DOI : 10.5958/2349-4433.2024.00107.7

J Krishi Vigyan 2024, 12(3) : 612-616

Popularization of Low-Cost Mushroom Technology for Changthang Region of Cold Desert

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ABSTRACT

Mushroom is rich source of protein, carbohydrate, vitamins and good for health which can play important role in mitigating the malnutrition amongst resources poor people especially remote areas. In Changthang region of Ladakh availability of fresh vegetable limited, thus cultivating mushroom in such harsh climate is big challenge. To fulfil the requirement of local people of Changthang KVK, Nyoma located at +14000 ft took initiative to design and assessed low-cost mushroom technology 14X3X8 ft size black plastic unit was made inside (already exist) local mud type greenhouse 32X 18 ft size for mushroom cultivation and utilized temperature and humidity of green house. In every single shift 15 mushroom bags can be installed and harvested 4 times @ 120 -128g bag and sold @320/-kg. The cost of cultivation including inputs and unit was only Rs 2000/- and got net return of 3760/- in 4 months with B.C Ratio 1.28, mushroom can grow in entire season if temperature of greenhouse remains optimum and increase net profit. Hence, this low-cost technology is not only a source of income generation for remote nomadic farmers of Changthang but also became a supplement for nutritional security and their socio-economic upliftment.

Key Words: Low-Cost Technology, Malnutrition, Nutritional Security, Socio Economic, Nomadic.

INTRODUCTION

Agriculture sector is one of most important sectors in India it has a key position to provide the employment to unemployed peoples. The growing population and nutritional security are major challenges for the agricultural scientists and Indian government. In this context, mushrooms have a great role to play which can be grown even by landless people that need agricultural waste materials and could be a source for proteineous food (Ambili and Nitiya, 2014). There are 20 species of mushroom grown in the country, of which 5-6 are poisonous; and the recommended species for cultivation are oyster (*Pleurotus spp.*) and white button mushroom (*Agaricus bisporus*) Milky mushroom (*Calocybe indica*) are more popular mushroom (Bhatia and Mohammed, 2007). Similarly, Oyster mushroom is one of the most suitable fungal organisms for producing protein rich food from various agro wastes without composting. Oyster mushroom can be grown in the plains and in temperatures ranging from 32 to 38^{0}C and it's also grown in hilly area. Dey *et al* (2020) stated that about 85-90% moisture contain in the fresh mushroom ,3% of protein, Carbohydrates 4%, 0.3-0.4% fats and 1% minerals and vitamins. Keeping in view, the remotest area Changthang located in Ladakh where temperature varies from +35^{0}C to -32^{0}C and availability of fresh vegetable is very less, and getting healthy nutritious food cum vegetable for women, children is biggest challenges. Under such circumstances mushroom is a good source of protein for those women of remotest area. To fulfil the requirement of local people of Changthang KVK Nyoma located at +14000ft took initiative to design and assessed low-cost mushroom technology for income generation and a supplement for nutritional security and their socio-economic upliftment in such a harsh climatic condition.

MATERIAL AND METHODS

The present study was conducted in Krish Vigyan Kendre Nyoma (Changthang) SKUAST-K Leh

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Table 1. Material required for mushroom cultivation.

Sr.No	Material	Quantity
1	Barley straw	10kg
2	Spawn	1 Kg
3	Formalin	125ml
4	Bavistin	7.5 gm
5	Water	90 lt

Source: Angmo et al (2021) Good Agriculture Practice book

located at highest altitude +14000ft in 2021-22. *Changthang* region falls in the eastern part of Ladakh and the originals are known as *Changpas*. The temperature in the region varies from -5 ºC to -35 ºC in winter and up to maximum of 30 ºC in summer. The average precipitation mostly in the form of snow is less than 10 mm and can be fatal to the livestock of the nomads during winter month. The region is spread over an area of 22000 km^2 and comprises of two subdivisions *i.e.,* Nyoma and Durbuk. The present study was based on Changthang region of Ladakh where availability of fresh vegetable limited, thus cultivating mushroom in such harsh climate is big challenge. To fulfil the requirement of local people of Changthang KVK Nyoma located at +14000ft took initiative to design and assessed low-cost mushroom technology for income generation of remote nomadic farmers.

MATERIAL USED FOR MUSHROOM CULTIVATION

Oyster at +14000 ft KVK Nyoma

During this study we used already exist low-cost mud type green house of 32 x16ft size normally available at every farmer's house, 15 m black polyethene sheet for mushroom unit, and also applied black colour paints at back side of greenhouse to maintain heat, local available resources such as local mud bricks and willow branches or called Talu were also used.

Procedure for Design Mushroom unit

Step 1: Took existing local mud type greenhouse of 32 X 16 ft size, normally we left foot path where back of greenhouse wall exist, we utilized that area for mushroom cultivation. For demonstration purpose, we made a size of 14x3x8 ft black plastic unit and colour the back wall of green house with black paint to maintain heat inside the green house.

