

Cultivation technique of button Mushrooms - I

White Button Mushroom

1. WHITE BUTTON MUSHROOM (*Agaricus brunnescens* Peck.)

White variety -----*A. brunnescens* var. *albidus*

Brown variety -----*A. brunnescens* var. *bisporus*

Cream variety -----*A. brunnescens* var. *avellaneous*

This mushroom is commonly found growing in soil enriched with cow dung, horse dung or forest litters in temperate climate. A most widely cultivated mushroom in the world. The name *Agaricus* originated from the Greek word *Agaricon*—with a Scythian people called *Agari* who were knowing the use of medicinal plants and employed a fungus called — *agaricum* l, probably a polypore in the genus *Fomes*. *Brunnescens* means brown in Latin, as the colour changes to brownish after bruising. It is also called as *A. bisporus* because of the two spore basidium.

Description:

White button mushroom (*A. brunnescens*) is thick fleshed, robust with thin gills on the underside of the cap that are pinkish white in early age and darkening to chocolate brown at maturity. Cap is whitish, cream coloured or brown. Cap surface smooth to appressed and dry. The stem is short, thick adorned with a persistent membranous annulus from a well developed partial veil. Spores chocolate brown in mass, basidia bipolar (two spored) forming diploid spores, secondarily homothallic, clamp connection absent. Mating of compatible dikaryons typically results in development of strain which is more vigorous and high yielding. Mycelium is dingy white, moderately rhizomorphic.



White button mushroom (*A. bisporus*) cultivation

Nutritional Value : Button mushrooms contain 90-92 % water and only 8-9% dry matter. Also contains 3.92 % protein, 1.09 % crude fibre, 1.25 % ash, 0.19 % fat and 56 mg. niacin / 100 g weight.

Spawn production : The Master culture and spawn are produced on wheat or rye grains buffered with Calcium carbonate and Calcium sulphate.

Cultivation : Button mushrooms, including the high temperature species *A. bitorquis* (20 – 25° C) require well decomposed manure for its cultivation which is prepared by long method or the pasteurization method

of composting by mixing wheat or rye straw with supplements like chicken manure, cotton seed cake, wheat bran, urea, gypsum etc. The prepared compost is filled in polythene bags or wooden trays, spawned by through or layer spawning method and incubated in a closed room at $25 \pm 1^\circ\text{C}$ and 90 % relative humidity with high concentration of carbon dioxide (5,000 to 10,000 ppm) in the absence of light . After 10 -15 days of incubation, when mycelium of spawn completely impregnates the compost, it is covered with 1-1.5 inch layer of sterilized wet casing mixture containing FYM alone or FYM + spent compost or FYM + forest soil or soil + sand + coco coir or sand + soil + paddy ash or peat soil . The mycelium of button mushroom will not fructify unless it is covered on the surface with a layer of fine casing mixture.

Composting

Composting: Compost can be prepared by two methods :

1. Long method of composting
2. Short or pasteurization method of composting

1. Long Method of Composting:

A) Formula developed by Mushroom Research Laboratory, Solan

Wheat straw ----- 1,000Kg or
Paddy straw ----- 1,250Kg
CAN ----- 30Kg
Super phosphate ----- 25Kg
Urea ----- 12Kg
Muriate of Potash ----- 10Kg
Wheat bran ----- 100Kg
Molasses ----- 16.6litres
Gypsum ----- 100Kg
Folidol dust ----- 750 g

B) Formula developed by IIHR, Bangalore

Paddy straw ----- 150Kg
Maize stalks ----- 150Kg
Ammonium sulphate ---- 9Kg
Super phosphate ----- 9Kg
Urea ----- 4Kg
Rice bran ----- 50Kg
Cotton seed meal ----- 15Kg
Gypsum ----- 12Kg
Calcium carbonate ----- 10 Kg

Long method of composting was first advocated in India by Mantel *et al.* (1972). To begin with the composting process, clean the composting yard thoroughly and wash it with 2% formalin solution. Wheat straw or any other base material to be used is spread in a thin layer of 8-10 inches thickness over the floor of composting yard. Sprinkle water over the straw with a hose pipe and wetting of straw is done repeatedly at least 2-3 times a day for 2 days with the help of forks. Before mixing with the wet wheat straw, the ingredients like urea, CAN, super phosphate, wheat bran etc. (except insecticides and gypsum) are thoroughly mixed , wetted with water and then covered with damp gunny bags 14-16 hours before use.



