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Mushroom Marvels : Empowering Hill Farmers of India through Transformative Entrepreneurship

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ABSTRACT

The global mushroom market has undergone substantial expansion due to the paradigm shift among consumers particularly in the aftermath of the COVID-19 pandemic in quest of healthy nutrition. Grey oyster mushroom, white oyster mushroom , button mushroom , milky mushroom are the commonly grown mushrooms for commercial production in india. mushroom cultivation has multifaceted advantages for entrepreneurship development in rural arena particularly for marginal levels. By drawing inspiration from global exemplars like China and adapting context-specific strategies, nations such as India can chart a course to invigorate their agricultural economies and contribute to a resilient global landscape.

Key words : Mushroom. Types, Mushroom nutrition, Mushroom entrepreneurship, Problems and policy

Introduction

Amidst a rapidly evolving agricultural landscape, the global mushroom market is poised for substantial expansion, projected to surge from 15.25 million tonnes in 2021 to an anticipated 24.05 million tonnes by 2028, reflecting an impressive compound annual growth rate (CAGR) of 6.74% over the forecast period. This robust growth trajectory is deeply intertwined with shifting consumer paradigms, particularly in the aftermath of the COVID-19 pandemic, where heightened health consciousness has propelled the consumption of nutritious and health-enhancing foods such as mushrooms and Truffles. Notably, within this diverse market, the demand for Button mushrooms takes center stage, driving the market's upward trajectory. Yet, the inherent challenge of cultivating Button mushrooms year-round in the plains due to specific climatic requirements underscores the potential pivot towards hill regions, offering a favorable alternative for their sustainable production. In the picturesque landscapes of rural India, where hills extend as far as the eye can see and agriculture reigns supreme, a silent revolution is underway. The traditional narrative of agrarian challenges in these regions is being rewritten, thanks

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to an unexpected protagonist – mushrooms. As the country grapples with the need for sustainable livelihood options, mushroom entrepreneurship has emerged as a beacon of hope, transforming the lives of hill farmers in remarkable ways. Recent data and figures shed light on the potency of this alternative livelihood pursuit.

Scope of mushroom cultivation

According to the National Sample Survey Office (NSSO), over 70% of India's population resides in rural areas, predominantly dependent on agriculture. However, the conventional agricultural practices often prove inadequate in providing consistent income due to various factors including climate vulnerability, shrinking landholdings, and market volatility.

In this context, mushroom cultivation has emerged as a game-changer. The Food and Agriculture Organization of the United Nations (FAO) reports a growing trend of mushroom consumption in India due to its nutritional benefits and versatility in culinary applications. Mushroom farming requires minimal land and water resources, making it an ideal venture for regions grappling with scarcity. Importantly, it offers a faster turnaround time compared to traditional crops – while a paddy crop might take several months to mature, mushrooms can be harvested within weeks, ensuring a more predictable income stream.

Recent success stories bolster the case for mushroom entrepreneurship. In the hills of Himachal Pradesh, for instance, the state government's push towards mushroom cultivation has led to a significant increase in farmer incomes. Reports from the Department of Agriculture reveal that mushroom production in the state has tripled over the past five years, with thousands of farmers reaping the benefits of diversification. A similar trend can be observed in Uttarakhand, where the Horticulture Department's initiatives have spurred a wave of mushroom farming, transforming barren lands into thriving mushroom farms and offering rural communities a lifeline out of poverty.

Over the past decade, rural India has witnessed a significant exodus of its youth from the agricultural sector, with many opting to migrate to urban centers in pursuit of job opportunities, particularly in the infrastructure sector. This trend has prompted a notable shift in focus, where the cultivation of youth entrepreneurship has garnered attention not only from the government and policymakers but also from the research community. While previously an underexplored field, the mounting unemployment rates have compelled thinkers and experts to reassess this paradigm.

Intriguingly, the endeavour to attract and retain young individuals within the realm of agriculture has now evolved into a critical concern for the future of Indian agriculture. The statistics paint a somber picture – more than 2,000 farmers bid farewell to agriculture each day, and over the span of time since 1991, a staggering 15 million farmers have forsaken this occupation (Sainath, 2013). The repercussions of this mass exodus are profound and far-reaching, casting shadows over both the sustenance of Indian agriculture and the nation's overarching food security.

Yet, amidst these challenges lies an untapped potential. The youth, if properly engaged and motivated, can emerge as key players in the preservation of food security. Their active involvement in farming could be a transformative force, rejuvenating the agricultural landscape and ensuring a more stable food supply for the nation. However, this potential can only be harnessed if the myriad challenges that young farmers encounter are effectively addressed.

