Mushroom Cultivation

St.Ann's Degree College for women

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Malkapuram, visakhapatnam

Ph : 7993707565

1st sem students of Bsc microbiology

(Email : ujwalarongali31@gmail.com)

Topic : APICULTURE 🐝

Principal

Name : Dr. Sr. Prema Kumari
Designation : Principal
Qualification : M.Sc. Botany, Ph.D
College: St.Ann's College for Women-VSKP

Mentors:

S. Lakshmi Tulasi
(impact creator).
Lecturer M.Sc Zoology
(Pursuing PhD)
Skill Qualification:
Mushroom cultivation,
Vermiculture & value Addition.

Dr. G.Adiseshu
(Product advisor)
Asst. Professor M.Sc Botany
M.Phil , PhD , B.Ed
Skill Qualification:
PG Diploma in Environmental Studies , PGDCA.

Acknowledgement

=> This book will give a clear concept of mushroom cultivation.
=> One can learn many new things about mushrooms and its cultivation.
=> This book will provide vital information for the people who are working on mushroom cultivation.
=> Our beloved principal Dr.Sr.Prema Kumari built confidence in us and encouraged us in making this book.
=>Mentor Dr.G.Adiseshu M.Sc Botany, M.Phil , PhD, B.Ed
Madam supported our work and helped us to move in the right way.
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=> May the blessings of God be there on the people who perceive this.

Content Pg.No

Introduction

Mushroom cultivation is a technology of growing mushrooms using plant, animal and industrial waste. In short it is wealth out of waste technology.

Mushroom cultivation is a process utilizing waste materials such as horse manure, chicken manure, pig manure, wheat straw, rice straw, corn cobs, wood bark, sawdust, and cottonseed hulls to produce a delicious and nutritious food. Therefore, it can be considered as a twofold beneficial operation. Mushroom technology has enabled farmers to harvest close to one pound of fresh mushrooms from one pound of compost spawned. Undoubtedly, the mushroom industry will continue to grow rapidly as it becomes more available and more widely accepted as a regular food. The mechanization of cultivation, especially in mushroom harvesting, and the application of automatic control will increase the production efficiency and minimize production cost. As a result, very reasonably low priced mushrooms will become available for consumption. Such a technical know-how requires more investigations by biologists and engineers.

History

The consumption of mushrooms probably occurred during prehistory, in the hunting and gathering period. Unlike plants, mushrooms could not be cultivated at first and were collected for a long period of time. Even today, relatively few species of mushrooms can be cultivated compared to the number of edible species. Mushrooms were thought to be special and supernatural in origin – 4600 years ago, the Egyptians believed mushrooms to be plants of immortality; the Pharaohs decreed that only they could eat mushrooms. The Romans thought mushrooms were the food of the gods. Many people collect mushrooms for the purpose of consumption, but lots of myths and false concepts still survive today.

The Chinese and Japanese have used mushrooms for medicinal purposes for thousands of years. *Lentinus edodes,* Shiitake, was originally cultured in China about 800 years ago. Research in Japan claims that this mushroom has medicinal use – Shiitake was combined with AIDs drugs to boost immune response, combat chronic fatigue and induce antibody formation to Hepatitis B; it also stimulated antitumor activity. *Auricularia polytricha*, "ear fungus", was first cultivated in ancient China around 300 to 200 B.C. This mushroom is now cultivated in many South Pacific countries. Flammulina velutipes, Enokitake, has been cultivated for several centuries; this small delicate mushroom was cultivated on sawdust.

Different cultures cultivated different species – cultivation of mushrooms in Western cultures was first recorded in Paris, France, around 1650. Agaricus bisporus, the quintessential "shop mushroom", was first observed growing in melon crop compost. This mushroom was cultivated in open fields for 160 years and then moved underground into caves, excavated tunnels or quarries – this form of cultivation is still used in France today. From France, the gardeners of England found Agaricus bisporus a very easy crop to grow which required little labor, investment and space. By 1865, the United States began mushroom cultivation. There are two widely known genetic variants of *Agaricus bisporus* – these are Portobello and Crimini.

Truffles have been collected as far back as 1600 B.C. As recently as 1903, truffles were believed to be a product of oak trees. Until after World War II, the only means of obtaining truffles was collecting them in the wild. These subterranean mushrooms cannot be "cultivated" in the usual sense because they form a mycorrhizal (symbiotic) relationship with the roots of trees. The two most popular species "cultivated" are *Tuber melanosporum*, the Perigord Truffle, and *Tuber magnatum*, the White Truffle (both are not British). The idea of "growing" truffles began in 1972, in an oak plantation – this required up to 10 years or more before the first truffles were harvested. Numerous efforts have been made to grow oaks outside of their native area that mostly failed, until 1987, when some New Zealanders attempted to grow truffles – this was successful and it only took 5 years to harvest the mushrooms.

Numerous attempts have been made to cultivate morels but this mushroom has never been successfully cultivated commercially. Although there are several species of edible morels, *Morchella esculenta* is the most sought after; during 1980 in the United States, Ron Ower grew the first *Morchella esculenta*, but his yield was very low. Several years later, Gary Mills of Neogene Corporation, collaborated with Ron and seemed to successfully produce a high yield method, but it only worked in Michigan; attempts to use this method elsewhere failed.

Mushroom

In the vegetable kingdom, mushrooms are ranked with heterotrophic organisms (lower plants). Unlike high, green plants, these heterotrophs aren't able to photosynthesis. Fungi are the scavengers of nature. In mushroom cultivation, waste merchandise consisting of chicken manure, horse manure, straw, gypsum and wastewater (from their very own compost) are used to provide the high high-satisfactory substrate from which mushrooms will grow. The ammonia is eliminated from the process air through an ammonia washer before it is returned to nature. Even ammonia from the air is used as a source of nitrogen in composting.

The fungus, also referred to as mycelium, makes use of manure as a source of energy for its combustion, liberating energy that is used for growth. Mushrooms contain many vitamins and minerals, like B- Complex and iron, and are a good source of quality proteins like lysine. Mushrooms are completely fat (cholesterol) free and also rich in antioxidants.

A mushroom or toadstool is the fleshy, spore-bearing fruiting body of a fungus, typically produced above ground, on soil, or on its food source. Toadstool generally denotes one poisonous to humans.

