**Adoption Patterns and Constraints of Mushroom Cultivation Technology among KVK Beneficiaries in Manipur: A Comparative Study of CAU and NGO Managed KVKs**

***ABSTRACT***

This study compares the adoption patterns of mushroom cultivation technology among beneficiaries of two Krishi Vigyan Kendras (KVKs) in Manipur, India. Manipur is known for cultivating various mushroom species, with Oyster Mushroom being the most common. It's easily grown with minimal effort, providing a potential source of income for poor farmers and a nutritious addition to their diets, helping combat malnutrition.A total of 120 respondents were selected from KVK Imphal East (CAU-managed) and KVK Senapati (NGO-managed). The results show that respondents from KVK Imphal East had a higher adoption rate of mushroom cultivation practices compared to KVK Senapati. The study identified significant constraints faced by respondents, including unawareness of government subsidy programs (62.5%), non-availability of recent varieties (45.0%), and limited inclusion of recent releases in frontline demonstrations (39.2%). KVK Senapati faced more constraints due to remote location and poor infrastructure. The study suggests that KVK Imphal East's better infrastructure, resources, and financial status contributed to its higher adoption rates. The findings can inform strategies to improve KVK functioning and enhance adoption of mushroom cultivation technology among farmers, particularly in remote areas.

*Key words: Adoption, Mushroom cultivation, KVK, Manipur*

**INTRODUCTION**

 Krishi Vigyan Kendras (KVKs) are pivotal components of the National Agricultural Research System (NARS), playing a vital role in evaluating, refining, and demonstrating location-specific agricultural technologies. As Knowledge Resource Centers, KVKs facilitate the dissemination of innovative agricultural practices, bridging the gap between research and extension systems (kvk.icar.gov.in). The main purpose of KVK is to impart learning by ‘work experience’ and they tailor the training and programs according to the needs of the farmers of the specific region. They organize trainings for the capacity development of the farmers by methods of ‘teaching by doing’ and ‘learning by doing’ (Nath *et al* 2016). Established on the recommendations of the Education Commission (1964-66), ICAR proposed the idea of establishing innovative institutions to provide vocational training to rural youth, self employed farmers and extension functionaries known as KVKs or Farm Science Centers. The concept of KVK was formally recognized by the Indian Council of Agricultural Research (ICAR) in 1973 leading to the establishment of the first KVK in Pondicherry in 1974 on pilot basis and was managed by the Tamil Nadu Agricultural University, Coimbatore (Jadav, 2019). Dr. Mohan Singh Mehta Committee laid down the concept of the KVK as follows: (i) The Kendra's focus will be on imparting knowledge through hands-on experience, emphasizing technical literacy. This type of learning doesn't inherently demand the ability to read and write as a prerequisite. (ii) The Kendra will provide training exclusively to extension workers who are currently employed or to farmers and fishermen who are actively practicing. In simpler terms, the Kendra's services will be tailored to meet the requirements of individuals who are already employed or those who aspire to establish their own self-employment ventures.(iii) Kendra will not follow a standardized syllabus. Instead, the curriculum and program for each Kendra will be customized based on the perceived requirements, available natural resources, and the agricultural growth potential specific to that particular region (Kumar, 2014).

This study is motivated by the growing importance of KVKs in agricultural development and the need to assess their effectiveness in promoting technological adoption among farmers focusing on mushroom cultivation as it has emerged as a promising and sustainable agricultural enterprise worldwide, contributing not only to economic development but also addressing food security and environmental concerns. Mushrooms, being a crop suitable for cultivation even by landless individuals, can thrive on waste materials, offering a source of protein-rich food (Ambili and Nithya, 2014).Mushroom entrepreneurship being technologically intensive agribusiness, its success in a country like India is contingent upon the technological and institutional support available to it. (Shirur *et al*, 2016). Mushroom cultivation in India is growing gradually as an enterprise for income generation. (Sharma et.al, 2017)

According to Beetz and Kustudia (2004) the choice of species to raise mushroom depends both on the growth media available and on market considerations. Oyster mushrooms, which grow on many substrates, are easiest for a beginner.