Within the context of rural India, where traditional agricultural practices have faced challenges in providing consistent income, agri-based entrepreneurship emerges as a promising avenue for the upliftment of rural youth. This shift in focus from conventional farming to entrepreneurship marks a transformative approach towards economic betterment.

At its core, entrepreneurship entails the dynamic process of conceiving, developing, and nurturing a business or venture. It involves formulating a comprehensive business model, acquiring the necessary resources, and then embarking on a journey of perpetual growth through innovation, creativity, and unwavering dedication. The essence of an entrepreneur lies in their ability to envision opportunities where others see obstacles, and to channel their efforts towards realizing these opportunities.

In rural settings, where the traditional agrarian lifestyle has often struggled to provide sustainable livelihoods, the concept of rural entrepreneurship assumes paramount importance. The prospect of diversifying income sources and venturing into innovative enterprises has gained traction, as it holds the potential to not only bolster individual financial situations but also contribute to the overall economic development of rural communities.

Within the spectrum of rural entrepreneurship, there exists a spectrum of possibilities, each uniquely suited to the resources, skills, and aspirations of the local populace. Among these myriad options, one particularly stands out: mushroom-based entrepreneurship. This emerging avenue has garnered attention for its distinctive blend of low initial investment, resource efficiency, and high returns.

Mushroom cultivation, as an entrepreneurial endeavour, epitomizes the fusion of science and nature. It demands a meticulous understanding of environmental conditions, substrate preparation, and cultivation techniques. Entrepreneurs in this domain must master the art of creating a conducive ecosystem for the growth of these fungi, ensuring optimal humidity, temperature, and nutrition. However, the investment in terms of both capital and space is relatively modest compared to traditional forms of agriculture.

Mushroom is one of the most demanded food commodities in world market as for rich source of nutrition. The worldwide mushroom industry has grown at a rapid rate since the late 1990s. World mushroom production has increased more than 25-fold during the last 35 years. Five main genera constitute more than 85% of the world's mushroom supply. *Agaricus bisporus* is the major genus contributing about 30% of the world's cultivated

mushrooms. Pleurotus with 5 to 6 cultivated species constitutes about 27% of the world's output while Lentinula edodes contributes about 17%. The other two genera, Auricularia and Flammulina are responsible for 6% and 5% of the volume, respectively (Royse, 2014). China is the main producer of edible mushrooms. In India mushroom production has increases in recent years with more than 70,000 MT in 2003-04 to over 2.5 Lakh MT in 2021 (DMR, 2022). There was significant increase in production of mushroom in hill states, 2203 MT in 1999-2000 to more than 30000MT in 2021, due to favourable growing environment.

Commonly grown mushrooms for commercial production in India

Grey Oyster Mushroom (*Pleurotusostreatus*) : The Grey Oyster mushroom, characterized by its striking grayish-brown cap and delicate gills, is a popular choice among mushroom enthusiasts. With a subtle, nutty flavor, it is prized for culinary applications and is known for its versatility in various dishes. Grey Oysters thrive on a range of substrates and are relatively easy to cultivate, making them an attractive option for both amateur and commercial cultivators.

White Oyster Mushroom (*Pleurotusflorida*) : Distinguished by its ivory to pale beige hue, the White Oyster mushroom stands out not only for its aesthetic appeal but also its delicate, slightly sweet taste. Its velvety texture and quick growth cycle make it a favorite among home growers and chefs alike. This variety has gained traction for its adaptability to different climates and growing conditions.

Button Mushroom (*Agaricusbisporus*) : The Button Mushroom, often considered a staple in the culinary world, is recognized for its familiar appearance with a white to light beige cap and a firm texture. Widely cultivated and consumed, it boasts a mild, earthy flavor that lends itself well to a wide range of dishes. Button Mushrooms are commonly found in grocery stores and are a valuable source of essential nutrients like B vitamins and selenium.

Milky Mushroom (*Calocybeindica*) : The Milky Mushroom, native to India, stands out for its distinctive appearance with a creamy white cap and thick stem. Renowned for its succulent taste and meaty texture, this mushroom has gained popularity in various cuisines. Milky Mushrooms are not only sought after for their culinary attributes but also for their potential health benefits, as they are believed to possess antioxidant and immune-modulatory properties.

