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Impact of mushroom production training on socio-economic development of marginalized farmers in Haryana

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Abstract

This study examines the socio-economic impact of mushroom production training on marginalized farmers in Haryana, focusing on Kurukshetra and Kaithal districts. It evaluates the effectiveness of training programs conducted by KVKs under Haryana Agricultural University, Hisar, in enhancing participants' income, employment, knowledge, and adoption of mushroom production technology. A total of 160 respondents, including 80 training participants and 80 non-participants, were surveyed using a structured interview schedule. The study assessed impact using five key indicators: knowledge, adoption, income, employment, and socio-economic empowerment.

The results show a significant positive impact, with 60 percent of participants reporting an income increase exceeding ₹100,000 per season, compared to 20 percent of non-participants. Mushroom production contributed over 50 percent to household income for 52.5 percent of participants, while 65 percent of non-participants reported no contribution. Additionally, 57.5 percent of participant families employed two members in mushroom production, compared to 22.5 percent of non-participants. Knowledge levels were significantly higher among participants, demonstrating the training's effectiveness.

The study concludes that mushroom production training can be transformative for socio-economic development among marginalized farmers. However, challenges such as high input costs hinder full adoption, necessitating continued support. It emphasizes the role of structured vocational training in improving livelihoods and promoting sustainable agriculture.

Keywords: Mushroom, socio-economic development, marginalized farmers, training, Haryana, employment, agricultural extension

Introduction

Mushroom production has gained prominence as an innovative and profitable agricultural enterprise, especially for marginalized farmers in India. Among various agricultural pursuits, mushroom cultivation offers a unique opportunity due to its low input requirements, quick turnaround, and potential for generating substantial income. For small and landless farmers, it serves as a tool for socio-economic upliftment, enabling them to diversify income sources and engage in value-added agricultural activities.

Several studies have underscored the significance of vocational training programs in enhancing the skills and knowledge of farmers. Mushroom cultivation training, in particular, has been demonstrated to significantly increase adoption rates, improve income levels, and promote employment generation among rural households. A study by Kaur *et al.* (2019) [3] found that mushroom cultivation training provided to marginalized farmers in Punjab resulted in higher income and improved food security. Similarly, Gupta and Verma (2021) [1] emphasized that the introduction of vocational training in mushroom cultivation had a positive impact on women farmers by creating employment opportunities and promoting entrepreneurship in Haryana.

The Krishi Vigyan Kendras (KVKs) in India have played a crucial role in providing these training programs, with an emphasis on marginalized sections of society. These trainings not only equip farmers with the technical know-how for mushroom production but also address the socio-economic challenges faced by rural communities. Several studies have highlighted the effectiveness of such initiatives. A study by Yadav and Mishra (2020) [9] revealed that farmers trained in mushroom cultivation reported a 40.00 percent increase in their household income within one year of training. These findings underscore the potential of mushroom production training to act as a catalyst for socio-economic development in rural India.

In Haryana, mushroom cultivation has shown great promise, particularly among marginalized and landless farmers. The vocational training programs organized by KVKs in Kurukshetra and Kaithal, targeting these groups, aim to empower farmers by increasing their income, enhancing their knowledge, and generating employment opportunities within their families. Given the potential benefits, it is essential to evaluate the impact of these training programs in Haryana to determine their effectiveness in promoting

socio-economic development.

The present research study focuses on assessing the impact of mushroom production training on marginalized farmers in Haryana. By examining various indicators such as knowledge acquisition, income generation, employment creation, and adoption of mushroom cultivation practices, this study seeks to provide a comprehensive understanding of how such training programs contribute to the socio-economic upliftment of marginalized communities.