Mushroom farming is such a component of the farming system that not only imparts diversification but also helps in addressing the problems of quality food, health and environment related issues (Atkin, 2009)

Mushroom cultivation has gained attention as an appealing business opportunity within the agricultural sector due to its relatively straightforward procedures and the abundant availability of agro-wastes (Singh and Sidhu, 2014). Although so many programme have been initiated but still many of the mushroom cultivators were unaware on many aspects.Keeping the above points in view, the present study was designed to investigate the adoption pattern of mushroom package of practice wise cultivation technology and constraints faced by the respondents of KVK Imphal East (CAU managed KVK) and KVK Senapati (NGO managed KVK) and the constraints faced by them.

**METERIALS AND METHODS**

Ex-post facto research design was adopted to carry out the investigation. The study was conducted in Manipur, India, specifically in the Imphal East and Senapati districts. These districts were selected purposively due to their unique characteristics, with Imphal East representing a plain area and Senapati representing a hilly area.A multistage sampling method was used to select the respondents. Manipur has 9 Krishi Vigyan Kendras (KVKs) under different administrative set up, comprising 2 KVKs managed by NGOs i.e Foundation for Environment and Economic Development Services (FEEDS) and Utlou Joint Farming cum Pisciculture Cooperative Society Ltd.), 5 KVKs managed by ICAR,1 KVK managed by Central Agricultural University (CAU), Imphal and 1 KVK managed by the State Department of Agriculture(icarzcu3.gov.in) .For this study, KVK, Imphal East was selected under CAU, Imphal, and KVK, Senapati was selected under NGO purposively because of accessibility of the location and to diversify the sample as KVK, Imphal East comes under plain area and KVK, Senapati falls under hilly area. From these KVKs, a list of trainees who attended Osyter mushroom cultivation technology training from 2020-21 to 2022-23 was collected. A random sample of 60 respondents was selected from each KVK, resulting in a total sample size of 120 respondents. The data was collected by personal interview using structured schedule. Statistical tools like mean, standard deviation, frequency, percentage were used for the analysis and interpretation of the data.