Culinary mushrooms in a diversity of shapes and colors

The standard for the name "mushroom" is the cultivated white button mushroom, *Agaricus bisporus;* hence the word "mushroom" is most often applied to those fungi (Basidiomycota, Agaricomycetes) that have a stem (stipe), a cap (pileus), and gills (lamellae, sing. lamella) on the underside of the cap. "Mushroom" also describes a variety of other gilled fungi, with or without stems, therefore the term is used to describe the fleshy fruiting bodies of some Ascomycota. The gills produce microscopic spores which help the fungus spread across the ground or its occupant surface.

Forms deviating from the standard morphology usually have more specific names, such as "bolete", "puffball", "stinkhorn", and "morel", and gilled mushrooms themselves are often called "agarics" in reference to their similarity to *Agaricus* or their order Agaricales. By extension, the term "mushroom" can also refer to either the entire fungus when in culture, the thallus (called mycelium) of species forming the fruiting bodies called mushrooms, or the species itself.

TYPES OF MUSHROOMS

There are four types of mushrooms: saprotrophic, mycorrhizal, parasitic, and endophytic.

While there are many different types of mushrooms within these categories, not all of them are edible. Since some may be poisonous or hallucinogenic, it's important to be careful if you ever try to pick mushrooms in the wild. Edible mushrooms you buy at the grocery store are safe and full of nutritional value.

Saprotrophic Mushroom:

Saprotrophic mushrooms are the fruiting bodies of fungi that live and feed on dead and decaying organic matter.

Saprotrophic has Greek roots and comes from "sapros" meaning rotten or putrid, and "troph" meaning nourishment or food.

Saprotrophic fungi facilitate the decomposition of organic matter and play a vital role in natural ecosystems.

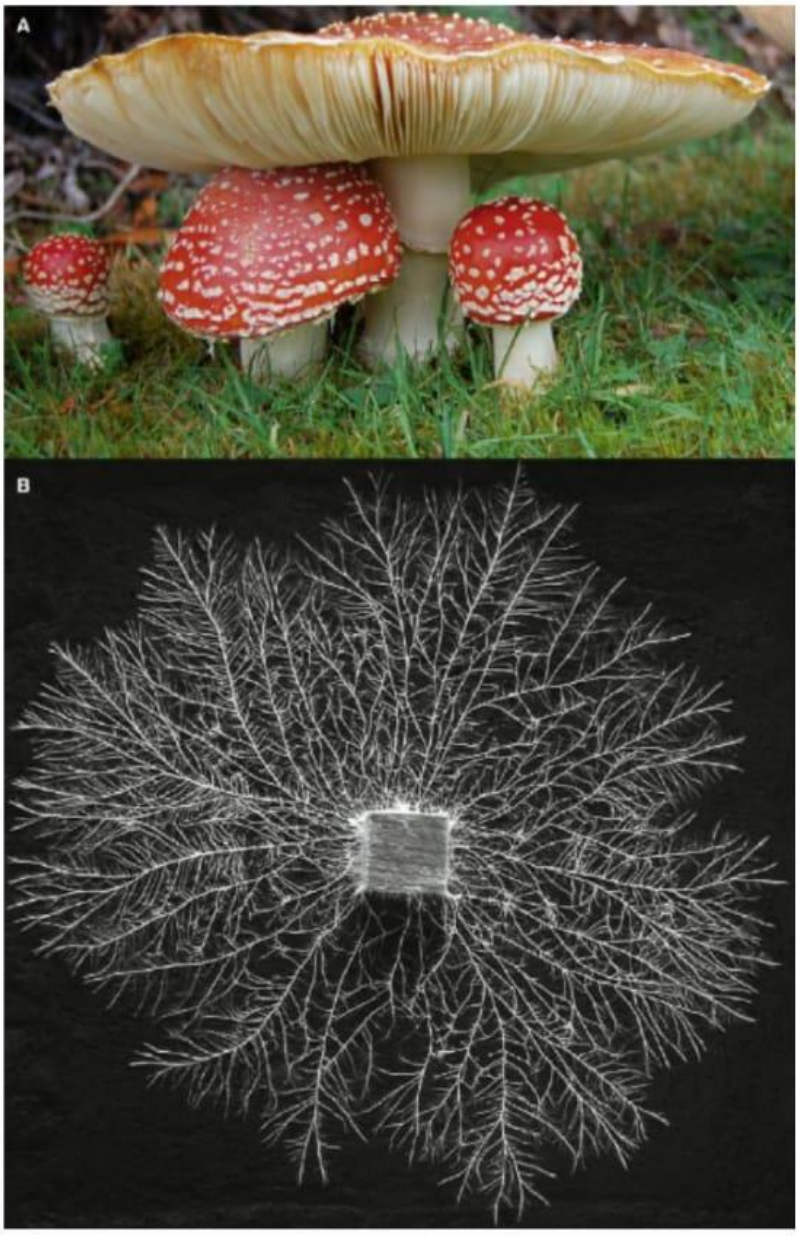
Mycorrhizal Mushroom:

Mycorrhizal mushrooms are mutualistic fungi that form symbiotic relationships with plants and trees.

The fungi use their underground mycelial network to interact with the roots of the plants or trees.

The word mycorrhiza means "fungus root" and comes from the Greek words mykós, meaning fungus, and riza, meaning root.

A mycorrhiza is a mutually beneficial association or relationship between a fungus and a plant.
The plural of mycorrhiza is mycorrhizae or mycorrhizas.
Fungi that form these relationships or associations are known as mycorrhizal fungi.



Parasitic Mushroom:

Asterophora parasitica, commonly known as the parasitic Asterophora or the Russula parasite, is a species of fungus that grows as a parasite on other mushrooms. The fruit bodies are small, with silky fibers on the surface of grayish caps and thick, widely spaced gills. Mushrooms fruit in clusters on the decaying remains of Lactarius and Russula species, particularly those in the Russula nigricans group. Found primarily in temperate zones of Europe and North America, the fungus is widespread but not common.

Endophytic Mushroom:

Endophytic fungi promote the growth of host plants by directly producing secondary metabolites, which enhances the plant's resistance to biotic and abiotic stresses.

Additionally, they are capable of biosynthesizing medically important "phytochemicals" that were initially thought to be produced only by the host plant. In this review, we summarized some compounds from endophytic fungi with novel structures and diverse biological activities published between 2011 and 2021, with a focus on the origin of endophytic fungi, the structural and biological activity of the compounds they produce, and special attention paid to the exploration of pharmacological activities and mechanisms of action of certain compounds. This review revealed that endophytic fungi had high potential to be harnessed as an alternative source of secondary metabolites for pharmacological studies.

