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RESEARCH ARTICLE

BENEFIT-COST RATIO ANALYSIS OF PLEUROTUS MUSHROOM CULTIVATION USING DIFFERENT SUBSTRATES IN CAMPUS OF LIVE SCIENCES, DANG, NEPAL

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ABSTRACT

In order to determine the benefit cost ratio analysis of Pleurotus ostreatus mushroom cultivation using different substrates an experiment was conducted in the field of Campus of Live Sciences, Tulsipur, Dang. Different substrates such as straw, khar, banana leaves and tree leaves were used for mushroom cultivation. On 30th day, the mycelium completely colonized the different substrate and reached pinhead stage of mushroom. After one week of mycelium colonization first harvesting was done and yield of 755gm,130gm,211gm and 300gm were obtained on rice straw,banana leaves,tree leaves and khar respectively. Then,second harvesting was carried out on 44th day and yield of 475gm,100gm,0gm and 180gm were obtained on rice straw, banana leaves, tree leaves and khar respectively. Total yield of 1230gm, 230gm, 211gm and 480gm were found on straw, banana leaves, tree leaves and khar respectively. Cost of cultivation under different substrates was almost similar and by anlaysing benefit obtained from mushroom cultivation under different substrates, benefit cost ratio was analysed and found to be 2.47,0.46,0.42 and 0.96 under straw,banana leaves, tree leaves and khar respectively. From this research it is clarified that it is benefical to grow Pleurotus mushroom using rice straw substrate as the benefit cost ratio is higher when rice straw was used as substrate than in any other substrates.

KEYWORDS

Pleurotus sajor-caju, cultivation, temperature, substrates.

1. INTRODUCTION

Pleurotus mushroom commonly referred as 'Kanya chyau' in Nepal, is a basidiomycetes and belongs to the genus 'Pleurotus'. The fruit bodies of this mushroom are distinctly shell, fan or spatula shaped with different shades of white, cream, grey, yellow, pink or light brown depending upon the species. However, the colour of the sporophores is extremely variable character influenced by the temperature, light intensity and nutrients present in the substrate. This mushroom is cultivated in about 25 countries of far-east Asia, Europe and America. It is the 3rd largest cultivated mushroom in the world. China alone contributes 88% of the total world production. The other major oyster producing countries are South Korea, Japan, Italy, Taiwan, Thailand and Philippines. Oyster mushroom production is a most appropriate technology for the poor landless farmers and women farmers in Nepal. The farmers of many districts of Nepal have grown oyster mushrooms in a small scale and have benefited highly. They are mainly utilizing the agricultural waste of wheat and paddy straw, and thus mushroom cultivation has improved the living conditions of many poor farmers in Nepal. Among all the species of *Pleurotus*, *P. sajor caju* is most popular and widely practiced in commercial level. Temperature requirement of *Pleurotus* is higher than *Agaricus* and lower than that of the *Volvorella,* it is gaining more popularity in different ecological zones. In India, paddy and wheat straw were used for commercial production of oyster mushroom (Jain and Vyas, 2002). Paddy straw proved to be best substrate for cultivation of oyster mushroom (Bano and Shrivastava, 1962; Bonatti et al., 2004). The fungi used for conversion of lingo-cellulosic materials into protein rich food by non-conventional method. Different types of cellulosic substrates were used for cultivation of oyster mushroom. Next to paddy straw, wheat straw proved to be best substrate for cultivation of *Pleurotus* species (Bhatti et al., 1987; Thampi et al., 1966; Bonatti et al., 2004).

2. REVIEW OF LITERATURE

Mushrooms were first cultivated in France in 1650.The method of cultivation of temperate mushroom (Agaricus bisporus) was first developed by a French Gardener in A.D.1700. In the east mushroom began to be grown on commercial scale in the People's Republic of China, South

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Korea and Taiwan (Singh, 1997). The oriental mushroom Lentinus edodes and Volvariella volvacea have been cultivated for 2000 years in China and Japan. Their cultivation technology according must be a very ancient art (Singer, 1961). The method of cultivation of jaw's ear (Auricularia sp) has been recorded in the ancient Chinese Publication Liki about 300BC. The authentic record are available only for Agaricus biosporus (botton mushroom) whose cultivation was introduced into Paris (France) around 700 A.D by an unknown French horticulturist in the open. Towards the end of the seventeenth century, someone whose name is not recorded involved a method of treating horse manure and planting it with the spawn of wild mushroom. But the first-time published method of mushroom cultivation is by Tournefort a Frenchman (Kapoor, 1999).

