Name of the Firm/Promoter:

M/s --

{Promoter:

Project Report

For

20 TPA White Button Mushroom Project

Rs. 30.50 lakhs

Prepared by:

Directorate of Mushroom Research
Chambaghat, Solan, (H.P.)-173213

Name of the Firm/Promoter:

FEASIBILITY REPORT

INTRODUCTION

The promoter is..................... The total capital out lay is Rs. 30.50 lakhs. The registered office address is ....

SECTOR BACKGROUND

Mushrooms have been identified as priority item in government's recent programme of promoting production of vegetables and fruits in the country. Though there are many types of mushrooms produced and marketed worldwide and the white button mushroom (*Agaricus bisporus*) contributes 15% of the total world production and more than 70% of Indian production is of this mushroom. Cultivation of mushrooms in India is of recent origin and it started in the year 1962 in the state of HP. Since then country has progressed tremendously at this front, and today we are producing around 1,81,000 tons of mushrooms per annum. However, this much production does not stand anywhere compared to China that is producing around 33 million tons of this mushroom. Mushrooms are very good source of proteins and are having many medicinal values. In India this sector is growing at the rate of 10% per annum.

PROJECT REPORT FOR SETTING UP OF INTEGRATED MUSHROOM CULTIVATION UNIT

BROAD OUT LINE OF THE PROJECT

1.	**Name of the company**	:	--
2.	**Registered office and address**	:	....
3.	**Proposed location**	:	....
4.	**Promoter(s)**	:	....
5.	**Cost of the project**	:	Rs. 30.50 lakhs
6.	**Proposed capacity**	:	Around 20 tons of white button mushroom production
7.	**Future planning**	:	
	The capacity will be doubled to 40 tons in the 5th year of operation by extending the composting yard and adding pasteurization tunnels, phase one bunkers and growing rooms.		
8.	**Raw materials**	:	
	Main raw materials for cultivation of mushrooms and spawn production i.e. wheat straw, paddy straw, chicken manure, urea, gypsum, wheat/paddy grain, calcium carbonates, etc are available throughout the year in the region where project is proposed to be setup. Raw materials needed for canning of mushrooms, tin cans and corrugated boxes are available in the market.		
9.	**Marketing**	:	
	During the past 5 years, the consumption of mushrooms has grown 15 times. Besides the sizable domestic market, which is underfed, there is great demand for mushrooms in USA, France, Germany, Canada, Italy and UK. Besides this, fresh market in the gulf remains untapped. China which is the largest exporter of mushrooms to the American and European countries is facing anti dumping duties on its products. Further Chinese mushrooms are not available throughout the year, and hence it is the right time that India enters billion-dollar global mushroom market to earn valuable foreign exchange for the country. Since the promoters are already in the processing business including canning, they are seeing tremendous potential in this field. They are unable to meet the demand of canned		

Name of the Firm/Promoter:

	mushrooms as the fresh mushrooms are not available easily and if available they have to pay very heavy price for the same there by eroding the profits. The demand for mushrooms, domestic as well as international is rising at a phenomenal speed. World production of mushrooms was about 12.2 million tons in the year 2002 and China remains the main producer and exporter of mushrooms. India is roughly producing around 1,81,000 tons of mushrooms annually of which 60,000 tons is produced by a single unit the Agro Dutch Foods Lalru, Punjab, which boasts of the single largest producer and exporter of mushrooms in the world. Besides this very big unit there are many other small white button mushroom units in Punjab, Haryana, Uttarakhand, Maharashtra, Gujrat, etc cultivating this mushroom all the year round and are running successfully. These units are located in Phagwara, Jullandhar, Bhatinda, Banga, Bannore, Haridwar, Dehradun, Pune, Nasik, Badnagar, etc. In the state of HP, units located at Poanta sahib and Nalagrah are doing exceedingly well and are in for expansion. In Uttrakhand Ms Flex Foods is doing very good and producing around 2000 tons of this mushroom. The promoters don't foresee any problem in marketing their produce. Now with adoption of latest technology of mushroom production under controlled environmental conditions, it is possible to grow high qualities of mushrooms throughout the year to meet the domestic and international demand. The promoters have under taken the market surveys and made inquiries regarding the demand for mushrooms. Besides the big demand in the countries mentioned above there is a fast mushroom market developing in the gulf countries. Domestic market is also expanding at phenomenal rate, which is reflected in the increase in the production. Most important of all for this project is ever increasing demand and lucrative prices for canned mushrooms in India and abroad. Our per capita of mushrooms consumption of the mushrooms is the lowest in the world, which is 60-80 g against the 3 kg in the developed countries. This poor consumption is mainly due to non-availability of mushrooms in most part of the country for most of the year. As such no difficulty in marketing of mushrooms will be experienced.		
10.	**Employment**	:	2 persons
11.	**Power**	:	Rounded Power requirement 12 KW
12.	**Sales**	:	Rs. 24.00 lakhs
13.	**Profit**	:	Rs. 4.38 lakhs

WHY MUSHROOM CULTIVATION

1. Excellent source of good quality proteins to fight protein malnutrition in the Indian masses. Highest producer of protein per unit area and time.
2. Profitable and environmentally sustainable way of recycling abundant agro wastes for food.
3. To reduce pressure on arable land (grown indoors utilizing space also)
4. Excellent medicinal value (diabetes, cardiac diseases anticancer etc.)
5. Labour intensive providing gainful employment.
6. Foreign exchange earner through exports.

TECHNOLOGY ENVISAGED

Various levels of technologies are available for production of button mushroom- right from cottage industry of China to automated and mechanized technology of the developed countries. The present project proposes to adopt the modern technology of mushroom growing under controlled growing rooms with necessary mechanization and automation owing mainly due to large size of the project and handling of the raw materials in bulk on regular basis to achieve uniform and constant production. This shall cut down the cost of production and improve the quality of mushrooms. Low cost of production will boost competitiveness in the national and international market.

Name of the Firm/Promoter:

MANUFACTURING PROCESS AND DETAIL OF PRODUCTION

The project will have capacity of producing around 20 TPA of button mushroom of which will be sold 100% fresh. Stages of growing and manufacturing details are given below.

PRODUCTION TECHNOLOGY OF *AGARICUS BISPORUS*

Unlike other crops, cultivation of white button mushroom is a complex process and requires special technical skill for raising a successful crop. *A. bisporus* for its growth requires 22-28^{0}C temperature for spawn run and 15-18^{0}C for its fructification. Besides this it requires 85-90% RH and enough of ventilation. Due to low temperature requirement the cultivation is more popular in hilly region. However, due to advancement of the cultivation technology and advent of the controlled facilities its cultivation is now successfully extended to the plains. Cultivation of white button mushroom requires three basic steps

1. **Production or procurement of spawn**
2. **Preparation of selective medium (compost)**
3. **Production of Crop.**

1. Spawn (mushroom seed) production:

In the first phase of implementation of the project, the spawn (seed) will be procured from a reliable source/ laboratory situated nearby or directly from ICAR-DMR, Solan (HP). In the second phase of increasing the capacity of the unit it will be produced in-house.

To get improved yields and quality latest hybrids like S -130, S- 140, A-15, NBS-5 etc. which give optimum production in 30 days of cropping will be used to ensure minimum 6-7 crops per room per year.

2. Preparation of selective medium (compost):

Like other fungi *Agaricus bisporus* is a heterotrophic organism. It required carbon compounds that have already been formed by green plants. Besides carbon it requires nitrogen, essential elements such as phosphorus, sulfur, potassium and iron vitamins such as thiamine and biotin. All the ingredients that contain these compounds when fermented in a set pattern form a substrate, which is very selective in nature. On this selective substrate *A. bisporus* mycelium grows successfully at the practical exclusion of other competing micro-organisms.

In this case, compost can be purchased from a reliable govt/private source.