Presently 3 varieties of mushroom are cultivated namely, white mushroom or button mushrooms (*Agaricus bisporus),* the paddy-straw mushroom (*Volvariella volvacea*) and oyster mushroom (*Pleurotus Sajor-Caju).*

Agaricus bisporus

Agaricus bisporus, known as table mushroom, cultivated mushroom or button mushroom, is an edible basidiomycete fungus which naturally occurs in grasslands, fields and meadows across Europe and North America, though has spread much more widely and is one of the most widely cultivated mushrooms in the world.

Volvariella volvacea

Volvariella volvacea, also known as the straw mushroom or Chinese mushroom, is an edible fungus that grows in tropical and subtropical regions.

Pleurotus sajor-caju

Oyster mushroom or sajor-caju can be successfully grown on paddy straw at a temperature range of 19.1-30.5oC and relative humidity 65.5-80%, there is a decline in yield above and below this temperature .

SPORE GERMINATION

Like a plant seed, a mushroom spore germinates (sprouts) when the environmental conditions are right. Usually, this involves high humidity, plus a favorable temperature for that particular species.

When the spore germinates, a strand of mycelium emerges from it. The strands of mycelium spreads through a substrate, gathering water and nutrients, to be able to produce fruiting bodies (mushrooms)

COLONISATION

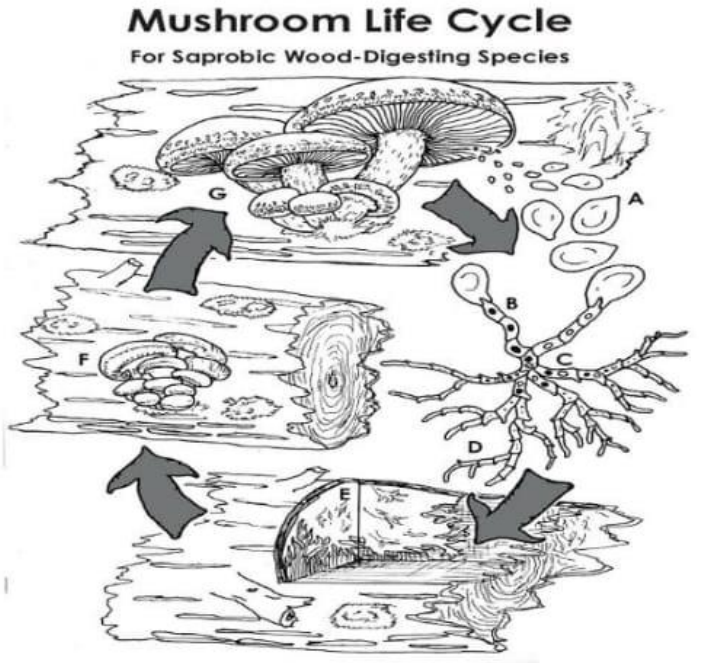
This process of mycelium spreading through a substrate is called colonization.

Mycelium slowly spreads through its substrate, trying to colonize as much area as possible. The more substrate that a single body of mycelium has colonized, the greater its access to nutrients, and therefore the greater its capacity to produce lots and lots of fruiting bodies (mushrooms) to continue to produce spores and procreate.

BIOLOGY AND LIFE CYCLE OF A MUSHROOM

Mushrooms are very interesting organisms. Biologically speaking, they are more closely related to animals than they are to plants. Similarly to animals, they get their nutrients by digesting and absorbing food. They 'breathe' oxygen in and CO2 out.

Their food is the substrate that they are growing in. This is commonly wood, manure, or soil. The mycelium (the 'body' or 'roots' of the mushroom) grows through this substrate and secretes enzymes to convert it into an absorbable form.



A *Spores distributed via air currents* **B** *Spore germination, hyphal strand* **C** *Spore mating* **D** *Fertile mycelium excretes enzymes and absorbs nutrients* **E** *Mycelium colonises substrate* **F** *Mushroom primordia start forming* **G** *Mature mushrooms begin sporulation*

FRUITING

Once the body of mycelium has gained access to enough nutrients, certain environmental conditions will trigger the formation of fruiting bodies, better known as mushrooms.

These environmental conditions vary from species to species, but commonly involve high humidity and a slight drop in temperature, which is one reason why mushrooms are the most abundant in autumn.

The first stage of a mushroom fruit body is called a hyphal knot. This is when the individual strands of hyphae bundle together and prepare to grow a mushroom.

From there, a small cluster of visible bumps form on the surface of the mycelium. As they grow, they begin to look like miniature mushrooms just a few millimeters in size, known as primordia.These are commonly called ‘pins’ in the cultivation world.

From this point, provided humidity and temperatures remain favorable, the pins continue to grow into full size mushrooms. Depending on temperatures, and the individual species, this process of a pin growing into a full size mushroom can take anywhere between two days to a week or longer.

SPORULATION

As the mushroom fruit body matures, **gills** (or pores in some cases) begin to become visible on the underside of the mushroom. Some mushrooms have a 'veil' or a ring around the stem protecting the gills during early growth. But eventually as the cap of the mushroom grows, the gills become exposed and begin to release **spores**.

Sometimes spores can be released in such vast quantities that they appear as wisps of smoke wafting from the mushroom's gills. It is also common for spore deposits to be visible on the ground (or log) around the mushroom.

Spores are so small that they are easily carried away in air currents, and once airborne they are capable of traveling vast distances including thousands of kilometers across oceans and continents, just waiting to land in a favorable place to germinate and continue through the life cycle once again.

MUSHROOM CULTIVATION

Different kinds of Mushroom cultivation in India:

There are three sorts of Mushrooms that are being cultivated in India, they are button mushroom, straw mushroom and oyster mushroom. Paddy straw mushrooms can develop in temperatures ranging from 35° to 40°C. Button mushrooms grow at some point in winter. Oyster mushrooms are grown in the northern plains. All the three mushrooms of business significance are grown with the aid of one of a kind techniques. They are grown on extraordinary beds called compost beds. Learn how to domesticate mushrooms of each type.

Steps of Mushroom Farming:

The six steps of mushroom farming are given as follows:

Step 1: Compost Preparation

To begin with this fabulous farming idea we need to delve right into the concept of "compost preparation".

