Notes

5

CULTIVATION OF PADDY STRAW MUSHROOM

We have learnt about the cultivation of two popular mushrooms in our country in earlier two lessons. In coastal districts of Odisha and adjoining states another mushroom, commonly called paddy straw mushroom, is highly popular. There it is cultivated almost throughout the year. Its scientific name is *Volvariella volvacea*. It can be grown in other parts of the country as well during hot months. In this lesson we will learn about the cultivation of this mushroom.

The production of this mushroom is around 15,000 tons/year in our country. In India it was experimentally cultivated in early 1940s. It grows at relatively high temperature (30-38°C) and high relative humidity (80-90%). It is a fast growing mushroom and total crop cycle is completed within 3-4 weeks. *Volvariella* comprises 5% of the total mushroom production of the world. The unique flavour and textural characteristics distinguish this mushroom from other edible mushrooms.

OBJECTIVES

After reading this lesson you will be able to

- prepare culture and spawn of paddy straw mushroom;
- follow traditional outdoor method of its cultivation under trees;
- practice indoor cultivation method;
- harvest and process paddy straw mushroom.

5.1 SPAWN PREPARATION

You can obtain starting culture for making spawn from any authorized agency. You can also raise it by tissue culture method, single spore culture technique or by

Notes

multispore culture technique as described in the earlier chapters. The culture of paddy straw mushroom cannot be kept at low temperature. Hence, normally cultures are kept at 17-20°C or above. We can prepare the spawn of this mushroom on number of substrates like grains, straw, etc. Many prefer to use paddy grains or even paddy straw for spawn. Procedure for making the spawn is same as we have learnt in the earlier chapter. In case of paddy straw mushroom, however, after inoculation the bags are incubated at temperatures of 30-35°C. It takes only 5-7 days for complete colonization of the substrate and the spawn becomes ready for use within a week. Spawn cannot be stored and may be used within 10-15 days.

INTEXT QUESTIONS 5.1

State True or False

(i) Spawn of paddy straw mushroom can be stored in fridge for 15 days.

(ii) It takes only a week for complete colonization of the substrate while making spawn.

(iii) Bags after inoculation are kept at 25°C for spread of mycelium.

(iv) Culture can be raised by tissue culture method, single spore culture technique or multi-spore culture technique.

5.2 CONVENTIONAL METHOD OF CULTIVATION

We can grow this mushroom outdoors under shade of trees or indoors. The conventional method involves its cultivation under shade of trees. Biological efficiency (i.e. fresh mushrooms produced on 100 kg dry substrate) in this method is very low (10%) but it is popular because the initial investment is very low and natural conditions make its cultivation possible outdoors. We here describe the steps in conventional cultivation.

5.2.1 Substrate Preparation

This mushroom can use wide range of cellulosic materials and we can easily grow it on uncomposted substrates such as paddy straw and cotton wastes or other cellulosic organic waste materials. It prefers high cellulose, low lignin containing substrate. Earlier it was only the paddy straw, which was in use for paddy straw mushroom cultivation. However, in 1971, cotton waste (Ginning mill waste) was first introduced that gives a higher and more stable yield (30 to 40%) along with early fructification and harvesting. In Odisha it is conventionally grown on paddy straw.

This is one of the few mushrooms which are grown outdoors in our country. In Odisha, it can be seen being cultivated under shade of coconut trees. Paddy straw bundles are made uniform by cutting from ends (45 cm long and 10 cm wide). These are then soaked in clean water overnight (12-18 hours). We add about 2 per cent $CaCO_3$ to this water before soaking the bundles. Next day we take the bundles out of water and drain excess water by keeping these bundles on bamboos or raised platform.

