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Economic Feasibility of Straw Mushroom Production in Odisha: A Case Study

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Abstract

Straw Mushroom is regarded as a means of supplementing nutrition to the human beings and is considered as a remunerative enterprise in the state of Odisha. The present study estimates the cost and return in paddy straw mushroom production and tests the economic feasibility of this enterprise highlighting the constraints in straw mushroom production and marketing as well. Various analytical tools viz. cost concepts, benefit-cost ratio, SWOT analysis, and Garrett's ranking technique were employed. The annual benefit-cost ratio was 0.988 indicating that it is not an economically viable enterprise particularly for the small holders. However, the returns over the variable cost were positive. High perishability, storage facilities and extreme climatic conditions were the major threats to the mushroom producers. The study concludes that paddy straw mushroom is an enterprise for subsistence and not a highly remunerative one.

Keywords: Benefit-Cost, Farmers' nutrition, Straw mushroom, Profit

JEL Classification: D61, P42

Introduction

Since ancient times, mushrooms have proved to be one of the most important and preferred food items. Its consumption has increased overtime owing to its remarkable role as a source of nutrition for human health and in mitigating diseases (Uddin *et al*, 2011). Mushrooms have a diverse range of species that act as supplementing food to the humans (Singh *et al*, 2018). However, out of all the species, only 4-5 are importantly used in industries at the global level. In India, only 3 species are used for commercial cultivation, i.e, *Agaricus bisporus* (Button Mushroom), *Pleurotus florida* (Oyster Mushroom) and *Volveriella volvacea* (Paddy Straw Mushroom or Straw Mushroom).

Volveriella volvacea (Straw Mushroom) is one of the popular edible mushrooms throughout the world and especially in India. It grows on decomposed paddy straw under preferably humid conditions. Though it can be grown throughout the year using controlled atmosphere, the most favorable time for its cultivation is February to August. The substrate is spawned with 65% of moisture at 30-35 ºC with minimum ventilation and proper light. The fruiting bodies are then harvested within 14-21 days of bed preparation (Reyes, 2000). Reports show that this mushroom also acts an anti-microbial, anti-cancer and anti-tumor food product (Mathew *et al*, 2008; Da Silva *et al*, 2008). It also includes substantial amounts of crude fibres, acids like ascorbic acid and minerals like potassium, iron, copper and magnesium (Mshandete *et al*, 2007).

In India, straw mushrooms are more commonly produced in coastal states like Odisha, Andhra Pradesh, Tamil Nadu, Kerala and West Bengal. However, they can also be produced in other states that have suitable agro-climatic conditions and good amount of available agricultural wastes. In Odisha, experimental cultivation of Straw mushrooms was started in the year 1972 but commercial production started since 1992. In India, Odisha leads in the production of straw mushrooms with an annual harvest of 8129 tonnes (Mohapatra and Chinara, 2014). Straw mushrooms are cultivated as intercrop in coconut plantations from February to

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November in Odisha The hot and humid coastal climate favours the production of this mushroom during the summer and rainy months. However, it is found that the traditional method of cultivating under the tree shades lead to almost 10% lower and unstable production (Mohapatra *et al*, 2011).

Mushroom cultivation has always been promoted as a source of livelihood generation among the rural poor. However, the profits incurred largely depend on the type of enterprise. As most of the farmers take it up as a supplementing enterprise, it is time to evaluate if straw mushrooms can be used as a sole livelihood generating farm enterprise for employment generation. Thus, the present study is taken up with the objectives to compute the annual cost and return in sole paddy straw mushroom production, to find the benefit-cost ratio for sole enterprise of straw mushroom and to elicit the problems or constraints in mushroom production and marketing.

Data Sources and Methodology

Assumptions

Before starting the study, some assumptions were taken for better understanding and ease in computing the results. The mushroom was produced organically, i.e., there was no use of fungicides or chemical supplements. The average farm gate price of straw mushroom was taken as Rs. 180 per kg. The opportunity cost of paddy straw was ignored. A total of 9 production cycles were taken in a year that spread over a period of 6 months, preferably from March to August. The infrastructure for mushroom production had an area of 1000 square feet. Two tier system was taken for the calculation, with 120 beds of mushroom in each tier. Each bed had an efficiency of 75%. Finally, the fixed costs were considered to spread over a period of 10 years.