This initial step of compost preparation is generally done outdoors although an enclosed structure with a shade over it could be used. Here a concrete slab, also known as a wharf, is required for composting. Plus, a compost turner to aerate and irrigate the ingredients, and a trolley to move the ingredients to the turner is needed.

In earlier times piles were turned by hand using pitchforks, which is still an alternative to mechanical tools and equipment, but it is quite labor intensive and physically demanding for a job like this.

It is all initiated by mixing and wetting the required ingredients as they are stacked in a pile of rectangular shapes with tight sides and a loose center. Normally, the bulk ingredients are put through a compost turner. After this water is sprinkled onto the horse manure or synthetic compost for instance, as these materials move past the turner. Now Nitrogen supplements and gypsum($CaSO_4 . 2H_2O$) are spread over the top of the bulk ingredients and are thoroughly and vigilantly mixed by the turner. Once the pile is soaked and formed, fermentation (composting) commences as a result of the exponential growth and reproduction of microorganisms, which is a natural process in the bulk ingredients.

This Compost for growing mushrooms develops as the chemical nature of the raw ingredients is converted by the activity of microorganisms, heat, and some exothermic chemical reactions. These things cumulatively result in a food source most suited for the growth of the mushroom and also inhibits the development of other fungi and bacteria. There must be optimal moisture, oxygen, nitrogen, and carbohydrates present throughout the process, otherwise, the process might stop. This is why water and other additives are added cyclically and periodically, and the compost pile is agitated as it moves through the turner. Interestingly Gypsum here is added to minimize the viscosity the compost normally tends to have. Gypsum increases the fluidity of certain chemicals in the compost, and they adhere to straw or hay rather than hindering the porosity between the straws. Apart from this, the side benefit of this phenomenon is that air can permeate the pile comfortably, and the air is essential to the composting process.

The exclusion of air results in an anaerobic environment in which putrid chemical compounds are formed which is extremely harmful to the crop.
Gypsum is added at the outset of composting at approximately 18 kg per ton of dry ingredients.
Yet another important supplement is the Nitrogen supplements, which in general use today include brewer's grain, seed meals of soybeans, peanuts, or cotton, and chicken manure, etc. The whole and sole purpose of these supplements are to increase the nitrogen content to 1.5 % for horse manure or 1.7 % for synthetic, both calculated on a dry weight basis.
Synthetic compost requires the addition of ammonium nitrate or urea at the outset of composting to provide the compost microflora with a readily available form of nitrogen for their reproduction and growth.

But sometimes the Corn cobs are unavailable or available at a price considered to be exorbitant. Substitutes for corn cobs include shredded hardwood bark or sawdust, for instance, cottonseed hulls, neutralized grape pomace, cocoa bean hulls, and neutralized grape pomace. The management of a compost pile containing any one of these materials is unique in terms of what the requirements are for watering and the interval between turning the pile.

This initial composting process lasts not more than a couple of weeks, depending on the nature of the material at the start and its characteristics at each point. There is a strong ammonia smell associated with composting, which is usually complemented by a sweet, mol dy smell. When compost temperatures are 68-degree centigrade and higher, and ammonia is present, chemical changes occur which result in a nourishing rather exclusively used by the mushrooms.

As a by-product of the chemical changes, heat is released and the compost temperatures increase. Temperatures in the compost can reach 76 to 82 degrees Celsius during the second and third turns when a desirable level of biological and chemical activities are happening. At the end of Phase one the compost should: 1) have a chocolatey brown color; 2) have soft, tender straws, 3) have a moisture content of about 68 to 74 per cent; and 4) have a strong smell of ammonia. When the moisture, temperature, color, and odor described have been achieved, congratulations! You're now done with Step 1.

Step 2: Finishing the Compost

Now that you have finished with phase one composting, we'll be heading towards the second and extremely important step that is "Finishing the Compost".

So, here are two major reasons for Phase two or step 2 of composting. Pasteurization is necessary to kill any unwanted bacteria, insects, nematodes, pests, fungi, or other headaches that may be present in the compost. And secondly, it is necessary to remove the ammonia which formed during Phase I composting. Ammonia at the end of Step 2 in a concentration higher than 0.07 per cent is often dangerous to mushroom spawn growth, so it must be eliminated; On average, a person can sense ammonia when the concentration reaches the threshold of 0.10 per cent.

Whether the compost is kept in beds, trays, or bulk, should be spread uniformly in-depth and compression or density. Compost density should allow for the gas to move around, this would make sure that ammonia and carbon dioxide would be replaced by the outside air.

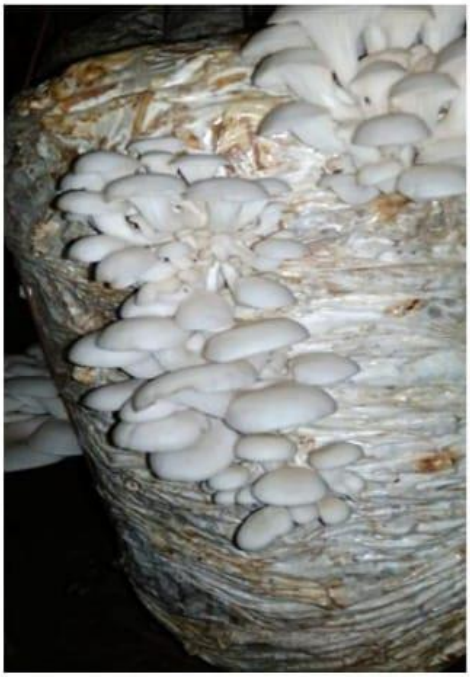
Step 2 composting can be perceived as a regulated, temperature-dependent, ecological process using air to maintain the compost in a temperature range optimal for the de-ammonifying organisms to grow and reproduce. The growth of these thermophilic (heat-loving) organisms depends on the availability of usable carbohydrates and nitrogen, some of the nitrogen in the form of ammonia.

Optimum management for Phase II is difficult to pinpoint and most growers(commercial) tend toward one of the two systems in common use today: high temperature or low temperature. Due to the jargon nature of this process, it's quite difficult to put the variables into exact numbers.

For that, you need to consult online, with someone who has experience in this field and it's better if you find that person in your vicinity.