We keep 4-5 bundles side by side in first layer. We put spawn at 7-8 spots on these bundles and put some gram powder on each spot. Then we put second layer of bundles over it and repeat the process of putting spawn and gram powder. Orientation of bundles in each layer is at right angle to the previous layer. (In summers when more aeration is needed, we may not criss- cross the bundles but may keep all in same direction.). We normally put 4-5 layers like this. For one bed of 30-40 kg paddy straw and having 4-5 layers, about 500 g spawn and 150 g red gram powder is used. We cover the bundles with polythene sheet for maintaining requisite humidity (80-85%) and temperature (30-35°C) for about 8-10 days for complete spread of mycelium in the straw.

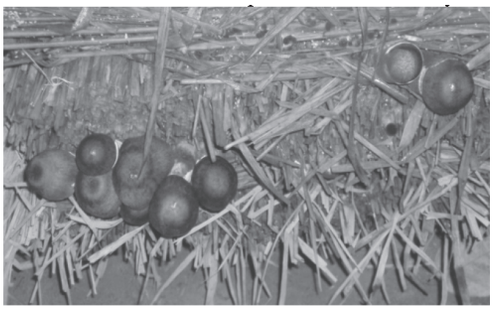
5.2.2 Cropping

After complete spawn run, we remove the sheet and lightly water the bundles. Mushrooms start appearing on sides after 4-5 days (Fig. 5.1) and need to be harvested before these open. The mushroom is very fast growing and harvesting at times is needed twice in a day during 10-15 days of cropping. The major problem with the mushroom is its very short shelf life. Generally, the mushrooms are sold and consumed on same or at the maximum next day. We cannot store mushrooms at low temperature. After crop harvest the left over substrate can be converted into manure for its use in the fields. In general, 10-15% BE is obtained on paddy straw in this conventional method. However, higher yields (25-30%) are obtained on cotton waste.

Bundles are spawned in orderly manner

Rows are covered for spawn run for 10 days

Sheet is removed after spawn run



Fruiting bodies start appearing

Fig. 5.1: Spawning, spawn run and fruiting in paddy straw mushroom

INTEXT QUESTIONS 5.2

State True or False

(i) Paddy straw mushroom can be grown outdoors under shade of trees or indoors.

(ii) Yields are low when cultivation is done outdoors under shade of trees.

(iii) Straw is composted for outdoor cultivation of paddy straw mushroom.

(iv) Cotton waste gives higher yield than paddy straw.

(v) The pattern of keeping bundles in different layers can be different in summer and winter.

(vi) This mushroom grows fast and may be harvested twice in a day but it has short shelf life.

(vii) The mushroom can be stored for 1-2 days in the fridge.

5.3 INDOOR CULTIVATION METHOD

We have learnt the method of outdoor cultivation which is very simple and requires very little facilities. However, yield is very low. We can get much higher yields by cultivating this mushroom indoors. There it is grown in specially constructed insulated rooms having facility for steam pasteurization. The substrate on which we grow it can be cotton-ginning-mill waste alone or in combination with paddy straw. We compost the substrate for 4 days outdoor and then pasteurize/condition it for 4 days in the cropping room itself. The details of various steps of indoor method are as below.

Notes

5.3.1 Substrate

Cotton waste is the preferred substrate for cultivation of paddy straw mushroom by this method. However, paddy straw can also be used. We can use combination of the two substrates.

5.3.2 Compost Preparation

We wet the substrate for first 2 days with sufficient treading of the cotton waste so that it absorbs sufficient water. We can use cotton ginning mill waste alone or paddy straw + cotton ginning mill waste in 1:1, w/w ratio. If we use paddy straw + cotton ginning mill waste formula, then after 2 days of substrate wetting, we add poultry manure @ 5.0% to the wetted substrate. Pile of substrate wetted for two days is raised and pile is normally 1.5 m high x 1.5 m wide. We give three turnings at an interval of one day each and add calcium carbonate @ 1.5% (dry wt basis) at third turning and the substrate is left for fermentation for next 1 day. Moisture content of 60-65% is maintained in the compost.

