

MUSHROOMS

Mushroom is one of the best diet, which contains protein, minerals and vitamins like Nutritive material in a sufficient quantity. Mushroom is having less quantity of fats due to this reason it is very good diet for heart patients and due to the very less carbohydrates mushroom is most suitable diet for diabetic patients. Mushroom is not required direct sunlight as it is required in case of vegetables which are having green leaves plants but the beds of the mushroom should be protected from the direct sunlight and rains so the mushroom is grown either in house or in hut or any cover and below the any cover of the root which is having sufficient aeration. About one dozen mushroom species are commercially grown in the world but in Haryana mainly two species are cultivated which are grown at commercial level. The description detail is given in the table:-

Table:- On the basis of the season to popular species are cultivated on the basis of time and temperature.

| Sr. No. | Mushroom | Optimum Temperature | Optimum time for cultivation |
|---------|-----------------------------------|---|------------------------------|
| 1. | White Button or European Mushroom | For spawning 20-25 degree Celsius for production During production 14-18 degree centigrade | In Winter-Nov.-February. |
| 2. | Oyster Mushroom or Dhingri | 20-30 degree centigrade | Whole Year except May-June. |

For above all mushroom is required maximum humidity above 80% the higher temperature above than optimum temperature is harmful to all mushroom but due to low temperature the growth of the spawn germination and the growth of the mushroom slow down.

Method of growing button mushroom:- To grow this mushroom three basic things are required for its cultivation which are compost, spawn (seed of mushroom) and casing mixture. It is necessary in fact that these three components should have high quality but to have good yield of mushroom a good quality of compost is must required. The material on which the mushroom is grown is called compost, which are made with the many articles which are mixed in a particular proportion. The main base of the compost is weed or paddy straw but as per the recommendation of the Haryana Agricultural University, Hissar, which has round the straw of mustard, is also suitable for making compost. There are two method of preparation of compost which are long or short method of composting. In both the methods, the compost mixture is

made in open on the floor by fermentation but in short method compost are prepared in a specific room where the mixture is filled for two weeks which are called chamber or tunnel. The floor of the chamber is of sieve type and below this the air is passed through the blower (fan) that maintain the uniform temperature of the compost. With the result of that compost is prepared early and the compost prepared by this method about doubled productivity in comparison to the compost made by long method. Most of the farmers in Haryana is not having the facility of the chamber because mostly the farmers are small and they prepared the compost by long method. This method is explained below in detail.

Methods of preparing of Compost:-

Formulation No. 1

| | | |
|------------------------|---|---------|
| Wheat Straw | - | 300 Kg. |
| Wheat bran | - | 30 kg. |
| Gypsum | - | 30 kg. |
| Urea | - | 3.6 Kg. |
| Muriate of Potash | - | 3 Kg. |
| Single Super Phosphate | - | 3 Kg. |
| Mollasses | - | 5 Kg. |
| CAN | - | 9 Kg. |

Formula No. 2

| | | |
|---------------------------|---|---------|
| Wheat Straw | - | 300 Kg. |
| Chicken Manure | - | 60 |
| Wheat Bran | - | 7.5 Kg. |
| Gypsum | - | 30 Kg. |
| Calcium Ammonium Nitrate- | | 6 kg. |
| Urea | - | 2 Kg. |
| Muriate of Potash | - | 2.0 Kg. |
| Mollasses | - | 5 Kg. |

Formulation No.3

| | | |
|------------------------|---|---------|
| Mustard Straw | - | 300 Kg. |
| Chicken Manure | - | 60 Kg. |
| Wheat Bran | - | 8 Kg. |
| Gypsum | - | 20 Kg. |
| Urea | - | 4 Kg. |
| Single Super Phosphate | - | 2 Kg. |

Time Schedule of Compost Preparation: -

0+6+10+13+16+19+22+25+28 days

Method of preparation of Compost: - A wheat straw which should be shiny and not without soaked should be spread on the concrete floor for 48 hours and wet the straw fully. If the pucca floor is not available then kuccha clean space may be used.