Step 3: Spawning

Mushroom spawning is similar to the seedling stage in agriculture and means keeping the spawn (mycelium) of mushrooms that can be purchased from a laboratory at nominal prices. After laying the spawns evenly on the tray and distributing it ergonomically, cover it with a thin layer of compost and keep it moist. Cover the tray with a wet sheet of paper and sprinkle water at regular intervals. The trays can be stacked on top of each other at a spacing of 15–20 cm. Keep the walls and floors wet to maintain a humidity-filled environment and temperature at 25 ° C.



Step 4: Casing

The casing is a covering applied to the spawn-run compost on which the mushrooms slowly and steadily form. The constituents are, field soil clay-loam, a mixture of peat moss with ground limestone, or reclaimed weathered, spent compost that could be utilised as the casing.

The Casing doesn't require nutrients as the casing only acts as a water reservoir and a place where the formation of rhizomorphs takes place. The Rhizomorphs look like thick strings and form when the very fine mycelium fuses.

Casing must be pasteurized to eliminate any insects and pathogens which it might be carrying. It's also quite important that the uniformity of the layers remains intact. This allows the spawn to move into and through the casing at the same pace and, ultimately, mushroom growth happens tauta chromatically. The casing should be able to retain moisture since moisture is essential for the development of a healthy mushroom.

The crop management after casing requires that the compost temperature be kept at around 24° C for up to 5 days after casing, and the relative humidity should be high. Thereafter, the compost temperature should be lowered to about -16.5°C each day until small mushroom initials have formed. Throughout the period following casing, water must be applied periodically to raise the moisture level to field capacity before the mushroom pins form.
Knowing when, how, and how much water to apply to casing is an "art form" which is the subtle difference that acts as a trench between experienced growers from beginners.

Step 5: Pinning

The Mushroom instigates as and when rhizomorphs have started growing in the casing. The initials are minuscule but can be seen protruding on a rhizomorph. Once an initial grow four folds in size, the structure is a pin. Pins continue to grow larger through the button stage, and ultimately a button enlarges to a mushroom.

The harvestable crop appears after around three weeks or maybe a few days here and there. Pins develop when the carbon dioxide content of room air is lowered to 0.08 per cent or lower, depending on the skill set of the grower, by introducing clean and fresh air into the growing room. Outside air has a CO^2 content of about 0.04 %.
If the CO^2 is lowered too early by airing too soon, the mycelium ceases to grow through the casing and mushroom initials plunge to the surface of the casing.

As such mushrooms continue to thrive, they push through the casing and are tedious at harvest time. Too little wetness can also result in mushrooms forming below the surface of the casing. Pinning affects both the potential yield and quality of a crop and is a stepping stone in the production cycle.

Step 6: Cropping

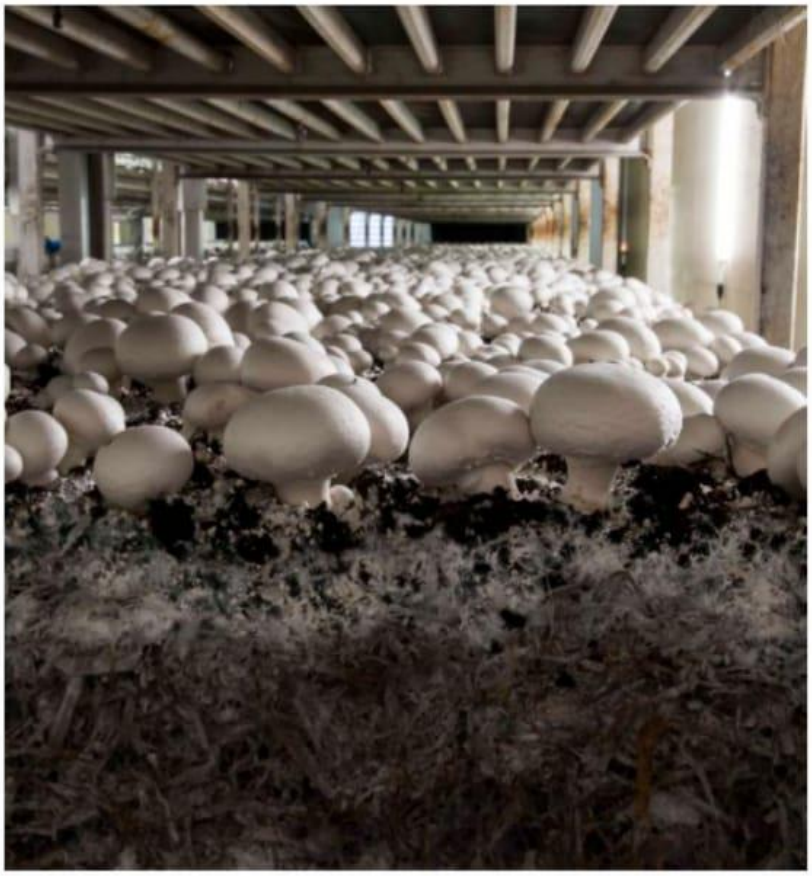
It's the final but a step of utmost importance. The value you'll be generating out of this business always goes hand in hand with the ingenuity you're putting in the cropping process.

It varies from person to person and depends upon the given below factors:

It varies from person to person and depends upon the given below factors:

- Production Capacity
- Ambient Conditions
- Investment
- Cropping Pattern

These were some of the variables you have to take care of if you want good returns. This comes in naturally as you get more and more experienced in the trade.

