



## Oyster Mushroom Technology: Impact and Assessment Study in South Gujarat

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**ABSTRACT:** The Krishi Vigyan Kendras (KVKs) of India have been widely acknowledged for their crucial effort in promoting oyster mushroom cultivation technology to rural youth through training and demonstration programs. The purpose of present study is to investigate the impact of training programs, evaluate the mushroom production technology conducted by KVK in Tapi, Gujarat, and the challenges faced by adopters. The training and demonstration program was found to be beneficial for agricultural farming and animal husbandry because mushroom cultivation technology can provide additional income. Pre-training knowledge score was not much satisfactory. The knowledge score obtained before training was not very satisfactory. Despite this, the knowledge score that respondents received after training was more satisfactory in every aspect. The participants' education level and socioeconomic factors played a significant positive role in their knowledge gain. The evaluation of the small scale mushroom production demonstration resulted in a positive outcome, resulting in a net profit. The primary obstacle that all the respondents faced was the shortage of mushroom spawn, followed by the absence of an organized market for fresh oyster mushrooms and small-scale mushroom cultivation units are not receiving government initiatives or subsidies.

**Keywords:** Impact, Assessment, Oyster mushroom, Trainings, Demonstrations.

### INTRODUCTION

The peculiar morphology of oyster mushrooms (*Pleurotus* spp.) makes them easily recognized in nature due to their affinity for lignocellulose. Due to simple low cost cultivation technology, it is the most popular cultivated edible mushroom, consumed for its delicacy, flavour, pleasant consistency besides having nutritive and medicinal value (Deepalakshmi and Sankaran 2014). Among all the cultivated mushrooms, *Pleurotus* has maximum number of commercially cultivated species suitable for round the year cultivation (Valverde *et al.*, 2015; Deepalakshmi and Sankaran 2014). Producing protein-rich food without composting can be done by the oyster mushroom, which is one of the most suitable fungal organisms for producing agricultural waste. China, India, South Korea, Japan, Italy, Taiwan, Thailand, and the Philippines are all popular locations for growing the third largest cultivated mushroom in the world. Das and Sarkar (2016) report that India produces 10,000 tons of oyster mushrooms annually. There are multiple species of oyster mushrooms that can be grown indoors without the use of pesticides. The popularity of mushrooms among health conscious consumers may be due to their high nutritional value, medicinal properties, and absence of pesticide residue.

The health benefits of mushroom cultivation and consumption in Gujarat were limited in certain areas due to a lack of awareness about their health benefits. The popularity of mushroom among the people of Gujarat, especially the rural masses, has been achieved through collaboration with Agricultural Universities and line departments due to the efforts of Krishi Vigyan Kendras (KVK) through trainings, awareness and demonstration programmes. In South Gujarat, October to April is the main season for oyster mushroom cultivation (Chavan *et al.*, 2024). The lack of organized market in Tapi district of Gujarat made it difficult for many entrepreneurs to cultivate oyster mushrooms on a small scale. The number of oyster mushroom consumers and growers in rural and urban areas of the district has grown manifold after KVK Tapi's continuous efforts to conduct vocational training, demonstrations, and awareness programmes since 2016. This health food has the potential to become popular among consumers and encourage unemployed rural youths to start oyster mushroom cultivation as a self-employment venture. To promote mushroom cultivation in the district, it is crucial to examine the impact of KVK's training programs and mushroom production technology assessment on mushroom cultivation and the obstacles that oyster mushroom cultivation

technology adopters have been faced. In this context, Krishi Vigyan Kendra, Tapi conducted a research trial on impact and assessment study of oyster mushroom cultivation technology through trainings and demonstrations among tribal entrepreneurs.