Methodology

The present study was conducted in two districts of Haryana state *i.e.* Kurukshetra and Kaithal. Krishi Vigyan Kendra (KVK) Kurukshetra and KVK, Kaithal of CCS Haryana Agricultural University, Hisar were selected purposively for the investigation. Both the KVKs organized vocational training for deprived & marginalised groups of society on various vocations as mushroom production, cutting & tailoring, spray technology, milk procession & its value addition, food processing and bakery product making. After analysed the training data of both the KVKs, It was noted that trainings on button mushroom production was organized frequently by both the KVKs due to more interest shown by the participants. Therefore, the research study was focused on button mushroom production trainings. Only vocational trainings organised in the year 2020-21, 2021-22 and 2022-23 for deprived and marginalised farmers were taken into consideration for impact analysis. To select the sample for the research study 40 landless agricultural labours who took training on button mushroom were selected from each KVK. Thus, a total of 80 participants were selected from the button mushroom trainings from both the KVKs. The systematic random sampling method was used for sample selection. For comparison and impact assessment, 80 non-participants respondents, who also belongs to deprived & marginalised groups of the society and engaged in mushroom production were also selected randomly from the 10 different villages. Thus, in total 160 respondents were selected for the study sample. To assess impact of the trainings five development indicators were selected like knowledge, adoption, income, employment and socio-economic empowerment. The study was focused on these indicators. A comprehensive interview schedules was prepared validated and used for primary data collection. Thereafter, data were collected from the selected respondents by using personal interview techniques as well as google form technology. Collected data were analysed in M.S. Excel and SPSS software using appropriate statistical tools than tabulated and interpreted in the light of the objectives of the study. Results of the study are presented in subsequent tables.

Results and Discussion

The results of the study have been depicted in subsequent table followed by interpretation and discussion of the results.

Table 1 shows that the majority of respondents (54.38%) were from the middle age group (36-50 years), with 50.00 percent of participants and 59.17 percent of non-participants falling in this category. A significant portion of respondents (41.25%) belonged to the young age group (20-35 years), with 47.50 percent of participants and 35.00 percent of non-participants. Only a small fraction (4.38%) was in the elderly age group (above 51 years). Therefore, it can be concluded that most respondents were either young or middle-aged. In terms of education, the largest proportion of respondents (39.38%) had completed secondary school (up to 10^{th} standard), with participants making up 35.00 percent and non-participants 44.17 percent. A considerable number (30.63%) had higher secondary education, followed by 19.38 percent who had primary education. Only a small group held a bachelor's degree (8.75%) or a master's degree (1.88%). This indicates that most respondents had moderate educational qualifications, mainly at the secondary or higher secondary level.

Gender distribution shows that 51.88 percent of respondents were male, with more males among non-participants (60.83%). Females made up 48.13 percent of respondents, and 57.50 percent of them were participants. This indicates that there was a nearly equal gender split, with more males among non-participants and more females among participants. Regarding income, the majority of respondents (46.25%) had an annual income of ₹1-3 lakhs, with a higher proportion of non-participants (52.50%) in this category. A considerable number (33.13%) earned less than ₹1 lakh, while 20.63 percent earned between ₹3-5 lakhs. This suggests that most respondents were in the lower to middle-income range.

Occupationally, most respondents (79.38%) were engaged in labour, including 95.00 percent of participants and 64.17 percent of non-participants. Farming was less common (16.88%), and only a small number (3.13%) were employed in jobs or services. This indicates that labour was the predominant occupation, particularly among participants. In terms of farming experience, 48.13 percent of respondents had 5-15 years of experience. A significant portion (41.88%) had less than 5 years of experience. Only a small group (10%) had more than 15 years of experience, indicating that most respondents had moderate farming experience.

Table 2 shows the satisfaction levels regarding the effectiveness of the trainings organized by KVKs among the respondents. For the quality of food and refreshment provided during the training, only a minority expressed satisfaction, with 17.50 percent very satisfied and another 17.50 percent satisfied. However, a significant portion (60.00%) were partially satisfied, indicating that while the refreshments met some expectations, improvements are needed. A small number (5.00%) were not satisfied at all. Regarding the quality of reading materials provided as training content, the responses were more favourable. Here, 27.50 percent of respondents were very satisfied, and 47.50 percent were satisfied. Nevertheless, 10.00 percent were partially satisfied, and 15.00 percent were not satisfied, suggesting that while most respondents appreciated the materials, there is still room for enhancement in their quality.