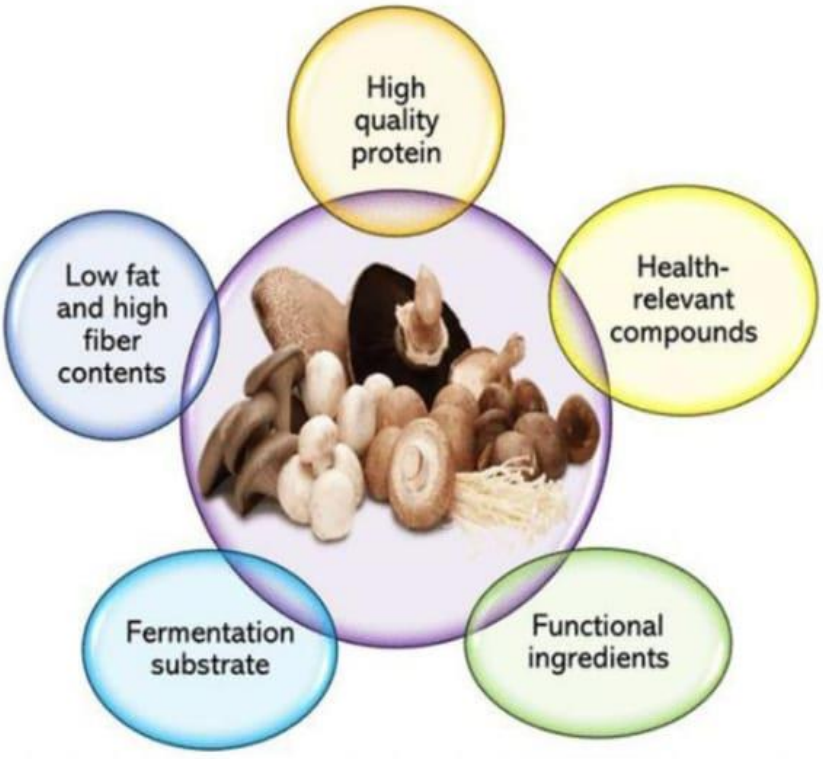


Importance

The economic importance of the mushroom lies primarily in its use as food for human consumption. It is rich in Vitamin C and B complex and the protein content varies between 1.6 to 2.5 percent. It has most of the mineral salts required by the human body. The niacin content is about ten times higher than any other vegetables.

The folic acid present in oyster mushrooms helps to cure anemia. It is suitable for people with hyper-tension, obesity and diabetes due to its low sodium : potassium ratio, starch, fat and calorific value. Alkaline ash and high fiber content makes them suitable for consumption for those having hyperacidity and constipation. A polycyclic aromatic compound pleurotin has been isolated from *P. griseus* which possess antibiotic properties.

The spent straw can be recycled for growing oyster mushrooms after supplementing with wheat or rice bran @ 10-15 % and also for preparing compost of white button mushroom after suitable supplementation with nitrogen rich horse or chicken manure (sun-dried before use). The spent straw can be used as cattle feed and also for biogas production, The slurry can be used as manure.



Scope

Global Mushroom Cultivation Market, By Type (Button Mushroom, Oyster Mushroom, Shiitake Mushroom and Others), Phase (Composting, Spawning, Casing, Pinning, Harvesting), Form (Canned, Frozen, Fresh, Dried, Others), Raw Material (Animal Based, Bio-Based Industrial Trash, Others), Applications (Bedding and Cushions and Others) – Industry Trends and Forecast to 2030.

Mushroom Cultivation Market Analysis and Size

Mushroom growing is one of the most advantageous agricultural businesses that can start with small capital and space. Mushroom farming is progressively becoming more popular among many people as a secondary source. Today, mushroom farming is most lucrative and fruitful industry. It is gradually gaining popularity because it swiftly turns the grueling labor of farmers into profit.

Moreover, an increase in demand for natural and vegan food and food in the diet and growing health-consciousness among consumers are the major factors anticipated to accelerate the demand for mushroom cultivation and enhance the market growth rate during the forecast period.

Data Bridge Market Research analyzes that the mushroom cultivation market is expected to reach USD 29.26 billion by 2030, which is USD 18.64 billion in 2022, registering a CAGR of 5.80% during the forecast period of 2023 to 2030.

In addition to the insights on market scenarios such as market value, growth rate, segmentation, geographical coverage, and major players, the market reports curated by the Data Bridge Market Research also include in-depth expert analysis, geographically represented company-wise production and capacity, network layouts of distributors and partners, detailed and updated price trend analysis and deficit analysis of supply chain and demand.

Segments Covered

Type (Button Mushroom, Oyster Mushroom, Shiitake Mushroom and Others), Phase (Composting, Spawning, Casing, Pinning, Harvesting), Form (Canned, Frozen, Fresh, Dried, Others), Applications (Bedding and Cushions and Others)

Countries Covered

U.S., Canada and Mexico in North America, Germany, France, U.K., Netherlands, Switzerland, Belgium, Russia, Italy, Spain, Turkey, Rest of Europe in Europe, China, Japan, India, South Korea, Singapore, Malaysia, Australia, Thailand, Indonesia, Philippines, Rest of Asia-Pacific (APAC) in the Asia-Pacific (APAC), Saudi Arabia, U.A.E, Israel, Egypt, South Africa, Rest of Middle East and Africa (MEA) as a part of Middle East and Africa (MEA), Brazil, Argentina and Rest of South America as part of South America

Market Players Covered

Monaghan Group (Ireland), WALSH MUSHROOMS GROUP (Ireland), Mycelia (Belgium), Smithy Mushrooms Ltd. (U.K.), Rheinische Pilz Zentrale GmbH (Germany), Italspwan (Italy), Mushroom SAS (Italy), Hirano Mushroom LLC (Kosovo), Fujishukin Co. Ltd. (Japan), Costa (India), Bonduelle (France), Monterey Mushrooms (U.S.), Cargill, Incorporated (U.S.), MycoTerraFarm (Belgium), Lambert Spawn (U.S.), The Greenyard (Belgium), Heereco (Netherlands), Bluff City Fungi (U.S.), Smithy Mushrooms (U.K.)

Market Opportunities

Rise in the introduction of latest technologies
Increase in the need for vegetarian food and rising health problems of people.

Market Definition

Mushroom cultivation is a technology of increasing mushrooms by using animal, plant and industrial waste. In brief it is wealth out of waste technology. This technology has gained significance globally because of its proteins and dietary fibres value. Mushroom is a fungi belonging to basidiomycetes. It is rich in vitamins, proteins, fibers and minerals. There are more than 3000 types of mushrooms. For instance, Oyster mushroom (Pleurotus sps.), Button mushroom (Agaricus bisporus), Paddy straw mushroom (Volvariella volvacea).

Global Mushroom Cultivation Market Dynamics

<u>Drivers</u>

- Growing demand for button mushroom

The button mushroom is a highly consumed mushroom type all around the globe and can potentially deliver many health benefits.

This mushroom type is grown commercially in almost all the major mushroom producing economies such as the US, China, Japan, the UK, Poland and Germany. Increased research and development activities on the white mushroom to find the potential to prevent cancer , coupled with its availability at reasonable prices as compared to other special mushroom varieties, is expected to increase the demand for the button mushroom in the forecast period. It contributes more than 40 percent of global production and eventually drives the growth rate of the market.

