
Commercial Utilization of Mushroom Cultivation: The Case of Assam

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ABSTRACT

Mushrooms are considered to be a complete, health food and suitable for all age groups, child to aged people. Mushrooms are rich in protein, dietary fiber, vitamins and minerals. In addition to good quality protein, no cholesterol, high fiber, low sodium, good quantity of vitamins and minerals, the mushrooms also have bioactive compounds like b-glucans, protein polysaccharide complexes that impart unique medicinal values like anti cancer and anti-viral properties. With ever increasing demand for quality food, mushroom cultivation is emerging as an important activity in different parts of our country. This activity requires very little land and can be good source of employment for small and landless farmers, educated youth and women in rural areas. The two primary inputs for mushroom cultivation i.e. agro-wastes and labour, are easily available in our country. Integrating mushroom cultivation in existing farming systems will supplement the income of rural masses, provide gainful employment and will lead to inclusive growth as all sections of society can adopt this venture. In this research paper an attempt is made to explore the commercial utilization of mushroom cultivation in Assam and also to suggest policy implications.

Keywords: Mushrooms, Nutritional Value, Medicinal Value, Rural Poor

Introduction:

Mushroom cultivation being an indoor activity, labour intensive and high profit venture provides ample opportunities for gainful employment of small farmers, landless labourers, women and unemployed youth in rural areas. Therefore, the commercial utilization of mushroom cultivation shall a step to meet nutritional and medicinal needs to reduce malnutrition and providing livelihood to rural poor. In Assam, mushrooms are a highly coveted item of food. The different kinds of edible and non-poisonous mushroom that are consumed in the state grow wild. There have been regular systematic plans at present to promote domestic cultivation of mushrooms. The horticulture department of almost all states do have scheme for promotion of mushrooms. And yet, commercial production of mushroom to a significant extent has not taken place so far. The efforts in this direction continue, both by the Government agencies and by voluntary social service organizations.

Assam is not easily accessible by normal surface or water transport, which is one of the reasons which inhibit the rapid economic development of the state. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura constitute the so-called NE, but for development programmes, Sikkim has also been added. As the cultivation is almost non-existent and agriculture is of subsistence in kind in most parts, unemployment and underemployment prevail. Any program for economic development of this region might take into account the profitability of the venture, employment generation suitability of the climate and linking of the people. A low volume-high value commodity venture like mushroom production is perhaps a highly suitable agro industrial venture. It is not only highly profitable but is also labour-intensive, and above all not dependent on arable land. Mushrooms are grown indoors and rooms or huts can be raised on otherwise idle land such as slopes. The venture, being indoor highly suited to womenfolk. Being highly profitable and labour intensive, it can attract the youth.

Objectives of the Study:

- i) To identify the commercial utilization of mushroom cultivation in Assam;
- ii) To study the problems of mushroom cultivation and to suggest policy measures.

Methodology:

The present study on the commercial utilization of mushroom cultivation in Assam was conducted a field study in the different survey spots of Assam. The documented information was verified by cross checking with knowledgeable and elderly farmers of different survey spots. The secondary data was also collected from different sources like books, journals, newspapers, reports, etc. The findings are discussed in light of published literature.

Discussion and Results:

Quality food, health and environment are the major concerns facing our state. Mushroom cultivation helps to address the issue of nutritional security and also provides solution for proper recycling of agro-wastes. In addition to good quality protein, no cholesterol, high fiber, low sodium, good quantity of vitamins and minerals, the mushrooms also have bioactive compounds like b-glucans, protein polysaccharide complexes that impart unique medicinal values like anti cancer and anti-viral properties. With ever increasing demand for quality food, mushroom cultivation is emerging as an important activity in different parts of our country. This activity requires very little land and can be good source of employment for small and landless farmers, educated youth and women. The two primary inputs for mushroom cultivation i.e. agro-wastes and labour, are easily available in our country. Integrating mushroom cultivation in existing farming systems will supplement the income of rural masses, provide gainful employment and will lead to inclusive growth as all sections of society can adopt this venture.

