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A Study on Input Suppliers to the Mushroom Industry in Odisha

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ABSTRACT: Mushroom farming promotes nutritional security, boost livelihoods, and empower rural women and the unemployed. For every production activity, input supply is one of the key components upon which the entire production set up is based. The activity of mushroom production is also based on the availability of the specific substrate and the mushroom spawn. A substance that allows the growth and establishment of mushroom mycelium is known as a mushroom substrate. In commercial mushroom cultivation, spores are collected and the resulting mycelium is propagated on sterile cereal grain (wheat) to produce a product called spawn. There has been little study regarding inputs for mushroom production. An attempt is herein made to study about the input suppliers to the mushroom industry. Since the mushroom production is highest in the state of Odisha, it was purposively selected for the study. The respondents were selected from four major mushroom producing districts i.e., Puri, Khurda, Ganjam and Dhenkanal. Forty spawn producers and twenty straw producers were taken for the study. The major actors of paddy straw value chain are rice farmer, producer, trader and user. The majority of the paddy straw is marketed in channel I (paddy growing farmer trader mushroom farmer) followed by channel II (paddy growing farmer mushroom farmer). The production cost of one kilogram of paddy straw which is equivalent to two bundles of paddy straw comes around Rs 4.22. Channel II which markets comparatively less paddy straw provides paddy straw at a lesser rate of twenty five paisa as compared to channel I while the farmers margin is also more in channel II. The margin of trader is ninety five paisa in channel I. The total cost of mushroom spawn production per month as observed is Rs. 202343. The actual spawn production is 18559 bottles and the net return comes around Rs. 40473. The BC ratio becomes 1.35. The cost of production per bottle is around eleven rupees. The major constraints in varying degree of severity are high cost of wheat grain, scarcity of skilled manpower, infection and contamination of spawn. All efforts are to be made to increase the quality mushrooms spawn production for the benefit of the mushroom growers.

Keywords: Mushroom, Spawn, Paddy, Straw and Constraints.

INTRODUCTION

From ancient times, people all across the world have been aware of mushrooms, which are now widely recognised as a perfect food source that is high in protein, low in fat and carbohydrates, and useful for recycling organic waste. Mushrooms have long been used in India as well. Nevertheless,the nation is yet to establish itself in the international mushroom market. Many different species of mushrooms can be found in nature, mostly in the rainy season, on practically all soil types, on decomposing organic materials, on wooden stumps, etc. But unfortunatelyit is evident from the local dailies that eating wild mushrooms has resulted in the loss of priceless lives. This advocates for encouraging mushroom farming on a large scale to promote nutritional security, boost livelihoods, and empower rural women and the unemployed. For every production activity, input supply is one of the key components upon which the entire production set up is based. Similar is the case with mushroom production. The activity of mushroom production is based on the availability of the substrate and the mushroom spawn.

A substance that allows the growth and establishment of mushroom mycelium is known as a mushroom substrate. The substrate supplies the nutrients, moisture, and energy necessary for mushrooms to grow and produce fruit. Growers employ a wide range of various substrates. A good substrate is dense in woody, fibrous materials like lignin, cellulose and hemicellulose. These contain a lot of carbon, which is the main food source for your mycelium. In this category, paddy straw is a cheap and effective material to use as a substrate which is mostly used in mushroom cultivation in Odisha as the predominately cultivated mushroom types are paddy straw mushroom and oyster mushroom. Using substrate to grow mushrooms is the equivalent of using soil to grow plants. It's where the mushrooms will get all of their nutrients while growing. Just like plants require soil with different properties, different kinds of mushrooms prefer specific types of substrates.

Seed or planting material of mushroom i.e. spawn, consists of mycelia of the fungus multiplied on suitable substrates like cereal grains. The mycelia of mushroom fungus cannot be propagated as such; hence the mycelia are multiplied on a carrier like cereal grains. Like in all other crop production systems, seed or spawn is the key input in mushroom cultivation. Good quality spawn confirms high yield potential, absence of contaminants, and better economic benefit. Non availability of quality spawn is the major constraint in mushroom production. (Borah *et al.*, 2019). Spawn production primarily depend on the easy availability of spawn substrates, a good source of fruit body supplies and laboratory conditions for a sterile environment which requires special technical skill and a laboratory for quality and economic spawn production. The basic steps involved in spawn production are pure culture preparation, mother spawn preparation, spawn multiplication/commercial spawn preparation.Spawn suppliers played the major role in the distribution of inputs, collection and marketing of the product (Woldemedhin *et al.*, 2016). In India the spawn demand is estimated about 8000-10000 tons per annum (Sharma *et al.*, 2017).