## MATERIALS AND METHODS

The office of the Krishi Vigyan Kendra, Tapi wanted to create awareness of oyster mushroom cultivation vegetables to the farmers of Tapi district. Therefore, in order to add to the income of the farmers and to introduce them to oyster mushroom, the KVK started vocational training programme from 2015-16 and Front Line Demonstrations (FLDs) on mushroom cultivation was conducted during 2018-19 to 2022-23. By

conducting pre- and post-training evaluations, we assessed the trainees' reasons for participating in training and demonstration programs, as well as their knowledge gain before and after. KVK also commenced supply of mushroom growing kit and introduced mushroom as Front Line Demonstration in the area details of inputs supplied for demonstration of mushroom production technology are given in Table 1. Farmers were trained in media preparation, spawning process, preparation of low cost mushroom house, care and maintenance of mushroom house, management during incubation and fruiting, harvesting through method demonstration (Fig. 1 A, D, E, F).

**Table 1: Details of inputs supplied for demonstration of mushroom production technology.**

| Sr. No. | Particular        | 2019     |               | 2020     |               |
|---------|-------------------|----------|---------------|----------|---------------|
|         |                   | Quantity | Cost (Rs)     | Quantity | Cost (Rs)     |
| 1.      | Mushroom spawn    | 2 kg     | 250.00        | 4 kg     | 540.00        |
| 2.      | Formalin          | 400 ml   | 50.00         | 1 lit    | 110.00        |
| 3.      | Carbendazim 50 WP | 100 gm   | 50.00         | 100 gm   | 100.00        |
| 4.      | Plastic bags      | 10 no.   | 50.00         | 20 no.   | 60.00         |
|         | <b>Total</b>      |          | <b>400.00</b> |          | <b>810.00</b> |



**Fig. 1. A-Training programme; B-Input distribution; C- Post training evaluation; D- Follow up visit at mushroom grower site; E- Method demonstration on bag filling; F-Diagnostic visit.**

The study was carried out in the villages in Tapi district of Gujarat to evaluate the training programmes and technology assessment on oyster mushroom cultivation. A random selection process was used to select 200 beneficiaries of the aforementioned training period from 7 blocks in Tapi district. Furthermore, a random sampling method was used to select 25 farmers from the list of 200 participants to start mushroom production. The training evaluation forms were also sort out of the selected candidates. The trainees' knowledge was evaluated using the method employed by Sarma *et al.* (2013); Upamanya *et al.* (2019). To determine the distribution of respondents according to their level of knowledge and measure the significance of differences between the mean score of knowledge, a knowledge test was developed. A score of '1' (one) was given for correct answers and a score of '0' (zero) was given for incorrect answers during the final knowledge test. The total number of questions used to assess the respondent's knowledge level was 30, so they could receive a maximum score of 30. The scores obtained for

various questions were consolidated. Using the procedure developed by Dasgupta (1989), the total score was used to categorize respondents into three classes: low, medium, and high levels of knowledge. The significance of differences in knowledge gained before and after was determined through the use of paired t-tests. A set of independent variables and the knowledge gained were also examined for their relationship. Mushroom kit consisting of mushroom spawn, media sterilizing chemicals, and plastic bags were distributed by KVK, Tapi to selected 25 farmers as FLD inputs (Fig. 1-B). Constant follow up visit (Fig. 1-D), diagnostic visits (Fig. 1-F) at each farmers field were carried out by KVK, Tapi. The cost of cultivation and average yield of mushroom produced by each beneficiary was noted. Based on these economics and thereby BC ration of mushroom cultivation technology was also calculated. Lastly, the constraints confronted by mushroom growers were investigated and ranked using the methodology devised by Singh *et al.* (2020).

## RESULTS AND DISCUSSION

### A. Identifying the respondents' characteristics

The study revealed that more than half (60 and 68 % during 2018 and 2019, respectively) of the respondents belong to the young age group of 18 to 30 years (Table 2). The training program may have a higher rate of participation among young age groups because of the lack of employment opportunities. Educational level of majority of respondents (32 and 36 %) was 'matriculate' followed by 'higher secondary level' (28 and 24 %).