0 Day: - Spread the wet straw in 1ft. layer and put 6 kg. CAN, 2.4 kg. Urea, 3 Kg. SSP, 3 Kg. MOP and 15 kg. wheat bran on it and mixed thoroughly. After that make a heat of 5 ft. height, 5ft. width and suitable length. After 48 hours of heat formation temperature will start rise and reaches to 70-75 degree Celsius. If chicken manure is used, then wet it and mixed together. Complete quantity of chemical fertilizer may also be put on zero day.

+ 6th day (1st Turning):- Outer layer of heap get dried because of exposure to air, due to which compost do not decompose. Turning of compost is done to ensure the temperature to every part of material. It should be kept in mind during turning that no outer part of heap may go inside and inner part of heap towards outside. Spray the water on outer dry part. First turning is done on sixth day. Add 3kg. CAN, 1.2kg. Urea, and 15 kg. bran at the time of this turning. Make the heat as such as heap of zero day

+ 10th Day (2nd Turning):- Cut 1ft. layer from all five part(four sides + top of heap) and spray some water, then expose the rest of the part remained after cutting as mentioned above and leave for cooling. It should be kept in mind during turning that outer part should be turned inside and inner part should be turned towards outside. Add 5 kg. mollassis in 10 liter of water and mix it in the compost before making the heap on this turning.

+ 13th Day (3rd Turning):- Turn the compost like 2nd turning Spray water on outer dry part. The moisture content in the compost should be optimum. Add 30 kg. gypsum in the compost. Compost will not be sticky and greasy with adding the gypsum. Break the heap as like as turning on the 10th day.

+ 16th Day (4th Turning):- As third turning was done likewise repeate 4th turning if the proper moisture in the compost.

+ **19th Day (5th Turning):-** If the full turning of the heap and then make the heap again. Keep the proper moisture condition in the compost.

+ **22nd Day (6th Turning):-** Make the turning of the full heat and again make the heap.

+ **25th Day (7th Turning):-** These days ammonia gas and moisture is examined in + **28th Day (8th Turning):-** compost if there is no smell of ammonia from the compost and the compost is having proper moisture condition then the compost is ready for sowing. Before sowing the spawn the heap should be opened so that the temperature of the compost cool down. In specific circumstances, if there is a smell of ammonia then every third day turning should be done. In case of poultry manure there are a great chances of remaining of ammonia. In all circumstances no ammonia gas should be left in the compost otherwise it is very harmful for the spawn germination. The optimum moisture condition can be judged by the simple method in which the small quantity of compost is taken in hand and hand full quantity of manure and apply the pressure on the finger on the compost. If the water comes out as a drop between the fingers then it shows the optimum condition in the compost in case water is coming as a stream then it shows that there is excess moisture present in the compost. In such cases compost is open and dry till it contained optimum moisture condition before spawning.

Spawning:- For cultivation of mushroom the seed which is used is called spawn. To have good production of the mushroom it is the basic requirement that the seed should be true to the type and of a good variety of high quality. In a spawn there should not be any stickyness or any smell and any foul smell.

Seed Rate:- The seed of the mushroom is prepared in the empty glucose bottles or in the poly prolene bags. 500 gms. spawn is required for 100 kg. prepared compost. The seed booking should be done atleast one month before of the spawning.

Method of Spawning:- 1. Mixed the spawn in whole compost.

2. Surface spawning.

Spawn is mixed in the compost and this mixture is filled either in polythene bags or spread on the racks. If the spawning is done by surface method then 1st spread 2" thickness compost and spawning should be done. After that again put 2" thickness compost and then spawning should be done. Likewise make the thickness about 2" of compost and spread the spawn on the upper side and after that this compost bed should be covered with 2% soakedd pharmlin newspaper or cover with polythene sheet. The room temperature should be maintained 24-25 degree celsius and RH should be maintained from 80-90%. As per the requirement above the newspaper and in the room morning and evening water spray should be given by the spray pump.

Cassing Mixture:- When the mycilium of a spawn can be spread on the compost completely then a cover of soil and ash of rice husk or any other mixture 1-1.5 " thickness should be spread this covering is called casing.