**RESULT AND DISCUSSION**

An investigation was carried out to study the adoption pattern of package of practice wise mushroom cultivation technology by the respondents of KVK Imphal East and KVK Senapati and is shown in Table no 1. In KVK, Imphal East, a majority (91.7%) of respondents fully adopted the practice of selecting quality paddy straw, whereas in KVK, Senapati, 83.3% of respondents fully adopted this practice. This suggests that both KVKs had a high level of adoption for this practice, but KVK, Imphal East had a slightly higher percentage. Practices like cutting the clean straw into 3-5 cm length with the help of chop cutter or sickle, all the respondents (100%) in both KVKs fully adopted this practice, indicating a uniform adoption rate across both locations. Regarding the soaking of the straw overnight in cold water, a majority of respondents (90%) in both KVKs fully adopted this practice, with no significant difference between the two locations. In substrate sterilization using hot water treatment, only 10% of respondents fully adopted in KVK, Imphal East , whereas in KVK, Senapati, 15% of respondents fully adopted it. A significant percentage of respondents in both KVKs did not adopt this practice (81.6% in KVK, Imphal East and 45% in KVK, Senapati). Practices like chemical sterilization of substrate, in KVK, Imphal East, 68.3% of respondents fully adopted this practice, whereas in KVK, Senapati, 50% of respondents fully adopted it. This suggests that KVK, Imphal East had a higher adoption rate for this practice. Regarding spawning the straw layer, majority of respondents (88.3% in KVK, Imphal East and 68.3% in KVK, Senapati) fully adopted this practice, with KVK, Imphal East having a slightly higher adoption rate. Practices like making perforated holes, in KVK, Imphal East, 96.7% of respondents fully adopted this practice, whereas in KVK, Senapati, 66.7% of respondents fully adopted it. This suggests that KVK, Imphal East had a higher adoption rate for this practice. In the practice of filling the polythene bag by making a total of five layers of straw and four layers of spawn in between, a majority of respondents (90% in KVK, Imphal East and 61.7% in KVK, Senapati) fully adopted this practice, with KVK, Imphal East having a higher adoption rate. Regarding ,tying the open end of the bag with a piece of jute thread and keep it as such for spawn running, 88.3% of respondents fully adopted this practice in KVK, Imphal East , whereas in KVK, Senapati, 80% of respondents fully adopted it. This suggests that both KVKs had a high level of adoption for this practice. Practices like labelling with the species name and date of spawning or preparation of the bed should be tagged to the bed for the record, in KVK, Imphal East, only 36.7% of respondents fully adopted this practice, whereas in KVK, Senapati, 51.7% of respondents fully adopted it. A significant percentage of respondents in both KVKs did not adopt this practice (55% in KVK, Imphal East and 5% in KVK, Senapati did not adopt, while 8.3% and 43.3% partially adopted respectively). Regarding incubation in a dark cropping room for 15 days till mycelium colonizes the straw, all respondents (100%) in KVK, Imphal East fully adopted this practice, whereas in KVK, Senapati, 48.3% of respondents fully adopted it. This suggests that KVK, Imphal East had a higher adoption rate for this practice. Practices like mushroom bed opening, in KVK, Imphal East, 68.3% of respondents fully adopted this practice, whereas in KVK, Senapati, 45% of respondents fully adopted it. This suggests that KVK, Imphal East had a higher adoption rate for this practice. Regarding cropping room, majority of respondents (90% in KVK, Imphal East and 58.3% in KVK, Senapati) fully adopted this practice, with KVK, Imphal East having a higher adoption rate. Practices like harvesting by twisting the stipe between thumb and fingers and cutting the stipe base to remove adhering straw, all respondents (100%) in KVK, Imphal East fully adopted this practice, whereas in KVK, Senapati, 75% of respondents fully adopted it. This suggests that KVK, Imphal East had a higher adoption rate for this practice. Regarding practices like removing bags from cropping rooms ,in KVK, Imphal East, only 18.3% of respondents fully adopted this practice, whereas in KVK, Senapati, 30% of respondents fully adopted it. A significant percentage of respondents in both KVKs did not adopt this practice (65% in KVK, Imphal East and 38.3% in KVK, Senapati). As indicated in Table1, overall the respondents of KVK, Imphal East had fully adopted more practices than respondents of KVK, Senapati. The higher level of adoption by the respondents of KVK, Imphal East might be due to resource availability and higher social participation. Respondents of KVK, Imphal East might be more educated and had more knowledge which could have contributed to overall better adoption. The partial adoption of practices was comparatively higher in KVK, Senapati. It might be due to lack of proper knowledge and non-availability of spawns**.**

# Table 1: Distribution of respondents of KVK, Imphal East and KVK Senapati according to Package of practice wise adoption of mushroom cultivation technology (N=120)