Hence it is ascertained that paddy straw and spawn are the pre requisites for mushroom production. Most of the literatures that have been reviewed basically delt on the production and marketing aspects of mushroom, but hardly found any such literature that specifically studied about the input supply to the mushroom production activity or more specifically the creation of backward linkage. An attempt is herein made to study about the input suppliers to the mushroom industry with the following specific objectives:

1. To study the value chain map of paddy straw along with its production and marketing cost among different marketing channels
2. To study the cost and return structure of mushroom spawn production as well as it marketing system and constraints involved in its production

METHEDOLOGY

Selection of the sampling strategy is considered a critical decision in a study. The sample is a subset of a larger population that is taken as its representative. Sampling influences the objectivity and in turn the validity of the research outcomes (Naoum, 2012). In this study the sample involved two supply chain actors: mushroom spawn producers and paddy straw pfroducers.Since the mushroom production is highest in the state of Odisha, it was purposively selected for the study. The respondents were selected from four major mushroom producing districts i.e., Puri, Khurda, Ganjam and Dhenkanal. The mushroom spawn producers of each district were enlisted. Out of them ten spawn producers were selected at random. In the same way, the paddy farmers who produced paddy straw on commercial lines were also ennumerated in each state. From among themfive paddy straw producing farmers were selected at random. Thus forty spawn producers and twenty straw producers were taken for the study (Table 1).

Table 1: Selection of respondents.

Sr. No.	Input suppliers Districts	Spawn producers	Straw producers
1.	Puri	10	5
2.	Khurda	10	5
3.	Ganjam	10	5
4.	Dhenkanal	10	5
5.	Total	40	20
6.	**Grand total**		**60**

The data were collected via a pre-tested interview schedule to investigate the components, including the construction of a mushroom spawn unit, media preparation, daily maintenance, cost of production and marketing, etc. The collected data were tabulated and analyzed by various means and are represented by tables and figures.

Cost of cultivation and cost of production. To arrive at the objectives of cost of mushroom spawn production, fixed and variable costs were estimated. General farm management concepts were used to work out income measures. The cost of cultivation was computed in terms of fixed cost which include interest and depreciation on building used as mushroom spawn unit. The fixed cost included depreciation and interest on working capital

was calculated at 10 per cent. For mushroom spawn production cost calculation, the fixed cost was calculated taking the fixed assets for usage value of twenty years. The depreciation was computed by straight line depreciation method.

Computation of returns from mushroom production:

The gross returns were calculated as

$GR = Y_M * P_M$

where,

GR = Gross returns from mushroom spawn

Y_M = Mushroom spawn bottles

P_M= Price per bottle of mushroom spawn in rupees

The net returns were arrived at by deducting total cost from gross return.

Net return (NR) = Gross returns (GR)- Total cost (TC)

The return over variable cost was calculated by deducting total variable cost from total variable cost.

Return over variable cost= Gross returns (GR)- Total Variable Cost (TVC)

Financial test ratios:

To guide the financial viability, following financial tests ratio was computed.

$$\text{B:C Ratio} = \frac{\text{Total Return}}{\text{Total cost}}$$

Break-even point (BEP). In any business entity, costs, volume and profit are interrelated. Break even point is the level of output where there is no profit no loss. It means the production cost equalises with the total return. The break even point was computed by

Break Even of Production = Total cost/ Price per bottle

Marketing costs and margins. To find out marketing costs and margins, primary data on various aspects such as prices received and paid for the mushroom produce, the different costs incurred while packing, assembling, handling and transporting by traders or retailers of different markets was collected. To attribute the marketing costs, margin, price-spread and marketing efficiency of mushroom through various marketing channels, tabular analysis was performed to work out the following:

$$TC_{mm} = C_{mg} + \Sigma MC_i \quad (1)$$

where,

TC_{mm} = Total cost of mushroom marketing,

C_{mg} = Cost borne by the producer in the marketing of his produce

MC_i= marketing cost incurred by i^{th} middlemen

$$AM_{mi} = SP_{mi} - (PP_{mi} - MC_i) \quad (2)$$

where,

AM_{mi} = Absolute margin of the i^{th} middleman

SP_{mi} = selling price of i^{th} middlemen

PP_{mi} = Purchase price of i^{th} middlemen

The mushroom spawn producers' or paddy straw producers' share in consumer's rupee was arrived at as under:

$$G_s = \frac{G_p}{C_p} * 100$$

where,

G_s= Grower's share in consumer's rupee

G_p = Grower's price

C_p= Consumer's price

Price Spread

Price spread can be defined as the difference between the price paid by the consumer and the price received by the farmer.

