GURU NANAK COLLEGE (AUTONOMOUS)
VELACHERY- CHENNAI – 42.

- DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
- SEMESTER II
- COURSE: MUSHROOM CULTIVATION (NME)
- COURESE CODE: 16UNME02F
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SEMESTER II

NON MAJOR ELECTIVE

MUSHROOM CULTIVATION

OVERVIEW

1. Introduction
2. Categories of Mushroom
3. Why Mushroom
4. Types of Mushroom for Commercial Cultivation
5. Status of Mushroom Production
6. Cultivation Process of Paddy Straw Mushroom
7. Cultivation Process of Oyster Mushroom
8. Diseases of Mushroom
9. Economics
10. Conclusion

INTRODUCTION

MUSHROOM ?

Fruiting body of Macro fungus

Epigeous (above) / Hypogeous (Below) Seen with unaided eye

Picked by hand

Saprophyte (needs substrate)

Mushroom Science – principles and practices of mushroom cultivation

INTRODUCTION

SUBSTRATES

Growing Medium	Mushroom Species
Rice straw	Straw (*Volvariella*), Oyster (*Pleurotus*), Common (*Agaricus*)
Wheat straw	Oyster (*Pleurotus*), Common (*Agaricus*), Straw (*Volvariella*), Roundhead (*Stropharia*)
Coffee pulp	Oyster (*Pleurotus*), Shiitake (*Lentinus*)
Sawdust	Shiitake (*Lentinus*), Oyster (*Pleurotus*), Lion's Head or Pom Pom (*Hericium*), Ear (*Auricularis*), Ganoderma (*Reishi*), Maitake (*Grifola frondosa*), Winter (*Flammulina*)
Sawdust-straw	Oyster (*Pleurotus*), Roundhead (*Stropharia*)
Cotton waste from textile industry	Oyster (*Pleurotus*), Straw (*Volvariella*)
Cotton seed hulls	Oyster (*Pleurotus*), Shiitake (*Lentinus*)
Logs	Nameko (*Pholiota*), Shiitake (*Lentinus*), White jelly (*Tremella*)