5.3.3 Bedding and Pasteurisation

After 4 days of outdoor composting, we spread 5 cm to 10 cm thick compost on shelves. During summer months lesser thickness is needed. The compost surface is made even by pressing it lightly. After 8-12 hours of compost filling we introduce live steam in the room. A temperature of 60-62°C is maintained for 4-5 hours for cotton waste compost and 65°C for 6 hours for paddy straw compost. After pasteurisation, the compost is kept at a temperature of 50°C for next 24-36 hours. This is followed by its natural cooling. The compost is spawned when substrate temperature reaches 35°C.

5.3.4 Spawning

We spawn the compost with fresh spawn @ 1.5% (dry weight) or 0.4% (wet weight) basis of the compost. The pieces of broken spawn are inserted at a depth of 2 to 2.5 cm at a distance of 12 to 15 cm apart. We cover the spawn with displaced compost and cover the bed with thin plastic sheet. The room temperature is maintained at 32 to 34°C during spawn run and at this temperature the compost will be colonized within next 4-5 days in cotton waste based compost and 5-6 days in paddy straw compost.

5.3.5 Fructification and Crop Management

During spawn running, water and light are not needed but a little ventilation is required. By the end of 3-4 days fluorescent light along with little more ventilation is provided in the rooms. We remove the plastic sheets on 4-5th day, followed by

Notes

little water spray on the beds. The pinheads will start appearing on $5^{th} – 6^{th}$ day of spawning. After another 4 to 5 days, the first flush of mushroom is ready for harvest. We need 30°C temperature, 80% relative humidity, fluorescent light and intermittent fresh air for better fruit-body production.

INTEXT QUESTIONS 5.3

State True or False

(i) Indoor cultivation is done in insulated rooms having facility for steam pasteurization of substrate.

(ii) Substrate for indoor cultivation is composited before pasteurization.

(iii) Cotton waste is the preferred substrate for cultivation of paddy straw mushroom by this method.

(iv) Spawn run takes 4-6 days at room temperature of 32 to 34°C.

(v) First flush appears after about 10 days of spawning.

5.4 HARVESTING OF MUSHROOMS

5.4.1 Harvesting

We harvest the straw mushroom before the volva breaks. This stage is called the egg stages as mushroom is oval in shape. This mushroom grows very fast and thus we may have to harvest twice or thrice in a day (morning, noon and afternoon). This mushroom usually take 9-10 days from spawning to harvest of first crop and the first flush normally exist for 3 days, which constitute about 70 to 90% of the expected mushroom yield. The intervening period of 3 to 5 days requires thorough watering and maintaining of optimum conditions inside the rooms. The next flush will again survive for 2-3 days and mushroom production will be less than the first flush. The second flush contributes only 10 to 30% of the total crop.

On reaching the harvestable size, the fruiting bodies should be carefully separated from the beds/substrate base by lifting and shaking slightly left or right and then twisting them off. The mushrooms should not be cut off by knives or scissors from the base of the stalk, because the stalks left behind on the bed/substrate will rot and will be attacked by pests and moulds, which in turn will destroy the mushroom bed.

Paddy straw mushroom contains around 90% water. On dry weight basis it contains 30-43% crude protein and 1-6% fat. The fat content increases with the

Notes

maturation stage. The straw mushroom is known to be rich in minerals. Potassium forms the major fraction of minerals.

5.4.2 Processing

Straw mushroom is more perishable than other edible mushrooms and cannot be stored at 4°C as it undergoes autolysis at this temperature. Straw mushroom can be canned, pickled and dried. Sun drying is common in straw mushroom. We should cut the mushrooms longitudinally before drying. Drying by hot air is better than sun drying because mushroom retains better flavour and colour. Do not dry mushrooms above 55 to 60°C. Weight of the dried mushroom is about one-tenth of their original weight. Keep the dried mushrooms in air tight containers. These can be powdered and then used for making soup, ketchup or curry after reconstitution in water.