Mushrooms as Nutraceutical Value:

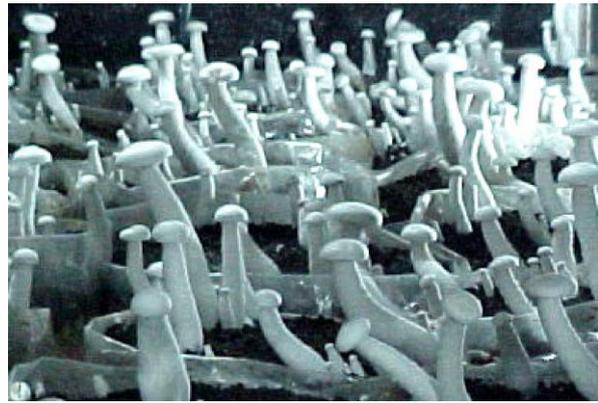
It is well known that the Assamese diet is primarily based on cereals (rice, wheat, and maize), which is deficient in protein. Supplementation of mushroom recipe in Assamese diet will bridge protein gap and improve the general health of socio-economically backward communities. Earlier mushrooms were considered as an expensive vegetable and were preferred by affluent peoples for culinary purposes. Currently common populace also considers mushroom as a quality food due to its health benefits.

Mushrooms are considered to be a complete, health food and suitable for all age groups, child to aged people. The nutritional value of mushroom is affected by numerous factors such as species, stage of development and environmental conditions. Mushrooms are rich in protein, dietary fiber, vitamins and minerals. The digestible carbohydrate profile of mushroom includes starches, pentoses, hexoses, disaccharides, amino sugars, sugar alcohols and sugar acids. The total carbohydrate content in mushroom varied from 26-82% on dry weight basis in different mushrooms. The crude fibre composition of the mushroom consists of partially digestible polysaccharides and chitin. Edible mushrooms

commonly have insignificant lipid level with higher proportion of polyunsaturated fatty acids. All these result in low calorific yield from mushroom foods.

Mushrooms do not have cholesterol. Instead, they have ergo sterol that acts as a precursor for Vitamin D synthesis in human body. Similarly, ergo sterol in button mushroom is converted in to vitamin D₂ when exposed to UV radiation or sunlight. The protein content of edible mushrooms is usually high, but varies greatly. The crude protein content of mushrooms varied from 12-35% depending upon the species. The free amino acids composition differs widely but in general they are rich in histidine and valine but deficient in sulphur containing amino acids (methionine and cysteine).

Mushrooms comprise about 80-90% of water, and 8-10% of fiber. In addition to these, mushroom is an excellent source of vitamins especially C and B (Folic acid, Thiamine, Riboflavin and Niacin). Minerals viz., potassium, sodium and phosphorous are higher in fruit bodies of the mushroom. It also contains other essential minerals (Cu, Zn, Mg) in traces but deficient in iron and calcium.



Button Mushrooms

Milky Mushrooms



Oyster Mushrooms

Table 1: Present Trend of Mushroom Production in Assam including NER (tones), 2010

State	Button	Oyster	Milky	Other Mushroom	Total Production
Assam	20	100	5	0	125
Arunachal Pradesh	20	5	0	1	26
Manipur	0	10	0	50	60
Mizoram	0	50	0	0	50
Meghalaya	25	2	0	0	27
Tripura	0	100	0	0	100
Nagaland	0	75	0	0	75
Sikkim	1	2	0	0	3

Source: RMCU, DMR, Solan, 2010

Mushrooms as Medicinal Value:

Since thousands of years, edible fungi have been revered for their immense health benefits and extensively used in folk medicine. Specific biochemical compounds in mushrooms are responsible for improving human health in many ways. These bioactive compounds include polysaccharides, tri-terpenoids, low molecular weight proteins, glycoproteins and immunomodulating compounds. Hence mushrooms have been shown to promote immune function; boost health; lower the risk of cancer; inhibit tumor growth; help balancing blood sugar; ward off viruses, bacteria, and fungi; reduce inflammation; and support the body's detoxification mechanisms. Increasing recognition of mushrooms in complementing conventional medicines is also well known for fighting many diseases. Medicinal values of the some important mushroom are given in the following heads.

