

Mushroom production

for farmers' additional income

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The arable land resources of the world are limited and the food demand is in an ever increasing trend. Strive to achieve nutritional security and sustainability in agricultural production is ongoing as quality food, health and environment are the concerns of the society. This warrants food production, which not only augments the deficits but is also nutritious, able to sustain agroecosystem and is climate resilient. In this context, mushroom production is a suitable component which alleviates environmental pollution besides producing a highly valuable protein rich food. Mushroom production can help address the problems of nutritional security, agricultural sustainability and management of agro-industrial wastes. Mushroom farming requires very little land and provides lucrative employment opportunities for the rural youth, farm-women and have the potential to supplement the farmers income. It is a vertical farming system carried out indoors with efficient management of inputs thereby production of maximum protein per unit space and time.

Key words: Farmers, Income, Mushroom, Production

IN present times, mechanization and automation of mushroom cultivation has given the venture a status of hi-tech industry in some of the developed countries of Europe and America. Major share of world's mushroom production, about 96% comes from the three regions Europe, America and East Asia with 85% of world consumption mainly concentrated in six countries known as G-6 (USA, Germany, UK, France, Italy and Canada). However, the production, consumer and export market for mushrooms in the world is dominated by China, growing more than 60 species with a production of 21,524,473 tonnes. The varieties of mushroom cultivated internationally are button (31%), shiitake (24%), oyster (14%), black ear mushroom (9%), paddy-straw mushroom (8%) and milky/others. Commercial mushroom farming in India has started only recently and is gaining popularity in parts of the country as export oriented business.

India contributes 1.5% of the world mushroom production and ranks eighth in the global production scenario. In India, the total production of mushroom is about 1,13,315 tonnes, of which major share (80%) goes to button mushroom and rest of the share (20%) goes to tropical mushrooms such as oyster, paddy straw and milky mushrooms. Commercial button mushroom farming is done in Punjab, Haryana, Himachal Pradesh, Uttar Pradesh, Rajasthan, and Jammu and Kashmir. Punjab leads in mushroom production by contributing 50% of the total production. Seasonal cultivation of two to three crops of button mushroom is done in the temperate regions of the country, while one crop can be grown during winter in the north-western and north-eastern parts. The subtropical and tropical mushrooms like the oyster, paddy-straw and milky mushrooms are grown in parts of the north-

eastern Himalayan range and in the plains – Tamil Nadu, Odisha, Kerala, Karnataka and Andhra Pradesh. Still the mushroom production system in India is mixed type with both seasonal farming as well as hi-tech industry while the mushroom market is unorganized at several places.

Mushrooms the quality food, a nature's boon

Mushrooms are considered as nature's boon especially in the remote locations as number of mushroom species spring up with the onset of the monsoon showers on almost all types of soils, on decaying organic matter, wooden stumps, meadows, woods, foothills, near termite mounds etc. It has been customary with many generations of the indigenous communities to go for mushroom picking during the rainy season. Many individuals from these communities have developed skill over time to distinguish between the wild edible otherwise mild to deadly



Oyster mushroom



Pleurotus species



Termitomyces species

poisonous wild mushrooms. Wild edible mushrooms have also been an item of trade in the far remote local or roadside markets. They relish this delicious and nutritious food item as a royal savory dish.

Ages since mushrooms have been providing the natural way to good health. Considered as a delicacy by the young as well as the old, mushroom occupies a place in between meat and vegetables nutritionally and are thus referred to as 'Vegetarians meat' or 'White vegetables'. Mushrooms contain good quality proteins, rich in vitamins, fiber, low in sodium (Na) and contains no cholesterol. They make up suitable diet for diabetic patients with low carbohydrate content and no starch. It is a 'heart food' with the precursor of ergosterol and the low calories (32 KCal/100g fresh mushroom) and low fat (max. 0.3%) content make suitable diet for obese persons. Its high fibre and alkaline ash content (>1%) makes it suitable for those having constipation and acidity/gastritis problems. Mushrooms with almost all the essential amino acids and rich amount of lysine and tryptophan (deficient in cereals) are abundant in protein content that ranges between 2.5 and 3% on fresh weight basis, and between 20 and 35% on dry weight basis. The rich vitamin content of mushrooms like the vitamin B complex, vitamin C, folic acid and vitamin B₁₂ is not depleted during the process of cooking. The bioactive compounds content in mushrooms act as blood cholesterol retardant. The dietary benefits, nutritive values and therapeutic uses make mushrooms wholesome food suitable for all age groups.

Mushroom species

Nature is bestowed with more than 10,000 known species of mushrooms world-wide of which about 2,000 are edible, 20 varieties are domesticated and only a dozen of them are cultivated on large-scale. The species like button (*Agaricus* spp., a temperate mushroom with some subtropical strains), oyster (*Pleurotus* spp., a sub-tropical to tropical mushroom), shiitake (*Lentinula edodes*, nutritional and medicinal mushroom), black ear (*Auricularia auricular*, nutritional and medicinal mushroom), milky (*Calocybe indica*, Indian button mushroom) and Guchhi (*Morchella* sp.) are being cultivated for their good demand in the local (India) as well as global markets. Although the Giant fungus (*Stropharia rugosa-annulata*), Enokitake (*Flammulina velutipes*), Jelly fungus (*Tremella fuciformis*), Nameko (*Pholiota nameko*), Black poplar (*Agrocybe aegerita*) and Truffle (*Tuber melanosporum*) are highly valued for their nutraceutical properties but are not much popular either due to the technological gap or non availability of raw materials.

