ITM UNIVERSITY
GWALIOR • MP • INDIA
"CELEBRATING DREAMS"

PROJECT REPORT ON EXPERIENTIAL LEARNING PROGRAMME (ELP)

ELP-Mushroom Cultivation technology

ELP-PP-401

Bachelor of Science (Agriculture)

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India is embracing Big Data in agriculture to manage its vast and diverse agro-climatic conditions through a centralized database accessible to scientists, students, farmers, and industry. This aligns with initiatives like Make-in-India, Start-up-India, and Digital India, emphasizing the need for a modernized agricultural education system that integrates creativity, technology, and entrepreneurship. Programs like ICAR's READY and ASPIRE are crucial in fostering rural entrepreneurship and retaining youth in agriculture. The Bill and Melinda Gates Foundation's initiatives and proposed incubation centers at research universities aim to stimulate innovation and link agriculture with digital communication. Education should focus on business management in agricultural courses and prioritize graduates for roles in the sector. By integrating contemporary challenges into curricula and promoting trans-disciplinary studies, India can attract talent and investment, enhancing its position in global agricultural education and addressing evolving socio-economic and environmental demands.

OBJECTIVE:

S. No.	Module
1	**Module-1** Introduction to mushroom- Taxonomical rank- History and Scope of mushroom cultivation- Edible and PoisonousMushroom- Vegetative characters.
2	**Module-2** Identification of common edible,medicinal and poisonous mushroom.
3	**Module-3** Health benefits of mushroom, Nutritional and medicinal valuesof mushroom. Therapeutic aspects- antitumor effect.
4	**Module-4** Spawn production- culture mediapreparation- production of pure culture, mother spawn preparation.
5	**Module-5** Sterilization and sanitization of mushroom houses, selection ofsubstrate for mushroom cultivation, Compositingtechnology, Mushroom bed preparation.
6	**Module-6** Spawning, Spawn running, Cultivation technology of oyster,milky and paddy straw mushroom and harvesting.
7	**Module-7** Problems in mushroom cultivation- disease, pests and nematodes, moulds and their management strategies.
8	**Module-8** Post-harvest technology: Preservation of mushrooms- freezing, dry freezing, drying, canning, quality assurance and entrepreneurship.

Module-1

Introduction to mushroom- Taxonomical rank- History and Scope of mushroomcultivation- Edible and Poisonous Mushroom- Vegetative characters.

Introduction to Mushrooms

Mushrooms are fleshy, spore-producing fungi typically found above ground. Unlike plants, they lack chlorophyll and depend on organic matter like straw or manure for nutrients. Their diverse forms include gilled mushrooms, puffballs, and morels. The mushroom's morphology consists of two main parts: the vegetative body (mycelium) and the fruiting body. Mycelium, an underground network of hyphae, absorbs nutrients and forms the mushroom's vegetative structure. The fruiting body, visible above ground, comprises the cap and stalk, with spore-bearing structures such as gills, pores, or teeth on the underside of the cap. Mushrooms reproduce through spores, which are microscopic and released in large numbers.

Taxonomic Rank

Mushrooms belong to the kingdom Fungi, distinct from plants and animals, and are classified into various phyla, classes, orders, families, genera, and species. Edible mushrooms often belong to the phylum Basidiomycota, specifically the class Agaricomycetes.

History and Scope of Mushroom Cultivation

Mushroom cultivation dates back thousands of years, originating in East Asia. Today, it is a global industry with significant economic impact. Common cultivated species include white button mushrooms (Agaricus bisporus), oyster mushrooms (Pleurotus spp.), and shiitake mushrooms (Lentinula edodes). Cultivation involves controlled environments with specific conditions for temperature, humidity, and substrate.

Edible and Poisonous Mushrooms

While many mushrooms are safe and nutritious, some are poisonous and can cause severe illness or death. Accurate identification is crucial, and foraging for wild mushrooms should be done only by trained experts.

Vegetative Characters

The vegetative part of mushrooms, the mycelium, plays a key role in nutrient uptake and ecosystem functioning by decomposing organic matter. The visible mushroom represents only a small portion of the fungus's life cycle.

Life Cycle of Mushrooms

The mushroom life cycle includes spore germination, colonization by mycelium, fruiting where the mushroom develops, and sporulation where spores are released to continue the cycle. This process involves growth from a spore to a mature mushroom capable of reproducing.

Module-2

Identification of common edible, medicinal and poisonous mushroom.

1. Button Mushroom (Agaricus bisporus): White with a smooth texture, turning brown with age. Cultivated commercially and sometimes found in meadows.
2. Oyster Mushroom (Pleurotus ostreatus): Fan-shaped cap in colors like grey, white, brown, or pink, with a velvety texture. Grows on straw, wood, and dead trees.
3. Shiitake Mushroom (Lentinula edodes): Brown, dome-shaped cap with rolled edges and white to light brown gills. Cultivated on logs and occasionally found in hilly regions.
4. Milky Mushroom (Calocybe indica): White or cream-colored cap with a smooth texture and milky latex. Found in forests under Shorea robusta trees.
5. Straw Mushroom (Volvariella volvacea): Bell-shaped cap, brown or yellowish-brown, with white gills turning pink with age. Cultivated on rice straw.
6. Morel Mushroom (Morchella spp.): Elongated, pitted cap, beige to brown, with a honeycomb appearance. Found in forests near elm or ash trees.
7. Enoki Mushroom (Flammulina velutipes): Clustered, needle-like white or light brown caps with white gills. Cultivated on logs and found on dead hardwood trees.

Medicinal Mushrooms

1. Reishi (Ganoderma lucidum): Reddish-brown with a shiny cap, known for immune-boosting and stress-reducing properties. Found on decaying hardwood trees.
2. Turkey Tail (Trametes versicolor): Colorful concentric rings resembling a turkey's tail. Rich in antioxidants, found on dead hardwood trees.
3. Lion's Mane (Hericium erinaceus): White spines, potential cognitive and nerve regeneration benefits. Grows on hardwood trees, especially oak and beech.
4. Cordyceps (Cordyceps sinensis): Slender, elongated fruiting bodies parasitizing insects. Used for energy and stamina. Found in the Himalayan region.
5. Chaga (Inonotus obliquus): Black, charred mass on birch trees. High in antioxidants and immune-boosting. Found on birch trees in temperate forests.
6. Maitake (Grifola frondosa): Fan-shaped clusters, known for immune support and anti-cancer properties. Found at the base of oak trees.
7. Shiitake (Lentinula edodes): Brown, umbrella-shaped caps, used in culinary dishes and for immune support. Cultivated on hardwood logs.
8. Almond Mushroom (Agaricus blazei): Mild taste, valued for immune-boosting properties. Grows in composted soil or decaying organic matter.
9. Tremella (Tremella fuciformis): Gelatinous white to yellowish fruiting bodies, used for skin health and anti-aging. Found on dead branches in forests.