Table 1: Analysis of socio-personal variables of the respondents (n=160)

S. No.	Mushroom Production Variables and Respondent's Category	Mushroom Production				Total respondents	
		Participants		Non participants			
		F	%	F	%	F	%
Age group							
1.	Young (20-35)	38	47.50	28	35.00	66	41.25
2.	Middle (36-50)	40	50.00	47	59.17	87	54.38
3.	Elderly (51 and above)	02	2.50	05	05.83	07	04.38
	Total	80	100	80	100	160	100.00
Education							
1.	Primary School (up to 5th Standard)	18	22.50	13	15.83	31	19.38
2.	Secondary School (up to 10th Standard)	28	35.00	35	44.17	63	39.38
3.	Higher Secondary School (up to 12th Standard)	28	35.00	21	26.67	49	30.63
4.	Bachelor's Degree	06	07.50	08	10.00	14	08.75
5.	Master's Degree	00	00	03	03.33	03	01.88
	Total	80	100	80	100	160	100.00
Gender							
1.	Female	46	57.50	31	39.17	77	48.13
2.	Male	34	42.50	49	60.83	83	51.88
3.	Total	80	100	80	100	160	100.00
Income							
1.	Less than 01 Lakh	38	47.50	15	18.33	53	33.13
2.	01-03 Lakh	32	40.00	42	52.50	74	46.25
3.	More than 03-05 Lakh	10	12.50	23	29.17	33	20.63
	Total	80	100	80	100	160	100.00
Occupation							
1.	Farming	02	2.50	25	31.67	27	16.88
2.	Labour	76	95.00	51	64.17	127	79.38
3.	Job/service	02	2.50	03	04.17	05	03.13
	Total	80	100	80	100	160	100.00
Farming experience							
1.	Less than 5 years	36	45.00	31	38.33	67	41.88
2.	5 to 15 years	36	45.00	41	51.67	77	48.13
3.	16 to 30 years	08	10.00	08	10.00	16	10.00
	Total	80	100	80	100	160	100.00

Table 2: Satisfaction level and effectiveness of the trainings organized by KVKs (n=80)

S. No.	Effectiveness indicators	Very Satisfied		Satisfied		Partially Satisfied		Not Satisfied		Total	
		F	%	F	%	F	%	F	%	F	%
1.	Quality of food and refreshment provided during the training	14	17.50	14	17.50	48	60.00	04	05.00	80	100.00
2.	Quality of reading materials provided as training content	22	27.50	38	47.50	08	10.00	12	15.00	80	100.00
3.	Quality of training materials for starting production unit	44	55.00	32	40.00	04	05.00	00	00.00	80	100.00
4.	Process & criteria adopted by KVK for trainees' selection	20	25.00	36	45.00	16	20.00	08	10.00	80	100.00

In terms of the quality of training materials for starting a production unit, the feedback was overwhelmingly positive, with 55.00 percent of respondents very satisfied and 40.00 percent satisfied. This indicates a strong approval of the materials provided, as none of the respondents reported being dissatisfied. Lastly, the effectiveness of the process and criteria adopted by KVK for trainee selection received mixed reviews. While 25.00 percent were very satisfied and 45.00 percent satisfied, a notable 20.00 percent were only partially satisfied, and 10.00 percent were not satisfied. This suggests that while the selection process was generally viewed positively, there are areas that could be improved to enhance participant satisfaction. In conclusion, the data indicates that while respondents had varied satisfaction levels regarding different aspects of the training, the quality of training materials for starting a production unit received the highest approval, while food quality and the trainee selection process showed opportunities for improvement. Similar findings were reported by Singh, D., & Singh, K. (2016) [7] who revealed that majority of the trainees were found to be satisfied with respect to various aspects of training programmes like subject matter content, training duration, practical exercises, provision of literature. More than 90 percent trainees found their training programme effective in meeting their expectations.

The prevalent misconception that participation in such vocational training programs was merely to acquire material goods, such as mushroom bags, tool kit and other equipments which was thoroughly investigated in this study.