Step 2: Utilizing left over material of talu (willow branches) and made two parallel willow frames with hollow inside (in Ladakh we called stair shape) with the help of nails and local bricks used for support and made a vertical support for making shelf.

Step 3: Made 4 shelves in which 15 mushroom bags installed at a time.

Step 4: To stop entry of the solar light this black polyethene was properly join with tape or any binding material.

Procedure for Cultivation Method

Cultivation methods of Oyster mushroom followed and material used was as under (Table 1).




Boiling method of sterilisation (without using chemical)

For cultivating oyster mushroom we need in large number of agro wastes such as cereal straw, sugarcane bagasse, sawdust, dried grass, discarded newspaper etc. In Ladakh maximum we used barley straw as it is most easily available agro waste resources. Barley straw substrate can be sterilised either by using chemical method (Bavistin and Formaldehyde) or boiling method to eliminate the competitor fungi. While in boiling methods, sterilisation can be done just by boiling the straw was spread on a clean surface so that excess water is drained out. When the straw is left with around 60-70% moisture (few drops should come out when pressed in palm) it is ready for spawning. In the chemical method, the barley straw was soaked in the water with Bavistin and Formalin for overnight (10-12 hrs) in airtight condition. When the straw is left with around 60-70% moisture (few drops should come out when pressed in palm) it is ready for spawning

Spawning and Inoculation

Spawn is basically the mushroom seed prepared in lab. The method of mixing of spawn with the substrate is known as spawning. This can be done by different methods such as layer spawning and broadcasting. We observed that layer spawning was more effective than broad casting in case of oyster mushroom. Spawning was done by placing one layer of straw and one layer of spawn, up to 3-4 layers in the polybag, give small cut in corner of polybags for excessive drainage of water and provide aeration. Lastly the bags were closed tightly and around 10-15 holes are made on the bags. Then the bags were kept in the dome shelf for spawn run.

Management technique

The optimum temperature required for oyster mushroom spawn run is 22^0C to 26^0C with relative humidity 80-85% for its mycelia growth

Table 2. Cost of cultivation of mushroom.

Total Cost of Cultivation (Rs)	2000 for 15 bags
Days of first picking	25-35 days
No. of picking (nos)	04
Market rate (Rs /kg)	320
Gross return for 15 bags (Rs)	5760
Net return (Rs)	3760
B.C. (Rat io)	1:2.88

(Mycelium is the vegetative part of fungus.). When the mycelium fully colonises the substrate, its forms thick mycelia mat which is called spawn run. This indicated its readiness for fruiting. Normally, it was observed in green house around 25-30 days for complete spawn run. We observed even at lower temperature and humidity spawn run occurs but takes longer time than at optimum level. Proper ventilation is needed during the fruiting period for air .Pin head formation only takes place after full spawn run occurs which later turns into the fruiting bodies.

Harvesting

Harvesting of mushroom was ready in 7-10 d after pinhead formation. They were harvested while the edges of the mushroom still curled down., Oyster mushroom can be stored for 2-3 days at normal room temperature without deterioration after harvesting. It can also be sun dried and stored for 4-6 m successfully without losing its original properties. For Ladakhi / Nomadic people this can be a nutritious diet especially during winter months. Although optimum temperature and humidity was needed for maximum production, but growing it in highest altitude and coldest place like Changthang there were less chances of contamination as compared to other plane areas.

RESULTS AND DISCUSSION

The cost of the cost of cultivation for 15 poly bags was Rs. 2000/- with four-time pickings. First harvest was done within 20-30 days as per temperature and humidity in green house. The mushroom was in great demand in Ladakh, cost of mushroom was Rs.320/ Kg . The gross return and net return were Rs.5760/- and Rs.1760/-, respectively with B.C ratio 1:2.88. The B.C ratio can be increased if this low-cost technology implemented at large scale and having its own local resources like barley straw, and greenhouses etc. Seeing the technology more reliable and low cost, KVK Nyoma disseminated this technology among farmers through trainings to farmers, youth, SHG's and also demonstration unit at farmers field and boost the knowledge of mushroom cultivation among the farmers, farm women and youth and enhance socio economic status of remote area.

CONCLUSION

Mushrooms are low fat high protein fungi having high economic value. Seeing the problem of malnutrition and socio-economic issues in remotest area of Changthang in Ladakh. Low-cost mushroom technology was designed as per farmers needs, and played innovative role in mitigating the mal nutrition amongst poor people especially farm women's, children's in those remote areas. Meantime its uplift the Socio-economic status of the nomadic farmers along with supplement for nutritional security and their socio-economic upliftment

ACKNOWLEDGEMENT

We are thankful to the Programme Coordinator KVK Nyoma SKUAST-K Leh and team for providing necessary facilities. Through this Kendra today we are able to disseminate this technology into ground level in those remotest places of Ladakh and last but not the least most important my entire farmers of Ladakh and other department such as Agriculture, Horticulture, Animal Husbandry, Sheep Husbandry etc. to keep faith on our team to make this research demonstration successfully in entire Ladakh

region.

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Received on 28/3/2024 Accepted on 5/7/2024