The marketing efficiency was worked out by employing Shepherd's formula as well as Acharya's formula as given under:

$$ME = \frac{V}{I} \quad \text{(Shepherd's formula)}$$

$$ME = \frac{V}{I} - 1 \quad \text{(Acharya's formula)}$$

Where,

ME = Index of marketing efficiency

V = Retailer's sale price or consumer's purchase price

I = Total marketing costs and margins

Value chain map. The value chain map demonstrates how a product in an industry moves from raw material through, processing and other steps until it eventually winds up with the consumer. The Steps in Value chain map include the following:

Market research

Writing the steps in transformation process

End markets

Depicting the relationship

Representing support services

Additional overlays

Additional market research

Finalisation

Garrett ranking technique. In the study Garrett ranking has been used to elucidate the constraints of mushroom spawn producers. Respondents were asked to assign rank for all the factors. Ranks were converted into per cent position by the following formula.

$$\text{Percent position} = \frac{R_{ij} - 0.5}{N_j} \times 100$$

With the help of Garrett's table given by, the per cent position of each rank were converted into scores. For each factor, the scores of each individual were added together and divided by the total number of the respondents for whom scores will be added. Thus, mean value of scores were calculated. These mean scores for all the factors were arranged in descending order and ranks were given. The factor with the highest mean value was considered the most important factor or constraint.

RESULT AND DISCUSSION

As per the study under consideration there is addressed a comprehensively analytical study on the notion of the topic concerned under the following sub heads:

Paddy straw production

Mushroom spawn production

Paddy straw production. The Fig. 1 highlights the value chain of paddy straw in the state. The activities include harvesting of the paddy crop, collection of paddy straw, its distribution among different stakeholders and final utilisation that includes cattle feed, manuring, thatching, poultry litter, packing material, industrial uses

in paper industry, mushroom cultivation. The major actors are rice farmer, producer, trader and user. The production and level of production of paddy straw are influenced by variety, land and soil type, level and method of fertilization, irrigation, seasonal effect and cultivation area. Market linkage and awareness, skill based training and proper storage are the critical needs in proper management of paddy straw value chain. It is worth noting again that, unlike food products whose end-markets are food consumers (via national and international food markets), paddy straw generally ends up being used as an input for the production of other food and nonfood products. The end-markets of paddy straw are often input markets. Currently, in the study area, paddy straw is mainly used in the production of mushroom, ruminant feed, compost, mulching, and lining materials for the transportation of fragile fruits (e.g., watermelon) due to concrete, significant market demand for these straw-based products. Even though other new technologies and utilizations of rice straw (e.g., biochar, briquettes, bioenergy, biodegradable products, biofiber, etc.) are also already introduced, markets barely exist for these products (although they are emerging). Therefore, the markets for these relatively new straw-based products are categorized as "future markets". The overall paddy straw value chain process involves the collection of in-field rice straw and then transportation of the straw to end-users for their straw-based production activities. Specifically, paddy straw that remains on the field after rice harvesting is collected, usually by the farmers or straw traders (who purchase in-field straw from farmers and then collect straw at their costs or purchase straw from farmers). Paddy straw collection involves physical pretreatment of the straw, i.e., transforming straw that is spread around the field into various forms such as loose, compacted, or chopped straw, depending on the specific subsequent uses. Similar findings were obtained in the study of Demont *et al.* (2019) on Rice Straw Value Chains and Case Study on Straw Mushroom in Vietnam's Mekong River Delta.

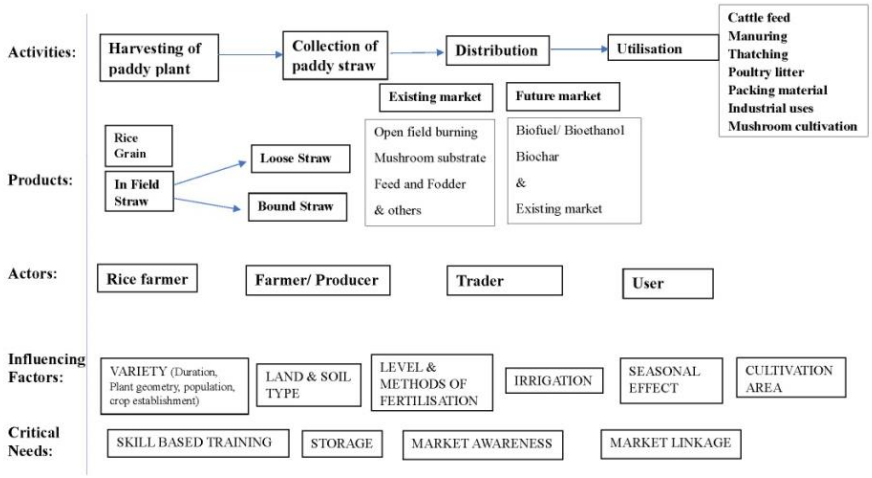

Fig. 1. Value chain map of paddy straw.