The untapped potential

Varied agro-climatic conditions prevailing throughout the country and availability of agricultural residues and industrial wastes offer great opportunities for cultivating different mushrooms on commercial-scale. Agricultural residues of about 600 million tonnes are produced per annum and a major part of it is left out either to decompose naturally or burnt *in situ*. There are many species of mushroom which can be grown in the different climatic conditions of the country which will facilitate

recycling of the agro-wastes available in different seasons. The varied agro-climatic zones of the Indian subcontinent support rich mushroom biodiversity.

Agaricus bisporus (Button) mushroom is produced mainly in Uttar Pradesh, Punjab and Haryana and occupies the major mushroom market in the country. Seasonal cultivation of the other mushrooms like paddy-straw mushroom, milky mushroom is carried out in Tamil Nadu, Odisha and Kerala. Large-scale commercial cultivation of button mushroom utilizing high technological skill is done by few growers in Punjab and Haryana. Oyster mushroom is seasonally cultivated mainly in the North-Eastern States as well as West Bengal. Milky mushroom and oyster mushroom are still in the status of a cottage industry. There is tremendous scope for standardization and cultivation of different species of mushrooms in the biodiversity hotspot region of North-East India. The black ear mushrooms are not cultivated anywhere in the country although its cultivation technology has been standardized. However, in the local markets of Manipur and Nagaland this mushroom is sold during the season after the fruit-bodies are picked from the wild. Similarly many such wild edible mushrooms are found in abundance during the growing season which gives an indication that agro-climatic conditions of the region can support varied mushroom species. The production of tropical mushrooms like oyster mushroom, paddy-straw mushroom, milky mushroom, and black-ear mushroom can be done utilizing locally available substrates viz., paddy-straw, water hyacinth, tree



Lentinula edodes (Shiitake) mushroom



Agaricus (Button) species



Calocybe indica (Milky) mushroom

saw dust, sugarcane bagasse, wild grasses and various categories of refuse and lignocellulosic wastes. Moreover there is ample scope for production of organic mushroom in North-East India as this region is said to be organic by default. Organic produce will help farmers to fetch premium price.

SUMMARY

In North-East India with congenial climatic conditions and availability of agricultural, forestry and industrial many different mushroom species can be cultivated commercially. Cultivation of different

mushrooms will eye appealing, add variety, flavour and also meet the need for new dishes. Above all the fear of loss of precious life (mushroom phobia) will not persist which usually occurs due to consumption of wild poisonous mushrooms. Many a times reports of mushroom poisoning appeared in the local dailies of Sikkim, Asom and Nagaland. In the north-eastern region the mushroom growers are mostly seasonal or beginners and hence the existing mushroom produce is insufficient to meet the demand. In true sense mushroom industry has not geared up not only

in the north-eastern region but also in India due to small mushroom holdings with temporary/seasonal nature. Hence extensive motivation strategies need to be exercised projecting smart mushroom farming as one of the best additional or subsidiary income generating avenue of agriculture.

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Science, Technology and Innovation Policy: A New Paradigm

Science, technology and innovation can exist separately on their own in disconnected spaces. But, it is their integration that leads to new value creation. India's global competitiveness will be determined by the extent to which the STI enterprise contributes social good and/or economic wealth. There is, therefore, the need to create the necessary framework for enabling this integration in identified priority areas by exploiting endogenous resources, strengths and capacities. New structural mechanisms and models are needed to address the pressing challenges of energy and environment, food and nutrition, water and sanitation, habitat, affordable health care and skill building and unemployment.

"Science technology and innovation for the people" is the new paradigm of the Indian STI enterprise. The national STI system must, therefore, recognize the Indian society as its major stake holder. Global innovation systems tend to bypass large sections of the community. Innovation for inclusive growth implies ensuring access, availability and affordability of solutions to as large a population as possible. Innovation, therefore, must be inclusive. The instruments of the STI policy will enable this to be realized. The policy will drive both investment in science and investment of science-led technology and innovation in select areas of socio-economic importance. Emphasis will be to bridge the gaps between the STI system and the socio-economic sectors by developing a symbiotic relationship with economic and other policies.

Capturing Aspirations

The key elements of the STI policy are:

- Promoting the spread of scientific temper amongst all sections of society.
- Enhancing skill for applications of science among the young from all social strata.
- Making careers in science, research and innovation attractive enough for talented and bright minds.
- Establishing world class infrastructure for R&D for gaining global leadership in some select frontier areas of science.
- Positioning India among the top five global scientific powers by 2020.
- Linking contributions of science, research and innovation system with the inclusive economic growth agenda and combining priorities of excellence and relevance.
- Creating an environment for enhanced Private Sector Participation in R&D.
- Enabling conversion of R&D outputs into societal and commercial applications by replicating hitherto successful models as well as establishing of new PPP structures.
- Seeding S&T-based high-risk innovations through new mechanisms.
- Fostering resource-optimized, cost-effective innovations across size and technology domains.
- Triggering changes in the mindset and value systems to recognize, respect and reward performances which create wealth from S&T derived knowledge.
- Creating a robust national innovation system.