These mushroom varieties, each with its unique characteristics and flavors, contribute not only to gastronomic diversity but also to the growing field of mushroom cultivation and entrepreneurship. From the visually appealing Grey Oyster and White Oyster mushrooms to the ubiquitous Button Mushroom and the culturally significant Milky Mushroom, these fungi offer a myriad of opportunities for both culinary exploration and economic endeavors. The commonly grown mushrooms in Uttarakhand are listed in Table 1.

Table 1 : Types of cultivated speciality mushrooms and their temperature range

Common name	Scientific name	Temperature range
Grey Oyster	*Pleurotussajor-caju*	20-28^0 C
White Oyster	*Pleurotusflorida*	20-25^0 C
Button Mushroom	*Agaricusbisporus*	14-22^0 C
Milky Mushroom	*Calocybeindica*	28-32^0 C

Source : AICRP on Mushroom Workshop. 2016

Mushroom nutrition

- ***High Nutritional and Medicinal Value :*** Mushrooms are distinguished for their notable nutritional and medicinal contributions.
- ***Protein Content :*** Mushrooms contain approximately 3-7% protein (fresh weight basis) and 25-40% (dry weight basis), thereby offering a significant protein source.
- ***Essential Amino Acids :*** Mushroom composition includes all essential amino acids, notably lysine, tryptophan, and amides, underpinning their comprehensive nutritional profile.
- ***Health Impact :*** Mushroom consumption showcases potential in impeding the progression and impact of ailments such as cancer, heart diseases, and HIV/AIDS, attributed to its immunomodulatory effects.
- ***Economic Significance :*** Mushrooms offer avenues for improved income generation and employment opportunities, adding to their socioeconomic significance.
- ***Vitamin Content :*** Noteworthy vitamin content encompasses Vitamin C and Cyanocobalamin (Vitamin B12), a nutrient typically associated with animal products.
- ***Sodium Content :*** Mushroom's naturally low sodium content renders it suitable for individuals with cardiovascular and renal conditions, mitigating risks.
- ***Mineral Composition :*** The inclusion of essential minerals such as iron, calcium, potassium, phosphorus, and folic acid further amplifies the nutritional worth of mushrooms.

Mushroom entrepreneurship :

As an entrepreneurship, mushroom cultivation has several advantages. Besides other agricultural activities, farmers can grow mushroom in any spare room or low cost hut with limited resources which are readily available such as paddy straw, wheat straw, minimum labour and capital required for raising the crop. This activity helps them to increase their annual income and extends employment days as well as diversity in socio-economic conditions of farmers. Yet mushroom cultivation requires sufficient knowledge and technical know-how, economics of mushroom

production and marketing strategy for developing entrepreneurial skills in this important crop.

Mushroom production advantages

1. *Space Utilization Versatility:* Mushroom cultivation thrives within existing structures such as spare rooms, huts, and garages, ingeniously optimizing underutilized spaces for entrepreneurial ventures.
2. *Low Capital Entry Barrier :* With minimal initial capital requirements, mushroom- based entrepreneurship opens doors to individuals with limited financial resources, fostering a more inclusive and diverse entrepreneurial landscape.
3. *Year-Round Production :* The distinct advantage of continuous cultivation translates to consistent year-round production, mitigating the impact of seasonal fluctuations on income stability.
4. *Resourceful Waste Utilization :* Harnessing agricultural waste materials like paddy straw and wheat straw as substrates underscores the circular economy approach, transforming discarded materials into valuable resources.
5. *Eco-Friendly Bio-Degraders :* Mushrooms play a pivotal role in ecosystem health by acting as bio-degraders, effectively breaking down organic matter and contributing to the recycling of vital soil minerals.
6. *Nutrient-Rich Yield :* The resulting mushroom harvest is a nutrient-rich yield that contributes to both household sustenance and potential income generation, offering a multi-faceted approach to agricultural entrepreneurship.
7. *Shorter Growth Cycle :* Mushrooms boast a shorter growth cycle compared to many traditional crops, allowing for quicker turnover and potentially higher profit margins within a shorter timeframe.
8. *High-Value Crop :* Mushrooms occupy a premium niche in the culinary world due to their unique flavors and textures, positioning them as a high-value crop with potential for upscale markets.
9. *Health and Medicinal Attributes :* Certain mushroom varieties are known for their health-promoting and medicinal properties, tapping into a growing market segment focused on wellness and alternative therapies.
10. *Diversification of Income :* Integrating mushroom cultivation diversifies income sources for farmers, helping to reduce dependence on single crops and enhancing overall financial resilience.
11. *Employment Opportunities :* Beyond individual entrepreneurship, mushroom cultivation can foster community-based initiatives, generating employment opportunities and contributing to rural development.
12. *Educational and Skill Development :* The multifaceted nature of mushroom cultivation imparts valuable agricultural, technical, and

entrepreneurial skills, empowering individuals with diverse expertise.