INTRODUCTION

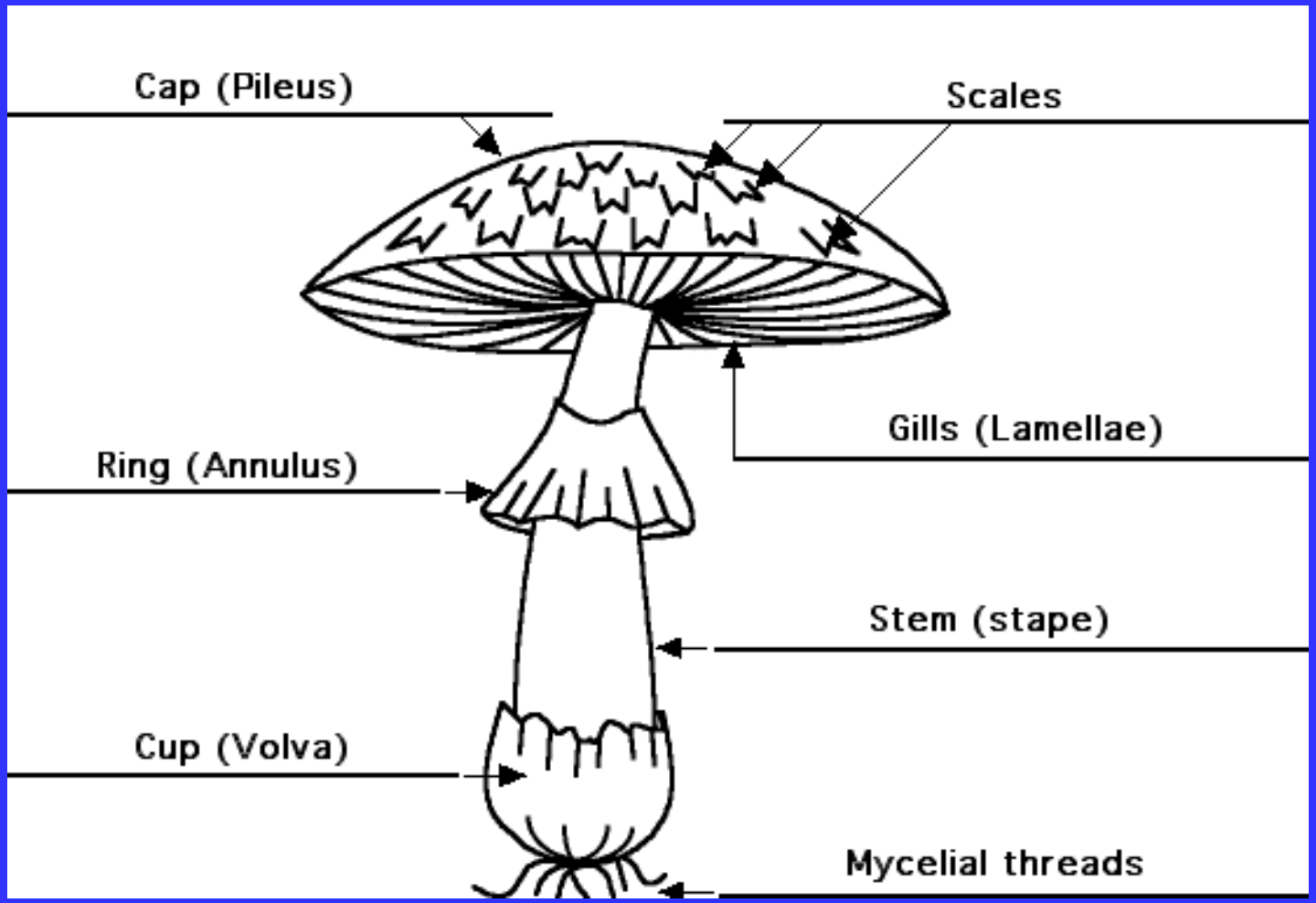
SUBSTRATES

Sawdust-rice bran	Nameko (*Pholiota*), Ear (*Auricularis*), Shaggy Mane (*Coprinus*), Winter (*Flammulina*), Shiitake (*Lentinus*)
Corncobs	Oyster (*Pleurotus*), Lion's Head or Pom Pom (*Hericium*), Shiitake (*Lentinus*)
Paper	Oyster (*Pleurotus*), Roundhead (*Stropharia*)
Horse manure (fresh or composted)	Common (*Agaricus*)
Molasses waste from sugar industry	Oyster (*Pleurotus*)
Water hyacinth/Water lily	Oyster (*Pleurotus*), Straw (*Volvariella*)
Oil palm waste	Straw (*Volvariella*)
Bean straw	Oyster (*Pleurotus*)
Cotton straw	Oyster (*Pleurotus*)
Cocoa shell waste	Oyster (*Pleurotus*)
Coir	Oyster (*Pleurotus*)
Banana leaves	Straw (*Volvariella*)
Distillers grain waste	Lion's Head or Pom Pom (*Hericium*)

Source: Beetz, A. & Kustudia, M. 2004. Mushroom cultivation and marketing. Horticulture Production Guide. ATTRA Publication IP 087.

INTRODUCTION

STRUCTURE;



CATEGORIES OF MUSHROOM

1. EDIBLE MUSHROOMS – 2 types Fleshy and Edible
   i. Cultivable ii. Noncultivable

2. MEDICINAL MUSHROOMS – Medicinal Applications

3. POISONOUS MUSHROOMS – Fatal / Health hazard.

4. OTHER MUSHROOMS – Properties not well defined

CATEGORIES OF MUSHROOM

1. EDIBLE MUSHROOMS – 2 types Fleshy and Edible
   i. Cultivable ii. Noncultivable

- Edibility

- No poisonous effects on humans
- desirable taste and aroma .
- Nutritive value

- Edible mushrooms include many fungal species that are either harvested wild or cultivated

CATEGORIES OF MUSHROOM

2. POISONOUS MUSHROOMS –

❖Poisonous Mushrooms look like edible mushroom in their morphology and lifecycle. However They can be distinguished by following features:

❖Brightly coloured fruit bodies.

❖Greenish tinge on gills and Yellow-Green spores.

❖Pink coloured spores in gills.

❖Presence of Vulva and Annulus on the Stalk.

❖Oozing of milky or coloured latex at damaged portions

❖Unpleasant odour

•E.g. *Amanita phalloides*

•*Tricholoma muscarium*

CATEGORIES OF MUSHROOM

1. POISONOUS MUSHROOMS –

***Amanita* sp.**

Lepiota brunneoincarnata

***Cortinarius* sp**

Cortinarius bolaris

***Lepiota* sp.**

Amanita muscaria

CATEGORIES OF MUSHROOM

Oyster Mushroom

Straw Mushroom

Reishi Mushroom

Enokitake Mushroom

Shitake Mushroom

Wood Ear Mushroom

HISTORICAL SIGNIFICANCE

1. A.D. 600 - *Aucularia auricula* – 1st mushroom cultivated in China on wood log.

Auricularia auricula

Ganoderma – King of herbs / Mushroom of Immortality

The officers of CIQ investigate our company organic Ganoderma lucidum plantation.