Table 3: Reasons for participation in the Mushroom production training program (n=80)

S. No.	Reasons for participation	Mushroom Training	
		Frequency	Percentage
1.	Getting a certificate, knowledge & skill	02	2.50
2.	Getting knowledge, skill, and getting training material (Mushroom bags etc.)	08	10.00
3.	Getting knowledge, skill and to start mushroom production unit.	12	15.00
4.	Getting training material and to start mushroom production unit	20	25.00
5.	Getting knowledge, skill, and training material to start mushroom production unit.	38	47.50
	Total	80	100.00

Table 3 shows the reasons for respondents' participation in the mushroom production training. Contrary to the common myth that participants attended the training solely to obtain mushroom bags for resale and earning money, the data reveals a more nuanced picture of motivations. The majority of respondents (47.50%) participated in the training to gain knowledge, skills, and training materials (such as mushroom bags) with the intent of starting a mushroom production unit. This indicates that nearly half of the participants were motivated by a comprehensive interest in both learning and entrepreneurship. A significant portion (25.00%) attended the training to obtain training materials and start their own production unit, suggesting that material support was a strong motivating factor for a quarter of the respondents. Another 15.00 percent joined the program with the intent of gaining knowledge and skills to start their own mushroom production unit, even if training materials were not the primary draw.

Interestingly, only 10.00 percent of the respondents cited the combined reasons of gaining knowledge, skills, and receiving training materials, but with no direct reference to starting a production unit. Only 2.50 percent respondents attended the training purely to gain a certificate, knowledge and skills, further debunking the myth that most participants attended only for material gain. In conclusion, the majority of participants attended the training not just to receive materials for resale, but with the intention of using both the knowledge and resources to establish mushroom production units, pointing to a deeper entrepreneurial and learning motivation among the respondents. Similar result was reported by Vishwakarma, N. *et al*., 2023 [8] and Mazumdar *et al*., 2020 [5].

Table 4: Impact of mushroom production trainings on the respondent's knowledge level (n=160)

S. No.	Knowledge score statistics	Mushroom production training	
		Participants	Non-participants
1.	Mean score	23.02	19.00
2.	K. Index average	56.16	46.34
3.	Standard Deviation	04.89	03.63

Table 4 illustrates the impact of mushroom production training on the knowledge level of participants compared to non-participants. The data clearly indicates that the training had a positive impact on the participants' knowledge. The mean knowledge score for participants (23.02) is notably higher than that of non-participants (19.00), suggesting that those who attended the training acquired more knowledge related to mushroom production than those who did not. The Knowledge Index (K. Index) further reinforces this, with participants average score 56.16, compared to 46.34 for non-participants. This difference of nearly 10 points highlights the training's effectiveness in enhancing knowledge. Furthermore, the standard deviation is slightly higher among participants (4.89) compared to non-participants (3.63), indicating more variation in the knowledge levels of trained individuals. This could be due to differences in how much participants learned from the training or their prior knowledge levels. Therefore, it can be inferred that the mushroom production training significantly improved the knowledge of participants compared to non-participants, as shown by the higher mean score and K. Index, although some variation in knowledge acquisition exists among the participants. Singh, D., & Singh, K. (2016) [7] also reported that there was significant gain in knowledge of trainees after participating in mushroom cultivation training programmes which support the finding of this study.

Table 5 reveals distinct differences in the knowledge levels of participants and non-participants regarding mushroom production. Data shows that in basic knowledge like 'primary substrate used for button mushroom cultivation' participants scored 90.00 percent which is significantly higher than the 67.50 percent of non-participants. It may be due to the practical demonstrations during training. Similarly, participants outperformed non-participants in understanding the 'moisture content in compost during the conditioning phase' (80.00% vs. 35.00%). The high participant score could be attributed to their hands-on involvement in the composting process. Table also depicts that non participants demonstrated better knowledge in technical areas such as the 'role of Nitrogen in the composting process' (25.00% vs. 17.50%), although both groups showed lower knowledge in this area. This might indicate that nitrogen's role was less emphasized in the training. In contrast, participants had a better understanding of the 'technique of spawn mixing into the compost' (45.00 percent vs. 37.50 percent) and the 'purpose of covering spawned compost with casing soil' (45.00% vs. 37.50%). These processes are critical to mushroom cultivation, and participants likely benefited from step-by-step guidance provided during their training.