13. *Environmental Sustainability :* The eco-friendly nature of mushroom cultivation aligns with sustainable farming practices, contributing to soil health, reducing waste, and minimizing environmental impact.
14. *Innovation and Research :* Engaging in mushroom entrepreneurship encourages innovation and research, driving advancements in cultivation techniques, resource utilization, and product development.
15. *Cultural and Culinary Exploration :* Different mushroom varieties offer a rich canvas for culinary creativity,

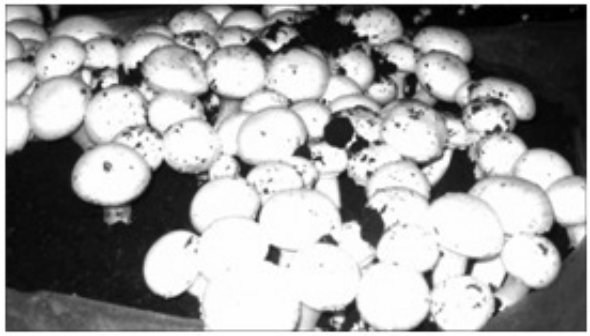

Plate 1 : Mushroom production activity on farmers' field at district Almora in Uttarakhand

- ***Sustainable Hut Construction :*** Crafting mushroom huts using eco-friendly and cost-effective materials such as straw, grasses, and bamboo lays the foundation for marginal-level mushroom production. These biodegradable materials not only keep production costs low but also align with environmentally conscious practices.
- ***Optimal Hut Size :*** Tailoring hut dimensions to accommodate mushroom production is crucial. For cultivating 5 tonnes of mushroom compost, a hut measuring 30 x 17 x 8 ft suffices, while 10 tonnes of compost necessitate a 40 x 23 x 8 ft hut. Within these huts, ingenious 4-tier racks can be ingeniously fashioned from bamboo, wooden sticks, and straw, optimizing space utilization.

- ***Knowledge Empowerment :*** Acquiring comprehensive knowledge and skills in mushroom production forms the bedrock of success. Engaging in training and skill development programs becomes paramount. Institutions and organizations offer short and long-term courses on mushroom cultivation, value addition, and marketing. Platforms like KVK, RSETI, and Block offices frequently organize workshops and sessions on mushroom-based entrepreneurship, providing valuable insights. Exploring agri-preneur schemes offered by NABARD further offers the possibility of setting up small-scale enterprises.

- ***Precise Compost Preparation :*** The pivotal role of compost in button mushroom growth underscores the need for meticulous composting. Pasteurization of compost is essential to create a disease-free medium for cultivation. Compost can be fashioned through personal efforts via the long composting method or sourced from certified dealers and suppliers through the short composting method.

- ***Lucrative Endeavor :*** Mushroom cultivation at the marginal level offers an economically viable prospect. It yields a substantial income stream, contributing to financial stability and potentially transforming marginal farmers into thriving entrepreneurs.

By strategically integrating these facets, mushroom production at the marginal level emerges as a promising pathway to enhance livelihoods, foster sustainable practices, and tap into the lucrative realm of agricultural entrepreneurship.

Profit of mushroom production in hills :

In hilly region mushroom can be an alternative options for livelihood. In hills mushroom can be grown year round as the agro-climatic conditions are suitable for mushroom cultivation in hills of Uttarakhand. The main two kind of mushrooms which has become commercial now a days can enhance the livelihood security of marginal and landless farmers. Mushroom farming is better option to such farmers along with other agricultural activities and it requires limited resources such as any spare room, paddy/ wheat or cereal straw, minimum labour and capital. The economics of mushroom and probable annual income is depicted in table 2 and table 3.

The year round production of mushroom can add an additional thirteen thousand to the pockets of hill farmer a month (Table 2-4). It has been seen that the migration problem has vacated several villages in Uttarakhand. The Uttarakhand state statistics department claims that 1065 villages have permanently turned into ghost villages because of migration (Chopra, 2014). Provision of optimum livelihood can attract and retain youth towards agriculture. In this aspect mushroom can act as a catalyst for hills.