Study area and data collection

Primary data was used for this study. The data was collected from 100 respondents that comprised local farmers, vendors, traders, hotels and restaurants during the financial year of 2018-19. Twenty respondents were taken from each category, in and around the outskirts of Bhubaneswar, Odisha. The vendors, hotels and restaurants were surveyed from 5 different locations of Bhubaneswar, viz. Delta square, Ram Mandir Square, Sishu Bhawan Square, CRP square and Rupali Square. The mushroom farmers and traders were interviewed from Pipli that is around 31km from Bhubaneswar.

Personal interview and Delphi technique were used to interview the vendors, hotels and restaurant owners. Delphi technique is a structured communication method wherein experts from the relevant field are interviewed face-to-face. Focus group discussion (FGD), is an interview technique where the interviewer gathers people from similar background to discuss the topic of interest. FGD was used to collect relevant information from the farmers and traders of paddy straw mushroom.

Cost of cultivation

For the calculation of cost of cultivation, the CACP cost concepts were used. Here, the cost per 1000 sq.ft was computed for a period of 1 year (9 production cycles), using the data collected from the respondents. The costs viz., Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, Cost C_2, Cost C_3, have been computed. Furthermore, for calculating the profitability of the enterprise, various costs and ratios, viz., operational cost, overhead cost, benefit-cost ratio, breakeven point, cost of production and average variable cost were calculated using the following formulae:

Operational Cost = Cost A_1 – Land Revenue – Depreciation + Wages of Family Labour

Overhead Cost = Cost C_2- Operational Cost

Benefit-cost ratio = Gross Return/ Total Costs

Breakeven Point= Fixed Cost/ (Revenue per unit – Variable cost per unit)

Average Variable Cost = Operational cost/ Total Production

Constraint analysis

Two techniques were used to identify and rank the problems faced in paddy straw mushroom cultivation, viz. SWOT analysis and Garrett's ranking. Firstly, SWOT analysis was used to categorize the strengths, weaknesses, opportunities and threats of paddy straw mushroom cultivation. SWOT analysis is a strategic planning and strategic management technique used to help a person or organization identify strengths, weaknesses, opportunities, and threats related to the enterprise. It is also known as situational assessment or situational analysis.

Secondly, we used the Garett's ranking to rank the problems faced in the cultivation of paddy straw

mushroom. Garrett's ranking technique is employed for ranking the preferences of respondents on different variables. This method helps to identify the most significant variable influencing the respondent. By this method the respondents are asked to rank their preference for all factors. The resultant outcomes of such rankings are converted to percent position using the formula:

$$\text{Percent position} = \frac{100(Rij-0.50)}{Ni}$$

Where, Rij = Rank given for the i^{th} variable by j^{th} respondents and Nj = Number of variables ranked by j^{th} respondents. From the Garrett's table, the percent position calculated is converted into scores. Then for each factor, the scores of each individual are added and the total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important factor.

Results and Discussion

Cost of cultivation

The total fixed cost (TFC) for the mushroom enterprise is found to be Rs 2,30,750 (See Annexure I). The TFC for one year of paddy straw mushroom cultivation was Rs 23075 after factorization.

The persual of table 1 reveals that the total annual operational cost and the overhead cost were found to be Rs 239280 and Rs 55620, respectively. The annual cost of cultivation was found to be Rs 294900.

With an efficiency of 75 per cent, 180 kg of straw mushroom were produced from 240 beds in an area of 1000 sq. feet. Therefore, a total of 1620 kg of paddy straw mushrooms were produced annually in 9 production cycles. Considering the selling price of Rs 180 per kg, the gross annual return was found to be Rs 291600, thereby showing a loss of Rs 3300. Thus, benefit cost ratio was 0.988 indicating a marginal loss in the overall production of straw mushrooms. Moreover, the cost of production was also computed to understand the loss incurred per kg of mushroom. A net loss was seen the production of per unit of straw mushrooms as the cost of production amounted to Rs 182.037.