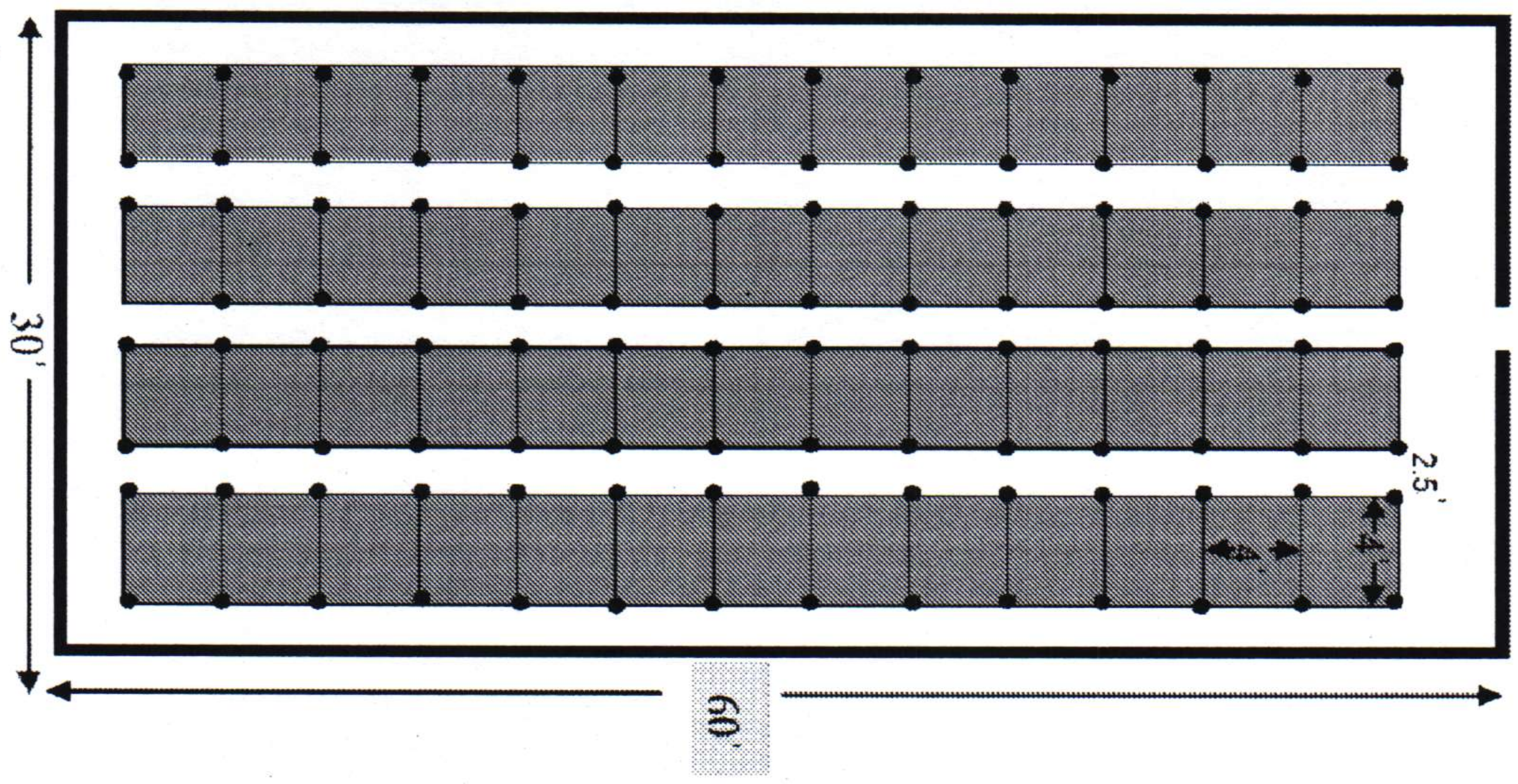
3. Crop Production

Design of cropping Rooms

Since mushrooms are grown indoors under simulated environment specially created for mushroom growth, the cropping rooms are required to be built specially for the purpose. Two types of cropping rooms are built suiting to particular requirement - those required for seasonal growing and those for environment controlled growing round the year.

Seasonal cropping rooms

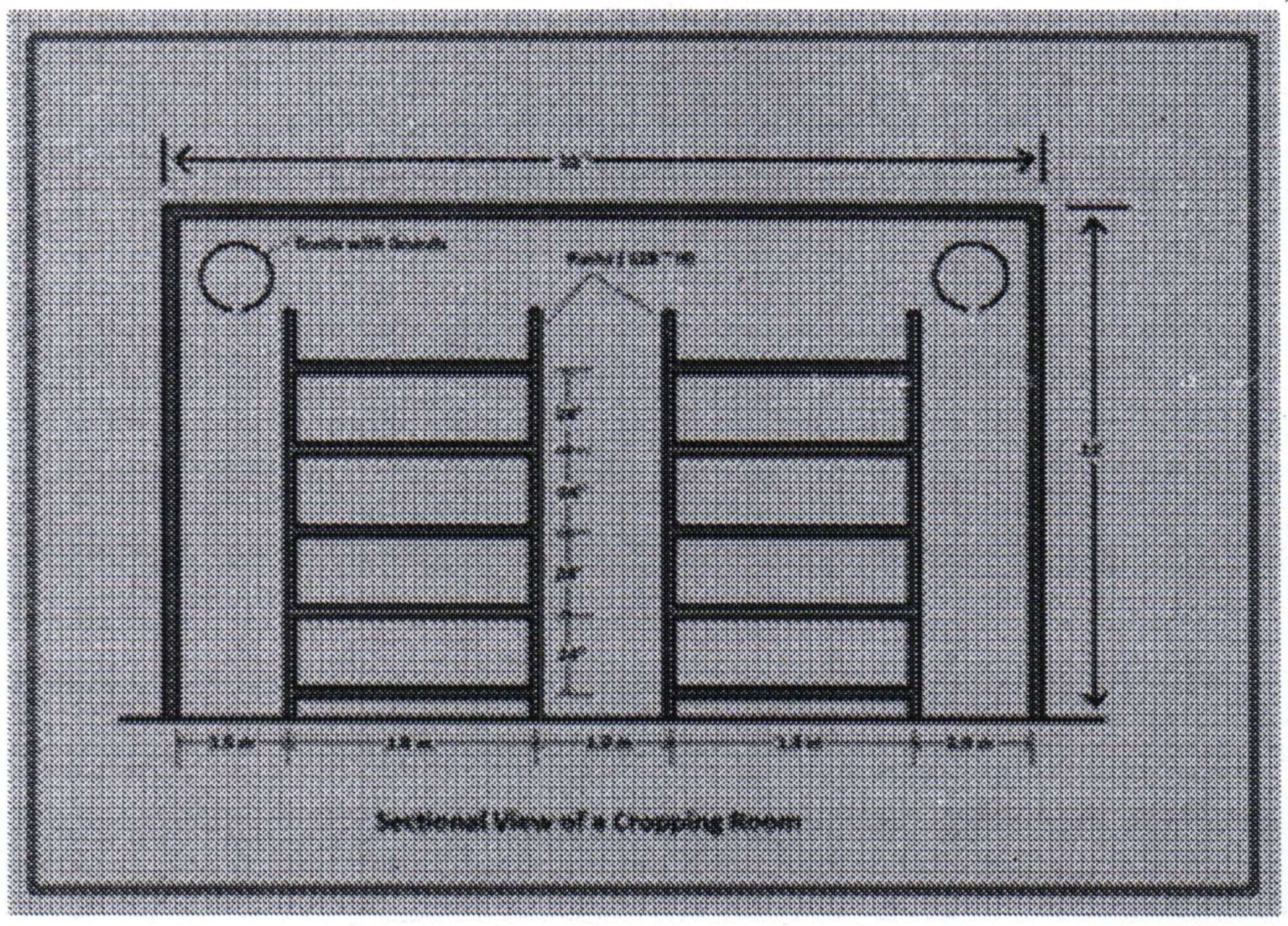
Seasonal cropping rooms are simple rooms with modifications for maintaining various growth parameters. These cropping rooms will have a cemented floor, cemented walls, cemented ceiling or a false ceiling with arrangement for forced air circulation inside. The seasonal cropping rooms are built of simple brick walls with roof made of asbestos sheets and a false ceiling. The room is more or less made air tight to make the air handling system work effectively for obtaining necessary air changes during growing. No insulation is required for seasonal growing rooms, as it will not allow heat dissipation from the room efficiently. These simple rooms are used for seasonal mushroom growing, coinciding various phases of growth with prevailing outside temperatures. No energy is generally used for heating/cooling of the rooms under seasonal growing conditions. However few units in plains have installed heavy-duty coolers to bring down the temperature in summer conditions. The cropping rooms for seasonal growing can also be made with a thatched roof and a false polythene ceiling. The door is installed on one end and the exhaust vents on the opposite end of the door. The mushrooms are grown on beds made out of bamboo sticks and sarkanda stems (a plant abundantly growing as a weed in North western plains of India). These growing rooms can also be built as low cost structure, steel pipe frame with high density polythene covering from outside. The real low cost growing houses built in rural areas are made of walls, roof and door of sarkanda. The mushroom houses made with bamboo frame and paddy straw have given good results conditions for seasonal growing. Design of one such hut is given below



Lay out of mushroom shed commonly used for seasonal cultivation

Environment controlled cropping rooms

The environment controlled cropping rooms are built like hermetically sealed chambers where the air movement is controlled either manually or semi automatically with mechanical control systems. These cropping rooms are appropriately insulated and the dimensions of a cropping room are determined by the amount of compost to be filled into the room. Rooms with greater length and narrower width gives better results as far as air handling inside the room is concerned. A cropping room, with a capacity to take compost from one bulk chamber, is considered advantageous as one bulk chamber load can straightaway be filled into one cropping room. Further, cropping cycles to be taken will determine the numbers of growing rooms in the unit. Now a day's 60 days cropping cycle is generally taken and in this manner a minimum of six crops are taken / room in a year. In such conditions a minimum of 12 rooms are required to have constant supply of mushrooms from the unit round the year. In this case every room is filled with the spawned compost after every 5 days. Both tunnel and cropping rooms of 20- 25 tons compost capacity are considered to be operationally efficient, as the filling/ emptying operation and spawning can conveniently be done in one day when machines are not to be used. However, bigger units may have the growing rooms handling compost to the tune of 60 tons or more. Growing rooms are such designed that maximum compost can be accommodated in least possible area without over looking to the mushroom growing requirements. To give an example a room size of 57 x 19.5x 12.5 ft can easily accommodate 20-25 tons of compost when cultivation is done in shelves or bags (Two rows of stands with 5 tiers, each 1.5 wide; and 3 paths each one metre = 6 m or 19.7 ft). The foundation of growing rooms should be laid on dry and firm ground. The floor is laid as per normal standards. The walls will be made of one brick thickness (9" thickness) and ceiling made of 4" thick RCC. The growing rooms will have a single insulated door and 2 vents for exhaust on the back wall 2-3 ft above ground level. One opening is provided on top of the door for entry of the Air Handling Unit (AHU) delivery duct or for fresh air intake inside the room through AHU. The walls, ceiling and floor should be insulated with 5 cm thick insulating material (Thermocol). The room should be made airtight and all leaks closed to prevent ingress of heat, flies, etc from outside. The cooling, heating and forced air circulation in the growing room is done via AHU installed for each cropping room individually or for whole of unit. The floor and walls of the cropping rooms should have a smooth finish.