If we go through mushroom statistics of the world, India's annual mushroom production is still negligible as compared to world production. Presently, about 0.12 million tons of fresh mushroom is being produced in India as against over 7.0 million tons world production of mushroom annually. In spite of three decades of

Table 2 : Economics of Button Mushroom (5 tonnes compost Capacity)

S.No	Particulars	Quantity required	Rate per kg in Rs.	Total cost in Rs.
1	**Fixed Cost**			
	Construction of mushroom hut	30*17*9 ft. with 4 tiers	38000	38000
	Spray pump	1	1500	1500
	Thermometer	1	100	100
	Hygrometer	1	1529	1529
	Balance/ weighing instrument	1	2283	2283
	Buckets/ mugs etc.	2	100	200
	Total fixed cost			43612
2	**Variable cost**			
	Dry substrates/Compost @ Rs 30/kg	190 kg	30	5700
	Casing soil	10 kg	15	150
	Spawn	42.5 kg	120	5100
	Pesticides and insecticides	To control pest & diseases	1000	1000
	Degradable polythene bags for packaging	1000 No.	3000	3000
	Labour cost	45 days	400/day	18000
	Fuel+ Electricity charges	45 days	5/day	225
	Transportation	Input & output	1000	1000
	Miscellaneous cost (Grading, packaging, marketing etc.)		5000	5000
	Total variable cost			39175
3	Total mushroom production cost			82787
4	Total mushroom production (@ 5 kg yield/kg of compost used)	850 kg		850
5	Farm level price of button mushroom/kg			150
6	Gross income	Framer's fMield price Rs. 150/kg	127500	127500
7	Depreciation on manually operated fixed assets (@ 20%)			8722.4
8	Interest on fixed capital investment @10%)			4361.2
9	Net Profit			75241.4
10	BC Ratio on total cost			1.540097
11	Net income, If farmer's takes 2 crops per year			150482.8

Table 3 : Economics of Oyster Mushroom (800 kg strawcapacity)

S.No	Particulars	Rs.
	Fixed **Cost**	
1	Cost of room construction 20*20	30000
2	Cost of 10 racks 6*6	5000
3	Drum	500
4	30 Gunny bags	1000
5	1 grass cutter	1000
6	1 Thermo hygrometer	1100
7	Boiling vessel to boil the grass	500
	Total fixed cost	39100
1	800 kg straw @ 5/- per kg	4000
2	500 polythene bags	100
3	80 kg spawn	8000
4	chemicals	200
5	labour, electricity, irrigation	2000
6	miscellaneous	1500
	Total variable cost	15800
	Total mushroom production cost	54900
	Total mushroom production (yield @ 60% of straw in kg)	480
	Farm level price of oyster mushroom/kg	120
	Gross income	57600
	Depreciation on manually operated fixed assets (@ 20%)	7820
	Interest on fixed capital investment (@10%)	3910
	Net Profit per crop rotation	30070
	BC Ratio on total cost	1.05
	Net income, If farmer's takes 2 crops per year	60140

Table 4 : Annual income through year round mushroom production in Hills

Sl No	**Mushroom**	**Crops per year**	**Profit/crop**	**Total profit**
1	Button	2 (Feb-April, Oct-Dec)	75241.4	150482.8
2	Oyster	2 (March-May, July-Sept)	30070	60140.0
	Total annual income			**210622.00**
	Average monthly income			**17551.83**

planned efforts, the mushroom cultivation is still at infant stage in our country. Apart from technical know-how, the climate for cultivation of various kinds of mushrooms is also conducive and the raw materials (agro-waste) required for their substrate preparation are available in plenty in rural India.

Different types of mushroom entrepreneurship options

Mushroom entrepreneurship offers a diverse range of options, each with its unique characteristics, challenges, and opportunities. Here are some different types of mushroom entrepreneurship options :

Commercial Mushroom Cultivation : This involves large-scale cultivation of mushrooms, such as oyster mushrooms, shiitake mushrooms, or button mushrooms, for sale in local markets, grocery stores, restaurants, and even export. It requires specialized knowledge in cultivation techniques, substrate preparation, and market trends.

Value-Added Products : Entrepreneurs can focus on creating value-added products using mushrooms, such as mushroom-based snacks, soups, sauces, and health supplements. This involves processing and packaging mushrooms in innovative ways to cater to specific consumer demands.

Mushroom Spawn Production : Producing and selling high-quality mushroom spawn (the seed material for mushroom cultivation) can be a lucrative venture. Entrepreneurs can establish spawn production units and supply them to mushroom cultivators, helping to meet the demand for quality planting material.