Poisonous Mushrooms

1. Death Cap (Amanita phalloides): Greenish-yellow, convex cap with white gills and a bulbous base. Found in deciduous and coniferous forests.
2. Destroying Angel (Amanita virosa): Smooth, white cap with white gills and a bulbous base. Often in mixed woodlands.
3. Deadly Webcap (Cortinarius rubellus): Bright red or orange-red, bell-shaped cap with reddish gills. Mycorrhizal with trees like beech and pine.
4. Fool's Funnel (Clitocybe rivulosa): Yellowish to brown, convex cap with white, crowded gills. Found in grassy areas, lawns, and meadows.

These summaries provide a guide to identifying and understanding the roles of various mushrooms found in India, highlighting their edible, medicinal, or poisonous nature and their typical habitats.

TYPES OF EDIBLE MUSHROOMS IN INDIA

Fig. Button Mushroom

Fig. Oyster Mushroom

Fig. Shiitake Mushroom

Fig. Morel Mushroom

Fig. Milky Mushroom

Fig. Straw Mushroom

TYPES OF MEDICINAL MUSHROOM IN INDIA

Fig. Reishi Mushroom

Fig. Lion's Mane Mushroom

Fig. Turkey Tail Mushroom

Fig. Tremella Mushroom

Fig. Shiitake Mushroom

Fig. Cordyceps

TYPES OF POISONOUS MUSHROOMS IN INDIA

Fig. Death Cap Mushroom

Fig. Destroying Angel

Fig. Deadly Webcap Mushroom

Fig. Fool's Funnel Mushroom

Module-3

Health benefits of mushroom, Nutritional and medicinal values of mushroom. Therapeutic aspects- antitumor effect.

Health Benefits, Nutritional and Medicinal Values of Mushrooms

Mushrooms are a nutritious and versatile food with a range of health benefits:

- **Rich in Nutrients**: Mushrooms are low in calories but high in essential nutrients like vitamins, minerals, and antioxidants. They support overall health by providing important nutrients without adding excessive calories.
- **Immune System Support**: Many mushrooms contain compounds that boost the immune system. For example, polysaccharides such as beta-glucans found in Shiitake and Reishi mushrooms can enhance immune response and potentially help in fighting infections and cancer cells.
- **Reduced Inflammation**: Mushrooms like Reishi and Lion's Mane have anti-inflammatory properties, which can aid in managing conditions like arthritis and inflammatory bowel disease.
- **Heart Health**: With no cholesterol and potential to lower LDL (bad cholesterol), mushrooms contribute to cardiovascular health. Shiitake and Enoki mushrooms, in particular, have been noted for their heart health benefits.
- **Weight Management**: Low in calories and fat, mushrooms are an excellent choice for those looking to manage their weight while still getting important nutrients.
- **Gut Health**: Certain mushrooms provide prebiotic fiber that fosters the growth of beneficial gut bacteria, improving digestion and gut health.
- **Vitamin D Source**: Exposure to sunlight can increase the vitamin D content in mushrooms, essential for bone health and immune function.
- **Cognitive Function**: Early studies suggest mushrooms like Lion's Mane may enhance cognitive function and reduce the risk of dementia by promoting nerve growth.

Medicinal Values

- **Immune System Enhancement**: Mushrooms such as Shiitake and Maitake contain beta-glucans that stimulate immune cells, aiding in the body's defense against diseases.
- **Anti-Cancer Properties**: Mushrooms like Maitake and Reishi have shown potential in inhibiting cancer cell growth. Compounds in these mushrooms may work through immune modulation, antioxidant activity, and inducing apoptosis (programmed cell death).
- **Anti-Inflammatory Effects**: Mushrooms with anti-inflammatory properties, such as Reishi and Turkey Tail, can help alleviate symptoms of inflammatory conditions.
- **Cardiovascular Health**: Some mushrooms may help lower cholesterol and blood pressure, benefiting cardiovascular health.
- **Cognitive Function**: Lion's Mane is noted for its potential to improve cognitive function and memory.

Therapeutic Aspects

- **Antitumor Effects**: Mushrooms like Maitake, Shiitake, Turkey Tail, and Cordyceps show promise in cancer therapy through mechanisms such as immune system activation, inhibition of new blood vessel formation (anti-angiogenesis), and inducing apoptosis in cancer cells. These therapeutic properties are still under investigation but offer exciting potential for cancer treatment.

Fig. *Ganoderma lucidum*

Fig. Cordyceps

Module-4

Spawn production- culture media preparation- production of pure culture, mother spawn preparation.

Preparation of Potato Dextrose Agar (PDA) Media

1. **Materials Required: Potato extract, dextrose, agar agar, distilled water, beakers or flasks, pH meter or strips, autoclave, petri dishes, stirring rod or magnetic stirrer, pH buffer solutions (optional).**
2. **Procedure:**
    - **Potato Extract: Peel and dice 200 grams of potatoes. Boil until soft, strain, and measure the extract.**
    - **PDA Media: Combine potato extract with distilled water. Dissolve 20 grams of dextrose and 20 grams of agar agar in this solution while stirring. Adjust pH to 5.6-5.8. Heat until agar is dissolved, adjust volume if necessary, then pour into petri dishes. Allow to solidify at room temperature.**
    - **Sterilization: Autoclave at 121°C and 15 psi for 15-20 minutes. Cool before use.**
3. **Precautions:**
    - **Maintain sterility to prevent contamination.**
    - **Adjust pH carefully for optimal growth.**
    - **Ensure complete agar dissolution and handle hot solutions cautiously.**

Preparation of Base Culture

1. **Materials Required: Mushroom, laminar airflow, PDA media, blades, forceps, ethanol.**
2. **Procedure:**
    - **Preparation: Select disease-free mushrooms, let moisture evaporate. Sterilize the workspace and tools.**
    - **Culture: Cut a small tissue from the mushroom and transfer it to a sterile PDA slant. Incubate at room temperature for 10 days. Observe for contamination and use the base spawn for preparing mother spawn.**

Culture Isolation Techniques

1. **Vegetative Mycelium Culture:**
    - **Clean and sterilize basidiocarps, treat with disinfectants, cut mycelial bits, place in PDA plates, incubate at 25°C. Transfer to test tubes for further incubation.**
2. **Multi Spore Culture:**
    - **Scrape and suspend spores in water, add to warm PDA plates, incubate, observe spore germination, transfer to culture tubes.**
3. **Single Spore Culture:**
    - **Dilute spores, isolate germinating spores under aseptic conditions, transfer to culture tubes, incubate.**

Preparation of Mother Spawn

1. **Materials Required: Wheat grains, dextrose, calcium carbonate, polypropylene bags, PVC rings, cotton, waste paper, rubber bands, autoclave, laminar airflow, BOD incubator.**
2. **Procedure:**
    - **Grain Preparation: Wash, soak, and dry wheat grains. Mix with dextrose and calcium carbonate. Fill in polypropylene bags, sterilize in autoclave, and cool.**
    - **Inoculation: Transfer fungal culture pieces into the bags in a laminar flow. Incubate in BOD for 10 days**

FLOW CHART OF MOTHER SPAWN

Wheat grain soaked for 24hrs.

