

Research Paper

Economic Analysis of Shiitake Mushroom Cultivation as an Agribusiness Enterprise in India

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ABSTRACT

With a great deal of constraints such as heavy dependence on weather, small and fragmented land holdings, depleting resource, demand shift etc. faced by traditional Indian agriculture, farmers are shifting towards allied enterprises. Mushroom is one such enterprise which provides remunerative and nutritive produce with less-land and investment requirements. Hence, the present study assessed the economic performance of the Shiitake mushroom production in terms of cost & return analysis, viability analysis and BEP assessment using primary data. The overall net returns were ₹ 235/ bag/ cycle of Shiitake with rate of return on capital of 1.93 showing the economic viability of the enterprise. It was also found that larger units of Shiitake mushroom were more viable and economically sound as compared to smaller and medium units. Since lesser land and other resources are required for Shiitake mushroom with higher returns and good nutritive value, such mushrooms ought to be promoted for adoption at large scale to alleviate poverty and nutritional insecurity of vulnerable Indian population.

HIGHLIGHTS

- The variable cost per bag was highest for small units (₹ 60/ bag) followed by medium (₹ 49/ bag) and large (₹ 36/ bag) units.
- Law of economies of scale was operating in the farm with returns over variable costs (ROVC) being highest for large units (₹ 255/ bag) followed by medium (₹ 229/ bag) and small (₹ 219/ bag) units.
- The larger units were highly viable with a rate of return of 3.33 and a BCR (Benefit-Cost Ratio) of 1.49.
- The BEP quantity for small, medium, and large Shiitake mushroom units was 14 Kg, 16 Kg, and 1050 Kg, respectively.
- The overall gross revenue was 12 lakh as against break even revenue of ₹ 2 lakhs.
- All the units were producing well-above their BEP (break Even Point) with MoS (Margin of Safety) at 48%, 92%, and 58% for small, medium, and large units, respectively.

Keywords: Mushroom, Shiitake, remunerative, viability, BEP, net returns, rate of return

The extant Indian agriculture has taken a shift from customary to commercial agriculture in recent times attributable to espousal of new entrepreneurial activities by next- gen farmers and also to recent diversion of consumer taste and preferences towards healthier and nutritionally rich food options (Shirur *et al.* 2014; Shirur *et al.* 2016). In Asia, mushroom production started well-before 1000 years, but it is a fairly new activity in India (Sharma *et al.* 2017). In the present health conscious epoch, the mushrooms are known to be future vegetable due to their

high nutritional and medicinal value. Mushrooms have been suggested by Food and Agriculture Organization (FAO) as protein food particularly for developing nations which are mainly dependent on cereals to meet their protein requirement. It is a type of eco-friendly and organic vegetable due to

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its method of cultivation. Like cereals, mushroom cultivation does not depend on large areas of land as its production is mostly done vertically. Scientifically followed mushroom cultivation can brace livelihood of small and marginal farmers both economically and nutritionally as it is a short term crop with numerous health benefits.

On commercial scale mushrooms have been grown in many parts of the world, but profit based large scale mushroom production in India has gained momentum recently. As India is an agriculture based country, it produces large amount of agricultural waste nearly 620 million tonnes yearly (Singh and Sidhu, 2014). For mushroom cultivation, ours is one of the most apposite countries in the world owing to its favorable weather with low production cost, availability of large agro-waste and cheap labor. Mushroom enterprise can act as an integral part for economic empowerment of vulnerable sections in India by improving living standards, savings and social-status (Singh *et al.* 2015; Singla and Goel, 2016).