j. Structural details special to cropping rooms

i. Floor

The floor must be well laid out and should be strong enough to take the heavy load of metal racks to be kept inside for growing mushrooms. The floor should be insulated with insulating material 5 cm thick (sheets of thermocol or glass wool or polyurethane). The insulation should be protected by a PVC sheeting, below and above, against moisture. It is then covered with wire mesh and finally 5 cm thick concrete floor is laid on top, which is given a smooth finish. The floor should have slight slope towards the entry point for discharge of cleaning water and placement of formalin trough for foot wash. The trough is connected near the wall to an exhaust drain to carry washings from the room. The water discharge hole is protected at this point to prevent leakage of air from the growing room. PUF pads can also be used specially in place of wall between rooms.

ii. Walls

The walls are made of brick 22.5 cm thick, which are given a smooth finish with cemented plaster. The insulation sheets are fixed on the walls (5 cm thick thermocol, glass wool/polyurethane), with the use of hot coal tar. Holes are drilled on four corners of the sheet/inside the cement wall for expansion fasteners which are fixed by screwing in the nail with 4"-5" long steel wire tied on its head. The wire hangs out of the sheet to be used for tightening of wire net fixed on top of the insulation. The layer of cement plaster is then applied (2 cm) on top of this and given a smooth finish. Bituminous paint is applied on cement plaster as a vapour barrier. The painting can be avoided in cropping rooms if the cook out is not done by steam. This wall will be good enough to give a K value of 0.5-0.6 kcal/m2h, even lesser and will facilitate proper control of climate inside the cropping room. Alternatively, the cropping rooms can also be made up of puff panels. The thickness of puff panel walls facing outside environment including roof should be of 80 mm thickness while the inner walls may be of 60 mm thickness.

iii. Roof

The roof is made of RCC (1 : 2 : 4) 12-15 cm thick. The inside is given a cement plaster finish for application of insulation (as explained for the wall). The roof on the outside is protected by tarring it on top, followed by 10 cm thick loose soil, 5 cm thick mud capping and finally the tiles. This will protect the roof from weathering effects of rain and will ensure longer life of insulation and prevent seepage of moisture into the room in rainy season. In hilly areas with a high rainfall index, slanting GI sheet roof over the insulated RCC roof will be excellent and in that case mud capping/tiling of the roof is not required. Alternatively, roofs of the cropping rooms can also be made up of puff panels. The thickness of puff panel walls facing outside environment including roof should be of 80 mm thickness and one shed may be given over roof to prolong the life of the roof panels.

iv. Doors/vents

The doors of the bulk chamber and the cropping room are made of wood or angle iron frame covered on inside and outside with aluminum sheets/GI sheets with insulation of 5-7 cm in the middle. The doors will have a rubber gasket lined on inner periphery so that the door becomes air tight when closed. The door will operate on hinges, with a strong locking latch for opening and closing of the door. The exhaust vents are fitted with wire net, louvers and insulated lids. The louvers allow the CO2 laden air to exhaust under positive pressure created by the blower inside the air handling unit.

v. Lighting arrangement

There should be a provision for tube lights and a mobile strong light for inspection in each cropping room. The tube lights should be protected with water proof housing. The tube lights should be fitted on all the walls vertically at various heights to facilitate lighting of all beds. There should be provision for a few electric points (5 and 15 Amp.) for operation of water spraying equipment and CO2 measuring instruments.

vi. Water connection and sewers

One clean water pipe line (1" or 1.25") with tullu pump installed to it for delivering clean water for spraying should be provided in each room. Underground drainage line for carrying the washings from the room and wash basin discharge should be laid before construction of the building. This waste water line should be connected to the common sewer. In H.D. polythene cropping rooms, sunkun traps on the floor for fresh water and drainage water are provided inside the growing house with each trap of 1' x 1' x 1' dimension fitted with an iron lid on top. It is desirable to lay underground drainage in the central gallery in advance of erecting the structure for carrying away the waste water/ washings from the cropping rooms.

vii. Gallery

The gallery between the rows of cropping rooms should be wide, (12-15 ft) to allow efficient performance of various operations. The height of the gallery should be same as for the growing rooms alternatively it may be about 8' with a false ceiling, leaving another 5 ft above for pipeline and space for AHUs.

viii. Racks

Racks are made up of the angle iron for horizontal and vertical support with iron mesh strips used for the shelves for housing compost. Length (vertical axis) of the racks is generally made up of 5 cm thick angle while horizontal support is made up of 3.5-4 cm thick. Width of the each shelf on the racks should not be more than 135 cm in any case as width more than that creates hindrance in performing various operations during cropping and most important of that is harvesting. Cultivation can be done in bags or in shelved beds. Five to seven rows of shelves (depending on height of the room) can be provided one above the other in the racks keeping a minimum distance of 60 cm in between. This distance can slightly be narrowed down if cultivation is employed in shelved beds. In such a case all the four sides of the shelf should be provided with 15- 20 cm high iron sheets for housing the compost in the beds. If more than 5 shelves on each rack are kept in the room than there should be provision of trolley running in between two rows of racks just above the fourth shelf for carrying out the various operations. Depth of the compost in shelves is generally kept at 15-20 cm while bags can be filled up to the maximum height of 30 cm. A room of standard size (60 x 17 x 12 ft) can accommodate 2 rows of racks each 4.5 ft. (135 cm wide). This will absorb 9 ft (270 cm) of the room and the rest 8ft can be used to have one central path of 3 ft. and 2 side paths of 2.5 ft. Length of each rack would be 52-55 ft.

ix. Air handling unit

This unit is employed for creating proper weather inside the growing room specific to white button mushroom. Air handling unit is generally installed in each room at the top of the door, which is made up of aluminum or G.I. Sheets. In certain cases it can also be placed on the top of the floor of the growing room or in the corridor. Indirect cooling of air through chilled water (5-60C) is generally employed in mushroom cultivation. Mushroom generally requires 225 m3 of air per hour per ton of compost. To meet this requirement a high speed centrifugal fan of required capacity having working pressure around 50 mm WG is generally mounted in the body of AHU. Alternatively if the capacity of the growing room is to accommodate around 20-25 tons of compost, then a fresh air fan of 600 mm dia of low pressure can also be chosen for this purpose, but in such case a booster fan of 375 mm dia will also required to be mounted in AHU for extracting fresh air from outside. In AHU cooling coils, humidifiers, heaters, eliminators and other components of AHU are mounted on the back of the supply air fan. Cooling coils are generally connected to the chilling unit via insulated ducts, which supply chilled water at 5-6C to these coils. This water is generally chilled in an insulated tank or by cooling unit comprising of a compressor, condenser, evaporator and a cooling tower. Heating unit of AHU can employ strip heaters or steam through a low-pressure boiler. Humidifiers can use free steam from the boiler to generate required humidity in combination with air pressure or can employ fine jets, which produce fine mist of water in the humidifier section of the AHU. PVC eliminators, eliminate the free water going inside the growing room. Booster fan in combination with supply air fan supplies fresh air inside the AHU through fresh air dampers. Since fresh air coming from outside atmosphere may contain fungal spores, which may contaminate the crop, this air is generally passed through pre filters and a HDPE micro filter section (2-5 um). The AHU has a mixing chamber with recycling dampers, which can regulate supply of fresh air or room air inside the growing room. Out let of the AHU is connected to the distribution duct in the growing room, which is generally made up of PVC sheeting having its end month closed. It hangs below the ceiling in the central corridor of the room. This duct has ports (5 cm dia) facing downward at a distance of around 50 cm each. When the air is blown inside the room via AHU a positive pressure is created and CO2 laden air of the growing room is expelled in the atmosphere through an outlet. In such cases back vents are not provided in the growing rooms. Alternatively AHU can be so fabricated having provision to exhaust CO2 laden air of the growing room in the atmosphere through an out let. In such cases back vents are not provided in the growing rooms. Central cooling unit can employ ammonia, Freon or vapour absorption machine (VAM) for cooling purpose. If size and capacity of growing unit is small, say 250 MT per annum employing around 12 rooms then cooling employing evaporator, inside the AHU can also be chosen. In such a case each AHU will be a self contended cooling unit, employing compressor, condenser and an evaporator. This unit will also have heating and humidifying arrangements.