Good for heart: The edible mushrooms have little fat with higher proportion of unsaturated fatty acids and absence of cholesterol and consequently it is the relevant choice for heart patients and treating cardiovascular diseases. Minimal sodium with rich potassium in mushroom enhances salt balance and maintaining blood circulation in human being. Hence, mushrooms are suitable for people suffering from high blood pressure. Regular consumption of mushrooms like *Lentinula*, *Pleurotus* spp. decreases cholesterol levels. The lovastatin obtained from *Pleurotus ostreatus* and eritadenine obtained from shiitake has the ability to reduce blood cholesterol levels.

Low calorie food: The diabetic patients choose mushroom as an ideal food due to its low calorific value, no starch, little fat and sugars. The lean proteins present in mushrooms help to burn cholesterol in the body. Thus it is most preferable food for people striving to shed their extra weight.

Prevents cancer: Compounds restricting tumor activities are found in some mushrooms but only a limited number have undergone clinical trials. All forms of edible mushrooms, and white button mushrooms in particular, can prevent prostate and breast cancer. Fresh mushrooms are capable of arresting the action of 5-alpha reductase and aromatase chemicals responsible for growth of cancerous tumors. The drug known as Polysaccharide-K (Kresin), is isolated from *Trametes vesicular* (*Coriolus versicolor*), which is used as a leading cancer drug. Some mushroom-derived polysaccharides have ability to reduce the side effects of radiotherapy and chemotherapy too. Such effects have been clinically validated in mushrooms like *Lentinula edodes*, *Trametes versicolor*, *Agaricus bisporus* and others. Selenium in the form of selenoproteins found in mushrooms has anticancer properties. According to the International Copper Association, the mushroom's high copper levels help to reduce colon cancer besides osteoporosis.

Anti-aging property: The polysaccharides from mushrooms are potent scavengers of super oxide free radicals. These antioxidants prevent the action of free radicals in the body, consequently reducing the aging process. Ergothioneine is a specific antioxidant found in *Flammulina velutipes* and *Agaricus bisporus* which is necessary for healthy eyes, kidney, bone marrow, liver and skin.

Regulates digestive system: The fermentable fiber as well as oligosaccharide from mushrooms acts as a prebiotics in intestine and therefore they anchor useful bacteria in the colon. This dietary fibre assists the digestion process and healthy functioning of bowel system.

Strengthens immunity: Mushrooms are capable of strengthening the immune system. A diverse collection of polysaccharides (beta-glucans) and minerals, isolated from mushroom is responsible for up-regulating the immune system. These compounds potentiate the host's innate (non-specific) and acquired (specific) immune responses and activate all kinds of immune cells.

Major Problems of Mushroom Cultivation:

Though the state of Assam has high potential for the development of mushroom cultivations, it is yet to become a commercial venture. Factors hindering the mushroom industry in the state are as follows:

Poor cultivation practices and low yield: General neglect and non-adoption of scientific cultivation practices are the major constraints for poor return from most of the mushroom cultivations in the state. Despite conducive environment, the productivity and growth of all mushroom productions are lower than the all India average.

Lack of desirable planting material: The disease free, true to type genuine planting material is absolutely lacking in case of a number of mushrooms. It is imperative to generate disease free & healthy planting materials & screening of planting materials before its distribution is of utmost importance.

Lack of marketing facilities: Due to lack of organized marketing structure the farmers are getting low return as compared to their counterparts in other states of India, whereas the middlemen amass a large chunk of profit at their expenses. For almost all the commodities including specialized products like sundry mushrooms, the producers face considerable marketing problems. Due to perishable nature of the products and absence of adequate market support, the farmers sell their produce at a throw away prices to the middleman without even getting the opportunity to display them. Transportation and storage is perhaps the most serious constraints in the mushrooms development of the state.

Scarcity of trained manpower and extension support: Dearth of trained manpower and inadequate extension support can be considered another set of pressing problem in the way of mushrooms development in this part of the country. In the states like Punjab, Himachal Pradesh, Haryana, *etc.*, where the extension services are reported to be very efficient, their pace of progress is also seen to be quite impressive.