Shiitake also known as golden oak mushroom is the No. 1 edible mushroom globally and has vast scope in India due to its nutraceutical importance and unique taste (Singh *et al.* 2021). This mushroom with incredible medicinal properties can be an important tool for livelihood and nutritional security for the farming as well as non-farming community. In 2006, although the production is dominated by log cultivation in United States, but sawdust substrate gives the highest production volume. Growers earned revenue of around ₹ 1.13 lakh for outdoor cultivation and ₹ 45.31 lakh were earned by those who adopted both outdoor and indoor method while those who just adopted saw dust based cultivation earned more than ₹ 45 lakh (Gold *et al.* 2008). In recent years, with log cultivation of Shiitake, growers are able to make ₹ 1800-2800 per Kg with an average yield of 10-25 Kg of Shiitake per week from 500-1000 logs in the United States (Gabriel, 2022). But in India, the specialty mushroom cultivation is in its nascent stage in India. Shiitake mushroom as an enterprise is input intensive owing to much sophisticated infrastructure requirement. Thus, for its larger adoption in the country, it becomes imperative to study the economic feasibility of Shiitake as an enterprise. While, extant literature does not shed

any light on its economic aspect in a developing country like India. This paper tries to address the cost and returns, financial feasibility, and economic viability aspect of Shiitake mushroom as a business unit in India.

DATA AND METHODOLOGY

Data

The primary data (2021) has been collected from 20 Shiitake mushroom growers all over India through random snowball sampling as it is a novel enterprise in India and growers are scattered in the country. Semi structured questionnaire was formed to collect primary data from these respondents across the country. The primary data (2021) were collected on fixed assets and costs, variable costs related to substrate, spawn, bags, labour, miscellaneous expenses, quantity sold, market price etc. The growers were divided into small (<300 bags), medium (300-1000 bags) and large (>1000 bags) with the help of Cumulative Square Root Frequency (CSRF) Method.

METHODOLOGY

Cost and return analysis

Total costs are categorized into Fixed and Variable Costs

(1) **Fixed Cost:** These are those costs which don't vary with the level of output and remain unchanged over a short period of time. Components of fixed costs are Depreciation and Interest on Fixed Capital. Capital Recovery Cost (CRC) Method was used to calculate the depreciation. The cost item interest on fixed capital does not need be accounted for separately when CRC approach is followed. The CRC method is defined as the annual payment that will repay the cost of fixed input over the useful life of input and provide an economic rate of return on investment.

Capital Recovery Cost of Civil Structures, Machinery and Equipment:

$$R = Z \left[\frac{(1+r)^n r}{(1+r)^n - 1} \right]$$

Where,

R = Capital recovery cost,

Z = Initial value of the capital asset,

n = useful life of the assets,

r = interest rate

When the asset is purchased from borrowed capital the (current) actual interest rate charged by the bank was taken as ' r '.

Variable cost: These are the costs which vary with the level of production such as cost of fodder/ compost, labour wages, miscellaneous charges etc.

Gross cost: Fixed Costs + Variable Costs

Net Returns: Gross returns – Gross cost

Return over Variable Cost: Gross cost – Variable cost

Financial Feasibility analysis

Financial ratio analysis technique was used for feasibility analysis across mushroom farm size. It consist of following parameters

$$\text{Rate of return on capital} = \frac{\text{Net Returns}}{\text{Initial capital invested}}$$

It determines how well the growers have allocated its capital to earn profits, It is the money a Shiitake enterprise will make which is above the cost and pays their debts and equity capital.

$$\text{Operating Ratio} = \frac{\text{Total operating expenses}}{\text{Gross Income}}$$

Operating ratio determines the efficiency of Shiitake enterprise to keep the operating expenses low and generate revenues as well. It compares the total variable expenses by gross sales.

$$BCR = \frac{|PV[Benefits]|}{|PV[Cost]|} = \frac{\sum_{t=0}^N \frac{CF_t [Benefits]}{(1+i_t)^t}}{\sum_{t=0}^N \frac{CF_t [Costs]}{(1+i_t)^t}}$$

Where, CR = Benefit Cost Ratio

PV = Present Value

CF = Cash Flow of a period (classified as benefit and cost, respectively)

i = Discount Rate or Interest Rate

N = Total Number of Periods

t = Period in which the Cash Flows occur

$$\text{Cost elasticity} = \frac{\frac{\% \Delta Q}{Q}}{\frac{\% \Delta X}{X}} = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta X}{X}}$$

Cost elasticity is one of the major of feasibility. It is calculated as proportionate change in output due to unit change in input. For Shiitake enterprise to be feasible, it should be less than zero.