The training and demonstration programs did not have any participants who were illiterate. It suggests that education is crucial for embracing modern agricultural technology methods. The result aligns with the observations made by Leihaothabam *et al.* (2020), who found that there were no illiterate farmers in their needs assessment study involving rice growers in Manipur, India. Similarly, in Barpeta district of Assam, Upamanya *et al.* (2020) reported zero per cent illiterate farmers in a study containing evaluation of training programmes on oyster mushroom cultivation. Recently Joshi *et al.* (2022) mushroom growers belongs to middle age group, major proportion of the respondents

were educated up to middle school. Farming with animal husbandry was the prime occupation for majority (72 and 68 %) of the respondents and more than 70 per cent respondents were marginal farmers (72 and 80 %). Availability of the inputs like rice straw, firewood and limitation of land resources may be the major factors behind the attraction of marginal farmers towards mushroom enterprise (Rachna *et al.*, 2013). The result further showed that 56 and 64 per cent of the respondents had only 1 to 5 years of experience in farming during both the consecutive years. These results are in conformity with Upamanya *et al.* (2020) wherein they found 55 per cent respondents had also 1 to 5 years of experience in a study containing evaluation of training programmes on oyster mushroom cultivation. The findings suggest that young individuals with little experience in conventional farming methods showed a keen interest in agricultural ventures that promise high returns with low investments. The respondents primarily relied on progressive farmers and fellow farmers, who accounted for 44% and 52% respectively, as well as input dealers, who represented 32% and 24% of their information sources.

**Table 2: Socio economic profile of the respondents.**

| Sr. No.   | Variables                                  | 2019      |            | 2020      |            |
|---|--|-----------|------------|-----------|------------|
|   |  | Frequency | Percentage | Frequency | Percentage |
| 1.  | <b>Age</b>                                 |           |            |           |            |
|   | Young (18-30)                              | 15        | 60.00      | 17        | 68.00      |
|   | Middle (31-50)                             | 6         | 24.00      | 5         | 20.00      |
|   | Old (> 51)                                 | 4         | 16.00      | 3         | 12.00      |
| 2.  | <b>Educational qualification</b>           |           |            |           |            |
|   | Illiterate(0)                              | 0         | 0.00       | 0         | 0.00       |
|   | Completed Primary School (1)               | 2         | 8.00       | 2         | 8.00       |
|   | Completed Middle School (2)                | 6         | 24.00      | 5         | 20.00      |
|   | Matriculate(3)                             | 8         | 32.00      | 9         | 36.00      |
|   | Higher Secondary (4)                       | 6         | 24.00      | 7         | 28.00      |
| Graduation and above(5)                             | 3  | 12.00     | 2          | 8.00      |            |
| 3.  | <b>Occupation</b>                          |           |            |           |            |
|   | Farming (1)                                | 5         | 20.00      | 4         | 16.00      |
|   | Farming with animal husbandry (2)          | 18        | 72.00      | 17        | 68.00      |
|   | Government servant (3)                     | 0         | 0.00       | 1         | 4.00       |
|   | Businessman (4)                            | 3         | 12.00      | 2         | 8.00       |
| Others (daily labourers, vegetable vendor etc.) (5) | 4  | 16.00     | 5          | 20.00     |            |
| 4.  | <b>Family type</b>                         |           |            |           |            |
|   | Nucleus(1)                                 | 22        | 88.00      | 20        | 80.00      |
|   | Joint(2)                                   | 3         | 12.00      | 5         | 20.00      |
| 5.  | <b>Experience in farming</b>               |           |            |           |            |
|   | 1-5 years (1)                              | 14        | 56.00      | 16        | 64.00      |
|   | 6-10 years(2)                              | 8         | 32.00      | 5         | 20.00      |
|   | > 11 years(3)                              | 3         | 12.00      | 4         | 16.00      |
| 6.  | <b>Source of information about farming</b> |           |            |           |            |
|   | Extension personnel (1)                    | 5         | 20.00      | 6         | 24.00      |
|   | Progressive farmers / Fellow farmers(2)    | 11        | 44.00      | 13        | 52.00      |
|   | Input dealers (3)                          | 8         | 32.00      | 6         | 24.00      |
| Newspaper /Radio/TV(4)                              | 1  | 4.00      | 0          | 0.00      |            |
| 7.  | <b>Farm size</b>                           |           |            |           |            |
|   | Landless (1)                               | 1         | 4.00       | 2         | 8.00       |
|   | Marginal (< 1 ha)(2)                       | 18        | 72.00      | 20        | 80.00      |
|   | Small (1-2 ha)(3)                          | 3         | 12.00      | 2         | 8.00       |
|   | Medium (3-10 ha)(4)                        | 1         | 4.00       | 0         | 0.00       |
| Large (> 10 ha)(5)                                  | 0  | 0.00      | 0          | 0.00      |            |

