ISSN 2583– 0260 (online) *ISSN 2394 -7837 (print)*

MUSHROOM CULTIVATION – A BENEFICIAL TECHNOLOGY FOR AGROWASTE MANAGEMENT

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Received: 15/4/2023 **Revised: 15/5/2023** **Accepted: 20/5/2023** **Published 30/12/2023**

Abstract
Utilizing Agro wastes for growing mushrooms can enhance income and impart higher level of sustainability. The cultivation of edible mushroom on agricultural wastes may be a value added process capable of converting these wastes, which are otherwise considered to be harmful, into foods and feeds. Mushroom cultivation is a beneficial technology because it solves two major problems simultaneously i.e. waste accumulation and shortage of proteinaceous food. It helps to increases the economy of farmer as a side business and provides self-employment for educated and unemployed youth. *Pleurotus* spp. are able to degrade and convert lingo-cellulosic compounds into protein-rich biomass and help in managing agro-wastes whose disposal has become a problem.

Keywords: Agrowastes, Mushroom*, Pleurotus,*Substrates

Introduction

Mushrooms are Chlorophyll less ,eukaryotic spore bearing organisms. Mushroom cultivation is a low cost and labour intensive activity. Mushroom farming is becoming successful because of its very low inputs. In India, mushroom growing can be highly rewarding because of various climates. The technology can be profitably considered in areas where land is limiting factor and agricultural residues are abundantly available. It can generate tremendous employment opportunities. Mushroom cultivation is eco-friendly also.

A huge amount of agro based lingo- cellulosic crop residues and byproducts are generated annually. The production of these wastes can cause environmental and many health problems (Garg and Gupta, 2009). The need for nutrition rich food and the management of agricultural residues paved the way for mushroom cultivation. Mushroom cultivation is an appropriate bioconversion of lignocellulosic wastes (Chang and Miles, 1992). Utilization of agro wastes helps in reducing the wastes, converting them into mushroom protein and vitamins .Cultivation of the oyster mushroom has various advantages as it converts complex organic ligno-cellulosic compounds into nutritious food ,aids recycling of agro-waste, contributes to pollution control, does not compete with agricultural land and provides avenues to self employment. Hence there is an urgent need to popularise the technology amongst the community.

Mushrooms are classified into Temperate mushrooms , Sub tropical mushrooms and Tropical mushrooms. Temperate mushrooms are Button mushroom(*A.bisporous*) ,Oyster mushroom *(Pleurotus florida, . Pleurotus ostreatus,) (*Shittake mushroom (*Lentinus edodes*) and Winter mushroom(*Flamulina velutipes*). Sub tropical mushrooms are White button mushroom (*A. bitorquis*) , *Oyster mushroom (Pleurotussajor-caju, P.flabellatus*) and Wood ear mushroom (*Auricularia sps*). Tropical mushrooms are Paddy straw mushroom (*Volvariella volvaceae*) ,Milky mushroom (*Calocybe indica*) and Reishy mushroom(*Ganoderma lucidum*).

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Importance of Mushroom

They are good quality proteins and rich in vitamins and minerals. 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 . Edible mushrooms commonly have insignificant lipid level with higher proportion of polyunsaturated fatty acids. They are low caloric foods with very little fat and sugars without starch and cholesterol. Mushrooms do not have cholesterol. Instead, they have ergosterol that acts as a precursor for Vitamin D synthesis in human body .

Common Indian Cultivated Mushrooms

There are about 100sps. of edible mushrooms all over the world. Although a great many species of mushrooms are edible, very few have been artificially cultivated. Among them, 4sps.are widely cultivated in commercial scale in India. They include White Button Mushroom (*Agaricus bisporous*),Paddy straw Mushroom (*Volvariella Spp*.),Oyster Mushroom (*Pleurotus Spp*.) Milky Mushroom *(Calocybe Spp.)* and Shiitake *(Lentinus edodes).*

Common Cultivated mushrooms in Kerala

In Kerala, commonly cultivated mushrooms are Oyster (*Pleurotus* spp.)and Milky (*Calocybe* spp.) types. Among these , oyster mushroom is the most widely cultivated type.

Pleurotus is one of the edible mushrooms which can be cultivated in the tropics. The *Pleurotus* mushroom is generally called the oyster mushroom because it looks like the oyster. Oyster mushrooms are by far the easiest and least expensive to grow of all industrially cultivated edible mushrooms. Several species are now available for cultivation. These are *P. sajorcaju, P. florida P. sapidus , P. eryngii, and P. flabellatus*.

Prospects of mushroom cultivation

The technology can be profitably considered in areas where land is limiting factor and agricultural residues are abundantly available. In India, mushroom growing can be highly rewarding because of various climates.Mushroom farming is becoming successful because of its very low inputs. Mushroom cultivation is a low cost and labour intensive activity. .It can generate tremendous employment opportunities. Mushroom cultivation is eco-friendly also.

Challenges of mushroom cultivation

Major problems and challenges faced by the farmers were lack of knowledge in mushroom cultivation and disease management, lack of financial assistance, unavailability of High quality seeds, packaging and storing methods ,difficulties in finding proper local market and producing value added mushroom products. Along with this, availability of better and low cost substrates, approaches of maintaining hygienic conditions in the culturing sheds, effective disease controlling techniques, introduction of new varieties of edible mushroom are also essential. The research and development aspects relevant to above issues need to be promoted to have a sustainable mushroom cultivation. The present study revealed that Mushroom cultivation can prove to be an important means to get a profitable business within a short period of time.