Table 5: Extent of level of knowledge of participants and non-participants about mushroom production (n=160)

S. No.	Knowledge statements	Mushroom production	
		Participant's MPS	Non-participant's MPS
1.	Primary substrate used for button mushroom cultivation	90.00	67.50
2.	Sterilization for preparing compost	42.50	40.00
3.	Ideal temperature range for pasteurizing compost	10.00	32.50
4.	Moisture content in compost during conditioning phase	80.00	35.00
5.	Role of Nitrogen in the composting process	17.50	25.00
6.	Spawn in context of mushroom cultivation	70.00	30.00
7.	Technique of spawn mixing into the compost	45.00	37.50
8.	Purpose of covering spawned compost with casing soil	45.00	37.50
9.	Recommended temperature range for incubating spawn-run compost	62.50	35.00
10.	Time to be taken by mycelium to colonize the compost after spawning	60.00	42.50
11.	Method for checking the readiness of compost for spawning	40.62	45.00
12.	Environmental conditions to induce pinhead formation in mushroom	70.00	45.00
13.	Optimal temperature range for fruiting mushroom	67.50	45.00
14.	Maintaining humidity levels during the fruiting stage	85.00	45.00
15.	Stage of mushroom ready for harvesting	57.50	40.00
16.	Harvesting method to ensure minimal damage to the fruiting body	62.50	45.00
17.	Recommended storage temperature for harvested mushroom	62.50	40.00
18.	Packaging method of mushroom for market sale to maintain freshness	92.50	67.50
19.	Effective method for marketing mushrooms to consumers	63.75	56.25
20.	Quality and safety of mushrooms during transportation to market	75.00	45.00
21.	Shelf life of harvested mushrooms under proper storage conditions	70.00	50.00
22.	Factors that can spoil mushrooms during storage and transportation	53.12	49.38
23.	Identification signs of mushroom spoilage	68.75	41.25
24.	Method for preserving button mushrooms for long-term storage	29.37	55.00
25.	Nutritional value of button mushrooms	60.62	55.00
	Average MPS	59.25	44.28
	Z-Test: Two Sample for Means		
		Participants	Non-participants
	Mean	59.25	44.28
	Known Variance	420.33	106.63
	Observations	25	25
	Hypothesized Mean Difference	0	
	Z value	3.262	
	P(Z<=z) one-tail	0.001	
	z Critical one-tail	1.645	
	P(Z<=z) two-tail	0.001	
	z Critical two-tail	1.960	

Temperature regulation is a crucial aspect of mushroom production, data shows that participants scored higher in areas such as 'recommended temperature range for incubating spawn-run compost' (62.50% vs. 35.00%) and 'optimal temperature range for fruiting mushrooms' (67.50% vs. 45.00%). It can be due to knowledge gained during the training programme. Participants also had better knowledge about "time required for mycelium colonization of compost after spawning' (60.00% vs. 42.50%), likely because of the practical experience gained during the training. Similarly, participants were more informed about the 'method for checking the readiness of compost for spawning' (40.62% vs. 45.00%), though non-participants showed slightly higher knowledge in this area, possibly due to prior experience in traditional practices. Furthermore, in post-harvest handling, participants excelled in their knowledge of 'maintaining humidity during the fruiting stage' (85.00% vs. 45.00%) and 'recommended storage temperature for harvested mushrooms' (62.50% vs. 40.00%). This highlights the effectiveness of the training in covering critical post-harvest processes that are vital for maintaining the quality and freshness of mushrooms. Participants were also more knowledgeable about the 'packaging method of mushrooms for market sale' (92.50% vs. 67.50%), emphasizing the training's focus on market preparation and quality maintenance during storage and transportation. Moreover, participants scored better on the 'environmental conditions to induce pinhead formation' (70.00% vs. 45.00%) and the 'harvesting stage of mushrooms' (57.50% vs. 40.00%). These are critical stages in mushroom production, and the practical aspects of the training likely contributed to their enhanced understanding. Results clearly demonstrated that knowledge about 'harvesting method to ensure minimal damage to the fruiting body' was 62.50 percent vs. 45.00 percent among participants and non-participants respectively.