Ganoderma

- Effect on Tumor
- Anti ageing
- Liver Protection & Detoxification
- Anti colesterol
- Effect on Cardiovascular
- Anti cancer
- Effect on Hypertension
- Anti biotic
- Treatment of Diabetes

*Letinus edodes (*Shitake) (Both edible & Medicinal) Most popular in Japan

Prevents cerebral hemorrhage Controls Blood pressure level

Pleurotus sp. (Oyster)

Pleurotus spp (Oyster)

WHY MUSHROOM

1. Good taste and unique flavour
2. Easy to Cultivate with short crop duration
3. Medicinal appeal
4. Less investment and high return
5. Self employment
6. Less time and labour intensive
7. Utilization of agricultural waste
8. High nutritional value
9. Suitable for small and landless farmers
10. High market demand
11. Suitable for woman
12. Probiotic in nature
13. Spent mushroom substrate can be used for vermicomposting

WHY MUSHROOM

14. Water productivity can be scaled up
15. Mushroom don’t compete with other crops for planting space
16. Much of Asia’s climate suitable for mushroom cultivation
17. Significant role in forest economy – decomposes dead plants, animals, etc

WHY MUSHROOM

Food value

- **Protein** - Most mushrooms have a high protein content, usually around 20-30% by dry weight.
- **Fiber** - Helps lower cholesterol and is important for the digestive system.

- **Vitamin D** - Essential for the absorption of calcium.

- **Copper** - Aids in helping the body absorb oxygen and create red blood cells.

- **Selenium** - An antioxidant that helps neutralize free radicals, thus preventing cell damage and reducing the risk of cancer and other diseases. Mushrooms contain more selenium than any other form of produce.

- **Potassium** - An extremely important mineral that regulates blood pressure and keeps cells functioning properly

- **Other important minerals** - Such as phosphorous, zinc, and magnesium.

- **Low levels of fat, calories, and sodium**
- **No cholesterol**

MUSHROOM VARIETY AND VALUE

- There are more than 75,000 identified types of mushrooms worldwide.

- 2000 of these are safely edible
- Around 1000 are poisonous
- Commercially 20 species are grown worldwide
- In India 4 species are grown world wide
- In Odisha mostly 2 species are commercially cultivated.

Yet there are still many undiscovered mushroom species and the effects of some mushrooms on human health remain unknown

COMMERCIALLY CULTIVATED MUSHROOMS WORLDWIDE

WORLD PRODUCTION

SL No.	MUSHROOM SPECIES	% SHARE
1	*Agaricus bisporus / bitorquis*	37.6
2	*Lentinus edodes*	16.8
3	*Pleurotus spp.*	16.3
4	*Volvariella spp.*	8.5
5	*Auricularia spp.*	6.1
6	*Flammulina velutipes*	4.7
7	*Tremella fuciformis*	3.2
8	*Hypsizygus marmoreus*	1.1
9	*Pholiota nameko*	.6
10	*Grifola frondosa*	.3
11	Others	4.8
Total		100

COMMERCIALLY CULTIVATED MUSHROOMS IN INDIA

SL No.	Mushroom species	Scientific name	Growing season
1	Paddy straw Mushroom	*Volvariella spp*	April – October Kharif and Zaid
2	Milky Mushroom	*Calocybe spp.*	
3	Oyster Mushroom	*Pleurotus spp.*	November – february Rabi / Winter
4	Button Mushroom	*Agaricus spp.*	

COMMERCIALLY CULTIVATED MUSHROOMS IN INDIA

PADDY STRAW MUSHROOM

OYSTER MUSHROOM

BUTTON MUSHROOM

MILKY MUSHROOM

CULTIVATION OF PADDY STRAW MUSHROOM

Paddy straw mushroom / Straw mushroom / Chinese mushroom / Nanhua Mushroom / warm mushroom .

Scientific Name – *Volvariella* spp.

Edible mushroom of tropical / subtropical climate

1st cultivated in Nanhua region of China in 1822 by monks for table purpose.