Why Casing is required:- Casing is helped to convert vegetative growth into mushroom. If casing is not done then there is no formation of mushroom. If there is some growth of mushroom then it is very less. Casing also helped to maintain proper moisture condition in the compost.

Casing Mixture:- Research conducted by Haryana Agricultural University, Hissar and it is concluded that the ash of the rice husk + soil 1:1 ratio (on the basis of the weight) is found better casing than other mixture. To sterilize the compost with 5% formalin solution and fully wet the compost and covered the compost with the polythene sheet for 3-4 days. After that the polythene sheet should be removed and compost turning should be done so that the smell of the formalin should be removed.

How to spread Casing Mixture: - Before casing remove the newspaper sheet or polythene sheet in general the thickness of casing 1-1.5". Casing should be done after sowing of 15-20 days when the mushroom mycelium is spread completely. After casing the water should be sprinkled immediately.

Casing and environment:- After casing the temperature should be maintained for one week for 23-25° degree Celsius. After that the temperature should be come down 17-18 degree centigrade. This temperature should be maintained till the growth of the mushroom. By the last week of December and in the month of January the temperature bit come down with the result of that there is reduction in the development of mushroom. The temperature should not be increase through the burning of smoky material. If the mushroom room temperature comes down below 12 degree Celsius then the steam should increase the temperature. The optimum moisture condition is necessary in the mushroom house. After casing the RH should be maintained about 80% when there is a production of mushroom then the RH should be maintained 80-90%. It is general observation that the mushroom growers generally sprinkle the water on the compost to maintain the optimum moisture condition. It is necessary to maintain proper condition to put the wet gunny bags on doors and windows. The outside dry air is very harmful for the growth of the mushroom.

Air Circulation:- After the spread of the mycelium of the mushroom it is necessary once or twice to give fresh air to the room. The CO₂ percentage should not exceed more than 2%. But for the formation of pin hold the CO₂ % age should not be exceed 0.3%. At the time of production of mushroom the CO₂ should not exceed 0.08- 0.1. It clearly shows that at the time of pin head formation there should be a good aeration in the compost.

Insect Pest of Mushroom :-

| Insect Pest & their Control | Disease & their Control |
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| The major insects of the Mushrooms which caused damage to this crop is | ***After the spawning into the compost there are many fungal disease appeared |

Mushroom Flies, mite, and spring tails.

****1. Mushroom Flies:-** Three types of flies have been found to cause damage to mushrooms (*Agaricus bisporus* and *Pleurotus sajor-caju*) from time to time. These are small, delicate, black, yellowish or brown in colour with different types of wing venations and size. Larval stage is the most damaging. Adults do not cause much damage except help in breeding to increase the population and dissemination of disease spores and other smaller insects including nematodes and mites on their hairy body parts. The larvae feed on the spawn or mycelium, pierce the hyphae and suck the contents. They also enter the fruiting bodies and make tunnels and honeycomb the pileus in the stem and top of the mushroom. Spent compost, soil and dirt are the breeding centers for these flies where from these migrate to the mushroom beds either directly or indirectly with the compost, casing and other material. The female flies are attracted by the smell of the nitrogenous material added to the compost and lay eggs and, thus, contaminate the beds. Under unfavourable conditions, the larvae remain hidden in the cracks and crevices of the wooden trays.

Control:- The control of this insect is given as under:-

- a) 20 ml. endosulpham 35 ECC or 1.2 to 1.0 gm. Diaflowbenzoran 25 WC or nimbidiseen (0.03%) 100 ml.ltr. to be added in 13-14 liter of water to mix in 100 kg. compost. This insecticide should be added in the last turning of the compost. Out of this anyone insecticide should be taken and used at the

in different type of compost with the result of that there is reduction in the yield of mushroom. There are many pathogens which caused damage to the mushroom crop which is given as under:-

a. **Cobweb** (*Dactylium dendroides*):- The mycelium of the pathogen is grayish to white when young but reddish as it ages. The fungus grows rapidly over the surface of the casing soil and envelops the fruiting bodies in a cropping bed. The mushrooms are reduced to a soft rotting mass. Soil and air are common sources of infection, and wet surface and high humidity are the predisposing factors. The fungus spreads due to negligence during picking because left over pieces of mushroom can initiate infection.