Medicinal Mushroom Cultivation : This involves growing medicinal and functional mushrooms known for their health benefits, like reishi, lion's mane, and cordyceps. Medicinal mushrooms are sought after for their potential immune-boosting, anti-inflammatory, and antioxidant properties.

Urban Mushroom Farming : Entrepreneurs can set up small-scale mushroom farms in urban areas, utilizing limited spaces like balconies, rooftops, or even indoors. This approach caters to urban markets and emphasizes sustainability and local food production.

Mushroom Tours and Workshops : Creating educational and experiential opportunities, entrepreneurs can offer guided tours of mushroom farms,

workshops on mushroom cultivation, and mushroom foraging experiences for enthusiasts and curious individuals.

Export-Oriented Mushroom Business : This involves targeting international markets by cultivating mushrooms that have high demand abroad and meeting quality and regulatory standards for export.

These various mushroom entrepreneurship options reflect the diverse avenues through which individuals can enter the thriving world of mushroom cultivation and contribute to both local economies and global food systems.

Learning points form China

China's meteoric rise to become the world's largest producer of mushrooms and truffles is a testament to its strategic approach, conducive environmental conditions, and sustained commitment to agricultural innovation. With an annual production volume of a staggering 7.8 Million tonnes, China has established itself as a global powerhouse in mushroom cultivation.

Several key factors have contributed to China's dominant position in the global mushroom market:

Scale of Production : China's vast land area and population provide a substantial base for agricultural activities, including mushroom cultivation. The country's extensive production infrastructure and workforce enable it to scale up mushroom cultivation to meet both domestic and international demand.

Diverse Geographic and Climatic Zones : China's diverse geography and climatic zones offer a wide range of conditions suitable for growing different mushroom varieties. This geographical diversity allows for year-round production of various mushroom species, ensuring a consistent supply to the market.

Government Support and Investment : The Chinese government has actively supported agricultural development, including mushroom cultivation, through policy incentives, research funding, and technical assistance. This support has facilitated the adoption of modern cultivation techniques and the development of advanced technologies.

Research and Innovation : China has invested significantly in mushroom research and development, leading to the creation of improved cultivation methods, disease-resistant strains, and optimized production processes. This commitment to innovation has contributed to higher yields and improved quality.

Export-Oriented Approach : China's focus on export-oriented agriculture has led to increased production for international markets. The country's efficient supply chain and competitive pricing have enabled it to capture a significant share of the global mushroom trade.

Entrepreneurial Culture : The entrepreneurial spirit within China's agricultural sector has driven the adoption of new technologies and business models in mushroom cultivation. This has encouraged the emergence of a diverse range of mushroom entrepreneurship options, from small-scale farmers to large commercial enterprises.

Problems of Mushroom Entrepreneurship in India

Despite all the favourable conditions, the cultivation of mushrooms in India is still primitive and is not spreading fast. Several reasons are there which may be directly or indirectly responsible for the slow development of mushroom cultivation.

Lack of good quality spawn : The yield of mushroom depends upon spawn quality. Good quality of spawn should be free from diseases with high yield potential. The non- availability of quality spawn is a common problem of the growers. Generally, the private spawn producers who are not equipped with the knowledge & facility for mushroom production are selling the spawn claiming that they have developed new high yielding strains. In fact, the spawn producers procure the mother culture of mushroom from Govt. organization or prepare the culture by selecting a healthy mushroom and using it for making commercial spawn of mushroom with their own brand name. Sometimes, mushroom growers get immature spawn which results in delayed spawn run or contamination.

Uncontrolled price structure of mushroom : When there is a glut in the market, the price of mushroom falls down to Rs. 20-30/kg but as the demand increases or shortage of mushrooms in the market the prices rise upto Rs. 60-70/kg. Thus there is always an uncertainty in market price of mushroom which reduces the amount of net profit and discourages the mushroom growers. This problem gets aggravated during peak production months, also because there is no minimum support price from the Govt. even in states with good number of mushroom farmers.

Lack of common facility for pre-cooling and storage of fresh mushroom : This is also severe problem being experienced by mushroom growers. During the peak production period, growers are unable to dispose of their fresh mushroom on the same day and they are forced to keep it for the next day. In such a situation, the quality of fresh mushroom deteriorates and it also loses weight as it is a highly perishable commodity which can only be stored for about 12 hrs at room temperature and 2-3 days at 5^0C.