#

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Package of practices** | **KVK, Imphal East****n₁=60** | **KVK, Senapati****n₂=60** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  |  | No adoption | Partial adoption | Full adoption | No adoption | Partial adoption | Full adoption |
| **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** |
| **1** | Selection of quality paddy straw (golden yellow in colour, rain and mould free). | 0 | 0 | 5 | 8.3 | 55 | 91.7 | 4 | 6.7 | 6 | 10 | 50 | 83.3 |
| **2** | Cutting the clean straw into 3-5 cm length with the help of a chop cutter or sickle.  | 0 | 0 | 0 | 0 | 60 | 100 | 0 | 0 | 0 | 0 | 60 | 100 |
| **3** | Soaking of the straw overnight (6-8 hours) in cold water.   | 0 | 0 | 6 | 10 | 54 | 90 | 0 | 0 | 6 | 10 | 54 | 90 |
| **4** | Substrate sterilization using Hot water treatment by soaking the straw in the hot water (750C) for 30 minutes. | 49 | 81.6 | 5 | 8.3 | 6 | 10 | 27 | 45 | 24 | 40 | 9 | 15 |
| **5** | Chemical sterilization of substrate using Carbendazim 50% wp @ 5-7gm/100 litres of water. | 12 | 20 | 7 | 11.7 | 41 | 68.3 | 10 | 16.7 | 20 | 33.3 | 30 | 50 |
| **6** | Spawning the straw layer with 200 gm/ bag. | 0 | 0 | 7 | 11.7 | 53 | 88.3 | 5 | 8.3 | 14 | 23.3 | 41 | 68.3 |
| **7** | Making perforated holes with size 1/2 to 1 cm diameter having a distance of 10 cm between the hole for good aeration. | 0 | 0 | 2 | 3.3 | 58 | 96.7 | 0 | 0 | 20 | 33.3 | 40 | 66.7 |
| **8** | Filling the polythene bag by making a total of five layers of straw and four layers of spawn in between. | 0 | 0 | 6 | 10 | 54 | 90 | 0 | 0 | 23 | 38.3 | 37 | 61.7 |
| **9** | Once the bag is filled up, tying the open end of the bag with a piece of jute thread and keep it as such for spawn running. | 0 | 0 | 7 | 11.7 | 53 | 88.3 | 0 | 0 | 12 | 20 | 48 | 80 |
| **10** | Labelling with the species name and date of spawning or preparation of the bed should be tagged to the bed for the record. | 33 | 55 | 5 | 8.3 | 22 | 36.7 | 3 | 5 | 26 | 43.3 | 31 | 51.7 |
| **11** | Incubation in a dark cropping room for 15 days till mycelium colonizes the straw. | 0 | 0 | 0 | 0 | 60 | 100 | 2 | 3.3 | 29 | 48.3 | 29 | 48.3 |
| **12** | Mushroom bed opening -Taking out the blocks from polythene bags & keeping them in a well-ventilated room. | 8 | 13.3 | 11 | 18.3 | 41 | 68.3 | 3 | 5 | 30 | 50 | 27 | 45 |
| **13** | Cropping Room-Putting the mushroom bed on racks or hanging it in the mushroom house. Keeping the bed moist by spraying water 2-3 times a day or when necessary. | 0 | 0 | 6 | 10 | 54 | 90 | 0 | 0 | 25 | 41.7 | 35 | 58.3 |
| **14** | Harvesting by twisting the stipe between thumb and fingers and cutting the stipe base to remove adhering straw etc. | 0 | 0 | 0 | 0 | 60 | 100 | 2 | 3.3 | 13 | 21.7 | 45 | 75 |
| **15** | Removing the bags from cropping rooms and putting them in a pit for composting to use after one year as farm compost. | 39 | 65 | 10 | 16.7 | 11 | 18.3 | 23 | 38.3 | 19 | 31.7 | 18 | 30 |

# Constraints encountered by the beneficiaries of KVKs

# An effort was made to study the constraints encountered by the beneficiaries of KVKs using a semi structured schedule with a set of problem statements prepared after reviewing relevant literature and discussion with the experts. Data presented in Table 2 reveals that the most significant constraint faced by the beneficiaries of both KVKs was unawareness of government subsidy programs, with 55% of respondents in KVK, Imphal East and 70% in KVK, Senapati reporting this constraint. This suggests that many beneficiaries are not aware of the government subsidies available to them, which could be a major hindrance to their agricultural development. The second most significant constraint was the non-availability of seeds of recent varieties at KVK, with 40% of respondents in KVK, Imphal East and 50% in KVK, Senapati reporting this constraint. This suggests that many beneficiaries are not getting access to the latest crop varieties, which could impact their productivity and income. The findings are in line with the findings of Gurdarshan and Gurmeet (2017) and Rachna and Sodhi, (2013) . The third most significant constraint was the non-inclusion of recent release varieties in front-line demonstrations, with 43.3% of respondents in KVK, Imphal East and 35% in KVK, Senapati reporting this constraint. This suggests that many beneficiaries are not getting exposure to the latest crop varieties through front-line demonstrations.