Washing of grain

Wheat grain drying

Wheat grain dried

Filling wheat grain in bag

Weighing

Inserting PVC for capping

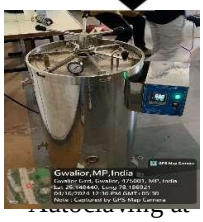
Autoclaving

Inserting Cotton Plug

Making Cotton Plug

Weighing CaCO3 + Weighing Dextrose

Mixing them with wheat grain



15psi for 2hr

UV treatment in Laminar Air Flow for 20 min

Sterilizing

Inoculation of mycelium

Cutting mycelium

Mother spawn ready for Storing in BOD

Module-5

Sterilization and sanitization of mushroom houses, selection of substrate for mushroom cultivation, Compositing technology, Mushroom bed preparation.

Sterilization Techniques:

1. **Autoclaving: For media sterilization, use 15 psi pressure for 20 minutes. For media with sugar, use 10 psi for 15 minutes. Sterilize solid media and soil/cereal grains for 2 hours on consecutive days. Small quantities can be sterilized in pressure cookers.**
2. **Surface Sterilization: Use 0.1% mercuric chloride or 2% sodium hypochlorite.**
3. **Hot Air Oven: Sterilize glassware and metallic vessels at 160-180°C for 2 hours.**
4. **Laminar Flow Chamber: Equipped with HEPA filters and UV light to control airborne contamination.**
5. **Disinfectants: Use formaldehyde and alcohol for cleaning.**

Sanitization Practices:

- **Maintain cleanliness and proper sanitation.**
- **Ensure hand hygiene and use personal protective equipment (PPE).**
- **Sterilize all equipment and maintain air filtration with HEPA filters.**
- **Isolate contaminated materials and sanitize footwear.**
- **Implement regular monitoring and staff training.**

Substrate Selection and Preparation:

1. **Substrate Selection: Use cellulosic farm waste like wheat straw, paddy straw, and sugarcane leaves. Ensure the substrate is dry, healthy, and undecomposed.**
2. **Preparation: Chop straw into 2-3 inch pieces and soak in water overnight.**
3. **Sterilization: Methods include hot water treatment, moist heat, or chemical sterilization with formaldehyde or fungicides. Maintain 65-70% moisture in the substrate.**
4. **Bagging and Spawning: Use polypropylene bags, add 2-3% spawn, and arrange in layers. Place bags in a spawn running room at 20-25°C and 80-90% humidity. Move to the crop room at 18-23°C and 85-90% moisture, with frequent water spraying if needed.**

STERILIZATION TECHNIQUE

Fig. Autoclave

Surface Sterilization:

- Uses mercuric chloride (0.1%) or sodium hypochlorite (2%) applied to materials.

Fig. Laminar Air Flow

DISINFECTANTS AND CLEANING:

Fig. Potassium Permanganate

Fig. Sterilization of lab

Module-6

Spawning, Spawn running, Cultivation technology of oyster, milky and paddy straw mushroom and harvesting.

Cultivation of Oyster Mushroom

Materials Required:

- 200-litre drum
- Water
- Formaldehyde (125 ml)
- Carbendazim (10g)
- Straw (10 kg)
- Mat
- Polyethylene bags
- Spawn
- Rubber bands

Procedure:

1. Fill the drum with water and mix in formaldehyde and carbendazim.
2. Soak 10 kg of straw in this solution for 16 hours, then strain and spread the straw on a sterilized mat to dry to 70% moisture.
3. Bagging: Fill polyethylene bags with 3 inches of straw, sprinkle with spawn, add another 5 inches of straw and spawn, repeating to create five layers. Press down, tie with rubber bands, and make ventilation holes.
4. Place bags in a dark room on racks, maintaining 22-25°C and 85-90% humidity.
5. Check daily for contamination or pests; remove contaminated bags and treat with pesticide if needed.
6. After 30-35 days, observe for pin head formation and transfer fully colonized bags to the cropping room

Cultivation of Button Mushrooms

Materials Required:

- Wheat or paddy straw (10 kg)
- Water
- Formaldehyde (125 ml)
- Carbendazim (10g)
- Certified button mushroom spawn (Agaricus bisporus)
- Perforated polyethylene bags
- Spray bottle
- Drum
- Rubber bands

Steps:

1. **Substrate Preparation**:
    - Soak straw in water for 1-2 days.
    - Mix with manure and add formaldehyde and carbendazim.
    - Compost at 55-60°C for 1-2 days, turning regularly.
    - Heat composted material to 60-63°C for 6-8 hours.
2. **Spawning**:
    - Dry straw to 60% moisture and cool compost to 22-25°C.
    - Mix with spawn (0.5% by weight) and fill sterilized bags.
3. **Spawn Run**:
    - Maintain 22-25°C and 80-85% humidity; minimal ventilation.
    - Mycelium should colonize in 12-15 days.

4. **Casing**:
    - Apply a 2-3 cm layer of moist casing material.
5. **Fruiting**:
    - Lower temperature to 15-18℃, maintain 85-90% humidity, and mist 2-3 times daily.
    - Pinheads appear in 7-10 days.
6. **Harvesting**:
    - Twist mushrooms at the base when caps are firm.
7. **Flushing**:
    - Maintain conditions for additional mushroom flushes.

Cultivation of Milky Mushroom

Milky mushrooms (Calocybe indica), known for their excellent shelf-life and attractive appearance, thrive on various agricultural wastes and are well-suited for people with hyperacidity and constipation. They offer moderate protein content and essential minerals.

To cultivate milky mushrooms, prepare the substrate as discussed for oyster mushrooms. Use transparent polythene covers (60 x 30 cm, 80 gauge) for bed preparation. After the substrate has fully colonized, cut the bed horizontally into two halves and compact it. Apply a 1 cm layer of casing soil, press it gently, and moisten it with water. Place the beds in a blue tent, maintaining a temperature of 30-35℃ and 80-85% humidity.

Daily observation is crucial for spraying water and checking for contamination or pests. Harvest when pinheads develop into mature mushrooms, typically 10 days after casing. For subsequent harvests, stir and re-water the beds, allowing for a maximum of three harvests, with yields of 350-400 g from 250 g of dry straw. Maintain proper conditions to ensure optimal growth and production.

Fig. Button Mushroom

Fig. Milky Mushroom

FLOW CHART OF CULTIVATION OF MUSHROOMS

Wheat Straw 10kg

Weighing Carbendazim

Filling drum with straw and water

Mixing Carbendazim, Formalin and wheat straw in water

Extracting straw from Drum

Drying straw upto 70% moisture

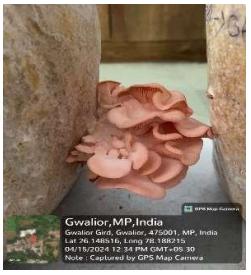
Spawn

Bagging

Bagging Done

Bag store in sterile room and holes are made in bags

Watering



Mushroom Grown

Harvesting

Packaging

Module-7

Problems in mushroom cultivation- disease, pests and nematodes, moulds and their management strategies.