High transportation charges: Though, agro and animal wastes are available in plenty in India yet their availability is not evenly distributed. Due to diversified climate and topography of land, different kinds of crops are raised in different parts of the country. For instance, wheat and paddy straw is easily available at cheaper rates in the plains of north India while the same is a scarce commodity in the hilly regions. Since mushroom cultivation is based on agro-waste, the raw materials required for its cultivation are usually transported from plains to hills in huge quantity and mushroom growers have to pay heavy transportation charges resulting in avoidable increase in cost of production and reduction in net profit.

Commercial rate of electricity tariff : Mushroom growers have to pay electricity charges at commercial rate, although mushroom farming is an agricultural activity. Many times it has been highlighted by the concerned scientific community during scientific gatherings, seminars, meetings, etc. This

has led to high cost of production due to increased capital as well as recurring expenditure on mushroom farming.

Lack of marketing facilities: When a large quantity of mushrooms is harvested per day, its marketing becomes a major problem. Mushroom growers cannot dispose of large quantity of mushroom more than the daily demand in the local market and in nearby cities. In such a situation, he has to dispose of the remaining quantity of mushroom either at a distress-price or he has to transport it to different places where demand of mushroom is high.

Complex process of obtaining loan/ finance : Mushroom cultivation demands heavy investment in the initial stages. The small & marginal seasonal mushroom growers who want to expand their temporary mushroom farms and those farmers who want to start afresh are usually unable to invest the required amount of money from their own pocket. Therefore, they approach the financial organization to obtain loan for this purpose. But the formalities of financial organization are so complex that the seasonal mushroom growers & farmers cannot get the finance easily.

Lack of training facilities: Training is an essential component for successful adoption of the technology of mushroom farming. Only a few State Agriculture Universities and KVK's are providing guidance on mushroom farming to farmers. Hence this is a major problem which discourages the farmers to take up the cultivation of this non-traditional crop.

Inadequate testing and diagnostic facilities: Besides technical expertise, mushroom cultivation also demands hygienic conditions in its surroundings. To maintain hygienic conditions in the village situation is very difficult and thus chances of contaminations are much more which sometimes damages mushroom crop to a greater extent. The extent of losses can be reduced if the causes of loss are diagnosed in time and remedial measures are taken urgently. However, there are very few research organizations where quality parameter testing and pest and diseases diagnostic facilities exist. Finally, when mushroom growers need guidance, they approach nearby Agriculture Universities/ State Department of Horticulture/State Department of Agriculture but they often return without proper solution as these institutions/departments lack expertise for testing the quality parameters as well as diagnosis and control measures of pests and diseases.

Lack of Interest of Academia : There is a lack of interest of academic scientists in the fundamental biological studies of edible mushrooms. This is responsible for delaying the massive production of edible mushrooms and fundamental knowledge of the biological nature of mushrooms cultivated is still meagre. Without such basic knowledge, the development of a mushroom industry is difficult, because cultivation of mushrooms requires very strong regional and local adaptation.

Last, but not least, is the problem of keeping the techniques secret. Mushroom growers in general do not trust their competitors and, unfortunately, some mushroom researchers also adopt the same attitude toward their colleagues. They should share their experience and knowledge in order to enlarge and promote

mushroom cultivation. By sharing their results, they will share the benefits.

Policy Recommendations for Enhancing hill based mushroom farming in India :

Spawn Quality Enhancement : Establish a centralized agency or research institute dedicated to the production and distribution of high-quality mushroom spawn. This initiative could include collaborations with research institutions and private enterprises to ensure accessibility of quality spawn to hill farmers.

Price Regulation Mechanism : Institute a price monitoring framework to regulate mushroom prices and prevent uncontrolled price fluctuations. Collaboration with local governments and market authorities could help stabilize prices, ensuring fair returns for farmers while keeping consumer affordability in mind.

Integrated Post-Harvest Infrastructure : Create a network of common pre-cooling and storage facilities strategically located in hill farming regions. Government funding and private partnerships could facilitate the establishment of these facilities, reducing post-harvest losses and extending shelf life.

Transportation Subsidies : Introduce transportation subsidies specifically targeting hill farmers to alleviate the burden of high transportation charges, ensuring that their produce reaches markets in a cost-effective manner.

Electrification Subsidies : Offer subsidized electricity tariffs for hill farmers engaged in mushroom cultivation, incentivizing their adoption of modern techniques and technology without undue financial strain.