- Rising health consciousness among consumers

The growth of the global market is expected to be fuelled by increasing consumer demand for foods which are low in fat and cholesterol and high in nutrients. Its usage in dietary supplements has augmented because it comprises digestive enzymes and fibers that support gut and immune health.

The demand for restaurants, hotels and cafeterias is increasing owing to the explosive growth of the food service industry.
Mushroom cultivation can provide health benefits and nutritional benefits by adding fungus powders to smoothies, sauces and soups.

Opportunities

- Rise in the introduction of latest technologies

Rise in the efforts by the major market players to adopt the latest technologies such as computerised and automated technologies will increase the commercial production of mushrooms, which is anticipated to generate numerous opportunities for the market players in the global mushroom cultivation market growth during the forecast period.

The development and improvement of modern technologies, such as preparation of compost, production of mushrooms in non-composted substrate, computerized control, automated mushroom harvesting, and new methods of spawn preparation and substrate sterilization, will increase the productivity of mushroom culture in upcoming years.

Restraints/ Challenges

- Issues associated with mushroom cultivation market

The limited shelf-life of the mushrooms and irregularity in the proper process management will anticipated to restrain the growth of the global mushroom cultivation market during the forecast period. Moreover, consumer credit is one of the foremost and biggest factor which will challenge the market growth. Also, the increase in the operational expenses might further challenge the mushroom cultivation market growth in upcoming years.

This mushroom cultivation market report provides details of new recent developments, trade regulations, import-export analysis, production analysis, value chain optimization, market share, impact of domestic and localized market players, analyses opportunities in terms of emerging revenue pockets, changes in market regulations, strategic market growth analysis, market size, category market growths, application niches and dominance, product approvals, product launches, geographic expansions, technological innovations in the market.

To gain more info on the mushroom cultivation market contact Data Bridge Market Research for an Analyst Brief, our team will help you take an informed market decision to achieve market growth.

Expected Impact of Economic Slowdown on the Pricing and Availability of Products

When economic activity slows, industries begin to suffer. The forecasted effects of the economic downturn on the pricing and accessibility of the products are taken into account in the market insight reports and intelligence services provided by DBMR. With this, our clients can typically keep one step ahead of their competitors, project their sales and revenue, and estimate their profit and loss expenditures.

Global Mushroom Cultivation Market Scope

The mushroom cultivation market is segmented on the basis of type, phase, form, raw material and applications. The growth amongst these segments will help you analyze meager growth segments in the industries and provide the users with a valuable market overview and market insights to help them make strategic decisions for identifying core market applications.

Types

Button Mushroom
Oyster Mushroom
Shiitake Mushroom
Others

Phase

Composting
Spawning
Casing
Pinning
Harvesting

Form

Canned
Frozen
Fresh
Dried
Others

Raw Material

Animal Based
Bio-Based Industrial Trash
Others

Applications

Bedding

Cushions

Others

Mushroom Cultivation Market Regional Analysis/Insights

The mushroom cultivation market is analyzed and market size insights and trends are provided by country, type, phase, form, raw material and applications as referenced above. The countries covered in the mushroom cultivation market report are U.S., Canada and Mexico in North America, Germany, France, U.K., Netherlands, Switzerland, Belgium, Russia, Italy, Spain, Turkey, Rest of Europe in Europe, China, Japan, India, South Korea, Singapore, Malaysia, Australia, Thailand, Indonesia, Philippines, Rest of Global (APAC) in the Global (APAC), Saudi Arabia, U.A.E, Israel, Egypt, South Africa, Rest of Middle East and Africa (MEA) as a part of Middle East and Africa (MEA), Brazil, Argentina and Rest of South America as part of South America.

Asia-Pacific dominates the mushroom cultivation market in terms of revenue and market share owing to the increasing per capita consumption of mushroom than other nations. Moreover, the growing consumption and increase in cultivation of mushroom will further enhance the growth of the market in this region.

Europe is anticipated to be the fastest growing region in the mushroom cultivation market during the forecast period of 2023-2030 due to the increasing demand for extremely nutritional food in this region.

The country section of the report also provides individual market impacting factors and changes in market regulation that impact the current and future trends of the market.

Data points like down-stream and upstream value chain analysis, technical trends and porter's five forces analysis, case studies are some of the pointers used to forecast the market scenario for individual countries. Also, the presence and availability of global brands and their challenges faced due to large or scarce competition from local and domestic brands, impact of domestic tariffs and trade routes are considered while providing forecast analysis of the country data.

Competitive Landscape and Mushroom Cultivation Market Share Analysis

The mushroom cultivation market competitive landscape provides details by competitor. Details included are company overview, company financials, revenue generated, market potential, investment in research and development, new market initiatives, global presence, production sites and facilities, production capacities, company strengths and weaknesses, product launch, product width and breadth, application dominance. The above data points provided are only related to the companies' focus related to the mushroom cultivation market.

Some of the major players operating in the mushroom cultivation market are:

- Monaghan Group (Ireland)
- WALSH MUSHROOMS GROUP (Ireland)
- Mycelia (Belgium)
- Smithy Mushrooms Ltd. (U.K.)
- Rheinische Pilz Zentrale GmbH (Germany)
- Italspwan (Italy)
- Mushroom SAS (Italy)
- Hirano Mushroom LLC (Kosovo)
- Fujishukin Co. Ltd. (Japan)
- Costa (India), Bonduelle (France)
- Monterey Mushrooms (U.S.)
- Cargill, Incorporated (U.S.)
- MycoTerraFarm (Belgium)
- Lambert Spawn (U.S.)
- The Greenyard (Belgium)
- Heereco (Netherlands)
- Bluff City Fungi (U.S.)
- Smithy Mushrooms (U.K.)
- SKU-54254

Advantages of Mushroom Farming:

- Use of ideal structure

- Environment friendly
- Use agriculture waste as substrate
- Possible production all the year-round
- Uses less capital
- Income and employment generator
- Mushrooms are rich in digestible essentials, amino acids, rich protein, vitamins and minerals but low volume of high-quality unsaturated fat and water-soluble carbohydrates.
- Have high medicinal properties.
- It constitutes one of the most promising resources for promoting rapid socio-economic development.