Photo

Control:- Reduce humidity to 80% and run fans soon after watering as a preventive measure. It can be best controlled by application of Dithane Z-78 (0.25%) sprayed three times at an interval of 10 days. Treatment with 20% PCNB dust or dusting localized areas with 70 % calcium hypochlorite has also been recommended.

b. **Drybubble** (*Verticillium fungicola*) The most characteristic symptom is the light brown superficial spottings on the cap. These spots extend in diameter by coalescing into brown patches and are distinctly different to those produced by bacterial blotch. Spots in caps start sinking and centre is covered with a heavy spore mass of dark brown colour with age. In case of severe attack, downward splitting of the stem giving a shattered appearance is also witnessed. Interference with proper growth of stem

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| <p>time of casing.</p> <p>b) At the time of the attack of the mushroom flies a spray should be done in inside of the wall of the mushroom house of melathion 50 EC or dischlorovas 76 EC 0.5ml. should be added in one liter of water at the interval of 3-4 days.</p> <p>c) The mushroom should not be harvested for 2-3 days after the spray and if it is consumed early it may cause mushroom should not be used/consumed earlier as it cause allergy and stomach ailments.</p> <p>1) Mites:- Several species of mites have been found associated with the mushroom crop. Tyrophagus putrescentiae has been recorded as the most damaging pest under our conditions. Mites are small, about the size of a pinhead, with white, yellowish, brown or red colouration and are often seen running speedily over the surface of the mushroom beds, fruit bodies, sides of the trays, walls and floors of the mushroom houses. In some cases these have glistening bodies and also long hairs. The harmful mits damage the crop directly by feeding on the spawn and mycelium, or puncture holes in mushroom caps and stalks and also cause stunting of fruit bodies as wellas brown spots on the caps and stems. Other mites do not damage the mycelium directly as almost all types feed on weed moulds and</p> | <p>causes the cap to remain small, titled and misshapened.</p> <p>Primary source of infection appears to be spent compost lying within the premises of the cropping rooms and the disease spreads through mites and fly infestations. Temperature above 18 degree Celsius and relative humidity above 90% are predisposing factors.</p> <div data-bbox="945 604 1161 676" data-label="Image"> </div> <p>Control:- Three sprays at 10 days interval with 0.25% dithane Z-78/Dithane M-45 reduce infection. Spraying with 0.05% Benlate also helps in control of the disease. Sanitation practices which include disposal of diseased sporophores after dipping in 5% formalin solution, disinfection of tools and other implements, sterilization of used trays at 71 degree +2 degree C for 10-12 h and control of mites and flies in the cropping room help the prevention of the disease significantly. In case of the disease prevalence, the crop should be harvested first from healthy cropping rooms and end up with the diseased ones.</p> <p>C. Bacterial blotch (Pseudomanas tolaasii) Circular, yellowish spots develop on the cap or near the margin and coalesce to form chocolate brown spots which penetrate into the fleshy tissues. In severe cases brown lesions develop even on the stems. Inadequately sterilized soil and contaminated implements are the main sources of infections. The pathogen spreads through splashing of water drops from infected to healthy sporophores, Pickers implements, flies and mites also help in spread of the</p> |
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sometimes create difficulty for the workers as they crawl over their body and may also carry spores of several diseases from bed to bed.

Control:-a) Diacophal 50 EC 1.00-2.00 ml. Kelthane 10 liter to be added in 10 liter of water and should be sprayed from time to time in the compost and on the wall of mushroom house.

b) Cook out the exhausted compost in the trays with steam at 71 degree Celsius for 10.12 hours.

2) Springtails:-Several species of springtails have been recorded to be damaging the mushroom crops. These are small insects (1 mm long) with stout antennae and are silvery, reddish brown or dark grayish in appearance. They are active in the dark and remain hidden either under the casing soil, compost or fruit bodies and move by springing several centimeters when disturbed and thus present a silvery appearance in light. These tiny insects feeds on the mycelium and the caps and stems of fruit bodies and cause serious damage. Use of inadequately sterilized casing soil and dirty water during composting are the two main sources of springtail infestation.