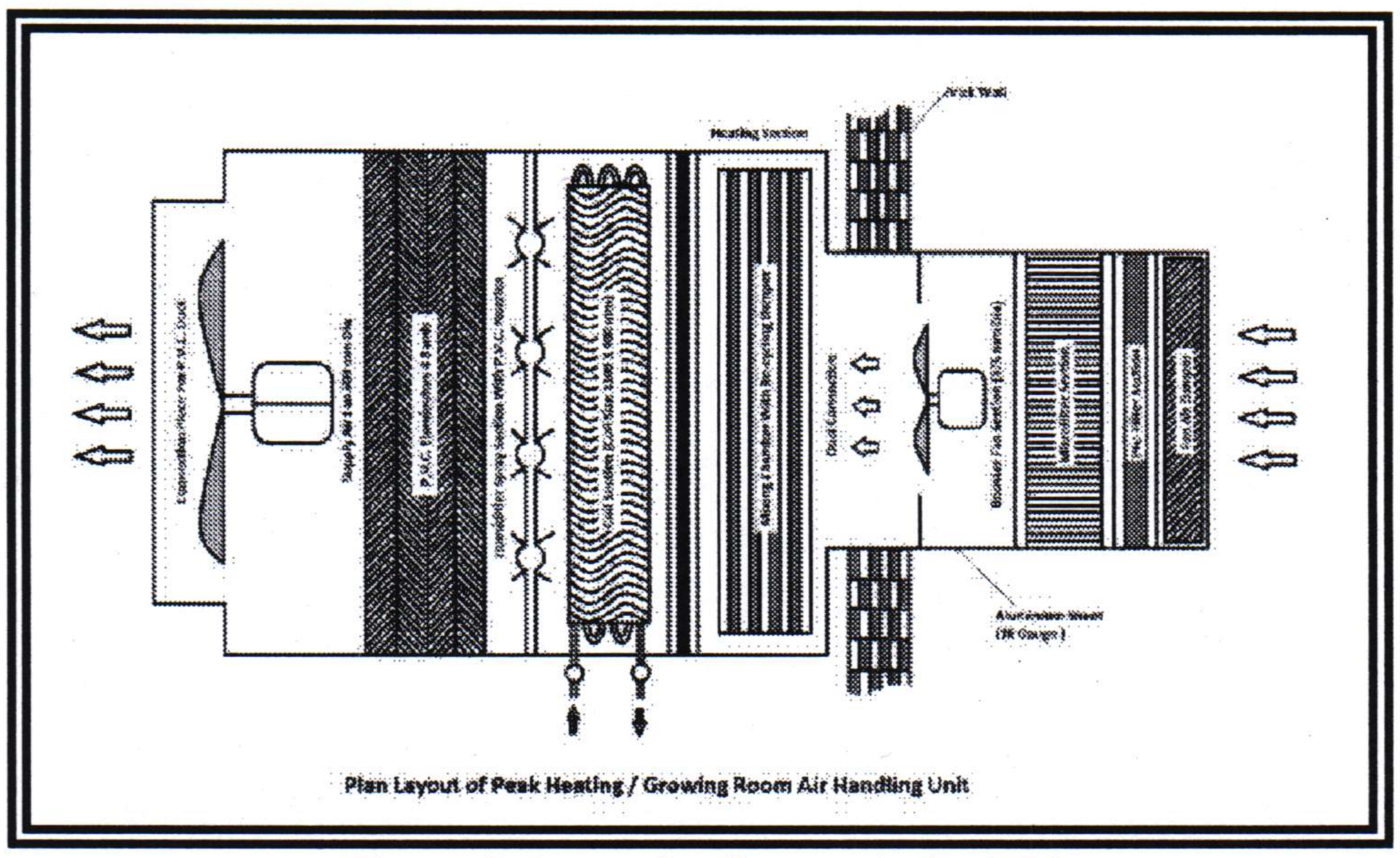
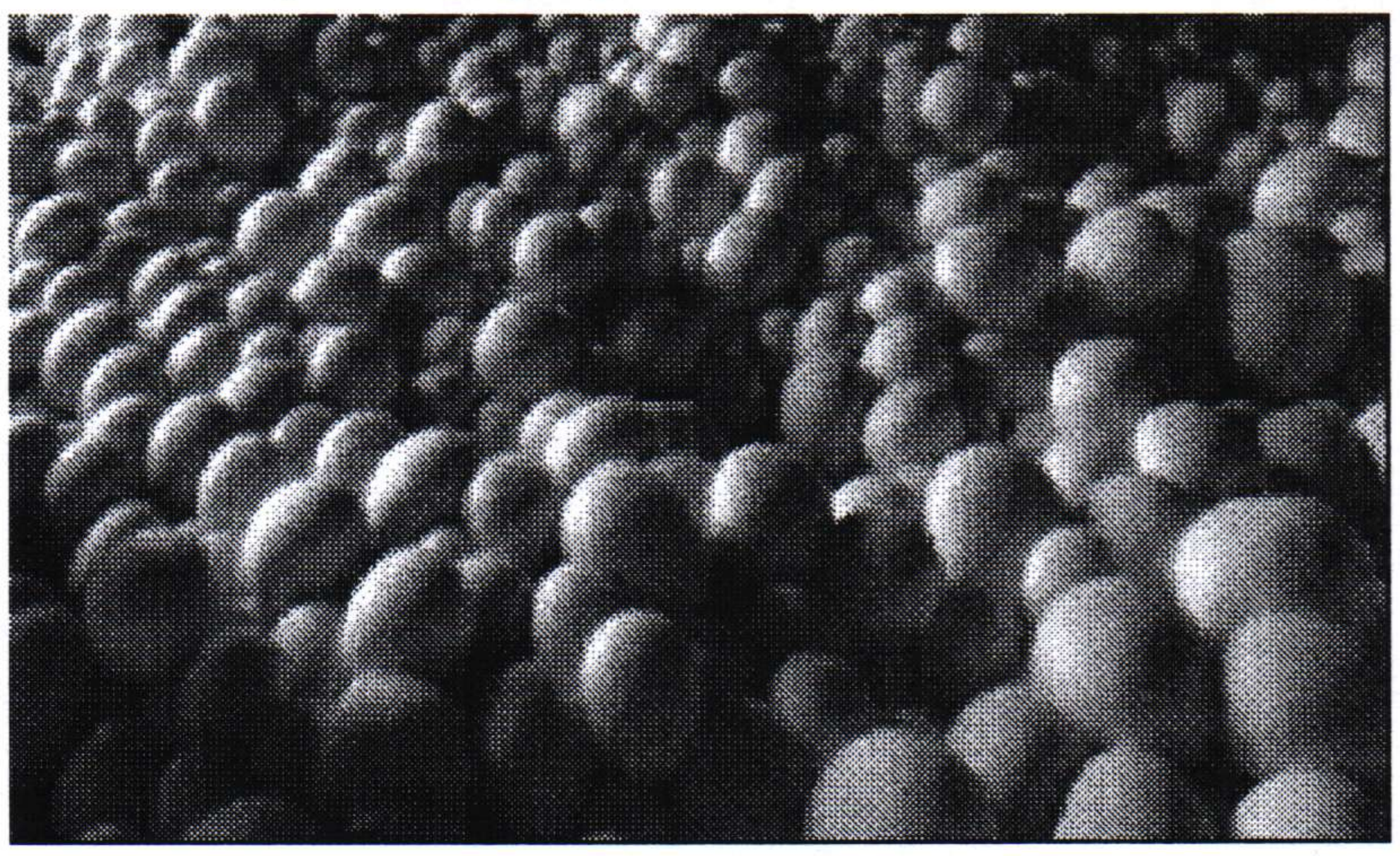


Fig 4. Schematic diagram of AHU

Crop Management

Button mushroom cultivation has two major components, composting (preparation of substrate/compost), and the crop management, (raising of mushroom crop). The substrate preparation has undergone scores of innovations/improvements suiting environment protection laws in many developed countries. At the same time, casing medium has also been standardized with use of peat and its alternative materials (FYM, Spent Mushroom Compost and Coir Pith) with prime objective to improve productivity and quality of mushrooms. Similarly, the crop management techniques have also been improved upon to harvest highest possible mushroom yield over a shortest period of time. All the operations/applications done after completion of composting are handled under the head crop management. These include:



A. Agronomic crop management
B. Environmental crop management

Name of the Firm/Promoter:

A. Agronomic Crop Management

Agronomic crop management deals with the compost quantity to be filled per m^2 bed area, moisture content of compost, spawning method employed, compost thickness in a bed or bag, casing application and thickness, watering regimes employed, harvesting of crop and after care, pest management, hygiene maintenance and so on. However, more important among these are

1. Spawning and spawn run
2. Casing materials, casing treatments, casing application, case run and pinhead formation

1. Spawning and spawn run The steps involved are

- Good quality compost with temperature of 25°C
- Mixing of grain based spawn (@ 0.5-0.7% of wet compost weight) under clean conditions (i.e. with clean hands and pre-sterilized area)
- Filling of spawned compost into polythene bags (12-15" depth) or beds (6-8" depth)
- Little compressing and levelling of spawned compost
- Loosely closing the mouth of polythene bags filled with spawned compost (Covering with a clean newspaper / plastic sheet if filled in trays/shelves)
- Shifting the compost filled bags in cropping rooms with a temperature of 23 ± 1°C (air temp.), RH of 95% and high CO_2 conc. (1.0-1.5% strain dependent), and keeping the bags under above conditions for 12-14 days
- Completion of spawn run (change of dark brown compost mass in to light brown colour)

Precautions

- Use of fresh pure culture spawn
- Spawning under clean conditions (preferably under positive pressure created using bacterial filters before inlet fans and air curtains at doors)
- Proper treatment of spawning area and tools with formalin, and cleaning of hands with dettol
- Maintaining good hygienic conditions during spawning by keeping all the doors/ windows closed

2. Casing and case run Casing is a 3-4 cm thick layer of soil applied on top of spawn run compost and is a pre-requisite for fructification in *A. bisporus*.

a. Casing materials Earlier sub-soil material or organic matter rich soils were used as casing in button mushroom cultivation. Presently peat is the most desirable casing material used world wide with excellent mushroom yields and superior fruit body quality. However, pest is not available in India. The other alternative recommended materials are,

- Well decomposed Farm Yard Manure (FYM) preferably two years old
- Well decomposed Spent Mushroom Compost (SMC) (two years old anaerobically decomposed)
- Composted coir pith (coir industry waste) (well decomposed & water leached)
- 1:1, 2:1 and 1:2, v/v of well decomposed FYM and SMC
- 1:1, v/v of decomposed FYM or SMC with composted coir pith
- Decomposed powdered bark of some forest trees
- Paper industry waste
- Burnt rice husk is also in use along with decomposed FYM (2:1, v/v) in seasonal cultivation of button mushroom in Hayrana and Punjab with reasonable success

b. Quality of casing materials

- Soft texture
- Light weight
- High water holding capacity
- High porosity

- Deficient in available form of C and N
- Neutral pH (7.0 – 7.5)
- Low conductivity (400-600 μ moh)

c. Casing treatment Casing material should be treated properly before its application on the spawn run compost and the steps involved are:

- Make a heap of casing material
- Wet it up to 50-60% water holding capacity
- Fill in trays and shift them to pasteurization chamber
- Steam pasteurization at 60-65°C for 6-8 hours
- Auto-Cooling