In areas related to market and consumer handling, participants displayed stronger knowledge in the 'effective methods for marketing of mushroom' (63.75% vs. 56.25%) and the 'quality and safety of mushrooms during transportation' (75.00% vs. 45.00%). This could be due to training focused on post-harvest management and marketing strategies. While non-participants outscored participants in a few areas like 'method for preserving mushrooms for long-term storage' (55.00% vs. 29.37%) and 'nutritional value of button mushrooms' (55.00% vs. 60.62%), participants

generally performed better overall. The 'shelf life of harvested mushrooms under proper storage conditions' (70.00% vs. 50.00%) was another area where participants showed their training advantage. The study by Mazumdar *et al*. (2020) [5] supports the findings that exposure to training significantly increased farmers' knowledge of mushroom production techniques by 73.7 percent. This improvement was attributed to the keen interest of participants, the ease of cultivation techniques, and the effectiveness of the technology transfer methods used in training programs. Similar trends were observed in the present study, highlighting the crucial role of structured training in enhancing farmers' technical skills and adoption of mushroom cultivation. Study is also in the line of finding of Shahi, V. *et al*. 2018 [6].

The Z-test results, with a Z value of 3.262 and P value of 0.001, confirm that the knowledge gap between participants and non-participants is statistically significant. The average MPS (Mean Percentage Score) of participants was 59.25 compared to 44.28 for non-participants, further validating the training's impact. In conclusion, the data shows that participants gained substantial benefits from the training, with significantly higher knowledge in most aspects of mushroom cultivation, post-harvest management, and marketing. This knowledge advantage can be due to hands-on training provided by the KVKs. The findings are evident with the results reported by Mavi H.K., Thakur, Prerna (2021) [4] who revealed that exposure to training had increased the knowledge of participants regarding techniques of mushroom production by 80.75 per cent.

Table 6: Adoption level of respondents about mushroom production technology (n=160)

S. No.	Adoption level	Mushroom Training			
		Participants		Non-participants	
		Frequency	Percentage	Frequency	Percentage
1.	Fully adopted	18	22.50	10	12.50
2.	Partially adopted	60	75.00	18	22.50
3.	Not adopted	02	2.50	52	65.00
	Total	80	100.00	80	100.00

The data in Table 6 illustrates the adoption levels of mushroom production technology among respondents, comparing participants who received training with non-participants. The findings revealed that 22.50 percent respondents fully adopted mushroom production technology whereas only 12.50 non-participants adopted the same. It shows that the absence of training resulted in lower engagement with the technology. A significant finding is that 75.00 percent participants partially adopted the technology. Gurram *et al*. (2018) [2] reported that 80 percent of trainees adopted mushroom farming, while 20 percent did not, reinforcing the present study's findings on the high adoption rate following vocational training in mushroom cultivation.

This high rate of partial adoption may be attributed to the high cost of inputs, particularly mushroom bags, which were provided immediately after the training but were not made available in subsequent years. As a result, while farmers were initially motivated to adopt the technology, many faced difficulties in sustaining their practices due to high cost of essential materials. In contrast, only 22.50 percent of non-participants partially adopted mushroom production, illustrating that without training and support, farmers encountered greater barriers to adopt the technology. Singh, D., & Singh, K. (2016) [7] also reported the similar results who observed that 37.24 percent of the trainees had adopted mushroom cultivation enterprise after training whereas 29.79 percent of the trainees discontinued the enterprise over time.

Furthermore, the non-adoption rates provide insight into the effectiveness of the training. Among participants, only 2.50 percent choose not to adopt the technology at all, highlighting the training's success in encouraging adoption. On the other hand, a substantial 65.00 percent of non-participants did not adopt mushroom production technology, emphasizing the critical role that training plays in facilitating initial uptake.

Table 7: Primary reasons for discontinued adoption / no adoption of mushroom production (n=160)

S. No.	Reasons for partial adoption/ no adoption	Participants		Non-participants	
		Frequency	Percentage	Frequency	Percentage
1.	High initial investment costs/ lack of money for purchasing spawn inoculated compost bags	58	72.50	24	30.00
2.	Lack of knowledge about technologies	12	15.00	44	55.00
3.	Concerns about the complexity or feasibility of implementation	08	10.00	04	5.00
4.	Less profit	00	0.00	06	7.50
5.	Any other (Diseases, marketing etc.)	02	2.50	02	2.50
Total		80	100.00	80	100.00

Table 7 outlines the primary reasons for discontinued or no adoption of mushroom production among participants and non-participants. The most significant barrier for participants was high initial investment costs, with 72.50 percent respondents cited the inability to afford spawn inoculated compost bags. This financial constraint hindered full adoption, even after training. Non-participants also identified high costs, but to a lesser extent as 30.00 percent respondents, indicated their hesitance to invest without prior support. Lack of knowledge about the mushroom production was another major reason, particularly for non-participants, with 55.00 percent respondents who expressed this concern.