However, the average variable cost was Rs 147.70 per kg, thereby showing that the return over variable cost was positive. Thus, the production could continue. The various parameters computed to find the economic feasibility of paddy straw mushroom have been mentioned in table 2.

It is clear that the revenue generated from paddy straw mushroom cultivation (as a sole crop for small farmers) covers the variable cost and thus the enterprise is not under the shutdown condition and production can be carried forward. However, looking at the total cost, it is seen that total revenue generated is marginally less from the total cost (fixed and variable cost). This calls for finding out the amount of production needed to bring a point of no loss-no profit, i.e., breakeven point. Once the breakeven point is known, further steps may be taken for profitability. The breakeven point was computed and found to be 7143.96 kg, which means that the farmer has to produce 7143.96 kg of paddy straw mushroom to come to a point of no profit and no loss. There is a huge gap between the present production (1620 Kg) and the production level required for bringing the breakeven point (7143.96 kg) which implies that the ongoing cultivation practice is not a suitable one for bringing about profitability to the farmers. In the current scenario, the variable cost is still higher, so effort should be made to reduce the cost of production by using cost effective resources, adoption of better technologies to enhance the production efficiency per bed or resource conservation technology for better utilization of available resources.

SWOT analysis and ranking of constraints

The SWOT analysis was done and the strengths, weaknesses, opportunities and treats were noted as shown in table 3.

The weaknesses and threats were identified as the constraints of the of paddy straw mushroom cultivation. All the constraints were ranked using Garrett's Ranking (Table 4).

It can be clearly seen that high perishability, storability and climatic vagaries were the topmost constraints in the cultivation of the paddy straw mushrooms. Though problems of transportation and taboos like considering mushroom as a non-vegetarian dish occupied the last ranks, still there is scope for development in these areas as well. While, easy availability of straw was a major strength, its high opportunity cost and demand in ceramic & other industries as a packaging material were found to be the major threats that could divert the farmers from mushroom cultivation.

Table 1. Cost of Cultivation of paddy straw mushroom

Particulars	Oty	Rate	Amount for 1 month/ Cycle		Amount for 1 yr
Value of Hired Human Labour	1	300	9,000	6	54,000
Cost of Straw	7kg/ bed	4/kg	6,720	9	60,480
Cost of Seeds (spawn)	1 bottle for 2 beds		5,400	9	48,600
Value of Wheat gram (feed)	200g/bed		7,200	9	64,800
Irrigation and electricity charges			1,500	6	9,000
Depreciation (per month)			1,670	6	10,020
Interest on working capital			400	6	2,400
Cost A_1					2,49,300
Rent paid for leased in land			0	6	0
Cost A_2 (A_1+Rent paid for Leased in land)			31,890		2,49,300
Interest on Fixed Capital/ Assets excluding Land			1,600	6	9,600
Cost B_1(Cost A_2+ Interest on Fixed Capital/ Assets excluding Land)			33,490		2,58,900
Rental Value of own land (bimonthly)			3,000	6	18,000
Cost B_2(Cost B_1+ Rental value of own Land)			36,490		2,76,900
Imputed Value of Family Labour		10 man days/ month @ 300/-	3,000	6	18,000
Cost C_1 (Cost B_1+ Imputed value of Family Labour)			36,490		18,000
Cost C_2 (Cost B_2+ Imputed Value of Family Labour)			39,490		2,94,900
Managerial Input cost of the farmer			3,949	6	23,694
Cost C_3 (Cost C_2+ Managerial Input of the farmer)			43,439		3,18,594

Table 2. Various parameters for determining the economic feasibility

Particulars	Value
Overhead Cost	Rs 55620
Operational Cost	Rs 239280
Annual Cost of Cultivation	Rs 294900
Gross Annual Return	Rs 291600
Cost of Production	Rs 182.037
Average Variable Cost per Kg	Rs 147.70
Benefit-Cost Ratio	0.988
Breakeven Point	7143.96 kg

Table 3. SWOT analysis of cultivation and marketing of paddy straw mushroom in Odisha