Economic viability analysis: Break Even Point (BEP) and Margin of Safety (MoS)

It is imperative for any enterprise to determine the minimum units of output to be sold so to at least cover the cost. It helps in averting risks and uncertainties, fixing realistic short and long term goals and to set budget for the mushroom enterprise accordingly.

Break-even point (BEP) of output was calculated by using the following formula:

$$BEP = \frac{TFC}{ASP - AVC}$$

where, TFC = Total Fixed cost excluding land cost (₹)

ASP = Average Sale Price of mushroom (₹/kg)

AVC = Average Variable Cost (₹/kg)

Shiitake cultivation like any agribusiness is prone to risks and uncertainties. Hence break even analysis determines the minimum point of economic viability and margin of safety *i.e.* how much the grower can bear reduced sales before the BEP is reached.

RESULTS AND DISCUSSION

Economic analysis of Shiitake mushroom cultivation

The cost and returns from Shiitake mushroom cultivation is given in Table 1. The share of fixed cost in total cost is 64 per cent on an average. It was highest for smaller units (₹ 129/ bag) followed by medium units (₹ 83/ bag) and larger units (₹ 59/ bag). The variable cost includes cost of raw materials, labour and energy costs. The variable cost/ bag was highest for small units (₹ 60/ bag) followed

Table 1: Costs and returns from Shiitake mushroom cultivation

Parameters	Categories a/o Mushroom unit size (₹/ bag/ cycle)			
	Small (300 bags)	Medium (300-1000 bags)	Large (>1000 bags)	Overall
Total Fixed Cost (CRC+ Salary)	128.77 (68.19%)	82.75 (62.64%)	59.01 (61.66%)	90.18 (64.16%)
Variable Cost				
Saw dust	2.71 (1.43%)	3.14 (2.38%)	4.27 (4.46%)	3.37 (2.76%)
Wheat bran	1.98 (1.05%)	2.26 (1.71%)	2.10 (2.20%)	2.11 (1.65%)
Chemicals	0.08 (0.04%)	0.13 (0.10%)	0.10 (0.11%)	0.10 (0.08%)
Labour cost	28.73 (15.21%)	24.43 (18.49%)	17.38 (18.16%)	23.51 (17.29%)
Energy cost	8.89 (4.71%)	5.51 (4.17%)	4.42 (4.62%)	6.28 (4.50%)
Spawn and other costs	17.70 (9.37%)	13.88 (10.51%)	8.41 (8.79%)	13.33 (9.56%)
Total Variable Cost	60.08 (31.81%)	49.34 (37.36%)	36.70 (38.34%)	48.71 (35.84%)
Gross Cost	188.86	132.09	95.70	138.88
Gross Returns	279.58	278.33	292.08	283.33
Net Returns	90.73	146.25	196.38	144.45
ROVC	219.50	228.99	255.39	234.63

Figures in parenthesis are respective share in gross cost.

by medium (₹ 49/ bag) and large (₹ 36/ bag) units. It shows the economies of scale operating in the Shiitake cultivation. Our results are in agreement with previous findings in Himachal Pradesh where larger units had lowest cost of production due to scale economies (Kangotra and Chauhan, 2014; Singh and Singh, 2018). The net returns and returns over variable costs (ROVC) are highest for large units as the size of unit is increased, the average cost declines and profits increase henceforth.

Market analysis

Table 2 provides the marketing details of Shiitake mushroom. The average price is about ₹ 1150, ₹ 1033, and ₹ 550 per kg of fresh Shiitake mushroom for small, medium, and large units respectively. Majority (74%) of the Shiitake mushroom has been sold in fresh form.