Alternatively,

- Make a heap of casing material on a cemented platform
- Wet it up to 50-60% water holding capacity
- Drench the wet casing with formalin @ 1 litre/m3 (40% formaldehyde) by mixing with shovel
- Cover it with polythene sheet and seal the outer periphery thereafter by pouring sand/soil on outside margin
- Keep the material for 24-48 hours in sun for fumigation effect
- Remove the cover after 48 h and expose the material to open air and sunlight by spreading over with clean tools and permitting the formalin fumes to escape in to air for 2-3 days before it is used as casing (formalin treatment effect decreases at low temperature due to inadequate fumigation)

d. Casing application

- Unfold the fully spawn run bag and make the top surface even by gentle pressing with hands Light spray of water on spawn run compost
- Application of 4-5 cm thick layer of casing uniformly using iron rings of 4 cm height or wooden blocks
- Water spray in instalments immediately after casing application

Precautions

- Casing material should not be sieved but used as such with clumps, which permits more air spaces in casing
- Top casing surface should have small mounts and valleys
- Care should be taken to prevent re-infection of the casing materials
- Store casing material in a sterilized /clean room before use in polythene bags or synthetic cloth bags
- Apply water to casing in a few installments so that water does not run into spawn run compost

e. Case run and pinhead formation

Case run is done at a temperature of 24 ± 1°C, RH-95% and CO_2 > 7500 ppm (strain dependent) for about one week. There is no requirement for fresh air introduction during case run. It is considered complete when mycelia come in the valleys of casing layer. After case run, the environmental conditions are changed by bringing down the temperature to 15-17°C (air), RH to 85% and CO_2 to 800-1000 ppm (strain dependent) by opening of the fresh air ventilation and exhausting CO_2. This change in environmental parameters induces pinhead formation in 3-4 days (strain dependent) time. The pinheads develop into solid button sized mushrooms in another 3-4 days. At this stage, the air inside the cropping room is changed 4-6 times in an hour to maintain appropriate CO_2 conc. as CO_2 production is at its peak during first flush (actually peaks at case run).

3. Supplementation

Supplementation with protein rich supplements such as cotton seed meal, soybean meal, alfa-alfa meal, feather meal, etc. has been found to increase the mushroom yield. Supplementation can either be done at spawning or after spawn run before casing. The later is more useful. Supplement is first grounded coarsely and denatured by treating with 5000 ppm formalin and before its mixing in compost. The practice normally increases the temperature of compost by 4-5°C and if done at the time of spawning or in poor quality compost, it results in killing of mushroom mycelium or increased incidence of moulds. If these problems are overcome supplementation can give 20-25% enhanced yield. Supplementation at casing in spawn run compost also helps in early and higher mushroom yield.

4. Ruffling

Ruffling of compost on completion of spawn run is done just before casing. This practice is particularly useful for round the year cropping when 5-6 crops are taken per year and cropping period is reduced to about 4 weeks, as this practice helps in exhaustion of compost earlier than normal. Ruffling of casing after a 3-4 days or so after casing is done by some growers to get uniform pinning.

5. Watering

Mushroom contains nearly 90% water and that gives us an idea how water is important for the crop. Mycelium gets water from compost during spawn run and compost + casing during case run and from casing during fruit body formation. Water level in casing is maintained in 2 ways. One way is by its regular spray when pinheads are pea sized and then by maintaining RH at 80-85% during cropping. If one of the factors, (water spraying and RH) during cropping is disturbed, it will affect crop productivity. Low RH during cropping will result in drying of beds, lightweight mushrooms, discoloration of mushrooms and crop losses. Drying of casing will seal the casing medium resulting in mat formation, which becomes impervious to water, and results in tremendous crop losses. Water has to be replenished in casing to accommodate the water losses from casing due to mushroom growth and evaporation. Lesser the water loss to room air, better it is. Bed moisture and RH are although two different factors, but are interdependent. Water spraying on mushroom beds at pin breaks should be avoided. The casing should be wet enough when fresh air is brought in and room temperature lowered. The wetness should be sustained till pin heads become pea sized, and that is the stage when bed will require additional watering to allow pea-sized pins to develop into button sized mushrooms. Watering to beds requires monitoring at each stage. RH in the cropping room is monitored by using dry & wet bulb thermometers. Two ordinary stem thermometers are put in the cropping room, placing one in the casing/compost bed and one hanging in the air nearby (few cm apart). Bed temperature is 1-2°C higher than air temperature. Computer control of AHU ensures application of cropping parameters with precision during spawn run, case run and cropping. The water used for irrigation (spraying) on mushroom beds should be clean, neutral in pH and free from salts, heavy metals and other impurities. Water good enough for drinking/watering for vegetables/field crops is also good for mushroom cultivation. It is desirable to test the quality of water before the mushroom growing is started at a particular site.

6. Harvesting and after care

Mushrooms with 4-5 cm dia., with hard pileus and closed veil are ready for the harvest. Mushrooms are harvested by holding them between forefinger and thumb, and rotating in clockwise/anticlockwise direction. The soiled stem portion is cut with sharp edged knife and mushrooms are collected grade-wise in baskets. Dropping of the stem cuttings on the floor or the bed should be avoided, as these will promote the growth of undesirable microorganisms. Cleaning of mushroom beds and floor is recommended after each crop harvest. Fresh casing is applied at places from where mushrooms have been removed. Water is sprayed at the rate the mushrooms have been harvested, i.e. for every kg of mushroom harvested 1 litre of water is added after harvesting. Damaged pins/ mushrooms, if any, are also to be removed from the bed manually. If bunching of mushrooms is observed, then there is a need to address the climate controls for creation of optimal environmental conditions during pinhead formation. Mushrooms after harvest are graded, packed in PP bags/card board boxes and preferably chilled at 4°C for 6-8 hours before sending to the market. The pre-market chilling enhances the shelf life of mushrooms. While harvesting care should be taken to keep the pileus free from casing soil, as it stains the mushrooms. Washing of mushrooms to make them extra white for increased acceptability in the market is undesirable, especially with Potassium metabisulphite solution. Unwashed mushrooms stay fresh for a longer period. Mushrooms should be handled carefully, and not bruised during the harvesting operation. Bruising will damage the mushroom tissue, which will turn the pileus dark/ pink on exposure to air. While packaging mushrooms in PP bag one should not forget to make a small hole (0.2 mm), as it will prevent the development of aflatoxins in transit or storage. Button mushroom can be stored at 4°C for a few days without any deterioration in its quality but it is desirable to consume/market fresh mushrooms. Since button mushroom has a very short shelf life and it cannot be stored for longer periods, hence it requires processing for long storage. Mushrooms are best preserved in brine solution after blanching, either in cans or jars. The properly processed mushrooms stay in good condition for over a period of 1 year. It is possible to transport canned mushrooms over longer distances without any deterioration in their quality. But fresh mushrooms can only be transported short distances in refrigerated vans/by air to reach up to a remunerative market.

B. Environmental Crop Management

Mushroom is an indoor crop, raised in cropping rooms with simulated environmental conditions suiting to a particular mushroom. Hence management of crop environment becomes utmost important. It includes the temperature, RH, CO_2 concentration, air speed/ evaporation rate over crop beds, air changes in the room/oxygen availability and other such factors, which directly influence crop productivity. The environment management in the cropping room includes addressing of the following factors: 1. Temperature, 2. Relative humidity (RH), 3. CO_2 concentration

1. Temperature

Temperature in the room has two areas for monitoring i.e., air temperature and bed temperature. Temperature has direct bearing on crop productivity in synergy with other factors like RH and CO_2 /O_2 conc. in the cropping room. The bed temperature in the cropping room is directly influenced by the air temperature, so it is the air temperature that has to be addressed. The air temperature inside the room can be manipulated with use of cooling/heating coils in an Air Handling Unit (AHU) installed inside or outside the cropping room for climate control. An independent AHU is desirable for each cropping room. The AHU inside contains a set of cooling coils, heating coils, RH fogging jets and a centrifugal blower fan for blowing the conditioned air into the cropping room. The AHU is generally installed on top of the entry door and is joined with a recirculating duct from inside the cropping room. The cooling coils are fed with chilled water from the chiller, while the heating coils are fed with steam from boiler and fogging jets get water from trough placed at the bottom of the AHU by a small pump. The cooling requirement will depend upon compost quantity fed inside the room, outside prevailing temperature, insulation on the walls, etc. The blower fan blows the conditioned air into the room. The fresh air into the room goes in via AHU through a control valve, and during most of the crop raising period fresh air valve is placed at 20-30% and re-circulating at 70-80%. During spawn run the entire air is re-circulated (100%) and no fresh air entry is required.

a. Spawn run

For spawn run air temperature of 23 ± 1°C is maintained inside the cropping room, which corresponds to bed temperature of 24-25°C (1-2°C higher than air temperature). During this phase, the fresh air valve is closed and entire air is recirculated, allowing the carbon dioxide to accumulate to the level of 15000 ppm, desirable for quick spawn run. Higher concentration of CO_2 accelerates the spawn run/vegetative growth of the mushroom. Any increase or decrease in temperature effects the CO_2 production of the compost and the RH of the room. With increase in temperature, RH will tend to fall, and just vice versa with decrease in temperature. The properly insulated room will ensure uniform temperature inside the cropping room at every stage of crop growth. The heat from the cropping room is removed via cooling coils fitted inside the AHU.

b. Case run

The environmental conditions suitable for spawn run, are suitable for case run as well. The same conditions, as for spawn run will be continued for next 7 days for case run, i.e., temperature of 23 ± 1°C in the air and 24-25°C in the bed. The RH/CO_2 will also be same as for spawn run. Under aforesaid conditions the case run will be completed within one week, and at the same time the mycelium is observed in the casing valleys. Valleys are the areas between the peaks as can be seen on top of casing. The CO_2 conc. and RH should also be maintained within the optimum range for quick and effective case run.

c. Cropping

After completion of case run, cooling inside the room is enhanced to bring the air temp. down to 15-17°C in the room within 2-3 days time. Simultaneously, the fresh air vent is opened to 30% and rest of the air is recirculated (70%). This brings down the CO_2 conc. inside the room to 800 to 1000 ppm, desired for pinhead formation. Likewise, the RH is also reduced to 85% from 95%. This facilitates pinhead formation on the casing within a week's time. The pinheads grow into full button sized mushrooms in another 3- 4 days. At this stage fresh air can be slightly reduced to achieve 1000-1500 ppm CO_2 concentration. The environment parameters are maintained as above during entire period of cropping. Since the temperature has influence on RH and CO_2 production from compost hence should be manipulated, keeping in mind its effect on other two factors. All the three parameters work in synergy with each other to induce pinning. The pinning will be affected adversely if any of these factors is not in its optimal range. High temperature for a long period of time during cropping will lead to sealing of casing, and will result in stopping of pinhead formation. The mycelium will continue growing in vegetative phase and will seal the casing, making it impervious to water, thus resulting in serious yield losses. The desired temperature in cropping room can be maintained with good precision by the use of sensors and controlling devices attached to cooling/heating coil inlets fitted inside the AHU. These devices are easily available and are effective in temperature control in the cropping room.

