summers, mushrooms such as straw mushrooms may be cultivated. Marketing is often done through the organizations that supply spawn, or through contracts with marketing companies for larger production amounts.

Production costs could be further minimized and net profit for farmers maximized. Rural residents need only to acquire the knowledge and training to set up their own small mushroom business. By this means they could earn money and improve their hygiene and diet. Oyster mushroom cultivation is a powerful remedy for many problems, as it prevents pollution caused by burning agricultural wastes, and instead turns those wastes into healthy food source. This cultivation activity also helps to alleviate poverty by allowing small farmers to sell mushrooms. Finally the spent substrate becomes animal fodder or organic fertilizer after it is composted.