Crop cycle completed in 21-25 days.

Grown in – Odisha, A.P., Tamil Nadu, Kerala & West Bengal.

CULTIVATION OF PADDY STRAW MUSHROOM

ATTRIBUTES:

1. Highest demand in Odisha as compared to other mushroom.

2. 2 species in Odisha – *V. volvacea* (kasara chatu)
   V. diplacea (dhala chatu)
3. Season – April – October
4. Duration – 21 – 25 days

CULTIVATION OF PADDY STRAW MUSHROOM

USES:

1. Very tasty
2. Yield is achieved in very less time i.e. 15 days
3. In Odisha can be cultivated for 8 – 9 months.
4. Very easy to cultivate.
5. Less insect pest and disease attack
6. More profitable

CULTIVATION OF PADDY STRAW MUSHROOM

DISADVANTAGES:

1. Less shelf life

2. Biological efficiency 10 – 15%

3. More use of straw

CULTIVATION OF PADDY STRAW MUSHROOM

FOOD VALUE of PADDY STRAW MUSHROOM

Ascorbic acid	8.0
Ash, gram	1.0
Calcium mg.	3.0
Fat g.	0.6
Fiber g.	1.2
Food Energy Cal.	39
Iron mg.	1.7
Moisture, %	87.7
Niacin, mg.	8.3
Phosphorous, mg.	94.0
Protein, g.	3.8
Riboflavin, mg.	0.17
Thiamine, mg.	0.11
Total carbohydrates	6.0

Requisites

1. Sterilization of Bed:

•Clean the Unit & sterilize the house before 48 hours of bed preparation by using 20ml formalin with 1 L of water.

•Use wet gunny bags for controlling humidity temperature & light.

•Laying of sand in the floor.

Requisites

CLIMATIC REQUIREMENTS

1. Temperature – 25^0C – 38^0C
2. Relative humidity – 85 % - 95 %
3. Light – 1000 Lux
4. Ventilation – Gas exchange is necessary to avoid co_2 accumulation

Requisites

MATERIAL REQUIREMENTS

1.Spawn – 1 bottle – 200g
2.Paddy Straw — 14 Bundles bed^{-1}
3.Nutrient (Pulse Powder) — 250 g bed^{-1}
4.Formalin (for Sterilization)
5.Lime
6.Soaking tank
7.Chaff cutter
8.Thermohygrometer
9.Humidifier 10.Fogger
11.Polythene