Mushrooms can be affected by various problems, including diseases, pests, and nematodes. Understanding these issues and implementing appropriate management strategies is crucial for successful cultivation.

Diseases of Mushrooms include fungal, bacterial, and viral infections. Fungal diseases such as Dry Bubble Disease, caused by Verticillium fungicola, manifest as muddy brown spots, grayish-white mold, and stunted growth. It spreads through airborne spores and contaminated materials, thriving in high humidity and poor ventilation. Management involves maintaining sanitation, proper ventilation, and using pasteurized casing material. Wet Bubble Disease, caused by Mycogone perniciosa, results in wet rot and malformed mushrooms, thriving in high humidity and injury-prone conditions. Control measures include sanitation and ventilation. Cobweb Disease, caused by Cladobotryum dendroides, is characterized by white, cobweb-like growth on mushrooms and casing material. Managing this disease requires sanitation, ventilation, and biological control agents.

Bacterial Blotch, caused by Pseudomonas tolaasii, leads to pale yellow or brown spots on mushrooms, potentially rotting them. It spreads through water splash and contaminated tools. Effective management includes maintaining hygiene, controlling moisture, and using copper-based bactericides. Viral diseases like La France Disease, caused by the Mushroom Bacilliform Virus, lead to deformed mushrooms and necrosis. It spreads via fungus gnats. Management includes controlling gnats with insecticides, maintaining sanitation, and removing infected mushrooms.

Common Mushroom Pests include fungus gnats and phorid flies. Fungus gnats, with larvae that feed on mycelium and young mushrooms, can cause brown, leathery rot and transmit diseases. Management involves reducing moisture, using sticky traps, and applying insecticides. Phorid flies target decaying matter, with larvae forming tunnels in mushrooms, causing them to turn brown and rot. Management includes maintaining cleanliness, reducing decaying matter, and using insecticides.

To prevent and manage these issues effectively, early detection and proper identification are essential. Preventive measures, maintaining optimal growing conditions, and using sanitation and appropriate control methods are critical for minimizing the impact of diseases and pests on mushroom cultivation.

Fig. Dry Bubble Disease

Fig. wet bubble disease

Module-8

Post-harvest technology: Preservation of mushrooms- freezing, dry freezing, drying,canning, quality assurance and entrepreneurship.

In the growing Indian mushroom industry, several preservation methods are utilized, each with distinct benefits. Freezing involves blanching mushrooms and packing them into containers for up to a year, though it may affect texture. Dry freezing, using temperatures below -80°C, preserves texture and flavor but requires specialized equipment. Drying mushrooms by slicing and dehydrating them intensifies their flavor and extends shelf life to a year. Dried mushrooms are lightweight and rehydrated easily. Canning preserves mushrooms for up to 5 years but requires careful adherence to procedures to avoid botulism, making it less suitable for beginners. Quality assurance involves using fresh mushrooms, thorough cleaning, and proper storage. Entrepreneurship opportunities include developing improved preservation methods, creating value-added products like mushroom powders or jerky, and partnering with local growers for a sustainable supply chain.

Fig. Mushroom Pickle

Fig. Mushroom Soup

Fig. Mushroom Coffee

Fig. Som-Mor Masala

Fig. Freezing

PROJECT COST - ANALYSIS FOR MUSHROOM CULTIVATION

Cost Analysis for Mushroom Cultivation

Mushroom growing is a highly profitable activity and can be taken up on a smaller or larger scale depending upon the capacity of an individual or organization. The spawn production, compost preparation and mushroom cropping are the components of mushroom farming which yield significant profit. The economics of commonly cultivated mushrooms is given as under :

A. Spawn Production Project

Economic of spawn production (100 spawn bags per day)

S.No	Item	Quantity	Rate(Rs.)	Total(Rs.)
A.	**Capital Investment**			
1.	Autoclave	2	20,000	40,000
2.	Boiler (GI drum 100 lit. Capacity)	2	2,000	4,000
3.	Culture room with work table	1	10,000	10,000
4.	UV lamp with fittings	1	1500	1500
5.	Tube light fittings	1	200	200
6.	Advance for LPG gas	2	2,000	4,000
7.	Spawn storage room	1	20,000	20,000
8.	Bunsen burner	1	150	150
9	Heat efficient chulah	1	600	600
	Total			80,450
B.	Fixed Cost			
1.	Interest on capital investment @ 12%			9,654
2.	Depreciation (Item 3 &7 @ 5%)			1,500
3.	Depreciation (Item 1, 2, 4, 5, 8&9 @10%)			4,645
	Total			15,799
C.	Recurring cost (100 spawn x 300 days)			
1.	Polypropylene (3%damage)	160 kg	80	12,800
2.	Cholam grain (3%damage)	9,300 kg	7	65,100
3.	Calcium carbonate (commercial grade)	185 kg	17	3,145
4.	Non- Absorbent Cotton (400 g Rolls)	775	60	46,500
5.	Fungicides & fumigants	-	-	1,000
6.	Electricity &fuel	-	-	25,000

Cost of production / Year:

1.	Working expenditure	1,92,545
2.	Interest and depreciation on fixed cost	15,799
3.	Total Cost	2,08,344
Income		
1.	By sale of 30,000 spawn @ RS. 120per bag	3,60,000
2.	Total income	2,08,344
3.	Net income per year	1,51,656

Mushroom Production Project

A. Mushroom Production Project

Economics of Oyster mushroom production (5 kg/day / 300 days)

S.No	Item	Quantity	Rate (Rs.)	Total (Rs.)
A.	**Capital Investment**			
1.	Mushroom growing room (attched)	1	7,500	7,500
2.	Chaff cutter (leaver type)	1	1,200	1,200
3.	Boiler	1	2,000	2,000
4.	Cement tub	1	1,000	1,000
5.	Sprayer	1	500	500
6.	Biomass stove	1	300	300
	Total			12,500
B.	**Fixed Cost**			
1.	Interest on A @ 12%			1,500
2.	Depreciation (Item 1 @ 30%)			2,250
3.	Depreciation (Item 2,3,4,5 &6 @ 10%)			500
	Total			4,250
C.	**Recurring Cost**			
1.	Paddy straw	3t	1,500/t	4,500
2.	Spawn bags	1,500	12	18,000

3.	Polythene bags for bed & packing	60 kg	80	3,600
4.	Fungicides, fumigants & chemicals	-	-	1,000
5.	Labour @ 1 per day	300	50 / head	15,000
6.	Others	-	-	5,000
	Total			47,100

Cost of production / Year:

1.	Working expenditure	47,100
2.	Interest and depreciation on fixedcost	4,250
3.	Total Cost	51,350
Income		
1.	By sale of 5 kg of mushroomdaily @ Rs. 60 per kg	90,000
2.	Cost of spent mushroom compost	10,000
3.	Total income	1,00,000
4.	Net income per year	48,650

Economics of Milky mushroom production (5 kg /day /300 days)

S.No	Item	Quantity	Rate (Rs.)	Total (Rs.)
A.	**Capital Investment**			
1.	Mushroom growing room (poly houses)	1	12,000	12,000
2.	Chaff cutter (leaver type)	1	400	400
3.	Boiler (one for paddy straw& one for casing soil sterilization)	1	2,000	2,000
4.	Cement tub	1	1,000	1,000
5.	Sprayer	1	500	500
6.	Biomass stove	1	300	300
	Total			19,800
B.	**Fixed Cost**			
1.	Interest on A @ 12%			2,376
2.	Depreciation (Item 1 @ 10%)			1,200
3.	Depreciation (Item 2,3,4,5 & 6 @ 10 %)			780

	Total			4,356
C.	Recurring Cost			
1.	Paddy straw	1.5t	1,500/t	2,250
2.	Spawn bags	1,200	12	14,400
3.	Polythene bags for bed & packing	35kg	80	2,800
4.	Fungicides, fumigants & chemicals	-	-	1,000
5.	Labour @ 1 per day	300	50/head	15,000
6.	Others	-	-	5,000
	Total			40,450

Cost of production / year

1. Working expenditure: 40,450
2. Interest and depreciation on fixed cost: 4,356
3. Total cost: 44,806

Income

1. By sale of 5 kg of mushrooms daily @ Rs. 65 per kg: 97,500
2. Cost of spent mushroom compost: 10,000
3. Total income: 1,07,500
4. Net income per year: 62,694

Economics of production of button mushroom (*Agaricus bisporus*)

Production of button mushroom on a small scale is not economical. However, if good compost is readily available or by creating facilities for LMC, button mushroom production can be takenup, especially at high elevation where suitable climatic condition normally exist.

Approximate cost estimated is given below (650 bags / crop having 10 kg of compost in each bag x 4 crops/ year

S.No	Item	Quantity	Rate (Rs.)	Total (Rs.)
A.	**Capital Investment**			
1.	Composting yard with cutting and soaking	-	-	2,00,000
2.	Spawn running & cropping rooms	6	25,000	1,50,000
3.	Casing soil preparation unit	1	20,000	20,000
4.	Steam generator, boiler & fittings	-	1,20,000	1,20,000
5.	Air cooler and humidifiers	6	25,000	1,50,000
6.	Water tank	-	-	50,000
	Total			6,90,900
B.	**Fixed Cost**			
1.	Interest on @ 12%			82,800
2.	Depreciation @ 10%			69,000
	Total			1,51,800
C.	Recurring Cost			
1.	Compost preparation by LMC	30t	-	90,000
2.	Fungicides, fumigants & chemicals	1,200	-	10,000
3.	Spawn bags	40	15	18,000
4.	Polythene bags	1,095	80	3,200
5.	Labour @ 3 per day	-	50	54,750
6.	Electricity, fuel etc.,	-	-	50,000
7.	Miscellaneous cost	-	-	10,000
	Total			2,35,950

Cost of production/year

1. Working expenditure : 2,35,950
2. Total fixed cost : 1,51,800 Total cost : 3,87,750

Income

1. By sale of 9,000kg mushrooms @ Rs.70 /kg: 6,30,000
2. Cost of spent mushroom compost: 20,000
3. Total income: 6,50,000
4. Net income per year: 2,62,250

PROJECT REPORT
ON
EXPERIENTIAL LEARNING PROGRAMME (ELP)

ELP-Production Technology of Bio-agents and Biofertilizers
ELP-ENT-402

Bachelor of Science Honors (Agriculture)

Submitted by:
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BAGN1AG20019

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School of Agriculture
ITM University, Gwalior, M.P
2024

India's agricultural education system is evolving to align with the country's thrust on initiatives like Make-in-India, Digital India, and Skill India. Emphasizing Big Data, the integration of modern information systems is crucial for enhancing accessibility and market efficiency. The ICAR's initiatives, such as READY and ASPIRE, aim to attract and nurture young talent, fostering entrepreneurship and innovation in agriculture. The establishment of incubation centers and the inclusion of business management in curricula are proposed to encourage agricultural graduates to become entrepreneurs. Partnerships with private companies and innovative projects like those from the Bill and Melinda Gates Foundation are highlighted as key to linking agriculture with technology and industry. These efforts are designed to make agriculture an intellectually stimulating and economically rewarding profession, ensuring that Indian agriculture education meets the demands of modern markets and contributes to the nation's development and global competitiveness.

OBJECTIVES:

1. Introduction, history, Importance and scope of biofertilizers and bio-agents.
2. Isolation and identification of fungal biocontrol agents i.e., *Trichoderma* spp. And *Beauveria bassiana* from rhizosphere.
3. Isolation and identification of bacterial biocontrol agents i.e., *Pseudomonas fluoresces and Bacillus subtilis* from soil, *Azospirillum* from plant roots.
4. Isolation and identification of bio- fertilizer i.e., *Rhizobium* from root nodules and *Azotobacter* from soil.
5. Mass production and formulation technology of bio-agent *Trichoderma viride* and *Pseudomonas fluoresces*
6. Mass production and formulation technology of bio-fertilizers *Rhizobium* and *Azotobacter spp.*
7. Methods of application technology of bio-agents and bio-fertilizers *in vitro* and field conditions.
8. Methods of increasing Storage, shelf- life, quality control and marketing of bio-agents and bio-fertilizers

MODULE-01

AIM: Introduction, history, Importance and scope of biofertilizers and bio-agents.

Biofertilizers are natural, eco-friendly fertilizers containing microbial inoculants such as bacteria, algae, and fungi that enhance soil fertility by fixing nitrogen, solubilizing phosphorus, and promoting plant growth. They are crucial for sustainable agriculture, increasing crop yields by 20-30% and improving soil health without harming the environment. Key types include bacterial, fungal, algal, and actinomycetes biofertilizers. The commercial use of biofertilizers began in 1895, and they continue to play a vital role in modern agriculture.
Bio-agents, or biological control agents, are organisms used to manage pests through predation, parasitism, and other natural mechanisms. They are cost-effective, environmentally safe, and promote plant health by controlling pests like insects and nematodes. The history of bio-agents dates back to 900 A.D. in China, and their use has expanded globally. Both biofertilizers and bio-agents are essential for sustainable agriculture, reducing the reliance on chemical inputs and minimizing environmental impact.

MODULE-02

AIM: Isolation and identification of *Trichoderma spp*. from rhizosphere.