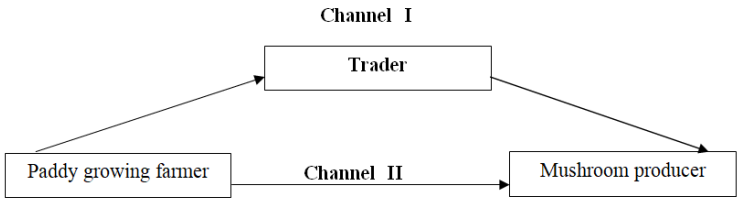

Fig. 2. Marketing channel of paddy straw.

Fig. 2 says the two different channels in which the paddy straw is marketed. In the first channel, paddy straw reaches the mushroom producer from the paddy farmer via the mushroom trader while in the second channel the paddy straw reaches the mushroom producer directly from the paddy farmer.

In the Table 2 the production and marketing cost of paddy straw in two different channels has been highlighted. The majority of the paddy straw is marketed in channel I followed by channel II. The production cost of one kilogram of paddy straw which is equivalent to two bundles of paddy straw comes around Rs. 4.22. This price is same and after production, the cost of paddy straw varies depending upon the channel in which it is marketed as it depends upon various factors like transportation, storage, loading and unloading. Channel II which markets comparatively less paddy straw provides paddy straw at a lesser rate of twenty five paisa as compared to channel I while the farmers margin is also more in channel II. The margin of trader is ninety five paisa in channel I.

Table 2: Production and marketing cost and marketing margin of paddy straw across various channels (in Rs).

Sr. No.	Particulars	Channel I (73%)	Channel II (27%)
1.	Production cost (1 kg)	4.22	4.22
2.	Farmers marketing cost (loading, unloading, transportation)	-	0.78
3.	Farmers margin	1.03	1.75
4.	Farmers selling price	5.25	6.75
5.	Trader's marketing cost	0.8	-
6.	Trader's margin	0.95	-
7.	Mushroom producers purchasing price	7	6.75

Spawn production. Table 3 shows the different fixed costs for mushroom spawn unit room for spawn unit, autoclave, pump with borewell, laminar air flow, refrigerator, UV light, culture tube, measuring cylinder, weighing balance, inoculation needle, plastic wire basket, LPG stove with gas, furniture, utensils. Taking all these into consideration, the fixed cost investment comes out to Rs. 818339. In the same way, the per month recurring expenses of mushroom spawn unit has been depicted in Table 4. In total the recurring cost for one month comes out to Rs. 192114. Table 5 shows the break up of cost of production in terms of variable cost and fixed cost that includes the interest and depreciation of mushroom spawn. The total cost of mushroom spawn production per month as observed is Rs. 202343. The cost and return from mushroom spawn production are given in Table 6. There is an average production of 20976 spawn bottles. But due to contamination of 11.53 per cent, the actual spawn production is 18559 bottles. The average selling price is Rs. 14.7 the net return comes around Rs. 40473. The BC ratio becomes 1.35. The cost of production per bottle is around eleven rupees.

Table 3: Fixed cost for spawn units by sample respondents.

Sr. No.	Particulars	Amount (Rs)
1.	Room for spawn unit	390133.55
2.	Autoclave	203549.2
3.	Pump with borewell	64211.9
4.	Laminar air flow	99121.67
5.	Refrigerator	24326.1
6.	UV light	1950.2
7.	Culture tube	4560.8
8.	Measuring cylinder	640.4
9.	Weighing balance	2770.2
10.	Innoculation needle	653.4
11.	Plastic wire basket	75.8
12.	LPG stove with gas	7664.9
13.	Furniture	9502.8
14.	Utensils	9178.6
15.	Total	818339.52

Table 4: Recurring cost for spawn unit for one month by the sample respondents.

Sr. No.	Particulars	Amount (Rs)
1.	Glass bottles for spawn	48580.2
2.	Non-absorbent cotton for bottles and culture tube	16633.8
3.	Wheat grains	81622.6
4.	Calcium carbonate	1511.45
5.	Butter paper	981.78
6.	Rubber band	531.2
7.	Dextrose	212.9
8.	Agar agar	151.1
9.	Potato	45.25
10.	Ambistryn	105.2
11.	Labor	24202
12.	Electricity	11729
13.	Misc.	4220.2
14.	Total	190526.7
15.	Interest on working capital @10pa	1587.73
16.	Total	192114.4

Table 5: Break up of cost of production of mushroom spawn.