Requisites

MATERIAL REQUIREMENTS

1. COLOUR
2. INOCULATION DATE
3. EXPIRY DATE
4. SPAWN PRODUCTION UNIT

SPAWN BOTTLE / SPAWN BAG

Requisites

MATERIAL REQUIREMENTS

1. Paddy Straw pH - 7

Requisites

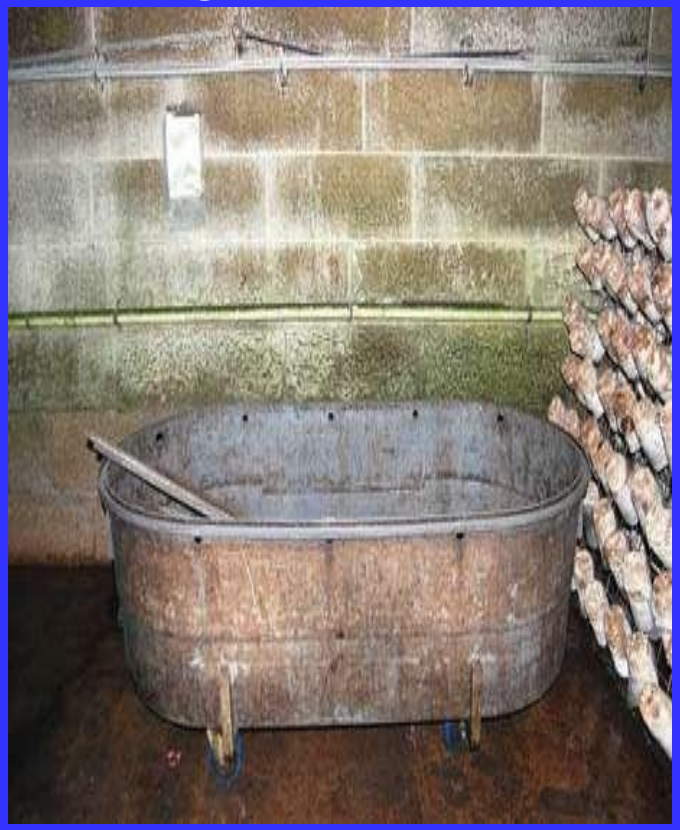
MATERIAL REQUIREMENTS

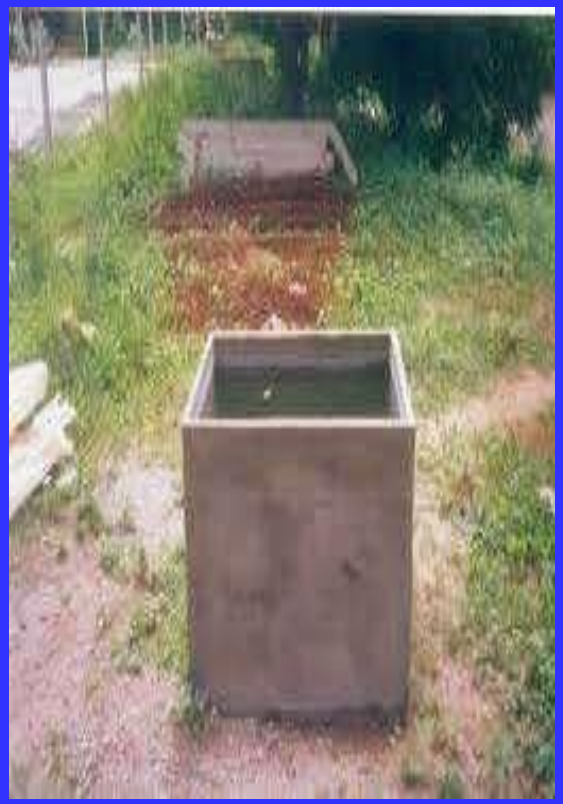
1. Nutrient (Pulse Powder) 250 g bed
   - horse, green gram, black gram, etc.

Requisites

MATERIAL REQUIREMENTS

Soaking tank





4’X4’X3’

Requisites

MATERIAL REQUIREMENTS

Polythene

Production system

1. Outdoor system – intercrop in coconut plantation.

2. Indoor in low cost thatched house. Low cost thatched house Asbestos room Agroshed net house Polyhouse (off season)

1. Outdoor system – intercrop in coconut plantation.

1. Indoor in low cost thatched house. Low cost thatched house

Production system

1. Indoor in low cost thatched house.

   Asbestos room

Production system

1. Indoor in low cost thatched house.

   Agro shade net

Method of cultivation

1. Cut the soft portion of Paddy straw 1.5’ & soak it for 6 - 8hours in water mixed with limestone @ 1kg / 100 lit. water.
2. Drain excess water
3. Dry the Paddy straw in shade (Moisture content -65%)
4. Spread the Paddy straw in the shelf (East-West) & apply ¼ th part of spawn & Nutrient. Cover again with paddy straw(North-South) & repeat the process.
5. Cover the bed of 1.5’ X1.5’X1.5’with polythene sheet for 6 days.
6. From day 7 onwards sprinkle water 2-3 times/day
7. Fruiting starts from 12th day onwards with 4 flush

CULTIVATION OF OYSTER MUSHROOM

Oyster mushroom

Scientific Name – *Pleurotus* spp.

Edible mushroom of temperate climate

Crop cycle completed in 45 - 60 days.

Grown in – Tamil Nadu, Odisha, A.P., Karnataka, Maharastra, Madhya Pradesh, West Bengal

CULTIVATION OF OYSTER MUSHROOM

USES:

1. Highest no. of species
2. Shelf life – 24- 48 hrs
3. Bioefficiency – 100%
4. Very easy to cultivate.
5. Less insect pest and disease attack
6. More profitable

CULTIVATION OF OYSTER MUSHROOM

- *Pleurotus sajor-caju*
- *Pleurotus florida*
- *Pleurotus sapidus*
- *Pleurotus ostreatus*
- *Pleurotus eous*
- *Pleurotus membranaceous*
- *Pleurotus citrinopileatus*
- *Pleurotus flabellatus*