This illustrates KVK's significant contribution to the spread of mushroom farming. The progressive farmers in touch with KVK may be the major source of information about the training and demonstration programme (Table 2). Earlier, Upamanya *et al.* (2020) also reported that the progressive farmers in touch with KVK were the major source of information about mushroom farming. More than half of the sample population relied on fellow farmers for information and updates regarding agriculture and related topics (Joshi *et al.*, 2022).

*B. Reasons of participation in the training programme of oyster mushroom cultivation*

Table 3 displays the frequency and percentage distribution of respondents according to the reasons they gave for taking part in the oyster mushroom cultivation training and demonstration program. All the

respondents (100%) joined the training and demonstration programme to know the technology for home consumption. However, 72 % of the respondents were interested to know the mushroom cultivation technology for additional source of income with agricultural farming and animal husbandry. Shahi *et al.* (2018); Upamanya *et al.* (2020) found that 75.25% and 82.33% of the respondents were interested in learning the technology to generate additional revenue, respectively. These results are more or less conformity with the present findings. Only learning about the nutritional and medicinal benefits of mushrooms (12%) and sharing the technology with other farmers (16%) piqued the interest of less experienced participants. Similar results were also reported by Kaur (2016); Upamanya *et al.* (2020).

**Table 3: Frequency and percentage distribution of respondents according to their stated reasons for participating in training and demonstration programme on oyster mushroom cultivation.**

| Sr. No. | Reasons for participation   | 2019 (n=25) |            | 2020 (n=25) |            |
|---------|---|-------------|------------|-------------|------------|
|         |   | Number      | Percentage | Number      | Percentage |
| 1.      | To adopt oyster mushroom farming for primary source of income   | 4           | 16.00      | 3           | 12.00      |
| 2.      | To adopt oyster mushroom technology for additional source of income with agricultural farming                                   | 5           | 20.00      | 4           | 16.00      |
| 3.      | To understand the technology of cultivation for a supplementary revenue stream in animal husbandry                              | 12          | 48.00      | 14          | 56.00      |
| 4.      | Understanding the technology of cultivation for supplementary revenue streams in both agricultural farming and animal husbandry | 22          | 88.00      | 20          | 80.00      |
| 5.      | To know the cultivation technology for own family consumption   | 25          | 100.00     | 25          | 100.00     |
| 6.      | To understand the nutritional worth and therapeutic potential of mushrooms  | 3           | 12.00      | 4           | 16.00      |
| 7.      | To obtain the training program certificate in order to be eligible for bank financial assistance                                | 2           | 8.00       | 3           | 12.00      |
| 8.      | For building a positive rapport with Krishi Vigyan Kendra   | 14          | 56.00      | 16          | 64.00      |

*C. Respondents' distribution based on their degree of expertise*

Based on their pre- and post-training evaluations of their knowledge of various facets of oyster mushroom cultivation, respondents were divided into three categories: low, medium, and high. Table 4 made it clear that, throughout the pre-training phase, 48% and 60% of the respondents, respectively, had low knowledge of the recommended mushroom production practices, while the remaining 52% and 40% had medium knowledge during 2019 and 2020, respectively. All respondents, however, were found to have increased their knowledge to a medium level (60 and 72 per cent) and a high level (40 and 28 per cent) in