Fig. 5.2 & 5.3 Fresh Wheat straw and Paddy straw stored for compost preparation
 Fig 5.4 Chicken manure stored for substrate preparation **Preparation :**

- **Day 0:** On this day fertilizer mixtures are spread evenly on the pre- wetted straw. This mixture is made into a stack with the help of wooden boards or pile formers . Dimensions of pile should be 5x5x adjustable length. Height and width of the pile should not be more than this otherwise pile may become too hot due to high temperature and the anaerobic conditions may prevail in the centre which may not yield good quality compost.
- **Day 1-5:** Start monitoring the temperature of the heap. Temperature should start rising after 24-48 hours of stacking and reach 65-70°C in central core. If the moisture of the mixture is less, than water can be sprayed. Watering should be stopped as soon as leaching starts from the bottom of pile. If water starts leaching in large quantity then it should be collected in a guddy pit and put on the top of the pile.



Long method of composting - stacking the heap on Day-0 with the help of pile formers (a & b) and a rectangular shaped compost heap raised after completion of the pile forming process (c)

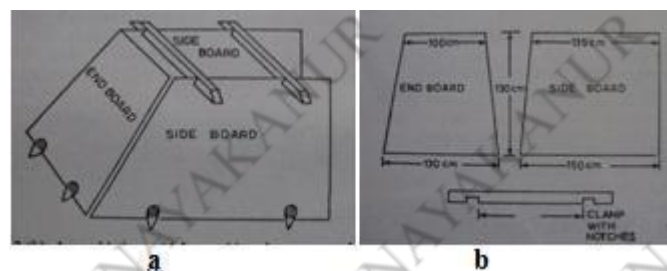


Diagram of a Pile Forming Board for stacking heap of compost during compost making in mushroom cultivation (a& b)

- **Day 6: First turning:** On this day first turning is given to the stack. The aim of turning is that every portion of the pile gets equal aeration and water for proper decomposition of the base material. The correct method of turning is as follows :
- Remove about 1 feet compost from top and side of pile, shake thoroughly so that excess of ammonia is released and it is exposed to the air properly, and keep this portion on one side. Now remove the central and bottom portion of the pile, shake these with the forks and keep them separately. Now the new pile is made with the help of boards keeping the central portion at the bottom. Top and sides portion should be placed at the centre while bottom part comes on the top and sides. During pile formation watering is done ,if required.
- **Day- 10: 2nd turning.** Break open the stack, remove it as indicated above, water may be added if required and restack it .
- **Day-13: 3rd turning:** Restack and add required quantity of gypsum
- **Day-16: 4th turning**
- **Day-19:5th turning**
- **Day-22:6th turning**
- **Day-25:7th turning :** add required quantity of Folidol dust
- **Day 28: Filling day.**Break open the pile and check for the smell of ammonia , if it still persists, give an additional turning after 3 days. This way compost is prepared by long method in 28-30 days.

2. Short or Pasteurization Method of Composting :

Formula given by Mushroom Research Laboratory , Solan

Wheat straw (chopped) ----- 1000 Kg
Chicken manure ----- 400 Kg
Brewer's grain or wheat bran -- 72 Kg
Urea ----- 14.5 Kg Gypsum ---
----- 30 Kg.

- This is done in two phases. **Phase- I** is done in the composting yard while **phase II**, inside a closed chamber called pasteurization chamber or tunnel (bulk chamber) with the help of aerated steam for pasteurization and conditioning of compost.
- **Phase I:** Phase - I involves pre-wetting of straw and mixing of ingredients in the straw as in long method. But in this case turning is given after every 48 hours (2nd day). During third turning or on 6th day total amount of gypsum is added in the compost. After 4th turning on 8th day, the compost is filled in pasteurization tunnel on 10th day.