Other significant constraints reported by the beneficiaries include lack of coordination with other agencies (36.7%), lack of transport facilities (29.2%), inability to purchase inputs recommended by KVK due to higher cost (27.5%), and inadequate demonstration facilities (21.7%). Whereas, constraints like the terms/concepts used in training programmes are scientific and hence difficult to understand (7.5%), less emphasis on practicals (Skill training) (5.8%) and KVK staff/scientists are untrained/inexperienced (0%) were the least encountered constraints by the respondents.A perusal of the constraints encountered by the beneficiaries of the two KVKs reveals that the beneficiaries of KVK, Senapati faced more constraints comparatively than KVK, Imphal East. Thus, it could be deduced that KVK, Imphal East managed by CAU, Imphal has better infrastrustural facilities, resources and financial status. The possible reason for more constraints faced by the beneficiaries of KVK, Senapati could be due to remote location, poor road connectivity and therefore lack of resources.The findings were in agreement with the findings of Ranjan *et al.* (2019).

# The findings of this study have implications for the functioning of KVKs in Manipur. The KVKs need to take steps to address the constraints faced by their beneficiaries, such as providing awareness about government subsidy programs, making available seeds of recent varieties, and including recent release varieties in front-line demonstrations. Additionally, the KVKs need to improve their coordination with other agencies and provide better transport facilities to their beneficiaries. Overall, the study highlights the need for KVKs to be more responsive to the needs of their beneficiaries and to take steps to address the constraints faced by them. By doing so, KVKs can improve the effectiveness of their programs and contribute to the agricultural development of the region.

**Table 2: Distribution of respondents according to the constraints encountered (**N=120)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Constraints** | **KVK, Imphal East** | **KVK, Senapati** | **Total****(F)** | **Total****(%)** | **Rank** |
| **F** | **%** | **F** | **%** |
| 1 | Non-availability of required inputs | 8 | 13.3 | 12 | 20 | 20 | 16.7 | XI |
| 2 | Lack of practical exercise during the training programme | 6 | 10 | 7 | 11.6 | 13 | 10.8 | XV |
| 3 | Less emphasis on practicals (Skill training) | 4 | 6.6 | 3 | 5 | 7 | 5.8 | XIX |
| 4 | Lack of coordination with other agencies | 21 | 35 | 23 | 38.3 | 44 | 36.7 | IV |
| 5 | Inadequate demonstration facilities | 11 | 18.3 | 15 | 25 | 26 | 21.7 | IX |
| 6 | Inadequate boarding and lodging facilities during training programmes | 18 | 30 | 6 | 10 | 24 | 20 | X |
| 7 | Lack of transport facilities | 24 | 40 | 11 | 18.3 | 35 | 29.2 | VI |
| 8 | The terms/concepts used in training programmes are scientific and hence difficult to understand | 4 | 6.6 | 5 | 8.3 | 9 | 7.5 | XVIII |
| 9 | Inability to purchase input recommended by KVK due to higher cost | 15 | 25 | 18 | 30 | 33 | 27.5 | VII |
| 10 | The training programmes are not need-based | 3 | 5 | 9 | 15 | 12 | 10 | XVII |
| 11 | Inconvenient training place of training programmes | 8 | 13.3 | 7 | 11.6 | 15 | 12.5 | XIV |
| 12 | Training programmes are not conducted at the proper time | 7 | 11.6 | 11 | 18.3 | 18 | 15 | XII |
| 13 | The written material was not provided at the time of training programmes | 13 | 21.6 | 19 | 31.6 | 32 | 26.7 | VIII |
| 14 | Training programmes on allied activities other than agriculture are not conducted regularly by KVK | 17 | 28.3 | 26 | 43.3 | 43 | 35.8 | V |
| 15 | The KVK staff/scientists are untrained/inexperienced | 0 | 0 | 0 | 0 | 0 | 0 | XX |
| 16 | Lack of awareness regarding the ICT use for educational and agricultural purpose | 5 | 8.3 | 10 | 16.6 | 15 | 12.5 | XIII |
| 17 | Training programmes are not followed by practical | 2 | 3.3 | 11 | 18.3 | 13 | 10.8 | XVI |
| 18 | Recent release varieties are not included in front-line demonstration | 26 | 43.3 | 21 | 35 | 47 | 39.2 | III |
| 19 | Seeds of recent varieties are not available at KVK | 24 | 40 | 30 | 50 | 54 | 45 | II |
| 20 | Unawareness of govt. subsidy programmes | 33 | 55 | 42 | 70 | 75 | 62.5 | I |