2019 and 2020, respectively, following the intervention. The computed "t" values (15.61 and 15.47) showed that, in 2019 and 2020, the post-training period had a noticeably higher level of knowledge than the pre-training period (Table 4). A lower level of knowledge during the pre-training phase might result from the district's farmers' ignorance of mushroom cultivation. The effectiveness of KVK's training and demonstration program was demonstrated by the shift in knowledge levels from lower to medium and high levels during the post-training period. Sohal and Fulzele (1986); Babu and Singh (1986); Sanadhya *et al.* (2002); Sarma *et al.* (2014); Upamanya *et al.* (2020) also reported similar results, showing that training and demonstrations were

effective in terms of increasing the existing knowledge of participants about different agricultural aspects.

#### D. Performance in terms of yield and economics of oyster mushroom cultivation technology

The performance in terms of yield and economics of oyster mushroom cultivation technology was mentioned in Table 5. Results revealed that during 2019, average 10 kg of fresh oyster mushroom was harvested from 1 kg spawn. The average cost of cultivation of 1 kg spawn was Rs. 400 and average gross return of Rs. 2000 was obtained from 1 kg spawn with prevailing market price of Rs. 200/kg fresh mushroom. Ultimately, average of Rs. 1600 was the net profit gained by each respondent with the higher benefit: cost ratio of 5:1. Similarly, during 2020, average 8.5 kg of fresh oyster mushroom was harvested from 1 kg spawn. The average cost of cultivation of 1 kg spawn was Rs. 500 and average gross return of Rs. 2125.00 was obtained from 1 kg spawn with prevailing market price of Rs. 250/kg mushroom. Ultimately, average of Rs.

1625 was the net profit gained by each respondent with the higher benefit: cost ratio of 4:25.

#### E. Challenges faced by mushroom growers

To learn more about the difficulties faced by mushroom growers in Gujarat's Tapi district, several responses were gathered. The results (Table 6) showed that, out of a number of constraints, the primary one cited by all respondents (100%) was the inability to supply mushroom spawn in accordance with demand, which they ranked I followed by lack of organized market for fresh oyster mushroom (96 %) and ranked II, followed by lack of government initiatives or support in terms of subsidies on small scale mushroom cultivation unit and ranked III (92%), followed by Lack of bank financing options for mushroom business owners (86 %) and ranked IV, followed by higher incidence of diseases in mushroom (72%) and ranked V, lack of low cost quality packaging material (68%) and ranked VI, Lack of reasonably priced driers for drying of mushroom (64%) and ranked VII, higher incidence of insect pests in oyster mushroom (16%) and ranked VIII.

**Table 4: Distribution of respondents according to knowledge gained on mushroom cultivation (2019 and 2020).**

| Category | Score range | Before (n=25)          |            |      |      | After (n=25)           |            |      |       | 't' value |
|----------|-------------|------------------------|------------|------|------|------------------------|------------|------|-------|-----------|
|          |             | Frequency & Percentage | Mean score | S.D. | C.V. | Frequency & Percentage | Mean score | S.D. | C.V.  |           |
| 2019     |             |                        |            |      |      |                        |            |      |       |           |
| Low      | 0 to 5      | 12 (48)                |            |      |      | 0 (0)                  |            |      |       |           |
| Medium   | 5 to 25     | 13 (52)                | 6.04       | 2.73 | 7.46 | 15 (60)                | 22.44      | 4.56 | 20.76 | 15.61     |
| High     | > 25        | 0 (0)                  |            |      |      | 10 (40)                |            |      |       |           |
| 2020     |             |                        |            |      |      |                        |            |      |       |           |
| Low      | 0 to 5      | 15 (60)                |            |      |      | 0 (0)                  |            |      |       |           |
| Medium   | 5 to 25     | 10 (40)                | 5.6        | 2.63 | 6.92 | 18 (72)                | 22.08      | 4.34 | 18.83 | 15.47     |
| High     | > 25        | 0 (0)                  |            |      |      | 7 (28)                 |            |      |       |           |