Trichoderma spp. are beneficial soil fungi that enhance plant health by improving nutrient uptake and immunity. The process of isolating Trichoderma from rhizospheric soil involves serial dilution, where soil samples are mixed with distilled water and diluted across multiple test tubes. Diluted samples are then plated on PDA (Potato Dextrose Agar) media and incubated to promote the growth of Trichoderma colonies, recognizable by their greenish appearance. For purification, a greenish colony is transferred to fresh PDA media with added antibiotics to inhibit unwanted microorganisms. The plates are incubated to obtain a pure culture. The PDA media, essential for fungal growth, is prepared by boiling potatoes, adding dextrose and agar, and sterilizing the mixture. The entire process is conducted under sterile conditions using tools like a laminar airflow, autoclave, and BOD incubator, ensuring the successful isolation and purification of Trichoderma spp.

MODULE-03

AIM: Isolation and identification of *Pseudomonas fluorescence* from soil.

Pseudomonas fluorescens is a beneficial Gram-negative bacterium known for its role in agriculture and bioremediation. It is commonly found in soil and plant rhizospheres, where it promotes plant growth and serves as a biocontrol agent. To isolate and identify P. fluorescens, soil samples are collected, and serial dilutions are prepared. These dilutions are spread onto King's B media, which supports bacterial growth. The plates are incubated at 30ºC, allowing the bacteria to form colonies. P. fluorescens can be identified by its characteristic yellowish-green colonies with light green pigmentation, often confirmed through molecular techniques like 16S rRNA analysis or PCR methods. The identification process is critical for its application in biofertilizers and biocontrol, contributing to sustainable agricultural practices by enhancing crop productivity and reducing the reliance on chemical inputs.

MODULE-04

Isolation and identification of Rhizobium from root nodules and *Azotobacter* from soil.

Rhizobium, a soil bacterium, forms a symbiotic relationship with leguminous plants, aiding in nitrogen fixation and enhancing soil fertility. To isolate and identify Rhizobium from root nodules, healthy pink nodules are collected, washed, and sterilized using 0.1% mercuric chloride and 70% ethanol. The nodules are then crushed, and the suspension is plated on Yeast Extract Mannitol (YEM) agar, a medium specifically designed to support Rhizobium growth. The plates are incubated at 28ºC for 2-3 days, allowing the development of characteristic Rhizobium colonies, which appear white with a central red dot. The isolated colonies are then transferred to fresh YEM plates for purification, ensuring the maintenance of a pure culture for further use. Rhizobium-based inoculants, derived from such cultures, are valuable biofertilizers that promote plant growth and reduce dependency on synthetic fertilizers, contributing to sustainable agriculture.

Azotobacter is a free-living soil bacterium known for its ability to fix atmospheric nitrogen and enhance plant growth, making it vital for sustainable agriculture. To isolate and identify Azotobacter from soil, Jensen's nitrogen-free medium is used. Soil samples are collected, diluted, and plated on the prepared medium. The process involves mixing 1 gram of soil with sterile water, creating serial dilutions, and spreading 0.1 mL of the diluted sample onto agar plates containing Jensen's medium. These plates are then incubated at 28-30°C in a BOD incubator. After incubation, colonies of Azotobacter, identified by their light brown to black pigmentation on the medium, are observed. Azotobacter-based biofertilizers provide a natural solution to enhance soil fertility, reduce reliance on chemical fertilizers, and promote sustainable agricultural practices, showcasing the potential of beneficial soil microorganisms in supporting global food security and environmental sustainability.

MODULE-05

AIM: Mass production and formulation technology of *Trichoderma viride*.

The mass production and formulation technology of **Trichoderma viride** and **Pseudomonas fluorescens** involves cultivating these beneficial microorganisms on specific media and formulating them into user-friendly products for agricultural use. Trichoderma viride is mass-multiplied using wheat grain or liquid Potato Dextrose (PD) broth. The process includes autoclaving the media, inoculating with pure Trichoderma culture, and incubating for optimal growth. Formulations include talc-based and vermicompost, where the fungal culture is mixed with either talcum powder or vermicompost, then packaged for application.
Similarly, **Pseudomonas fluorescens** is cultured in King's B media. The procedure involves cutting pure bacterial cultures, inoculating them into the media, and incubating at a controlled temperature. Talc-based and vermicompost formulations are prepared by mixing the bacterial culture with either talcum powder or vermicompost. These formulations enhance plant growth and provide disease control, supporting sustainable agriculture practices.

MODULE – 06

AIM: Mass production and formulation technology of bio-fertilizer *Rhizobium.*

The mass production and formulation technology of biofertilizers like **Rhizobium** and **Azotobacter** involves cultivating these beneficial bacteria in specific media and creating user-friendly formulations. For Rhizobium, the bacteria are grown in YEM (Yeast Extract Mannitol) broth. The culture is incubated for 5-7 days at 28°C, after which the bacteria are used to create talc-based and vermicompost formulations. The talc-based formulation requires 100 ml of Rhizobium culture mixed with 2 kg of talcum powder, while the vermicompost formulation uses 100 ml of culture mixed with 2 kg of finely broken vermicompost.
Similarly, **Azotobacter** is mass-produced in Jensen's nitrogen-free medium. After incubation at 25-26°C for 8-10 days, Azotobacter cultures are formulated into talc-based and vermicompost products using the same procedure as Rhizobium. These biofertilizers promote plant growth, enhance soil fertility, and support sustainable agriculture by reducing reliance on chemical fertilizers.

MODULE-07

AIM: Methods of application technology of bio agents and bio-fertilizer in vitro and field conditions.

The application of bio-agents and bio-fertilizers is crucial for sustainable agriculture, enhancing soil health, nutrient availability, and plant growth while reducing environmental impact. In vitro methods include **seed treatment**, where seeds are coated with beneficial microorganisms, and **root dip**, where roots are immersed in bio-agent suspensions before transplantation. **Liquid culture application** involves spraying or drenching plants with a high concentration of microorganisms, while **soil incorporation** mixes bio-fertilizers into the soil for even distribution.
In field conditions, methods include **foliar spray**, applying bio-agents directly to leaves; **seed coating**, which protects seeds and promotes root zone colonization; and **soil drenching**, where solutions are applied around plant bases. Incorporating bio-agents into **irrigation systems** ensures uniform distribution, while **intercropping and companion planting** enhance soil health by encouraging beneficial microorganism colonization across multiple crops. These techniques foster sustainable farming, improving crop productivity and soil fertility.

MODULE-08

AIM: Method of increasing storage, shelf-life, quality control and marketing of bio-agents and bio-fertilizers.

Ensuring the effective storage, extended shelf-life, quality control, and strategic marketing of bio-agents and bio-fertilizers is crucial for their success in sustainable agriculture. **Storage and shelf-life** are optimized by maintaining cool, dry conditions, using protective packaging, and incorporating inert carriers or microencapsulation techniques to enhance stability. **Quality control** involves implementing rigorous protocols, developing standardized formulations, and ensuring batch traceability, all while adhering to certifications and regulatory standards to guarantee product efficacy and safety.
Marketing strategies focus on educating stakeholders about the benefits of bio-agents, employing targeted campaigns tailored to specific agricultural needs, and forming distribution partnerships to broaden market reach. Distinctive branding and packaging further enhance product visibility and

consumer trust. By addressing these key areas, producers can safeguard the viability of bio-agents and bio-fertilizers, promote widespread adoption, and advance sustainable agricultural practices on a global scale.