CULTIVATION OF OYSTER MUSHROOM

- *Pleurotus sajor-caju*

CULTIVATION OF OYSTER MUSHROOM

- *Pleurotus florida*

CULTIVATION OF OYSTER MUSHROOM

- *Pleurotus sapidus*

CULTIVATION OF OYSTER MUSHROOM

- *Pleurotus ostratus*

CULTIVATION OF OYSTER MUSHROOM

- *Pleurotus eous*

CULTIVATION OF OYSTER MUSHROOM

- *Pleurotus citrinipileatus*

CULTIVATION OF OYSTER MUSHROOM

- *Pleurotus flabellatus*

CULTIVATION OF OYSTER MUSHROOM

CLIMATIC REQUIREMENTS

1. Temperature – $2O^0C$ – $3O^0C$

2. Relative humidity – 70 % - 80 %

3. Light – 200Lux

4. Ventilation – Gas exchange is necessary to avoid co_2 accumulation

5. pH – 7.0

CULTIVATION OF OYSTER MUSHROOM

MATERIAL REQUIREMENTS

1.Spawn – 1 bottle
2.Paddy Straw 2 - 3 inch size (1.5 – 2 kg)
3.Nutrient (Pulse Powder) 200 g per polybag
4.Formalin (for Sterilization)
5.Lime
6.Soaking tank
7.Chaff cutter
8.Thermohygrometer
9.Humidifier
10.Fogger
11.Polythene 80 X 40 cm size

CULTIVATION OF OYSTER MUSHROOM

FOOD VALUE

Sr. No.	Nutrient	Quantity
1.	Water	76.69 gm
2.	Enegry	28 kcl
3.	Protein	2.85 g
4.	Lipid(Fat)	0.35 g
5.	Ash	0.87 g
6.	Carbohydrate	5.24 g
7.	Fiber	2.0 g
8.	Sugar	0.95 g

Method of Cultivation

SUBSTRATE PREPARATION:

1.Chopping of Straw to 4 – 5 cm size by chaff cutter

2.Soaking of straw in Chalk powder mixed water for 6 – 8 hr @ 1 kg / 100lit. Water for pasteurization.

3.Soaking in hot water (65 – 70^0C)

4. Drain excess water & maintain moisture content of 60%

5. Substrate is devided into 4 lots after drying

RAISING OF BAG:

1 end of polythene is tied with rubber band and 1part of substrate is put to a height of 15cm

Method of Cultivation

RAISING OF BAG:

6. The bags are then kept in dark place at 25^0C for 15 - 20 days. During mycelial growth bags should not be opened.

6. Remove the polythene after full spreading of fungus.
7. It is ready for fruiting.
8. Bundles are then hanged or kept in shelves water is sprinkled 2 times daily.

10. In next 15 – 20 days 3 flush of crop can be harvested.
11. Biological efficiency is 100%

Method of Cultivation

Cutting of straw

Soaking

Hot water treatment

Draining of water

Method of Cultivation

Bed preparation

Layering of spawn

Pinning of bag

Spawn running

Method ofCultivation

Hanging of bed

Watering

Pinhead stage

Mature mushroom

Method of Cultivation

Hanging of bed

Method of Cultivation

Mature mushroom

Method of Cultivation

Harvesting of mushroom

packing of mushroom

Diseases and of Mushroom

1. Dry bubble disease – Verticillium fungicola – brown spot on mushroomcap

2. Wet bubble – *Mycogone perniciosa* - putrifaction of mushroom (foul odour)

3. Cow web disease – *Dactylium dendroides* – cottony growth of fungus

Economics of Mushroom

PADDY STRAW MUSHROOM				OYSTER MUSHROOM			
SL No.	ITEM	QUANTITY	AMOUNT Rs.	SL No.	ITEM	QUANTITY	AMOUNT Rs
1	STRAW	7 kg	14	1	STRAW	2 kg	4
2	SPAWN	200g	12	2	SPAWN	200g	12
3	WHEAT BRAN	200g	3	3	WHEAT BRAN	200g	4
4	$CaCO_3$	-	5	4	Polythene bag	1	3
5	Mis. Expenses	-	6	5	Mis. Expenses	-	7
Total Expenditure			40	Total Expenditure			30
Avg. yield per bed – 1kg				Avg. yield per bed – 1.5 kg			
Min. sale price: Rs. 80.00 /kg				Min. sale price: Rs. 40.00 /kg			
Net profit per bed: Rs.40.00				Net profit per bed: Rs.30.00			

- Value added product of milky mushroom

Conclusion

- Tray packed mushroom

Conclusion

- Mushroom packed in card board boxes

- Preserved oyster and button mushroom

Conclusion

- Mushroom soup powder and mushroom biscuit

- Mushroom sauce, candy & RTScurry