Among trained participants, only 15.00 percent felt knowledge was a barrier, suggesting training significantly reduced this issue. Additionally, concerns about the complexity of implementation were noted by 10.00 percent of participants and 05.00 percent of non-participants. Notably, none of the participants cited low profitability as a reason for discontinuation, while 7.50 percent of non-participants did, further emphasizing the impact of training on understanding the economic potential of mushroom production. Overall, these findings underscore the need for ongoing financial support and knowledge dissemination to enhance adoption rates.

Table 8: Impact of mushroom production training on overall income of respondents (n=160)

S. No.	Levels of Income	Participants		Non-participants	
		Frequency	Percentage	Frequency	Percentage
1.	Income increased significantly (> Rs.100000 per season)	48	60.00	16	20.00
2.	Income increased moderately (Between Rs. 50000 to 100000 per season)	24	30.00	12	15.00
3.	Income remained stable	08	10.00	52	65.00
4.	Income decreased	00	0.00	00	0.00
	Total	80	100.00	80	100.00

Table 8 shows the impact of mushroom production training on the overall income of respondents. The data reveals a significant difference in income levels between the two groups, highlighting the positive financial effect of training. Data depicts that 60.00 percent respondents reported a significant income increase of more than Rs. 100,000 per season, indicating that the training had a strong impact on boosting their earnings through mushroom production. In contrast, only 20.00 percent of non-participants experienced a similar income increase, suggesting that without training, the potential for high income gains is limited. Additionally, 30.00 percent of trained participants saw a moderate-income increase, earning between Rs. 50,000 to Rs. 100,000 per season. This is double the percentage of non-participants (15.00%) who reported the same income range. The gap indicates that even moderate-income improvements were more likely among those who received training.

On the other hand, only 10.00 percent of participants reported stable income levels, while a significant 65.00 percent of non-participants saw no change in their income. This suggests that the majority of non-participants remained stagnant in their earnings, underscoring the importance of training in driving income growth. Gurram *et al*. (2018) [2] reported similar findings, indicating that 45.00 percent of continued adopters of Milky Mushroom farming experienced a 60 to 80 percent increase in their family income, while 30.00 percent of continued adopters saw a 5 to 10 percent rise in their earnings. These results highlight the substantial economic benefits of vocational training in mushroom cultivation, aligning with the present study's findings.

Table 9: Contribution of mushroom production income to the total household's income in the growing season (n=160)

S. No.	Levels of contribution by mushroom Income	Participants		Non-participants	
		Frequency	Percentage	Frequency	Percentage
1.	No contribution	00	00.00	52	65.00
2.	Less than 10 percent	02	02.50	00	00.00
3.	From 10 to 25 percent	14	17.50	02	02.50
4.	From 26 to 50 percent	22	27.50	06	07.50
5.	More than 50 percent	42	52.50	20	25.00
	Total	80	100.00	80	100.00

The data presented in Table 9 highlights the contribution of mushroom production income to the total household income during the growing season for both participants and non-participants. Among the participants, a significant proportion (52.50%) reported that mushroom production contributed more than 50.00 percent to their total household income. This suggests that mushroom cultivation has become a primary income source for over half of the participants. Additionally, 27.50 percent of participants indicated that mushrooms contributed between 26 to 50 percent to their household income, while 17.50 percent reported contributions in the range of 10 to 25 percent. Only 2.50 percent of participants reported that mushrooms contributed less than 10.00 percent to their income, and notably, none reported that mushroom production made no contribution at all. In contrast, for the non-participants 65.00 percent reported no income contribution from mushroom production, indicating a lack of engagement in this activity. A smaller portion (25.00%) of non-participants experienced more than 50.00 percent of their income coming from mushrooms, while 07.50 percent reported a contribution between 26 to 50 percent. The remaining 02.50 percent indicated that mushrooms contributed between 10 to 25 percent of their income, and none had a contribution less than 10.00 percent.