Strengths	Weaknesses
Easy availability of Paddy straw as inputs Excellent Taste High nutritional value Simple production technology Short cropping duration High consumer preference Demand far exceeds supply (Perpetual demand exists throughout) Suitable climate conditions in Odisha	High perishability Lack of proper marketing space in line with Odisha Milk Federation (OMFED), Odisha Poultry Federation (OPOLFED) Storage problems Transportation Competitive market Most cost for common man Considered as non-vegetarian in certain areas so not used in pujas Lack of technical knowledge Problem of packaging Regulation of Microclimate w.r.t Temperature and Relative Humidity
Opportunities	**Threats**
Increasing awareness about the nutritional & medicinal properties of paddy straw mushroom Scope of employment opportunities Large scope for mushroom processing and value-added products Utilization of agricultural wastes and environmental protection. (Like semi compost method) Social, Nutritional, Financial security	Vagaries of nature like cyclone High opportunity cost of inputs particularly straw.

Table 4. Constraints in straw mushroom cultivation

Problems	Mean Score (%)	Rank
Unorganized Sellers and Difference in Prices	9.22	VII
High Perishability	10.53	I
Storage Problems	10.24	II
No Policy or Support from the Government	9.36	V
Lack of Awareness of Nutritional Value of Mushroom	8.67	VIII
Transportation	8.0005	X
Considered as Non-Veg among Certain Groups of people	6.64	XI
Climatic Vagaries	10.19	III
Problem of Packaging	9.82	IV
Lack of Proper Marketing Space like OMFED and OPOLFED	8.09	IX
High Cost of Inputs	9.24	VI

The constraint analysis has clearly ranked the problems of mushroom cultivation that can be helpful in mitigating and managing the problems of the same. The constraints include a variety of issues relating to all the stages of marketing starting from production to consumption, which calls for a wholesome management strategy both at individual and governmental levels. In order to achieve this, adoption of labor-saving technologies, creation of mushroom cooperatives like the ones for poultry may be done to procure the mushroom from the doorstep of the cultivator and also provide him with the necessary inputs. Also, processing of mushrooms at the farm gate level along with better packaging techniques to increase the shelf life of the

mushrooms can generate year-round revenue. Providing subsidy for mushroom cultivation may also be a good alternative to sustain the livelihood of sole mushroom farmer.

Conclusion and Policy Implications

Though paddy straw mushroom is considered to be one of the best crops for an entrepreneurial enterprise but the reality is something different. Considering the small farmers, as per the present study, it is not a remunerative sole enterprise as its B:C ratio comes to be 0.988 and thus not viable economically. However, if we consider the operational costs, some considerable amount of profit is incurred. This implies that it is rather an enterprise for subsistence. Thus, effort should be made to reduce the cost of production by using cost effective techniques and better utilization of available resources to make this enterprise economically feasible for a small farmer who wants to take up mushroom as a sole enterprise and not as a supplementary one. The study shows that high perishability, lack of proper storage facilities and climatic uncertainty are some of the major problems faced by the mushroom growers in Odisha, that need to be taken care of It is high time to realize the potential benefits of mushroom as a major nutritional supplement and a low-cost ethical income generating enterprise for the rural masses by giving due importance for improvement in the conditions of the small-scale mushroom farmers especially in a state like Odisha which is the main hub for paddy straw mushroom, thus creating a shift from subsistence enterprise to a remunerative one in the real sense by suitable policy and extension support.

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Annexure I
Fixed Costs involved in the Cultivation of Paddy Straw Mushroom

Particulars	Qty.	Rate (Rs.)	Amount (Rs.)
Cultivation Shed (Brick mortar with asbestos roofing) (50×20×15)	1	2,00,000	2,00,000
Straw Immersion Tank (brick mortar) (5×4×3)	2	4,000	8,000
Chaff cutter	2	1,000	2,000
Sprayer	1	2,000	2,000
Bamboo for making racks	25	250	6,250
Weighing balance (top pan)	1	1,000	1,000
Thermo-hygrometer	1	1,500	1,500
1 HP Tulu Pump with pipes	1	10,000	10,000
Total			2,30,750