Market Linkages and Promotion : Develop dedicated farmer-producer cooperatives or associations for mushroom growers to collectively address marketing challenges. Collaborate with retail chains, local markets, and e-commerce platforms to provide direct market access for hill farmers.

Streamlined Loan Application Process : Simplify and expedite the loan application process for agricultural entrepreneurs. Establish a dedicated agricultural finance cell that provides personalized guidance and support to hill farmers seeking financial assistance for mushroom cultivation.

Skill Development and Training : Establish training centers in collaboration with agricultural universities, research institutes, and industry experts. These centers would offer comprehensive training programs, equipping hill farmers with the technical know-how and best practices required for successful mushroom cultivation.

Diagnostic and Testing Centers : Invest in the establishment of testing and diagnostic facilities in hill farming regions to enable quick and accurate disease detection, quality assessment, and research-based solutions for mushroom cultivation challenges.

Academia-Industry Collaboration : Foster stronger ties between academia and mushroom cultivation industry players. Encourage research, knowledge sharing, and collaboration on innovative cultivation techniques, pest management, and market

trends to invigorate academic interest in the sector.

Research and Development Grants : Allocate government grants and incentives to encourage research and development efforts specifically focused on hill farming and mushroom cultivation. These grants could fund studies on local varieties, sustainable practices, and climate-resilient approaches tailored to hill regions.

Enabling Synergies: Fostering the Nexus between FPOs and Mushroom Enterprises

By formulating a comprehensive policy framework to tackle these obstacles, India holds the key to unlocking the immense potential of both hill farming and mushroom cultivation. This integrated approach not only envisions elevating agricultural practices but also paves the way for a flourishing ecosystem that empowers rural farmers, amplifies livelihood opportunities, and contributes holistically to the sustainability of the agricultural sector.

In this transformative journey, Farmer Producer Organizations (FPOs) play a pivotal role in steering rural livelihoods towards a brighter horizon. These collective entities serve as catalysts, channeling their collective strengths to foster economic growth and knowledge dissemination. Harnessing the potential of FPOs can lead to a paradigm shift, driving rural entrepreneurship and enhancing the export capacity of mushroom produce, thereby opening avenues for capturing lucrative Asian markets and potentially challenging China's dominance.

Strategic pathways emerge through these FPOs to forge robust linkages between entrepreneurs and inputs procurement. By facilitating bulk procurement of essential resources, FPOs optimize costs, enhance bargaining power, and ensure the consistent availability of quality inputs for mushroom cultivation. Concurrently, FPO-led export initiatives, ably supported by organizations like APEDA, can chart a course toward tapping into overseas markets, aligning with India's export-oriented agricultural ambitions.

The symbiotic relationship between FPOs and entrepreneurship further extends to financial facilitation. Collaborative efforts with institutions like NABARD can expedite the disbursement of loans, empowering aspiring mushroom entrepreneurs with the necessary financial backing to realize their endeavors. This synergy seamlessly interconnects input procurement, export orientation, and overseas market linkage, culminating in a comprehensive ecosystem that propels the mushroom industry towards unprecedented heights.

Conclusions

In the realm of rural entrepreneurship, mushrooms stand as a transformative catalyst, offering a tangible avenue for unemployed youth to secure a steady income source. This unassuming fungus, revered globally for its nutritional richness and market demand, holds the potential to metamorphose into a thriving small-scale industry, particularly within hilly regions. However, this burgeoning enterprise faces hurdles in the form of youth unawareness about its economic promise, persistent traditional misconceptions, and the scarcity of quality spawn. Nevertheless, these challenges are not insurmountable.

A concerted effort, fueled by targeted awareness programs, comprehensive training initiatives, and strategic collaborations with business entities and markets, can pave the way for a resounding transformation. As the narrative of mushroom entrepreneurship unfolds, it casts a beacon of optimism, seamlessly merging economic empowerment, environmental stewardship, and nutritional enhancement. By drawing inspiration from global exemplars like China and adapting context-specific strategies, nations such as India can chart a course to invigorate their agricultural economies and contribute to a resilient global landscape.

In the quest for sustainable agriculture, the mushroom's ascent from humble fungi to a formidable force in the agricultural domain underscores the potency of innovation, collective synergy, and visionary foresight. As we tread this path, we not only fortify our agricultural foundations but also lay the groundwork for a nourished and sustainable future. In this journey, the cultivation of mushrooms not only enriches our soils but also fosters an ecosystem where economic prosperity, environmental harmony, and wholesome nourishment coalesce—a testament to the indomitable spirit of human enterprise.

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