Materials and methods

Materials required are good quality Paddy Straw, Spawn , Polythene bags, Plastic string, Large vessel, Tray, Dettol, Formalin, Pottassiumpermanganate,Wood, Match box, News papers or a Polythene sheet. Mother culture of *Pleurotus florida* is obtained from CARD-KVK, Thelliyoor is used for the cultivation.

Preparation of the substrates

Soaking and Hot water Treatment: Paddy straw is cut into small pieces and soaked in water overnight. The straw is then boiled for 30-45 minutes. After boiling, excess water is drained off by spreading the straw over a cheese cloth or a plastic sheet. The water content of the straw is checked by squeezing the straw in between hands. At the right stage we

shouldn't get a drop of water from the straw, but it contains 75-80% moisture.

Bed preparation and spawning

When the sterilized substrate has cooled down to room temperature, filling and spawningwas done. Polythene bags (35 x 50cm, 150 gauge) is used for its cultivation. One 500 ml bottle spawn (200-250g) can be used for 10-12 kg wet substrate (2 bags). Layer spawning is practiced.

One bottle of spawn (about 200-250gm.) was divided into four equal parts. The base of the polythene bag was tied with a thread. Many small holes wre made along the surface of the bag to facilitate good aeration .The paddy straw was added into the polythene bag to a height of 5cms.One part of the spawn was spread over the paddy straw. A second layer of paddy straw was placed over the first layer and the second part of the spawn was spread over it and so on till fourth layer of paddy straw and spawn were spreaded. On the top of the spawn, a thin layer of paddy straw was spreaded. The mouth of the bag was tied with a thread. The spawned substrate in a polytene bag was called mushroom bed.10 bed were prepared.

Incubation and harvesting

Mushroom beds were kept either on racks in a hanging condition in the mushroom shed or mushroom house. Within 12-15 days after spawning , the fungal mycelium grows and forms a compact bed inside the bag. The polythene bag is removed after 15 days. The mushroom beds were watered twice a day so as to keep the temperature between 20-30^{o}C.Within 4-5 days after removing the polythene bag, small pin-head like mushrooms develop.

Results and Discussion

From the 10 Mushroom beds prepared, we got about 6kg and 200 gm of good quality Oyster Mushroom .With a minimum expenditure and labour we had a good profit .It was shown in the following chart.

Table 1. Expenditure for mushroom cultivation

Sl. No.	Particulars	Amount in Rs:
1	Rice straw 5 bundles@Rs:20	100 for 10 beds
2	Spawn-500 gms@Rs:30	150 for 5 packets
3	Polythene bag-1 bag@Rs:5	50 for 10 bags
4	Plastic string 1bundle@Rs:8	24 for 3 bundles
5	Wood -2 mann@Rs:75	150
6	Total expenditure	474

Table 2. Income from mushroom cultivation

Yield in kg	Mushroom sold @rate/ Kg	Income in Rs:	Expenditure in Rs:	Profit in Rs:
6.200	320	1984	474	1510

The bioconversion of agricultural wastes into a value added products is a good mean of their use. The property of edible mushroom fungi to convert complex organic compounds into simpler one's is used to transform the useless agricultural waste into valuable product (Kamthan R and Tiwari 2017). Pleurotus is easy to grow because it does not require complicated substrate preparation technique. Species of Pleurotus are characterized by rapidity of growth under wide range of temperature conditions, ability to colonize substrate on short duration and potential to tolerate high concentrations of CO2 which act as a protection cover against competitor molds.

Agricultural wastes are rich in lignin cellulosic components which are difficult to breakdown, but can easily be done through mushroom cultivation. Mushrooms are very nutritious products that can be generated from lignocellulosic waste materials.Mushroom cultivation can directly improve livelihoods through economic, nutritional

Figure 1. Showing different stages of mushroom cultivation

and medicinal contributions.Training courses aim at enhancing adoption and diffusion of innovations. Mushroom production has become an enterprises and has adopted in big way both at household level and as commercial enterprise as a source of income generation after the proper dissemination of technology through. Some other studies support the findings of the present study (Khan, *et al.*, 1981; Alexopoulos *et al.*, 1996; Bahl, 1998; Jose and Janardhanan, 2000; Agahar -Murugkar and Subbulakshmi, 2005; Garg and Gupta, 2009;)

Though mushroom cultivation is not so popularized in Kerala,, it comes out as an important source of livelihood for small –scale workers and farmers and can prove to be an important means to get a profitable business within a short period of time, by women self-help groups and unemployed youth. . Agro wastes are usually rich in lignocellulose and *Pleurotus*(Oyster mushroom) has an inherent ability of possessing a host of enzymes that can degrade the cellulosic materials. Since mushroom is a rich source of proteins , it can be a good food substitute in those places of the world that are facing the problem of food shortage and malnutrition. Since mushroom grows on various locally available substrates and their cultivation is of short duration and involves a simple and low-cost technology, there are good prospects for their commercial cultivation in Kerala.

Conclusion

Mushroom offers prospects for converting lignocelluloses residues from agricultural fields, into protein rich biomass. Such processing of agro waste not only reduces environmental pollution but the byproduct of mushroom cultivation is also a good source of manure, animal feed and soil conditioner. Mushroom cultivation is becoming popular because it is not only meets the dietary requirements but also adds to the economic development of growers with insufficient land. The study revealed that Mushroom cultivation can prove to be an important means to get a profitable business within a short period of time. Hence there is an urgent need to popularize the technology amongst the community.

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