2. Relative humidity

Relative Humidity (RH) is the ratio/proportion between absolute humidity (AH) and saturation point of humidity (SPH) at a given temperature, expressed in percentage. Absolute humidity is number of grams of water vapours contained in a cubic meter of air Crop at a given temperature. Saturation point of humidity is the maximum number of grams of water vapours feasible in a cubic meter of air at a given temperature. Relative humidity (RH) of 85% is necessary for obtaining highest pin head formation in synergy with other factors like temperature and CO_2 concentration. RH of 85% permits slow evaporation of water from the crop bed to air in the cropping room and thereby facilitating the upward movement of nutrients in the compost. This exchange of air facilitates loss of CO_2 + heat into the air, necessary for healthy pin head development and crop productivity. In the event of RH falling below 85% inside the cropping room, more moisture from the crop bed will be withdrawn resulting in drying of the casing layer. This will seal the casing and result in crop losses. Lower RH in the room will be indicated by bed temperature falling below the air temperature, an undesirable situation to be avoided at any cost. Under normal circumstances the bed temperature is always higher by 1-2°C than air temperature for development of a healthy crop of mushrooms. For round the clock monitoring of RH, monitoring of the bed and air temperature inside the room is desirable. The incoming air should be humidified enough to prevent loss of moisture from the crop beds. Evaporation of moisture from crop beds has to be taken into consideration for calculating the g of water vapours required per m3 air in a room for maintaining the required RH for cropping. Air in a cropping room contains 9.6 g water vapours per m3 of air at 14°C (A), the saturation point of humidity at 14°C is 12 g/m3 (S). The RH of the room air will be A/S × 100=9.6/12 × 100 = 80%. The ultimate expression is the quantity of water vapours contained per m3 of the air space of the room at a given temperature. 31 g of water vapours gets evaporated from 1 m2 bed area at 17°C/85% RH/hour. The change in room temperature will alter the RH in the room. Use of RH sensors with cut off/starting devices for recording and maintenance of RH in a cropping room is very useful. The sensors will control the fogging jets in the AHU as per the requirement in the room. For obtaining a temperature of 17°C and RH of 85% in the cropping room, air temperature is brought down to 14°C at exit point of AHU with 100% RH. The air on reaching the crop bed will receive some heat from crop bed and raise the air temperature to 17°C with RH automatically falling to 85%.

3. Carbon dioxide

Carbon dioxide concentration is the third important factor in management of environment inside the cropping room. CO_2 is produced by actively growing microorganisms in compost during spawn run, case run and by mushroom mycelia and mushrooms during entire cropping cycle. During spawn run, higher concentration of CO_2 is desirable, which helps in quick and quality spawn run. For spawn run, CO_2 concentration between 10000-15000 ppm is desirable (strain dependent) and it helps in quick spawn run in compost. Higher concentration of CO_2 is also desirable during case run. For pinning and cropping, the CO_2 concentration is lowered around ambient (800-1000 ppm). CO_2 concentration up to 1500 ppm is maintained during pinning & cropping, and this is done by venting/opening of fresh air duct to bring in oxygen and exhaust of CO_2 from exhaust vents under positive pressure. The opening of vent will bring in fresh air, which is conditioned in AHU (heated or cooled/humidified) and then blown into the cropping room via ducts. The CO_2 gets mixed up with the fresh air and is carried under positive pressure towards the exhaust vent and finally exhausted. This also facilitates the exhaust of heat alongwith the CO_2 from the room air. The heat is removed via cooling coils after the room air gets into the AHU via recirculating duct. During air circulation, recommended air speed over the crop beds is 15cm/sec. Ensure that the desired air movement is there in the central shelf in the middle row. This can be checked with the help of a burning incense stick, which will indicate the direction of air movement in the cropping room. Higher concentration of CO_2 during pinning can seal the casing or produce onion shaped mushrooms with a bulbous base & a small cap. During development from pinhead to button sized mushroom, higher concentration of CO_2 will lead to long stiped mushrooms with a small cap (opened), which reduces the crop yields. By gentle movement of air over the crop beds, the CO_2 is carried away from the crop canopy, thus saving the bad effect of CO_2 trapped between the mushrooms in the crop canopy. To ensure healthy crop production, about 6 air changes per hour are recommended from the venting time to completion of first 2 flushes. During this period, CO_2 production is highest (10 g/h/m2) and it requires to be removed at a faster rate. Along with CO_2, heat is also produced @ 10W per hour from one m2 bed area at 17°C and 88% RH. In subsequent flushes, 4 air changes per hour are sufficient to maintain right O_2 content in the cropping room (about 16%). During first two flushes fresh air vent is opened to 30% entry and 70% recirculation, and in subsequent flushes the fresh air vent is put at 20% and recirculation at 80%. Use 2 μm mesh filters on fresh air entry points into the cropping room to restrict the entry of diseases/competitor mould spores. The CO_2 after mixing with the room air, gets exhausted under positive pressure from exhaust vents, thereby helping in heat + CO_2 removal from the room. Maintenance of right combination of casing moisture (about 50 ± 2%), CO_2 concentration, RH and temperature at pinning stage of crop growth helps in obtaining a heavy pin set, thus resulting in a luxurious crop growth and excellent yield of mushrooms. If onion sized mushrooms/drum sticks are observed, correct air circulation for effective CO_2 removal from crop beds is required. Lack of air movement and accumulation of CO_2 creates this type of situation. Long stemmed mushrooms are again the outcome of CO_2 accumulation in the air around crop canopy due to faulty air movement/air circulation inside the cropping room.

C. Airing Procedure for Fruiting Venting or opening of fresh air for induction of fruiting after case run is a critical phase in mushroom growing. Whether to cool first or bring in fresh air first is a question bothering commercial mushroom growers. The airing is done suiting a particular situation, whether one wants to have a heavy first flush followed by moderate flushes later or equally spaced flushes. The airing accordingly is handled under 3 heads: 1. Soft airing 2. Moderate airing 3. Severe airing

1. Soft airing
Soft airing means that we will have severe restriction on venting to get smaller flushes suiting to market demand and the air is opened slowly. The growing parameters to be manipulated for soft airing are listed below: Air temperature : 19°C in 48 hours, 17°C in 72 hours, Compost temperature : 21°C in 96 hours, CO_2 concentration 4000 ppm in 48 hours, 2000 ppm next 24 hours, 1000 ppm after 72 hours, RH 98% to 92% in 48 hours.

2. Moderate airing
Moderate airing means that we will have some restriction on airing/venting to get well spaced flushes of moderate levels. The growing parameters to be manipulated for moderate airing are listed as under: Air temperature 17°C in 24 hours 20°C in 72 hours, Compost temperature 20°C in 72 hours, CO_2 concentration 2000-2500 ppm in 24 hours, Less than 1000 ppm in 48 hours, RH 98% to 92% in 24 hours.

3. Severe airing
Severe airing is done to obtain a heavy first flush and no restriction is put on airing. This results in heavy pin set and large first flush, followed by smaller subsequent flushes. The growing parameters to be manipulated for severe airing are listed below: Air temperature 15°C as soon as possible, Compost temperature 20°C in 48 hours, CO2 concentration, Less than 1000 ppm in 12 hours, RH 98% to 90% in 12 hours.