INTEXT QUESTIONS 5.4

State True or False

(i) Mushroom is harvested at egg stage before rupture of volva.

(ii) This mushroom usually takes 9-10 days from spawning to harvest of first crop and the first flushes normally exist for 3 days.

(iii) Over 70% yield is obtained in the first flush.

(iv) This mushroom had 90% water and has very short shelf life.

(v) The mushroom can be sun dried.

5.5 ORGANIC MUSHROOM PRODUCTION

You must be aware of the increasing demand of organic products in the market. You will be glad to know that it is possible to grow mushrooms like oyster mushroom, paddy straw mushroom, milky mushroom, etc without use of chemicals, i.e. organically. For this we properly pasteurize/ sterilise the straw, do spawning in clean area, follow proper sanitation and hygiene, use of nets and various biologicals.

There are few limitations of organic cultivation of mushroom.

- Chemical sterilisation method cannot be used for cultivation of mushroom and no chemicals can be sprayed (use of lime, common salt or gypsum may be fine in organic cultivation).

Notes

- It may be difficult to get substrate like straw or chicken manure that can be considered organic.
- We normally get fewer yields of mushrooms during organic cultivation (we can however, get more prices?).
- Growing mushrooms organically round the year at the same location may be a challenge as disease build up can be more.

We may not have easy solutions for these limitations. Many growers cultivate mushrooms at one location for only 2-3 years and shift the site before the built up of the disease inoculum.

INTEXT QUESTIONS 5.5

State True or False

(i) It is possible to grow mushrooms like oyster mushroom, paddy straw mushroom, milky mushroom, etc without use of chemicals.

(ii) The yields are normally less in organic cultivation.

(iii) Lime or gypsum can be used during organic cultivation of mushroom.

WHAT YOU HAVE LEARNT

Let us recapitulate the important points we have learnt in this lesson:

- Paddy Straw Mushroom is a tropical mushroom able to grow at temperature range of 30-38°C.
- This mushroom is popular in Odisha and is one of the few mushrooms cultivated outdoors.
- Neither spawn nor mushroom can be stored at low temperature. This is very fast growing fungus and spawn becomes ready within 5-7 days
- Conventionally it is cultivated on paddy straw where paddy straw bundles are soaked in 2% lime water, arranged in layers and spawn as well as gram powder is added in each layer.
- Fruiting starts after about 10 days of spawning and whole crop cycle gets completed in 3 weeks or so.

- Higher yields can be obtained by indoor cultivation on cotton waste alone or in combination with straw where substrate is composted and then pasteurized at 6065°C for 4-6 hours before spawning.
- Mushrooms appear at very high speed and may need to be harvested twice in a day. Maximum yield in obtained in the first flush within three days.
- It is a highly nutritious mushroom and can be dried in sun or ovens at temperature below 60°C

TERMINAL EXERCISE

1. In paddy straw mushroom, how much time is taken for spawn run and for how many days fruit bodies are normally harvested?
2. What are the substrates that can be used for preparation of spawn and cultivation of paddy straw mushroom?
3. Describe the method of substrate preparation in outdoor and indoor method of cultivation.

ANSWERS TO INTEXT QUESTIONS

5.1

(i) False (ii) True (iii) False (iv) True

5.2

(i) True (ii) True (iii) False (iv) True (v) True

(vi) True (vii) False

5.3

(i) True (ii) True (iii) True (iv) True (v) True

5.4

(i) True (ii) True (iii) True (iv) True (v) True

5.5

(i) True (ii) True (iii) True

Notes

SUGGESTED ACTIVITY

Search for literature and videos on cultivation of paddy straw mushroom on the internet. Make a list of websites having information about cultivation of mushrooms.

Key Learning Outcomes

- Prepare substrate and manage paddy straw mushroom crop.
- Pick, grade and pack the harvested paddy straw mushroom.