Long gestation period: Since mushroom cultivations more specially, plantation crops have long gestation period and initial cost of establishment of orchard or plantation is high, it becomes almost impossible for the marginal farmers to go for such ventures without long-term credits from financial institutions. Nationalized banks do not find it a favourable investment and are not sure about the recovery of loans because the existing land tenure system particularly in the tribal belts, does not permit land mortgages in favour of lending banks. Apart from these, the farmers are not tuned to the idea of considering agriculture as a business proposition and are not accustomed kitty- gritty of the bank loans. Thus, until and unless the system is changed, the much-needed financial investment will not be forthcoming.

Problems of processing: For a state like Assam, the success of mushroom growing is closely linked with the availability of processing facilities. The processing industry can help to a certain extent in sorting out the problem of proper disposal of perishable commodities. Till today, there are a few number of cold storage facilities available; few processing units exist but are not functioning up to the desired capacity. Use of appropriate pre and post harvest practices for mushroom cultivations is vital for the success of the crops and also to garner good returns. Unfortunately, this is one of the weakest areas in the entire region.

Inadequate investment on research: Investments on research in mushrooms have always remained low when compared to the large number of crops it covers. As a result, many more financial issues remain unexplained for years together. There is an urgent need to increase the level of investment on research front.

Absence of adequate insurance coverage: Risk management in mushroom cultivations is almost non-existent although the crops like onion and potato are covered under the National Agriculture Insurance Scheme. There is a need to cover the risk in case of other fruit crops as well, perhaps on the basis of potential production coverage instead of average yield. This would encourage higher investment to achieve higher productivity.

Suggestions:

Although, the state of Assam has the potential for development of mushroom cultivation with its wide range of topographical and agro-climatic variations, the state is yet to harness the potentiality. In a flood prone state like Assam where productivity of major crops like rice is not stable, increase in production of mushrooms can minimize the impact of

crop failure and provide monetary security to the farmers. Some of the suggestions to solve the problems of mushrooms in Assam are given below:

1. Popularize mushrooms using ICT as delicacy with nutritive and medicinal value, on mass media like Doordarshan, also advertisements and posters.
2. Break consumer resistance by creating awareness in new areas. Demonstration of recipes and free samples in new areas.
3. Create cold storage facility.
4. Create refrigerated transport facility.
5. Create processing facility.
6. Decrease the cost of production and bring down the sale price to boost the demand.
7. States should fix minimum support price.
8. Public sector marketing, processing and export organisations should come forward.
9. Assured supply throughout the year at a reasonable constant price is key to good marketing. Efforts should be made to diversify and cultivate different mushrooms throughout the year along with cultivating some of the important mushroom during off-season under controlled condition.
10. In a limited area, say a village or a cooperative, the crops should be time-scheduled to get a daily reasonably uniform production to avoid glut on a day, this is required to meet the commensurate demand. One cannot ask consumer to purchase more because all have got a peak flush during a week. The marketing system has to view as a value chain where all components are taken care of. The increased production should get translated into economic gain for mushroom producers. This is possible only when marketing is organized and demand is ensured. Considering that awareness about consumption and health benefits of numbers of mushrooms available for cultivation is limited, their demand is also less. Hence, multipronged strategy is required that means needs to Expand market, Increase demand, Organize marketing and Form cooperatives.

Conclusion:

Mushrooms, akin to plants, have a great potential for the production of quality food. These are the source of bioactive metabolites and are a prolific resource for drugs. Knowledge advancement in biochemistry, biotechnology and molecular biology boosts application of mushrooms in medical sciences. From a holistic consideration, the edible mushrooms and its by-products may offer highly palatable, nutritious and healthy food besides its pharmacological benefits.

Still there are enough challenges ahead. Until now, how these products work is elusive and vast numbers of potential wild mushrooms are not explored. The utility of mycelia is paid little attention but it has tremendous potential, as it can be produced year around with defined standards. Knowledge on dose requirement, route and timing of administration, mechanism of action and site of activity is also lacking. Work is under progress in various laboratories across the world to validate these medicinal properties and to isolate new compounds. If these challenges are met out in the coming days, mushroom industries will play a lead role in nutraceutical and pharmaceutical industries.

The increasing awareness about high nutritional value accompanied by medicinal properties means that mushrooms are going to be important food item in coming days and at places may emerge as a substitute to non-vegetarian foods. Growing mushroom is economically and ecologically beneficial. Consuming mushroom is beneficial in every respect. Thus mushrooms are truly health food, a promising nutraceutical.

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