\* Significant at 0.05 level of probability ; \*\* Significant at 0.01 level of probability

**Table 5: Performance of oyster mushroom technology in Tapi district.**

| Average Yield (kg) per 2 kg spawn | 2019 (n=25)                             |               |            |     | Average Yield (kg) per 2 kg spawn | 2020 (n=25)                             |              |            |      |
|-----------------------------------|---|---------------|------------|-----|-----------------------------------|---|--------------|------------|------|
|                                   | Economics of demonstration* (Rs./demo.) |               |            |     |                                   | Economics of demonstration (Rs./demon.) |              |            |      |
|                                   | Gross Cost                              | Gross Return* | Net Return | BCR |                                   | Gross Cost                              | Gross Return | Net Return | BCR  |
| 10 kg                             | 400                                     | 2000          | 1600       | 5:1 | 8.5                               | 500                                     | 2125         | 1625       | 4.25 |

Area per Demonstration: 100 sq.ft.

\*Prevailing market price of mushroom: Rs. 200 and 250 per kg during 2019 and 2020, respectively.

**Table 6: Constraints faced by the mushroom growers of Tapi district of Gujarat and distributions according to the rank (n=50).**

| Constraints   | Frequency | Percentage |
|---|-----------|------------|
| Insufficient availability of mushroom spawns to meet growers' demands   | 42        | 84.00      |
| Lack of organized marketplaces for the sale of fresh oyster mushrooms   | 48        | 96.00      |
| Lack of reasonably priced driers for drying the mushroom                | 32        | 64.00      |
| Lack of affordable, superior packaging technology                       | 34        | 68.00      |
| Lack of bank financing options for mushroom business owners             | 42        | 84.00      |
| Lack of government initiatives/support/schemes/subsidies on small scale | 50        | 100.00     |
| Higher incidence of insects pests in summer oyster mushroom             | 8         | 16.00      |
| Higher incidence of diseases in mushroom beds                           | 36        | 72.00      |

The limitations that mushroom growers in Karnataka's Belagavi district face, such as a lack of spawn, a lack of technical information and consultant exploitation, rising labor costs, and higher electricity costs, were also reported by Shirur *et al.* (2016). Similarly, Bashar

(2006) noted that one of the biggest obstacles facing mushroom growers was the increased cost of mushroom spawn. Upamanya *et al.* (2020) in Assam also reported the similar type of constraints found in present study. Ashiegbu *et al.* (2022) stated that the

mushroom farming experience is positively related with training needs of mushroom growers. Lack of infrastructure was seen by mushroom growers as a major obstacle. The training needs of mushroom growers were substantially correlated with mushroom farming experience, information-seeking behavior, and revenue from mushroom cultivation (Joshi *et al.*, 2022).

## CONCLUSIONS

The current study comes to the conclusion that demonstration and training are crucial for raising farmers' awareness levels and ensuring their successful adoption of technology for mushroom production. When choosing trainees for the adoption of technology that requires scientific expertise, such as mushroom cultivation, the educational background may be taken into account. In order to increase horizontal spread, it is necessary to assess the limitations that new technology adopters face. According to our current study, the main obstacles faced by adopters were a lack of organized markets and a shortage of mushroom spawn. These issues can be resolved by expanding vocational training on mushroom spawn production technology and value addition. It is important to note that the Tapi district's mushroom production is trending upward. All of the evaluation's findings for small-scale mushroom growers were favourable, suggesting that mushroom production initiatives were successful. Mushroom growers said they needed training and financial assistance from governmental and nongovernmental organizations to sustain high yields that yield enormous profits. The Tapi district's mushroom industry appears to be in its infancy and provides jobs for the unemployed, particularly young people.

## FUTURE SCOPE

—There is a great scope to increase the entrepreneur's engagement in mushroom cultivation and thereby increasing its production potential by financial and training support from both governmental and non-governmental organisations.

—Awareness about mushroom cultivation should be increased by trainings and demonstrations

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**Conflict of Interest.** None.

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