Action Points
a. Observe strict hygiene throughout the farm
b. Ensure that the temperature during peak heat is satisfactory
c. Make sure that casing ingredients are stored and mixed in clean area and casing is properly pasteurized
d. Make sure that all spent compost is removed from the farm
e. Properly clean the cropping rooms after every crop

Name of the Firm/Promoter:

SALES PROJECTIONS

Installed capacity	20 TPA
Sales	20 TPA fresh
Sale of 20 Tons fresh @Rs 120/kg	24 Lakh

ANNEXURE –A

LAND AND SITE DEVELOPMENT

A total of 1760.0 sq ft land will be required to host this project

	Item	Cost (Rs in Lakhs)
1	1760.0 sq ft of land (Cost not included in project)	-
2	Land leveling and site development	0.00
3	Gate and boundary wall	0.00
	Total	**0.00**

ANNEXURE –B

BUILDINGS

Infrastructure	Area (Sq Ft)	Unit Cost (Rs)	Total cost (Rs in Lakhs)
Cropping Room (Including Insulation)	1125.00	1300.00	14.63
Packing Room	250.00	800.00	2.00
Corridor	385	600	2.31
Total	**1760.00**		**18.93**

ANNEXURE – C

PLANT AND MACHINERY

Plant and Machinery	Number	Total Capacity	Price (in Lakhs)
Chilling station/individual AHU'S (complete in all respect.) (in Tons)	3	10	5.00
Temp. & Humidity controllers for growing rooms	3		0.45
Steel racks for the growing rooms	3		4.50
Spray system	1		0.50
Miscellaneous	1		0.51
Total			**10.96**

Name of the Firm/Promoter:

ANNEXURE – D

MISCELLANEOUS FIXED ASSETS

	Rs in Lakhs
Electric fittings	0.30
Water Tank	0.30
Total	**0.60**

ANNEXURE – E

RAW MATERIALS (For one crop for one cropping room)

S.No	Ingredients	Quantity in Tons	Rate	Amount (Rs in Lakhs)
1	Pasteurized Compost	8.00	8000.00	0.640
2	Spawn	0.08	80000.00	0.064
3	Pasteurized Casing material	2.00	2500.00	0.050
4	Chemicals		500.00	0.005
5	Miscellaneous		500.00	0.005
	Total (in Lakhs)			0.764
			No. of crops	Total cost
Total cost of raw materials required for crops			15	11.46

ANNEXURE –F

WAGES AND PERKS

Particulars	Number	Monthly Salary	Total/year
Labourers	2	8000	192000
Total	2		192000
		Total salary in Lakhs	**1.92**

ANNEXURE – G

ENERGY, FUEL,AND OTHER OVERHEADS (PER MONTH)

	Unit/month	Rs in Lakhs
Energy	3600	0.14
Fuel		0.03
Carriage and transport		0.00
	Total	0.18
	Annual Cost (12 months)	2.10

Name of the Firm/Promoter:

ANNEXURE - H

PROFITABILITY PROJECTIONS

Items	Cost (Rs. In Lakhs)	Rs in Lakhs
Raw materials		11.46
Power and fuel		2.10
Salary and wages		1.92
Admin expense	0	0.00
Interest on term loan (11%)	18.00	1.76
Interest on working capital (11%)	3.05	0.34
Depreciation		
Plant and Machinery + Misc. Fixed assets	11.56	1.10
Buildings	18.94	0.95
Income Tax @0%		0.00
Total		19.84
Sale	20	24.00
Profit	(B-C)	4.38

* *Project would be generating around 100 tons of spent compost annually, which is very good manure for field crops and can be sold @ Rs. 5 per kg. An additional profit of Rs. 5 lakhs is envisaged on its sale to the growers. Moreover, a total of -168 tons compost can be sold to the perspective growers earning a good profit.*

Name of the Firm/Promoter:

Financial Calculations

Name of the Firm/Promoter:

List of Annexure	
Annexure No.	
	Summary
I	Infrastructure
II	Plants and Machinery
III	Recurring expenses
IV	Cost of the Project
V	Repayment of term loan and interest calculation
VI	Depreciation
VII	Revenue Generation
VIII	Profitability Estimates
IX	Calculation of Break Even Point
X	Debt Service Coverage Ratio
XI	Calculation of Internal Rate of Return and Net Present Value
XII	Projected Balance Sheet
XIII	Projected Cash Flow Statement
XIV	Debt Equity Analysis

Name of the Firm/Promoter:

Summary

Production and Cost

PRODUCTION AND COST		
Production capacity	**20**	
Compost /room/crop	**7**	ton
No. of cropping rooms	**3**	
No of crops/year in each room	**5**	
Biological efficiency (kg mushroom/100 kg compost)	**20%**	
Selling price per kg of fresh mushrooms (Rs)	**120**	Rs
Income tax rate as percent of total income	**0%**	
Mushroom production per year **(TPA)**	**20**	ton
Total cost of the project	**30.50**	lakh
DEPRECIATION		
Depreciation rate Buildings	**5%**	
Depreciation rate Equipment's	**10%**	
LOAN		
Months after which loan re-payment will start	**12**	months
Rate of interest on loan	**11.00%**	
Percent of total admissible as loan	**66%**	
Max loan that can be taken from bank	**20.10**	lakh
Total admissible loan from bank out of Rs 20.1 lakh	**20.00**	lakh

SUMMARY

	1st Year	2nd year	3rd year	4th Year	5th Year
Annual installment (in Lakhs)	5.76	5.32	4.88	4.44	4.00
Pay back period	3 years 10 months				
Discounted PBP	4 years 9 months				
Break Even Point (1st year)	0.21	%			
DSCR (1st year)	1.42				
NPV	13.89	lakh			
IRR	13.0%				
IRR/NPV	91.67				
Discounted IRR	11.7%				
BC Ratio	1.46				
Current Ratio (1st Year)	0.42				
Debt to Equity Ratio (1st Year)	1.08				
Discount rate	10%				

Name of the Firm/Promoter:

Annexure-I

Infrastructure

Fixed cost	Unit	Qty	Rate	Cost (in Lakhs)
Land (Sq ft)	Sq ft	1760	0	0
Land Development				0.00
Leveling & Fencing				0.00
Total				**0.00**

Infrastructure	No.	Length	Width	Height	Area (Sq Ft)	Unit Cost (Rs)	Total cost (Rs in Lakhs)
Cropping Room (Including Insulation)	3	25	15	12	1125	1300	14.63
Packing Room	1	25	10	12	250	800	2.00
Corridor	1	55	7	9	385	600	2.31
Total					**1760**		**18.93**

Annexure-II

Plant and Machinery

Cost of machinery	No	Total capacity	Rate (per ton)	Cost in lakh
AHU for cropping rooms	3	10.00	0.50	5.00
Racks	3		1.50	4.50
Temp. & Humidity controllers for growing rooms	3		0.15	0.45
Spray system	1		0.50	0.50
Miscellaneous fixed assets				
Electrical fittings	1		0.30	0.30
Water tank	1		0.30	0.30
Other Miscellaneous	1		0.51	0.51
Weighing balance, CO2 meter, Thermometers, Ducting, Insulated doors, Air curtains, Trolleys, Coats, Gloves, caps, footwear (Gum boots), masks, First aid box, Fire safety equipment, vacuum cleaner, etc, Misc like knives, punnets, parafilm, chemicals, Data logger, VFD, HEPA filters, Humidity meters, humidifiers, Non contact printing machine, Communication system, etc				
Total	–			**11.56**

Name of the Firm/Promoter:

Annexure-III

Recurring expenses (Salary, Raw material and Energy)

	Amount/month	No	Months	Cost
Labour	8000	**2**	12	192000
Total Wages				**192000**
	Quantity	**Rate**		
Raw materials /annum	ton			
Pasteurized Compost	120.00	8000.00		960000
Spawn	1.20	80000.00		96000
Pasteurized Casing material	30.00	2500.00		75000
Chemicals such as (formaldehyde, Carbendazim, Malathion, etc	15.00	500.00		7500
Miscellaneous	15.00	500.00		7500
Total				1146000
Total in Lakhs				**11.46**
ELECTRICITY				
Energy consumption/year (units)	43200	4.00		172800
Fuel (Ltr)	480	78		37440.00
Total				**1356240.00**
Total recurring expenditure				**1,548,240**
Wages		1.92	lakh	
Raw materials, electricity, etc		13.56	lakh	
	Total	15.48		

Annexure-IV

Cost of Project

COST OF LAND, BUILDINGS & MACHINES		
Land	OWNED	
Building	18.94	Lakh
Machinery	10.96	Lakh
Total Cost of Project	30.50	Lakh
Miscellaneous fixed assets	0.60	Lakh
Working Capital	3.05	Lakh
MEANS OF FINANCE		
Proprietor's Capital	10.50	Lakh
Term Loan	20.00	Lakh
Total	30.50	Lakh
SUBSIDY		
Rate of Subsidy	As applicable	
CROP- PRODUCTION AND SALE PRICE		
Compost/Room/Crop	8.00	ton
Number of Cropping Rooms	3.00	
Number of Crops/year	5.00	
Biological efficiency (kg mushroom/100 kg compost)	20.00%	
Mushroom Production/Year	20.00	Ton
Selling Price/kg	120.00	Rs

Name of the Firm/Promoter:

Annexure-V

Repayment of term loan and interest calculation

Particulars	Opening Balance	Interest Capitalized	Repayment Principal	Closing Balance	Interest (11%)	Total Repayment
Year	20.00			20.00		
1st Year	20.00		4.00	16.00	1.76	5.76
2nd year	16.00		4.00	12.00	1.32	5.32
3rd year	12.00		4.00	8.00	0.88	4.88
4th year	8.00		4.00	4.00	0.44	4.44
5th year	4.00		4.00	-	-	4.00

Annexure-VI

Depreciation (in Lakhs)

Year	Depreciation	Building	Plant & Machinery	Total WDV	Dep. For Year	Total Dep
		5%	**10%**			
	Value	**18.94**	**10.96**	**29.90**		
1st Year	Depreciation	0.95	1.10		2.04	**2.04**
	WDV	**17.99**	**9.86**	**27.85**		
2nd year	Depreciation	0.90	0.99		1.89	**3.93**
	WDV	**17.09**	**8.88**	**25.97**		
3rd year	Depreciation	0.85	0.89		1.74	**5.67**
	WDV	**16.23**	**7.99**	**24.22**		
4th year	Depreciation	0.81	0.80		1.61	**7.28**
	WDV	**15.42**	**7.19**	**22.61**		
5th year	Depreciation	0.77	0.72		1.49	**8.77**
	WDV	**14.65**	**6.47**	**21.12**		
6th year	Depreciation	0.73	0.65		1.38	**10.15**
	WDV	13.92	5.82	**19.74**		
7th year	Depreciation	0.70	0.58		1.28	**11.43**
	WDV	13.22	5.24	**18.47**		

Annexure-VII

Revenue from Sale of Mushroom

	Year 1	Year 2	Year 3	Year 4	Year 5
Total mushroom sold/annum (ton)	20	20	20	20	20
Selling price/kg (5% increase)	120	126	132	139	146
Revenue from sale of mushroom (Rs in lakhs)	**24.00**	**25.20**	**26.46**	**27.78**	**29.17**