# CONCLUSION

The study revealed that respondents from KVK, Imphal East (CAU-managed) had a higher adoption rate of mushroom cultivation practices compared to KVK, Senapati (NGO-managed). The higher adoption rate in KVK, Imphal East might be attributed to better resource availability, social participation, and education level of the respondents. In contrast, respondents from KVK, Senapati faced more constraints, possibly due to remote location and poor infrastructure.The most significant constraints faced by respondents from both KVKs were related to unawareness of government subsidy programs, non-availability of recent varieties, and limited inclusion of recent releases in frontline demonstrations. Addressing these constraints could enhance the effectiveness of KVKs in promoting mushroom cultivation technology. Overall, the study suggests that KVK, Imphal East (CAU-managed) has better infrastructural facilities, resources, and financial status, contributing to its higher adoption rates and lower constraints. These findings can inform strategies to improve the functioning of KVKs, particularly in remote areas, and enhance the adoption of mushroom cultivation technology among farmers.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**References**

Ambili S, Nithya T.P. (2014) Oyster mushroom cultivation. A study in Palakkad District, Kerala. Int. J. Manag. Soc. Sci. Res. Rev 1(6):96-104

Atkins F.C.(2009).Mushroom Growing To-day .Cornel University, Faber Publisher, Edition (5)

Beetz A. and Kustudia, M. (2004). Mushroom cultivation and marketing. *Journal of Mushroom*. 46 (1):56-67.

Gurdarshan, S. & Gurmeet, S. (2017). Constraints in adoption of recommended button mushroom cultivation techniques. *Agric. Upd.*, **12**(3): 351-356.

ICAR-Agricultural Technology Application Research Institute, Umiam(Barapani) Ri-Bhoi District, Meghalaya. Available at <https://icarzcu3.gov.in/>, accessed on 15 october 2022.

Jadhav,V and Pirabu J.V. (2019). Role of KVK in Strengthening of Livelihood Security of Self Help Group Tribal Farm Women in Palghar District, India. *International Journal of Current Microbiology and Applied Sciences,* 8(8): 1151-1157.

Kumar, A. (2014). Impact of KVK on farmers technical knowledge and adoption in western U.P. Ph.D Thesis, C.C.S University, Meerut, U.P. Pp: 4.

KVK. Krishi Vigyan Kendra Knowledge Network. Available at [Krishi Vigyan Kendra Knowledge Network (icar.gov.in)](https://kvk.icar.gov.in/aboutkvk.aspx), accessed on 14 october 2022.

Nath D, Jain PK, Talukdar RK, Hansra BS. Constraints encountered by the beneficiaries of Krishi Vigyan Kendra in North Eastern region of India. Journal of Extension Education. 2016;28(2)

Rachna, R.G. & Sodhi, G.P.S. (2013). Evaluation of vocational training programmes organized on mushroom farming by Krishi Vigyan Kendra Patiala. Journal of Krishi Vigyan, **2**(1): 26-29.

Ranjan, R., Ansari, M. A., Shekhar, S., Singh, C. V., & Singh, R. K. (2019). Constraints experienced by the KVKS scientists and beneficiaries for improvement of kvks performance: A study in uttarakhand, India. *J. Community Mobilization & Sus. Dev.,* **14**(2): 229-236.

Sharma, V. P.; Annepu S. K; Gautam Y; Singh, M. and Kamal, S. (2017). Status of mushroom production in India. Mushroom Research. 26 (2): 111-120.

Shirur, M.; Shivalingegowda, N.S.; Chandregowda, M.J. and Rana, R.K. (2016). Technological adoption and constraint analysis of mushroom entrepreneurship in Karnataka. Economic Aff airs. 61(3): 427-436.

Singh Y, Sidhu HS. (2014). Management of cereal crop residues for sustainable rice-wheat production system in the Indo-Gangetic plains of India. Proceedings of the Indian National Science Academy.;80(1):95-114)