Control:- This insect can be controlled by the use of spray of 0.5 ml. melathion 50 EC or diacholorovas 76 EC (Nuwan) 0.5 ml. @ per liter of water to be sprayed on the wall of mushrooms rooms.

**(Mushroom cultivation in India by

disease to healthy trays.

Photo

Control:- High humidity (above 85%) and inadequate ventilation during cropping permit the pileus to remain wt for longer periods, which helps in the disease initiation and spread. Lowering of humidity to 80%and running fans immediately after watering to dry the caps prevent bacteria to spread on the growing sporophores. Spray the beds with 100 ppm bleaching powder.

d) Virus diseases:- Mushrooms are also subjected to attack by a number of viruses which cause disease commonly known as La France, watery stipe, die back, X-disease or brown disease and which may result into slight or total failur of the crop. On the basis of the size and shape of the particles five different viruses have been reporting attacking mushrooms and are known as virus 1,2,3,4 and 5. These viruses may occur alone or in any combination. In India there was no report about the occurrence of this disease, but recently it hassn reported from Bangalore. The most common symptoms are the elongation of the stalk with a small, tilted cap (drumstick). Deterioration of the mycelium (die back) is common which increases with the time resulting into bare patches of the crop. Sometimes small brown mushrooms develop which often open prematurely. Affected fruits bodies have a water soaked appearance (watery stipe) which are found to be totally water logged when squeezed. The viruses cannot live in soil or

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| <p>S/Shri R.K.Agarwal and C,L Jandaik”Indian Mushroom grower association, Solan)</p> | <p>outside the host tissues as these are obligate parasites. Hence affected crop debris, mushroom mycelium and spores survive readily on wooden boxes and in the spent compost which can be easily carried by air to distant places. Transmission of viruses through mushroom spores has been demonstrated. Some strains of mushroom spawn are also known to contain virus particles.</p> <p>Control:-</p> <ul style="list-style-type: none"> i) Strict hygiene inside the farm. ii) Use of filtered air inside the peak heating, spawn running and cropping rooms. iii) Mushrooms should be picked before they open. iv) All wooden parts of growing units should be thoroughly cleaned and sterilized to kill any mushroom mycelium from the earlier crop. v) Use of tolerant or resistant strains. <p>** (Mushroom cultivation in India by S/Shri R.K.Agarwal and C.L Jandaik” Indian Mushroom Grower Association, Solan)</p> <p>Control:- As per the recommendation of package practices of HAU, Hissar, the fungal disease can be controlled by the spray of bavistin or topsin-M (0.5 gm. per liter of water) or endophyl M 45 (1 gm. per liter of water).</p> |
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FLOWERING CROPS

Rose

Soil:- Well drainage soil which is having good availability of organic contents and the pH should be from 6-8 and soil should be sandy loam soil is suitable for rose cultivation.

Land Preparation: - Before planting of one month the pit should be dug at the distance of 60-90 cm. distances and pit size should be of 60-70 cm. deep. Such type of a pit can be made by the tractor drawn pit digger and which make the pit 60-70 cm. dia. Well rotten 5 kg. FYM and 20gram chloroperiphorus dust pit should be added. After filling the pit irrigation should be done or trench should be made 60-75 cm. deep and mix the above mixture and filled this trench in the same proportion. After filling the trench water should be given. If the soil is hard add sand at the upper depth of 10cm.

Manure & Fertilizer in rose garden: - The plants, which are growing in the field, the following quantity of manure and fertilizer should apply.

FYM: - 20 Ton per hectare

Urea:- 3.6 quintal per acre

Single Superphosphate:-5qtl. per acre

Muriate of potash:- 1.28 quintal per acre

If phosphorus is to be applied through DAP then the quantity of DAP should be applied on the basis of $1/3^{\text{rd}}$ part of Single Superphosphate and also the part of the urea should be reduced $1/5^{\text{th}}$ of the already given quantity.

Time of Manuring:-a) Full compost, phosphorus, potash and half nitrogen should be applied after pruning which is done mid-September. The balance dose of half Nitrogen should be applied after five weeks.

b) In the spring season to have a good flowering crops 10gms. Nitrogen and 10 gms. potash should apply additional dose per plant in the month of January.