The stark difference between the two groups highlights the significant impact of training in mushroom production. Participants not only engaged more actively in mushroom cultivation but also derived a substantial portion of their household income from it, emphasizing the economic impact of the training program.

Table 10: Impact of mushroom production trainings on the employment generation in family (n=160)

S. No.	Numbers of family member got employment in their production unit	Mushroom production trainings			
		Participants		Non-participants	
		Frequency	Percentage	Frequency	Percentage
1.	Only me	30	37.50	10	12.50
2.	Two family members	46	57.50	18	22.50
3.	Three family members	02	02.50	00	0.00
4.	No member	02	02.50	52	65.00
	Total	80	100.00	80	100.00

Table 10 illustrates the impact of mushroom production training on employment generation within the families of both participants and non-participants of the program. For the participants, the data reveals a significant increase in family employment due to mushroom production. A majority (57.50%) reported that two family members were employed in their production unit, indicating that the training program not only benefited the participant but also extended employment opportunities to other family members. Additionally, 37.50 percent of participants stated that only they were employed in the mushroom production unit, while a small fraction (2.50%) reported employment for three family members. Only 2.50 percent of participants indicated that no family member was employed, suggesting that almost all participants saw some employment benefits from mushroom production. In contrast, among the non-participants, a notable 65.00 percent reported that no family member was employed in mushroom production, reflecting their limited engagement in this activity as they adopted it to limited extent. Only 22.50 percent of non-participants indicated employment for two family members, and 12.50 percent reported that only they were employed. None of the non-participants employed more than two family members in mushroom production. This comparison highlights the considerable impact of mushroom production training on employment generation within families.

Conclusion

The findings of this research indicate that mushroom production training significantly enhances the socio-economic conditions of marginalized farmers in Haryana. Participants of the training programs experienced considerable improvements in various aspects, including income, employment generation, and knowledge acquisition. Approximately 60.00 percent of participants reported a substantial increase in their seasonal income, exceeding ₹100,000, compared to only 20.00 percent of non-participants. Additionally, 52.50 percent of participants stated that mushroom production contributed over 50.00 percent to their household income, demonstrating its potential as a primary income source.

In terms of employment, the study found that 57.50 percent of participant families generated employment for at least two family members through mushroom production, while only 22.50 percent of non-participants achieved similar results. The role of training in enhancing technical knowledge was also evident, with participants scoring significantly higher in key areas such as substrate preparation, temperature control, and post-harvest management. Despite these positive outcomes, challenges remain, particularly in sustaining the adoption of mushroom production technology. A significant proportion of participants (75.00%) partially adopted the technology, primarily due to high input costs and limited availability of high quality mushroom spawn bags. This highlights the need for continued support in terms of subsidies and access to inputs to ensure sustained adoption.

In conclusion, the research demonstrates that mushroom production training, when implemented effectively, can be a transformative tool for socio-economic development among marginalized farmers. The training not only boosts income and employment but also equips farmers with the technical knowledge required to succeed in mushroom cultivation. However, ongoing support in terms of resources and inputs is essential for maximizing the long-term impact of these training programs.

Recommendations

Mushroom production training should be regularly organized as it significantly contributes to household income and employment, thereby empowering marginalized farmers and uplifting their socio-economic status. To maximize impact, training programs should be extended to 10 to 12 days with a stronger focus on skill development, including compost and spawn making. Additionally, to ensure full adoption, production inputs like mushroom bags should be provided for three years; free in the first year, with a 75 percent subsidy in the second year, and with 50 percent subsidy in the third year. Structured market linkages should be developed by KVKs through Farmer Producer Organizations (FPOs) to support mushroom producers. Digital extension services, including mobile advisories, should be integrated for continuous technical support, and targeted financial assistance, such as micro-loans or grants, should be introduced to help farmers scale production.

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Disclaimer

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of the affiliated institution. The author is responsible for the accuracy and completeness of the information provided.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

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