Table 2: Market analysis of Shiitake mushroom

Particulars	Small	Medium	Large
Average Price : Fresh (₹/ kg)	1150.00	1033.33	550
Average Price : Dried (₹/ kg)	—	—	2000-3850
Shiitake mushroom sales			
Fresh	74%		
Dried	26%		

The details of the market channel are given in table 3.

Table 3: Market channels followed

Channel	Particulars
Channel I	Producer → Hospitality sector
Channel II	Producer → Local customers / Visitors
Channel III	Producer → Other states
Channel IV	Producer → Processor → Final customer

Financial Feasibility analysis

It is imperative to know whether the Shiitake growing units are viable in economic terms or not. The check for the economic feasibility is presented in table 4. The rate of return on capital measures the returns earned over invested capital *i.e.* the efficiency of invested funds. All the units are performing well over the optimum value of one. It is highest for large units (3.33). The operating ratio determines how efficiently the units are maintaining the operating expenses low while generating profit at the same time. For all the units the operating ratio is within optimum limit. Another important aspect of economic viability is the benefit cost ratio which is highest for larger unit showing an earning of Rs. 1.49 for every rupee spent. The cost elasticity is an important economic measure as it presents how the cost will change if units increase their production by one unit. A negative CE is optimum showing as the mushroom production scale is increased the average cost declines representing economies of scale operating in the sample units.

Table 4: Measures of economic feasibility of Shiitake mushroom

Parameters	Optimum	Small	Medium	Large	Overall
Rate of return on capital	>1	0.70	1.77	3.33	1.93
Operating ratio	<1	0.21	0.18	0.13	0.17
Benefit Cost Ratio	>1	0.45	0.47	1.49	0.80
Cost elasticity	-ve	-0.69	-0.15	-0.41	-0.42
Break Even (Quantity in Kg)		14	16	1050	360
MOS (Margin of Safety) %	+ve	48.18	92.56	58.41	66.38

Economic viability analysis: Break Even Point (BEP) and Margin of Safety (MoS)

The scale at which units are operating is crucial for their break even position. The breakeven point for all the units is given in the Fig. 1. The BEP for small, medium, and large Shiitake mushroom units is 14 Kg, 16 Kg, and 1050 Kg, respectively. At this point there is no profit no loss and total returns just cover the gross cost.

Table 5 gives the details of BEP analysis. The overall gross revenue is 12 lakh as against break even revenue of ₹ 2 lakhs. All the units are working above their BEP with MoS at 48%, 92%, and 58% for small, medium, and large units, respectively.