Sr. No.	Particulars	Amount
1	Fixed cost	10229.24
A	Depreciation	3409.74
B	Interest	6819.49
2	Total variable cost	192114.4
3	Total cost	202343.7

Table 6: Cost and return from mushroom spawn production.

Sr. No.	Particulars	Amount(Rs)
1.	Total variable cost	192114.4
2.	Total production cost	202343.7
3.	Spawn production	20976 bottles
4.	Infected spawn bottles	2417 bottles
	Infection rate	11.53 %
5.	Actual spawn bottles less infected	18559 bottles
6.	Average selling price per bottle	14.7
7.	Gross returns (5*6)	272817.3
8.	Net returns (7-2)	70473.6
9.	Return over variable cost (7-1)	80702.83
10.	Bc ratio (7/2)	1.35
11.	Cost of production per bottle (2/5)	10.9
12.	Break even point of output (2/6)	13764 bottles
13.	Net returns per bottle (6-11)	3.8

Fig. 3 point outs the two different marketing channels in marketing and distribution of mushroom spawn. In the first channel spawn is traded through the retailers to the mushroom producer from the mushroom spawn producer while in the second channel the spawn is traded directly to the mushroom grower from the spawn producer. Marketing cost, margin and efficiency of mushroom spawn in different channels is given in table 7. With the retailer involved in channel I, the price of the mushroom spawn is slight high as compare to channel II and in channel I producers share in consumers rupees comes around eighty two per cent.

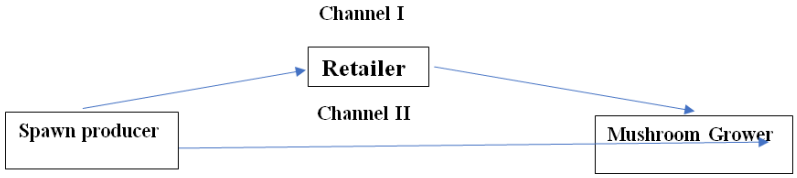

Fig. 3. Marketing channel of mushroom spawn.

Table 7: Marketing cost, margin and efficiency of mushroom spawn in different channels.

Sr. No.	Particulars	Channel I	Channel II
1.	Spawn producers sale price	13.91	15.5
2.	Retailers purchase price	13.91	-
I	Retailers Marketing cost	0.89	-
A	Transportation	0.64	-
B	Storage	0.25	-
II	Retailers marketing margin	2.05	-
3.	Retailers sale price	16.85	-
4.	Consumers purchase price	16.85	15.5
5.	Price spread	2.94	0
6.	Producers share in consumers rupee (%)	82.55	100
7.	Marketing efficiency (Acharya's formula)	4.73	-
8.	Marketing efficiency (Shephard's formula)	5.73	-

Table 8 tells the constraints in spawn production. The major constraints in varying degree of severity are high cost of wheat grain, scarcity of skilled manpower, infection and contamination of spawn. It indicates that

there is a financial burden on the spawn producers due to high price of wheat grain. Since mushroom spawn production is a technical activity, there is the requirement of skilled manpower. Without the skilled manpower there may be chances of infection and hence the spawn gets contaminated and such contaminated spawn lead to low or no mushroom production. Unless the spawn quality is good, we can't think about better mushroom production.

Table 8: Constraints in spawn production.

Sr. No.	Particulars	Garrett score	Rank
1.	High cost of wheat grain	70.9	1
2.	Scarcity of skilled manpower	50.8	2
3.	Infection and contamination of spawn	28.6	3

CONCLUSIONS

As it is evident from the above study that the particular substrate and spawn are essential for the mushroom cultivation, it is necessary to provide good quality spawn and appropriate paddy straw substrate for qualitative and adequate mushroom production. Skill based training, appropriate storage, market awareness and market linkage are necessary for upgrading of paddy straw value chain in the state. The mushrooms spawn producers have limited presence in study districts, as a result the supply of spawn is less than the desired. All efforts are to be made to increase the quality mushrooms spawn production for the benefit of the mushroom growers. Wheat may be provided to the spawn producers at subsidised rate. Technical know-how to be given to spawn producers to check spawn infection. There is an urgent need of infrastructural support, financial support, technical support, and extension support for improvement in mushroom value chain.

FUTURE SCOPE

In future, this study will help the policy makers to create new policies to safeguard the interest of spawn and straw producers. The researchers will also think about how to reduce the percentage contamination of spawn to produce quality mushroom spawn.

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Conflict of Interest. None.

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