- a) To meet the requirement of Micro-Nutrients a spray of 0.3% which is having a equal proportion of zinc sulphate , magnesium sulphate and magnese should be sprayed during last week of November. To have good crop in this season this spray should be done during February.

Irrigation:- a) In summer at 5 days interval. In winter at 10 days interval.

b) During spring season care should be taken that the water should not be stagnate in the field.

Propagation:- I) During mid September to mid November stock plant should be prepared and for this purpose rosa barnonia. Rosa Indica variety Odorota and Rosa Multiphlor. the cuttings of these varieties are planted as a distance of 10-15cm.

Collect buds from desired varieties and budding should be done on the stock and budding should be done in the month of January and February. In the area where the temperature is bit low the budding should be done successfully in the month of March.

Desi Roses plants are propagated through the cuttings.

Training & Pruning: - Pruning should be done at the height of 30cm. from the ground in the month of mid-September to mid-October. The plants, which are planted in summer the pruning, should be done at this time by keeping 4-5 branches per plant and each branch should have 5-6 buds. In each branches a slanting cut should be given above the last bud. Cut end should be pasted with bordo paste or blight ox or apply 25% bavistin paste.

Miniature, polymath and creeper roses are not required pruning. In these plants only dry wood, branches are cut.

Recommended Varieties:-

| Name of the group of the Rose | Colour of the flower | Name of the Variety |
|-------------------------------|----------------------|---|
| Hybrid-T | 1. White | Jawahar, Rajhans, Virgo, Paskali, Ganga, Pusa-Sania, Purnima, Priyatama, Appollo, Golden Giant, Golden masterpiece. |
| | 2. Pink | Ifan Tower, President, Ramakrishananan, Mrinalini, Mridula, Dr.G.P.Paul |
| | 3. Red Rose | Crimpson, Raktganda, Charles, Malrin, ChrimsonGlori. |
| | 4. Shiny blue Red | Tata Centour, Bluemoon, Blue Delite, Nilambri |
| | 5. Orange | Super Star, Motejuma |
| | 6. Double Colour | Double Delight, Piccadily, Kiss-off-fire, Sporten, Salman |
| Flouribunda Group | 1. White | Ice varg Samarsani, Chandrama, Chitchor. |
| | 2. Yellow | Sonora, C-pearl, Goden times, Golden Locks |
| | 3. Pink | Arunima, Queen, Elizebeth, Bridal, Pink, King Author |

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| | Shiny Red | Neel Neelambra |
| Polyantha Group | 1. Red | Anjana, Reshmi |
| | 2. Pink | Nartak, Prati, Swati |
| Miniature Group | 1. Red | DarkBeauty |
| | 2. Pink | Dajlat, Cry Cry |
| | 3. Yellow | Delhi Scarlet |
| | 4. Orange | Baby Muskowred, Ramba, Samba. |
| Creepers Group | 1. White | Delhi Height, Pearl, Sendors, Height Rambler |
| | 2. Pink | Snowgirl, Dortho Parkin |

Plucking of the flower:- When the bud developed in full colour the bud should be cut with long pedicel with sharp knife or sketcher and simultaneously these cut flowers should be put in the water basket or water tub.

Packing of flowers:- 20-20 bunches should be wrapped with the newspaper sheet are packed in the boxes of size 100 cm long, 50 cm. breadth and 6 and half cm. deep and after packing it should be sent for marketing in the flower market.

| Insect Pest & their control | Disease and their control |
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| <p>Rose-Scale:- The main stem is covered by the brown layer and the stem starts gradually drying.</p> <p>Control:-To prevent from this insect the spray of 0.05% oxy-dematon methyl 25 EC (Metacytox). (2gm. in one liter of water.</p> | <p>Dieback:- The plant shows symptoms of blackening from the top and the disease increase from top to bottom size and branches become drying.</p> <div style="text-align: center; border: 1px solid black; width: fit-content; margin: 10px auto;">Photo</div> <p>Control:- The affected branches should be cut and the cut ends should be pasted with bavistin paste of 0.2%.</p> |