ISOLATION, PURECULTURE & MASS MULTIPLICATION OF *Trichoderma*

Fig.1-Gram plant soil sample

Fig.2-Serial dilution

Fig.3-Preparing PDA

Fig.4- Pouring into the media

Fig.5-Packed the Petri-dish

Fig.6-Pure culture

Fig.7-Mass multiplication

Fig.8-Mass multiplication

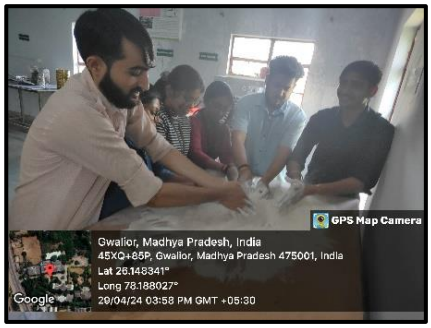

Fig.9-Talc base formulation

Fig.10-Weighing the product

Fig.11-Packaging

Fig.12-Final product

ISOLATION, PURE CULTURE & MASS MULTIPLICATION OF *Rhizobium*

Fig.1- Collect the root nodule

Fig.2-Wash the nodule

Fig.3-Drying the nodules

Fig.4-YEM media

Fig.5-Crushing the nodules

Fig.6-Pouring crush nodule

Fig.7-*Rhizobium* culture

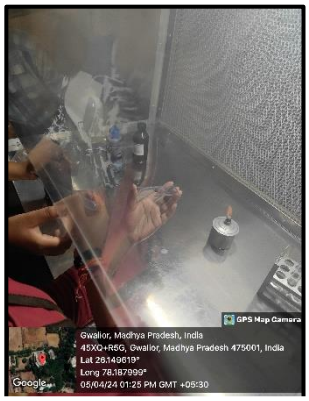

Fig.8-Gram staining

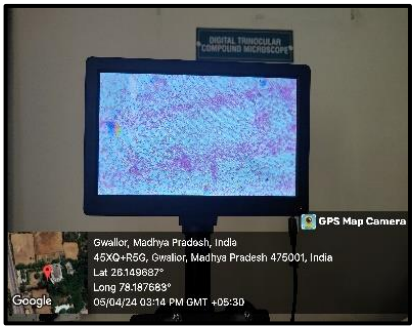

Fig.9-Gram negative

Fig.10-Talc base formulation

Fig.11-Packaging

Fig.12-Final product

ISOLATION, MASS MULTIPLICATION & FORMULATION OF *Azotobacter*

Fig.1- Media

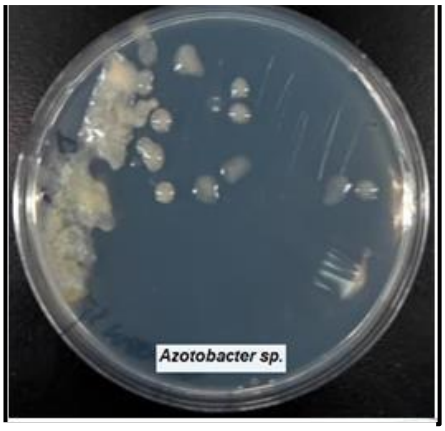

Fig.2 - *Azotobacter* isolation

Fig.3 - Talc base formulation

Fig.4 - Weighing the product

Fig.5 - Final product

ISOLATION, MASS MULTIPLICATION & FORMULATION OF *Pseudomonas*

Fig.1- Media

Fig.2- Culture

Fig.5- Final product

Fig.3- Inoculation

Fig.4- Packaging

ITM UNIVERSITY
GWALIOR • MP • INDIA
"CELEBRATING DREAMS"

Economic opportunities in broiler farming: A case study of Bhadauria Poultry Farm, Industrial Area, Gwalior.

Project based Learning (PBL)

Under the course

AHS-ELP - 401

Bachelor of Science (Agriculture)

Submitted by:

Kishan padhi

BAGN1AG20110

Submitted To:

Prof. Awadhesh Kishore

School of Agriculture ITM University, Gwalior, M.P

2024

Objectives

The objectives of the present project entitled "*Economic opportunities in broiler farming: A case study of Fogi Poultry Farm, Industrial Area, Gwalior*" were hereunder:

1. To study the nature of the broiler farm
2. To identify the parameters to compute cost of production per chicken
3. To find out the fixed capital investment pattern at the broiler farm
4. To record the variable cost pattern at the broiler farm
5. To calculate cost per broiler chicken at the broiler farm
6. To work out returns on broiler farming for the farmer
7. To compute the pay - back period of broiler farming
8. To evaluate the net present value of broiler farm

To estimate the internal rate of return of broiler farm

Methodology

The present project entitled "Economic opportunities in broiler farming: A case study of Fogi Poultry Farm, Industrial Area, Gwalior" employed panel data. Data in 2002 were collected using survey. Data were collected from the *Amir Ali khan (Fogi farm) from Sikander kampoo bara bigha, Gwalior* using a standardized questionnaire enclosed herewith. The farm is situated at (Complete address) run by the commercial broiler farmer Mr. –Amir Ali khan----.

The primary data was collected using questionnaire and interview of the farmer and the employees whereas the secondary data was recorded after consulting the records.

Table 1. Persnol information

Q1-01 Name of the Broiler farm	Fogi poultry farm
Q1-02 Address of the broiler farm	Sikander kampoo bara bigha
Q1-03 Name of the owner	Amir Ali khan
Q1-04 Mobile number	9826258325
Q1-05 Gender (male/female)	Male
Q1-06 Age (years)	57
Q1-07 Cadre (urban/rural)	Rural
Q1-08 Farm type (government/semi-government/private)	Private
Q1-09 Marital status (married/unmarried/others)	Married
Q1-10 Education(illiterate/school/college/university)	School
Q1-11 Health status (good/average/poor)	Good
Q1-12 Occupation (full-time/part-time)	Full-time
Q1-13 Work experience (years)	22
Q1-14 Training course (yes/no)	Yes
Q1-15 Annual family income other than poultry farm (Rs.)	300000

Summary: Fogi Poultry Farm, located at Sikander Kampoo, is owned by Amir Ali Khan, a 45-year-old male (assuming 22 years of work experience starting from age 23). He is a rural resident, married, and has a school education. He is in good health and works full-time on the farm, which is a private enterprise. He has attended training courses and has 22 years of experience in the field. His annual family income is supplemented by other sources

Table 2. Parameters to Compute Cost of Production Per Chicken

S. No.	**Particulars**	**Size of the Broiler Farm**			
					Overall
1	Number of Birds reared per batch				**4000**
2	Number of Batches reared per annum				**28000**
3	Total number of birds reared per annum				**27500**
4	Total number of mortalities per annum				**700**
5	Total number of birds alive per annum				**27300**
6	Mortality Rate				**2%**
7.	Average Weight				**2.5kg**