Although cultivation technology of different mushroom was developed in the foreign country much earlier, but to the context of Nepal, workshops and invention of mushroom cultivation was started later on. In 1974, Plant Pathology Division started research on mushroom cultivation. At first time research focused on Agaricus about compost preparation by using horse dung with different ingredients. Finally, by using solon formula, paddy straw compost was identified. Two seasons of cultivation were also identified as Agaricus can be harvested from March to May, if spawn is inoculated in compost January. Agaricus can be harvested from September- November if spawn is inoculated at July.In 1977, the cultivation technology was extended to the farmers. In 1984, the number of mushroom growers was about 50-60 only. In 1984, the cultivation technology of Pleurotus was introduced to Nepal. After spawn preparation and lab test the cultivation technology extended to the farmers in 1984-85. At that time number of farmers was about 100-150.

3. METHODOLOGY

3.1 Materials

1) Rice straw, Dried leaves, Banana leaves, Khar: 1.5 kg (Dry weight) for 1 plastic bag.
2) Spirit: 10 ml
3) Rope (jute): one ball
4) Fire Wood: 2 kg
5) Spawn (grain): 60 gm
6) Transparent polythene bag

3.2 Method of preparation

3.2.1 Preparation of Substrate

The common substrates were rice straw, banana leaf, tree leaf and khar. They were chopped manually with machine lengths of about 4-5 cm. The substrates were thoroughly washed and cleaned to a considerable degree with tap water to reduce its lignification and sterilized properly.

3.2.2 Sterilization

For sterilization local drum were used. They were washed properly filled with water as in autoclave to a certain volume and boiled. After boiling, the substrates were packed in a jute sack and kept in the drum for sterilization. Direct contact between the substrates and the water is avoided as it degrades the quality of substrates. Then the drum was closed tightly by a thick polythene. When the temperature reaches up to 70-80°c, plastic sheet gets swollen with steam, then heat was removed. The temperature starts to decline and then the straw was spread over clean sterilized plastic to remove heat. At 25°c filling of polythene bags was done.

3.2.3 Preparation of Bag

A polythene bag of 18''X14'' was used for filling of substrates. The bag was open both end. One end was closed by rope keeping a circular bottom.

3.2.4 Filling of Bags

We sterilized our hand with spirit and filling was done. First 3-4 cm of substrate was placed in the bag pressing it time and again and giving it the round shape. Then spawn were sown around the periphery. Again 3-4 cm of substrate layer in made in the same way and spawning is done. The process was repeated until the bags get filled, leaving some part for tying the open end. When the bags were filled the spawn was broadcasted on the top and then were covered with thin layer of substrate prepared. The bags were then tied and hole is prepared with sterilized needle to permit air circulation and cool down if there is increase in temperature.

3.2.5 Placement of filled Bags

The packed bags are incubated in well ventilated rooms where a uniform temperature 25°C but temperature varied from 18-25°c. They were placed in dark room where no light intensity was available for four weeks for proper colonization. Regular spraying of water was done by hand. Proper humidity was maintained by hanging water-soaked jute bags on the door and on the floor.

4. OBSERVATION

The mushroom was then supervised thoroughly and following changes were seen:

4.1 Growing

After the cutting of plastic in fouth week, mycelial mass covers the straw on single bulk. The Bulk of mushroom were placed on brick and are watered regularly in evening and morning. Primodial growth of mushroom were seen after one week of cutting plastic.

4.1.1 Pin Head Stage

This is the first clearly seen stage of mushroom during reproductive stage. In this stage mushroom primordial were seen growing from the base of mycelium covered straw. During this stage defused light.

4.1.2 Mature Stage

After 2-3 days of pin head primordia seen mushroom become mature. At this stage mushroom become ready for harvesting. If watering in previous stage was excess then they will toppled down at this stage.

4.2 Harvesting

Mushroom should be harvested when the cap begins to fold and has attained a diameter of 8-10 cm. Picking is done by twisting the mushroom gently so that it is pull out without leaving any stub, and also the surrounding fruiting bodies are not disturbed. The manual harvesting was done before release the spore.

4.3 Yield

Two harvesting was done for the mushroom. Frst harvesting gave a yield of 755gm and in second harvesting 475gm. So, a total yield of 1230 gm was obtained when grown in rice straw.

Problems encountered during cultivation:

1. Lack of sterilizing agent and properly Functioning isolation chamber during inoculation.
2. Lack of proper area for incubation.
3. Irregular temperature (high temp.) and humidity condition during the cultivation.
4. Growth of unwanted microorganism in growing culture
5. Low quality straw available due to which we became unable to harvest as we expected.
6. Mushroom is perishable commodity, so there was processing problem in farmers' level.