Disadvantages of Mushroom Farming:

- Lack of availability of quality spawn.
- Mushroom spores can enter your lungs and cause serious health complications.
- Mushrooms have an extremely strong smell and it worsens over time.
- Need to constantly regulate the temperature.
- Lack of proper training.
- The chances of contamination are high in the Farming of Mushrooms.

Disease and pest controlling measures in Mushroom Farming:

Mushroom flies:

These flies are small, delicate, black, yellowish or sometimes brown with different types of wing venation and size.

Management:

Spring is inside the wall of the mushroom house.

The insecticide should be added in the last turning of the compost.

Mites:

They are small in size and are Majorly white, yellow, red and brown.

They can be found running over the surface of the fruit bodies, mushroom beds and on the floors and walls of the mushroom houses.

They damage the crop by feeding on the spawn to make holes in the mushroom caps and stalks and cause stunting of fruit bodies as well as brown spots on the caps and stems.

Management:

Proper pasteurization of compost.

Proper hygiene and sanitation.

Disinfection of the mushroom houses by spraying 0.1% dicofol.

Burning sulfur in the empty room.

Springtails:

They are silver-gray 2 brown colors with a light violet band along the sides of the body and black cellular fields present on the head.

They are the main species that damage mushrooms.

They enter mushroom houses along with organic matter.

They feed on mycelium from spawn.

They also feed on the gills of the oyster mushroom destroying the lining and spit out the mycelial strands at the base of the stripes.

They also attack the fruiting bodies of button mushrooms and cause slight pitting and browning at feeding sites.

Management:

Cleaning the surrounding and inside of the mushroom house.

Proper disposal of spent compost.

Proper pasteurization of composed and casing material.

Raising the crop above the floor level

Diseases:

Fungal diseases dry bubble: Verticillium fungicola

They are Muddy brown, often sunken spots on the cap of the mushrooms.

Greyish white moldy

growth was seen on the pileus.

In a later stage, the mushroom

becomes dry and leathery.

Management:

Use clean equipment.

Control flies and mites.

Sanitary condition in growth house.

Bubbles can be destroyed with salt.

Infected mushrooms should be destroyed to prevent the spread.

Wet bubble:

Mycogen perniciosa:

Malformed mushrooms with swollen stipes.

Reduced or deformed caps.

Undifferentiated tissue becomes necrotic and a wet, soft rot emits a bad odor.

An amber liquid appears on infected mushrooms.

Mushrooms become brown.

Bubbles may be as large as a grapefruit.

It is also a parasite of wild mushrooms.

It produces two spore types, one which is small and water-dispersed like Verticillium. the second which is a large resting spore capable of persisting for a long time in the environment.

Management:

Hygiene and sanitation in a growth house.

Clean surroundings.

Benomyl at the rate of 0.95 g/m².

Carbendazim and Thiabendazole at the rate of 0.62 g/m².

Bacterial diseases:

Bacterial spot / brown blotch: Pseudomonas tolaasii

Pale yellow spots on the surface of the piles later turn yellow.

In severe cases, mushrooms are radially streaked.

Damage at storage and transit.

High humidity and watery conditions are favorable for disease.

Vector: Tyroglyphus mite.

Lesions on tissue that are pale yellow initially later become a golden yellow or rich chocolate brown.

The discoloration is superficial (not more than 2 to 3mm).
Management:

Hygiene and sanitation.

Low humidity.

Watering with an A1 50 ppm chlorine solution.
Viral diseases:

Virus (several)

Double-stranded RNA

Reduced cropping,

Bare patches on the beds,

Long-bent stalks with small caps,

Premature opening of mushrooms,

Stalks tapering towards the base of the stalk.

Management:

Farm hygiene.

Clean trays to prevent infection from old infected mycelia.

Maintaining 60°C temperature throughout the compost.

Features of mushroom subsidy

Under the directives of the National Horticulture Board, the subsidy for mushroom cultivation is provided in the Mission for Integrated Development of Horticulture (MIDH). The main features of this mushroom subsidy are,

- As per this subsidy on mushroom farming, it is the state government that will issue the loan.
- The cost of the mushroom plant is set to a maximum of 20 lakhs. A 50% of the total cost, i.e., up to 10 lakhs of the loan, will be provided.
- This will be in addition to other government subsidies for mushroom cultivation in the form of a 50% discount on compost.

Conclusion:

The world mushroom industry has accelerated very rapidly in the last two decades by way of new types of mushrooms for commercial farming. However, mushroom as a vegetable has not located an ordinary area amongst Indian consumers. Despite a favorable agro-climate, an abundance of agricultural wastes, noticeably low-cost labor and wealthy fungal biodiversity, India has seen a lukewarm response in its growth. Currently, the whole mushroom manufacturing industry in India is around 0.13 million tonnes.

From 2010-2017, the mushroom industry in India has recorded a common increase charge of 4.3% per year. Of the total mushrooms produced, white button mushroom accounts for 73%, observed through oyster mushrooms (16%), paddy straw mushrooms (7%) and milky mushrooms (3%). Compared to other vegetables; The per capita consumption of mushrooms in India is low and information shows that it is much less than 100 grams per year.

In the 12 months 2016-2017, the Indian mushroom enterprise generated an income of Rs. 7282.26 lakhs by exporting 1054 quintals of white button mushroom in canned and frozen form.Considering the production figures, the demand for spawn in India is estimated to be around 8000-10000 tonnes per year. The majority of this business spawn is furnished to non-public producers and the contribution of public region corporations in spawn grants used to be constrained to only 10%. In this article, we attempted to analyze the contemporary state of affairs of the mushroom industry with the assistance of AICRP community centers placed throughout the US and discuss the possibilities and challenges for the improvement of mushroom entrepreneurship in India.

THANK YOU NOTE

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(Asst.Professor M.ScBotany M.phil,PhD,B.Ed)

for guiding us in every situation and giving us an idea of this book.

REFERENCES

- Library of St. Ann's college for women , malkapuram is considered as a main place which helps in our project.
- Google is the major reference used in making this book.
- Learning apps like Byjus and toppr are very useful in our research on mushroom cultivation.
- Many websites of Google and chrome are used for data collecting.

https://rocketskills.in/blog/mushroom-farming-in-india-guide/#elementor-action%3Aaction%3Dpopup%3Aopen%26settings%3DeyJpZCI6IjYyMyIsInRvZ2dsZSI6ZmFsc2V9

Thank you!!

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Thank you!!

ujwalarongali31@gmail.com
visakhapatnam, Andhra Pradesh