Phase –I of composting ----- first turning after mixing urea and pile being formed with the help of a Pile Former (1) third turning being given by breaking the heap and adding water (2), picture of a front loader tractor (3) and compost turning machine (4) for mechanical composting

Phase II: (Pasteurization) □ After filling partially decomposed compost in pasteurization chamber or tunnel, a temperature of 48-50 ° C is maintained for next 2-3 days by circulating the inside air. Then with the introduction of steam, temperature of the tunnel is raised to 58-60°C for 6 hours.

- Fresh air is then allowed to enter the room so as to bring down the temperature to 50-52°C which is maintained for 3-4 days for conditioning. When ammonia smell gets eliminated, then fresh air is introduced in the tunnel to cool down the temperature of the compost to 25-28°C. By pasteurization method, compost is prepared within 18-20 days.

Qualities of a good Compost

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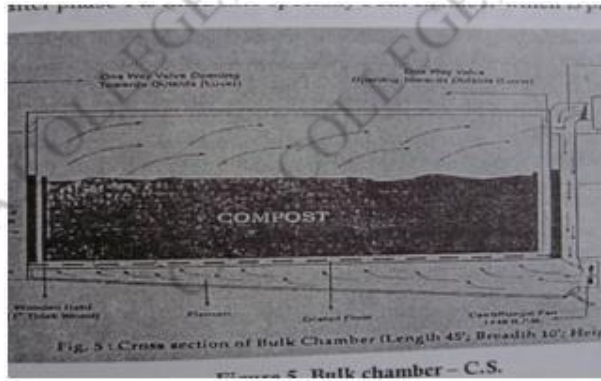
- Compost should be dark brown in colour with profuse fine fangs.
- Compost should have moisture percentage of about 68-70 percent.
- pH of the compost should be in the range of 7.2-7.8.
- There should not be any smell of ammonia.
- It should not be sticky or greasy.
- It should be free from insects and nematodes.

This method has got certain advantages over long method of composting as detailed below :

- More compost per unit weight of ingredients is produced .
- Total period of composting is reduced
- The yield is almost doubled
- All the harmful fungi, competitor moulds, insects, nematodes and other pathogens get killed during pasteurization which otherwise cause reduction in yield
- Most part of Ammonia liberated is converted into microbial protein which otherwise go waste in long method of composting.
- Conditions inside a pasteurization chamber favour proper temperature and aeration resulting in the preparation of good quality compost free from all types of harmful microorganisms .

3. Bulk pasteurization method:

It is similar to the short or pasteurization method of composting but in a modified form of technology. Here after phase -1 of composting, compost is treated / pasteurized in bulk inside a specially built chamber known as the chamber or tunnel in Phase –II .



The diagram of a Bulk Pasteurization Chamber (Tunnel) showing the compost after Phase-1, filled in the chamber having ducts for fresh air entry and the slanting floor with grated plenum and blower fitted underground



Pasteurization chamber/Tunnel of a Bulk Pasteurization Chamber showing grated panel (1) and compost after phase-I being filled in the chamber for pasteurization process or Phase II (2)



Showing the outer part of a bulk pasteurization chamber with its door closed and air handling unit (3) and the blowers fitted outside the pasteurization chamber

The bulk pasteurization method is again having some advantages over the short or pasteurization method of composting :

- More compost per unit size of the room can be treated at a time.
- Facilitates the preparation of best quality compost.
- The cost of pasteurization is reduced.
- Yield per unit weight of compost is much higher □ Labour cost is reduced.
- The heat generated by compost is utilized for its further pasteurization, hence cost of diesel, electricity or fuel is reduced.
- Spawn running can also be done in the tunnel itself thus reducing the cost and saving of time
- Environmental pollution is very much reduced.