Some disease seen during cultivation:

4.4 Green moulds

This is caused by *Trichoderma viridae.* These moulds form green patches surrounded by white margins on the cased beds. This problem may also associate with excess watering and unsanitary measures.

4.5 Compaction of bed

This problem was seen during growing stage. Due to this problem the bulk of straw compacted which cause the emergence of primordia only from the side surface.

4.6 Decomposition of bed

This is also problem encountered during the growing of Pleurotus. This problem may be due to the excess watering directly on the bulk covered with mycelia and also infection through the contaminated water with microorganisms.

Table 1: Calendar of activities

S.N.	Date	Observation / activities
1.	2072-09-29	Chopping of dry straw with chopping machine and soaking overnight.
2.	2072-10-01	Cleaning of overnight soaked straw with clean water.
3.	2072-10-01	Squeezing and sterilization of soaked straw in sterilizing drum.
4.	2072-10-02	Cooling of sterilized straw on plastic applied with rectified spirit.
5.	2072-10-02	Filling of bags with cooled straw and compressed with manual pressing.
6.	2072-10-02	Spawning in each 4-5 cm thick layer at last spreading all over the surface.
7.	2072-10-02	Placing of filled bags on wooden racks.
8.	2072-10-27	Little growth of mycelium were seen which binds all the straw in a single mass.
9.	2072-11-02	Pin head size fruiting body appears on the surface of substrate.
10.	2072-11-16	First harvesting of fruiting bodies yield was 755gm
11.	2072-11-29	Second harvesting of fruiting bodies yield was about 475gm.

Note: No third harvest due to excess rise in temperature

Similarly, yields obtained in different substrates were:

Substrate	1st harvest (gm)	2nd harvest (gm)	Total yield (gm)
Rice straw	755	475	1230
Banana leaves	130	100	230
Tree leaves	211	0	211
Khar	300	180	480

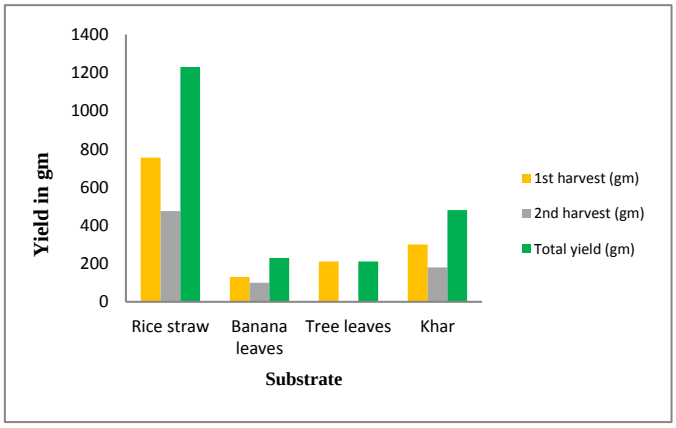

Figure 1: Bar diagram showing yield obtained from different substrates in different time of harvesting

Table 2: Economic analysis

Inputs

S.N.	Materials	Rate	Quantity	Amount (Rs.)
1.	Spawn	Rs 50/200 gm packet	1/3rd of packet	16/-
2.	Plastic bags	Rs 2/bag	1	2/-
3.	Substrate	Rs 1.5/kg	6 kg	9/-
4.	Rope		One ball	5/-
5.	Rectified Spirit		10ml	5/-
6.	Firewood	Rs 6/kg	2kg	12/-
7.	Labor cost	300 for one man day	1 laborer for quarter of a day	75/-
8.	Total cost of inputs			124/-

S.N.	Substrate	Total yield (gm)	Rate (Rs/kg)	Amount (Rs.)	Benifit/cost ratio	Rank
1	Rice straw	1230	250	307.5	2.4798	A
2	Banana leaves	230	250	57.5	0.46371	C
3	Tree leaves	211	250	52.75	0.425403	D
4	Khar	480	250	120	0.967742	B

5. Conclusion

Pleurotus sajor-caju mushroom was grown in rice straw in Campus of live sciences. In total period of 57 days we were able to get 1230 gm of mushroom in two harvests. Higher or lower temperature leads to a significant damage to the plant growth. During our cultivation fluctuating temperature and improper cultivation techniques led to decrease in the yield. Cultivation of *Pleurotus* mushroom needs an optimum temperature of 25°c and relative humidity should be high with well-ventilated condition. So, from the practice we can conclude that growing of *Pleurotus sajor-caju* mushroom is easy and profitable business if done properly.

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