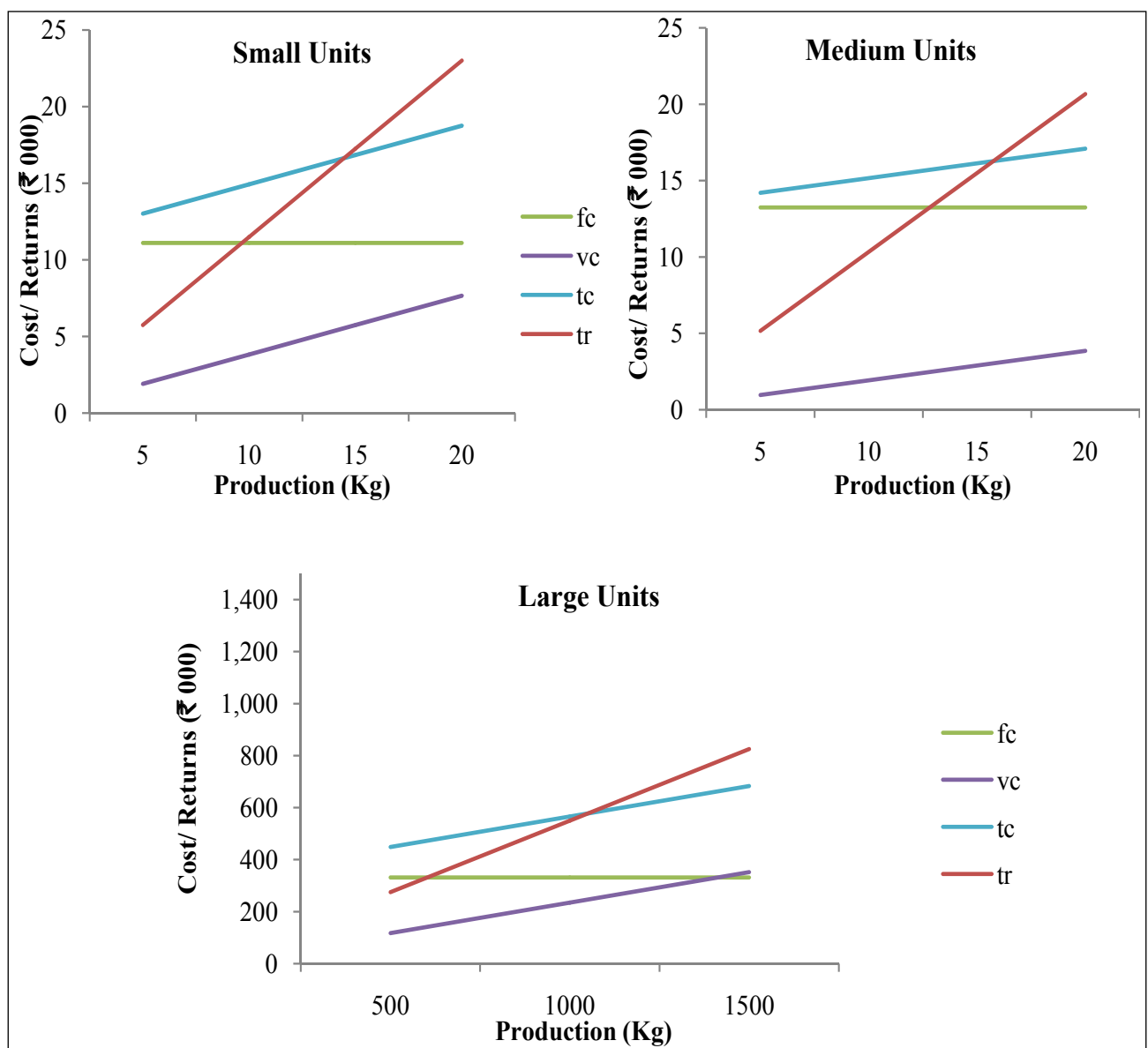
**Fig. 1:** BEP analysis of Shiitake mushroom cultivation across size categories

Table 5: Break Even and Margin of safety analysis

Particulars	Unit	Small	Medium	Large	Overall
Actual Output	Kg	28	212	2525	921.67
Break even Output	Kg	14	16	1050	360.00
Actual Sales	₹ lakhs	0.33	2.13	36.25	12.90
Break Even sales	₹ 000	0.17	0.16	5.78	2.04
MoS	%	48.18	92.56	58.41	66.38

CONCLUSION AND WAY FORWARD

Shiitake mushroom cultivation can be a promising enterprise for present and upcoming entrepreneurs. As it is capital intensive, the medium and large units can be considered as its optimum size to begin with. The smaller units may become viable by doing expansion overtime. The Indian market is not yet organized for Shiitake mushroom, yet the sale price in our study ranges from ₹ 500 to ₹ 1100/ kg for fresh and ₹ 2000-3000/ Kg for dried mushrooms. The units are also operating well above their breakeven point. It gives an idea about the economic feasibility and financial viability of Shiitake mushroom in India. Yet various aspects such as technical efficiency, profit efficiency, constraint analysis, value chain analysis are some untouched area in this golden oak mushroom which needs to be studied for the information among the mushroom stakeholders.

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