Summary: Parameters to Compute Cost of production:Number of Birds reared per 4000, Number of Batches reared per 6, Total number of birds reared 27500 Total number of

mortalities per 700 Total number of birds alive per 27300 Mortality Rate 2% Average Weight 2.5 kg

Table 3. Fixed Capital Investment Pattern on Different Broiler Farm

S. No.	Particulars	Size of the Broiler Fa ·m			
					Overall
1	Rental Value of land				**0**
2	Depreciation on Fixed Assets				**0**
3	Repairs and Maintenance				**2000**
4	Interest on Fixed Capital				**0**
5	**Total Fixed Cost**				**2000**

Source: Primary data

Summary: This indicates that the only fixed cost is Repairs and Maintenance, which is ₹2,000. The other components of fixed capital investment are zero, likely due to the assumptions mentioned above

Table 4. Variable Cost Pattern at the Broiler Farm

S.No.	Particulars	Size of the Broiler Farm			
					Overall
1	Chick Cost				**30rs**
2	Feed Cost				**110rs**
3	Medicine Cost				**5rs**
4	Shed Cleaning Cost				**2500rs**
5	Litter Cost				**4000rs**
6	Labour Cost				**10000rs**
37.	Brooding & Heating				**5000rs**
8.	Electricity Charges				**4000rs**
9.	Miscellaneous Expenses				**2000rs**
10.	Interest on Working Capital				**0**
	Total Variable Cost				**27645rs**

Summary: The variable costs for broiler farming are broken down into several components. The cost of chicks is ₹30, while the feed costs ₹110. Medicine costs 5, so we assume zero. Shed cleaning costs ₹2,500, litter costs ₹4,000, and labour costs ₹10,000. Brooding and heating expenses are ₹5,000, electricity charges are ₹4,000, and miscellaneous expenses are ₹2,000.The total variable cost comes out to be ₹27,645

Table 5. Cost per Broiler Chicken at the Broiler Farm

S. No.	Particulars	Size of the Broiler Farm			
					Overall
1	Chick Cost				**30rs**
2	Feed Cost				**110rs**
3	Medicine Cost				**5rs**
4	Shed Cleaning Cost				**2500rs**
5	Litter Cost				**4000rs**
6	Labour Cost				**10000rs**
7	Brooding & Heating				**5000rs**
8	Electricity Charges				**4000rs**
9	Miscellaneous Expenses				**2000rs**
10	Interest on working capital				**0**
11	**Total Variable Cost Fixed Cost**				**27645rs**
12	Rental Value of land				**0**
13	Depreciation on fixed assets				**0**
2.14	Repairs and Maintenance				**2000rs**
15	Interest on fixed capital				
16	**Total Fixed Cost**				**2000rs**
17	**Total Cost before Growing Cost**				**2000rs**
18	Growing Cost per bird				**170rs**
19	**Cost of Production per Bird**				**170rs**
20	Average Weight of Chicken grown				**2.5kg**
21	**Cost of Production per Kg**				**60rs**

Summary: The cost of producing broiler chickens under an integrated farming system is broken down into variable and fixed costs. The variable costs include chick cost (₹30), feed cost (₹110), medicine cost (₹5), and other expenses like shed cleaning, litter, labor, brooding, electricity, and miscellaneous costs, totaling ₹27,645. The fixed costs are minimal, with only ₹2,000 for repairs and maintenance, and no rental value for land, depreciation, or interest on fixed capital. The total cost before growing is ₹20,000, with a growing cost per bird of ₹170, resulting in a cost of production per bird of ₹170 and a cost of production per kg of ₹60, based on an average weight of 2.5 kg per chicken.

Table 6. Returns on Broiler Farming for the Farmer

S.No.	Particulars	Size of the Broiler Farm			
		Small	Medium	Large	Overall
1	Weight of Chicken grown				**2.5kg**
2	Growing Charge per kg				**60rs**
3	Total Growing Charge				**170rs**
4	Sale of Manure				**4000rs**
5	Sale of Gunny bags				**1000rs**
6	**Gross Return (3 + 4 + 5)**				**4270rs**
7	Total Cost				**4330rs**
8	**Net Return (6 7)**				**8600rs**
9	**NPR**				**75000rs**
10	**ROI**				**70.13**

Source: Primary data

Figures in parentheses are percentage to the total

Summary: Broiler farming generates significant returns for farmers. The weight of chicken grown is 2.5 kg, with a growing charge of ₹60 per kg, totaling ₹170. In addition to the growing charge, farmers earn ₹4,000 from selling manure and ₹100 from selling gunny bags, resulting in a gross return of ₹4,270. With a total cost of ₹4,330, the net return is ₹8,600, yielding a return on investment (ROI) of 70.13% and a net profit ratio (NPR) of ₹75,000.

Table 7. Pay - back Period of Broiler Farming

Sl. No.	Particulars	Payback Period	Cut off Year	Remarks
1.	Small Farming			
2.	Medium Farming	**8 Year**	**2 Year**	
3.	Large Farming			

Source: Primary data

Summary:

Pay back Period of broiler farming medium Farming 3 years and cut off Period 5 months

Table 8. Net Present Value of Broiler Farming

Sl. No.	Particulars	Net Present Value (Rupees)	Nature of NPV	Remarks
1.	Small Farming			
2.	Medium Farming	**7000000**	**Poultry farm**	
3.	Large Farming			

Table 9. Internal Rate of Return of Broiler Farming

Sl. No.	Particulars	Internal Rate of Return	Opportunity Cost of Capital	Remarks
1.	Small Farming			
2.	Medium Farming	**16%**	**12%**	
3.	Large Farming			

Summary : Internal rate of broiler farming in medium Farming: Internal rate of return 16% and Opportunity Cost of Capital 12%.

Conclusion

The total fixed investments per bird have been found the highest on small farms, followed by medium and large farms. The total variable costs as well as total costs per bird have been found highest on small farms, followed by medium and large farms. The total cost of meat production has been observed highest on small broiler farms, followed medium and large farms. The net returns per bird over the variable costs have been recorded the highest on large farms, followed by medium and small farms. This increasing trend of net income with the farm size could be attributed mainly to the economies of scale on the large farms. The production efficiency of broiler farms has increased with farm-size due to better utilization of inputs. On the basis of net present value, benefit-cost ratio and internal rate of return, investment in broiler farming has been found most profitable on large farms, followed by medium and smallfarms. The small broiler farms have beenobserved highly sensitive to increase in costs and decrease in net returns


GPS Map Camera
Gwalior, Madhya Pradesh, India
Guda, Pritam Puram Colony, Sikandar Kampoo, Gwalior, Madhya Pradesh
474001, India
Lat 26.175192°
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17/02/24 10:52 AM GMT +05:30
Google


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