Name of the Firm/Promoter:

Annexure-VIII

Profitability Estimates

lakhs

Sr. No.	Particulars	1st Year	2nd Year	3rd Year	4th Year	5th Year
A	**Sales (Revenue)**	24.00	25.20	26.46	27.78	29.17
	Total (A)	**24.00**	**25.20**	**26.46**	**27.78**	**29.17**
B	**Cost of Production/ Expenses**					
	Variable					
	Raw Material	11.46	12.03	12.63	13.27	13.93
	Fuel & energy	2.10	1.73	1.73	1.73	1.73
	packing cost	0.00	0.00	0.00	0.00	0.00
	Wages	1.92	2.06	2.22	2.39	2.56
	Direct Operating Exp.	**15.48**	**15.83**	**16.58**	**17.38**	**18.22**
	Fixed					
	Total (B)	15.48	15.83	16.58	17.38	18.22
	Gross Profit (A-B)	**8.52**	**9.38**	**9.88**	**10.40**	**10.95**
	Salary	0.00	0.00	0.00	0.00	0.00
	Admn. Expenses	0.00	0.00	0.00	0.00	0.00
	Depreciation	2.04	1.89	1.74	1.61	1.49
	Total	**2.04**	**1.89**	**1.74**	**1.61**	**1.49**
	Profit before Interest and tax	**6.47**	**7.49**	**8.14**	**8.79**	**9.46**
	Interest on term loan	1.76	1.32	0.88	0.44	0.00
	Interest on working capital	0.34	0.00	0.00	0.00	0.00
	Profit before Tax	**4.38**	**6.17**	**7.26**	**8.35**	**9.46**
	Income Tax@0%	0.00	0.00	0.00	0.00	0.00
	Net Profit after Tax	**4.38**	**6.17**	**7.26**	**8.35**	**9.46**
	Depreciation	2.04	1.89	1.74	1.61	1.49
	Cash Accruals	**6.42**	**8.06**	**9.00**	**9.96**	**10.95**
	Cumulative Profit	**4.38**	**10.55**	**17.80**	**26.16**	**35.62**
	Operating profit	**8.52**	**9.38**	**9.88**	**10.40**	**10.95**
	Net Profit ratio	18.25	24.48	27.42	30.06	32.43
	Interest Coverage Ratio	2.49	4.67	8.25	18.98	0.00
	Payback period=	**3 years 10 months**				
	Discount rate=	10%				
	Discounted PBP=	**4 years 9 months**				

Annexure-IX

Calculation of Break Even Point

(Based on 1st Year Working Results)

		1st Year	2nd Year	3rd Year	4th Year	5th Year
Sales		24.00	25.20	26.46	27.78	29.17
Less: Variable Exp.		15.48	15.83	16.58	17.38	18.22
Contribution		8.52	9.38	9.88	10.40	10.95
fixed Expenses						
Salary Expenses		0.00	0.00	0.00	0.00	0.00
Administration Expenses		0.00	0.00	0.00	0.00	0.00
Interest		1.76	1.32	0.88	0.44	0.00
Total Expenses		1.76	1.32	0.88	0.44	0.00
Total Expenses (Fixed in Nature)		1.76	1.32	0.88	0.44	0.00
Break Even Point(Cash, Operating B.E.P)						
	(At Sales Value)	**4.96**	**3.55**	**2.38**	**1.11**	**0.00**
	(At Capacity Level)	**20.66%**	**14.08%**	**9.00%**	**4.00%**	**0.00%**

Name of the Firm/Promoter:

Annexure-X

Projected Debt Service Coverage Ratio (DSCR)

	Particulars	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
	Profit after tax	4.38	6.17	7.26	8.35	9.46
Add:	Depreciation	2.04	1.89	1.74	1.61	1.49
	Cash Profit	**6.42**	**8.06**	**9.00**	**9.96**	**10.95**
Add:	**Interest**					
	Interest on Term Loan	1.76	1.32	0.88	0.44	0.00
	Cash Available to (Repayment Interest & Installment)	**8.19**	**9.38**	**9.88**	**10.40**	**10.95**
	Repayment					
A.	**Principal**					
	Repayment of Term Loan	4.00	4.00	4.00	4.00	4.00
B.	**Interest**	1.76	1.32	0.88	0.44	0.00
	Total Repayment(A+B)	**5.76**	**5.32**	**4.88**	**4.44**	**4.00**
	DSCR	**1.42**	**1.76**	**2.02**	**2.34**	**2.74**
	Avg. DSCR Ratio			**2.06**		

Annexure-XI

Calculation of Internal Rate of Return and Net Present Value

Particulars	**1st Year**	**2nd Year**	**3rd Year**	**4th Year**	**5th Year**
CASH INFLOWS					
Net Profit after Tax	4.38	6.17	7.26	8.35	9.46
Depreciation	2.04	1.89	1.74	1.61	1.49
	6.42	**8.06**	**9.00**	**9.96**	**10.95**
CALCULATION OF IRR			**Interest rate (10%)**		
			Yr	**cash flow**	
Year o (cash outflow)			**0**	**-30.50**	**-30.50**
1st Year (cash inflow)			**1**	**6.42**	**6.42**
2nd Year (cash inflow)			**2**	**8.06**	**8.06**
3rd Year (cash inflow)			3	9.00	**9.00**
4th Year (cash inflow)			4	9.96	**9.96**
5th Year (cash inflow)			5	10.95	**10.95**
NPV (check)					13.89
NPV					**13.89**
INTERNAL RATE OF RETURN (IRR)					**13%**
BC Ratio or PI					**1.46**
IRR/NPV					91.67%
Modified IRR					
Discount rate of reinvestment		10%			
Discounted IRR					**11.66%**

Name of the Firm/Promoter:

Annexure-XII

Projected Balance Sheet

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Sources of Fund					
Owner's Funds	10.50	14.87	21.04	28.30	36.65
Profit & Loss a/c	4.38	6.17	7.26	8.35	9.46
Closing Capital	14.87	21.04	28.30	36.65	46.11
Loan Funds					
Term Loan	16.00	12.00	8.00	4.00	0.00
Total	**30.87**	**33.04**	**36.30**	**40.65**	**46.11**
Applications Of Funds					
Fixed Assets					
Gross Block	30.50	30.50	30.50	30.50	30.50
Less:-Depreciation	2.04	3.93	5.67	7.28	8.77
Net Block	28.45	26.57	24.82	23.21	21.72
Net Working Capital					
Net Current Assets	2.42	6.48	11.48	17.44	24.39
Total	**30.87**	**33.04**	**36.30**	**40.65**	**46.11**

Annexure-XIII

Projected Cash Flow Statement

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Cash From Operating Activities					
Profit Before Tax	4.38	6.17	7.26	8.35	9.46
Add:					
Depreciation	2.04	1.89	1.74	1.61	1.49
Interest on Term Loan	1.76	1.32	0.88	0.44	0.00
Cash before working capital Change	8.18	9.38	9.88	10.40	10.95
Change in Working Capital	0.00	0.00	0.00	0.00	0.00
Tax	0.00	0.00	0.00	0.00	0.00
Cash from Operating Activities	**8.18**	**9.38**	**9.88**	**10.40**	**10.95**
Cash From Investing Activities					
Purchase of Fixed Assets	30.50	0.00	0.00	0.00	0.00
Cash generated from investing activities	**-30.50**	**0.00**	**0.00**	**0.00**	**0.00**
Cash From Financing Activities					
Promoter's Contribution	10.50	0.00	0.00	0.00	0.00
Capital Expenditure Loan	20.00	0.00	0.00	0.00	0.00
Repayment of Term Loan	4.00	4.00	4.00	4.00	4.00
Interest on Loan	1.76	1.32	0.88	0.44	0.00
Cash generated from Finance Activities	**24.74**	**-5.32**	**-4.88**	**-4.44**	**-4.00**
Opening Balance	0.00	2.42	6.48	11.48	17.44
Cash generated during the year	2.42	4.06	5.00	5.96	6.95
Closing Balance (Cash & Bank Balance)	**2.42**	**6.48**	**11.48**	**17.44**	**24.39**

Name of the Firm/Promoter:

Annexure-XIV

Debt Equity Analysis

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Debt Funds					
Term Loan	16.00	12.00	8.00	4.00	0.00
Debt Fund	**16.00**	**12.00**	**8.00**	**4.00**	**0.00**
Equity Fund					
Owner Funds	14.87	21.04	28.30	36.65	46.11
Debt Equity Ratio	**1.08**	**0.57**	**0.28**	**0.11**	**0.00**
Avg. D/E Ratio	**0.41**				
Net Current Asset	2.42	6.48	11.48	17.44	24.39
Net Current Liability	5.76	5.32	4.88	4.44	4.00
Current Ratio	**0.42**	**1.22**	**2.35**	**3.93**	**6.10**

CONCLUSION

Mushroom cultivation has tremendous potential in the country due to vast availability of raw materials and cheap labour. Mushrooms have been kept under a major thrust area by the govt. There is a vast potential of export of this commodity to Europe, America and middle East countries. Production figures envisaged in the project (Promoter: --, ...) are based on 100% capacity utilization, which can easily be achieved in a year's time if the farm is managed properly and there is a constant supply of raw materials. Yield realization are based on the cultivation of advanced hybrids by providing exact environment conditions to derive optimum potential of the strain. These projections can very well be achieved, however DMR, Solan (HP) in no way guarantees for the above production and profit since it will not be directly involved in the execution of the project and in the production phases. Much would depend upon the skill and management of the entrepreneur for the success of the project. At the moment most of the projects of similar capacity or more are running successfully and earning handsome profits.

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Dated: