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An Economic Assessment of Mushroom Grower's in Haryana

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ABSTRACT

Mushroom cultivation offers a highly efficient method of not only biodegradation and bioremediation of agro-industrial waste but also biotransformation into proteinaceous food that can sustain food security in the developing countries. The technology for the cultivation and handling of Calocybe indica (milky mushroom) was propagated in the selected villages of the Haryana state. The sample size constituted of 200 farmers which were trained intensively for period of three years (2015- 2017). In each selected village a mushroom centre were developed through which farmers were given hand holding support. For better adaptability of cultivation technology of C. indica, readymade spawned bags were distributed to compare the biomass yield obtained with the bags prepared by farmers using the conventional method. The fresh mushroom yield varied from 40 - 70 kg/ 100 kg dry substrate. As per the economics calculated it was found that a farmer can earn profit in the range of ` 33570-93570/annum. Farmers have been found to adopt this technology and some of them continuing this venture as a small side business. The identified constraints and suggestions pertaining to the C. indica crop were also described for further encouragement of mushroom farming in rural areas.

Key words: C. indica, constraints, mushroom farming, yield

INTRODUCTION

There is a continuous surge for execution of new technologies or alternatives that can help our country to improve their agricultural outputs, economic growth with high revenues, poverty, abolition of hunger, as well as under nutrition from the Indian societies (Gopalan, 2013). Mushroom technology fits in the picture of today's scenario, as it is a complete technology starting from the utilization or conversion of organic wastes into consumable protein rich food addressing vast problem of malnutrition, employment generation and waste utilization (Sharma *et al.*, 2016). Additionally, to meet the protein requirements alternative sources of proteins are required. As the production of pulses and other sources of proteins have not kept pace with our requirement, to overcome such situations mushrooms again is a good choice for combating widespread protein malnutrition. Above this the prosperity of any country lies in the rural development and there is a need to utilize the local talent, adopt alternatives and vocations such as mushroom cultivation as cottage industries. It is anticipated that introduction of such components in the farming system can make the system holistic and more sustainable.

Mushrooms are fruit bodies of fungi neither, they are plants nor, animals but have their own kingdom (Singh and Kamal, 2016). According to current estimates, mushrooms constitute at least 12,000 species worldwide and out of that 2000 species are reported as edible (Prasad *et al.*,2015). About 35 edible mushroom species are commercially cultivated whereas 6 species are grown at industrial scale (Rathore *et al.*, 2016). Mushroom cultivation has speeded up in about all the countries of the world, roughly at the rate of 10 percent. Currently, China is the leading mushroom cultivator contributing to about 70 percent of the total world production and India contributes to only 3 percent of the global mushroom production (Zhang *et al.*, 2014). In India Agaricus bisporus *i.e.* button mushroom is the predominating species and accounts for about 85 per cent of the total mushroom production in the country. The substantial part of the production comes from the commercial units situated in the different parts of country. The promotion of other tropical species such as Pleurotus spp., Calocybe indica and Volvariella volvacea also needs promotions

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and propagation amongst the masses.

Calocybe indica (P&C) var. APK2 (milky mushroom) is an indigenous culinary-medicinal mushroom, cultivated throughout the year in India at a large scale (Purkayastha, 1985). C. indica reported to grew well on lignocellulosic substrates and can be easily cultivated on any kind of waste substrates (Rathore et al., 2018). Nutritionally the species is strong and rich in protein, dietary fiber, ash, minerals and antioxidant properties (Rathore *et al.*, 2017).

In-spite of its simple and low cost cultivation technology, good biological efficiency and marvelous nutritional properties farmers are still not adopting mushroom venture and the cultivation of this particular mushroom is lacking behind. The current paper is dealing with the propagation of the C. indica mushroom technology in the rural areas of Haryana.

METHODOLOGY

The locale selected for the study was in the villages of Haryana *viz.* Farrukhnagar, Mubarikpur, Joniyavas, Mushedpur, Hari Nagar, Garhi Nathe Kha, Khera and Khurrampur. The farmers for the training were randomly selected as per their interest towards the mushroom cultivation, available resources (land and raw materials) and time. A structured interview schedule was prepared and pre-tested on 200 sampled respondents to gather the information pertaining to the awareness about the aspects of mushroom technology.

In all the selected eight different villages' different mushroom cultivation centres were made and at each centre ten farmers were associated to get mushroom training. Total of 20 centers were established, 4 centres were made at block Farrukhnagar, 3 at Joniawas, 1 each at Musedhpur, Mubarikpur, Hari Nagar, 5 at Khurrampur village, 3 at village Khera and 2 at Garhi Nathe Kha. Interestingly, from the village Hari Nagar a women self-help group was also involved with the activity.

C. indica was cultivated according to the procedure described by Krishnamoorthy *et al.,* (2000). Cultivation of C. indica on basal substrate 'wheat straw'. The straw was chemically treated with formalin and soaked overnight. The wheat straw was then spread on to the clean sheet for the complete removal of the extra moisture and foul odor of formalin. The moistened substrates, weighing 1 Kg each, were packed into the polypropylene bags (14 cm×22 cm) and inoculated with the C. indica spawn (10% dry weight basis) by opting the layer method. Spawn run was carried out at the mushroom centre having a temperature range of 30-35 ºC and relative humidity around 85-90% till colonization of the fungus. The bags were shifted to the cropping room having temperature range between 25 ºC and 35 ºC after a period of 20 days. About 2.5 cm thick top layer of sterilized casing soil (decomposed cow dung+rice straw+ash+coconut coir pith at 1:1 ratio) was applied on to the bags. The first crop of mushroom fruit bodies was harvested after a period of 25 days. The fruit bodies were subsequently harvested every other week.

In addition to the conventional method of mushroom cultivation, a rather practical approach *i.e.* readymade spawned mushroom bags were distributed at each mushroom centre, procured from Haryana Agro Industries Corporation (HAIC), Murthal, Haryana.

RESULTS AND DISCUSSION

It was observed that 25 percent of the population was interested to take part in training programs and were ready to accept this venture as one of the income generating activity. As depicted in fig 1, 14 percent of the people responded that they had only eaten mushrooms in marriages or parties, that too only button mushrooms and had never cooked any kind of mushroom species in their own houses. Only 7 percent of the population was aware of the medicinal benefits of the mushrooms whereas, hardly 1 percent told about the importance of utilizing spent wheat straw for the production of compost (fig 1).

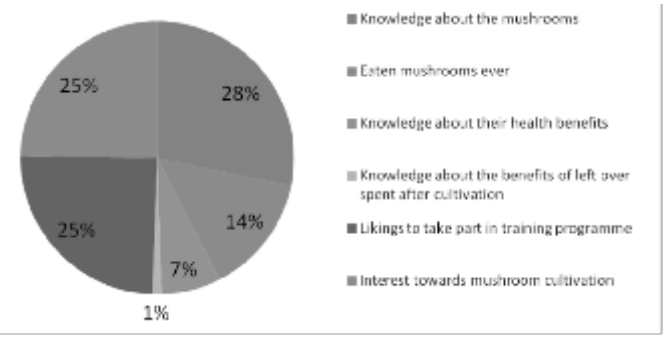

Fig. 1 Awareness pertaining to the aspects of mushroom technology

The data pertaining to the yield obtained by the farmers in three consecutive years (2015-2017) is illustrated in the table 1. Two variants viz. readymade packets by IITD and packets prepared by farmers themselves were used for cultivation and their yield was monitored. The intent was to notice the differences in applicability of the technology in the rural context. The

inference drawn can be summarized as readymade packets had a better acceptability due to ease in handling of operations and least chances of contamination in the packets due to the proper sterilization technique used for the pasteurization of substrates by the certified agency such as HAIC. It was observed that the centres developed at block Farrukhnagar were consistent in yielding the good biomass continuously for consecutive three years, which could be due to the ventilated centres, proper maintenance of sanitation as well as temperature in the cropping rooms. On the other hand group of SHG's working in the village Hari Nagar faced huge problems due to the unavailability of the land resources required for the mushroom technology.

In the first year, tremendous problems were faced with selling milky mushroom around the areas of Gurugram and the selected villages. The farmers decided to eat the mushrooms and cooked at their own places, they served the families, some of them distributed to the neighbors, relatives and rest sold their packets in the respective market in the Farrukhnagar and DLF market situated in Gurugram at a price of 100-150 Rs /Kg. Farmers also tried to come and sell at Azadpur sabzi mandi situated in Delhi, but as the process required a lot of energy for travelling to one city to another and the fluctuating price were some of the reasons they could not find this feasible. Later, the NGO associated (Gramin Vikas Sangathan) with the study helped to get registered at the Indian mega mart, an online marketing site for fast online selling of the milky mushrooms. This successfully helped in finding good buyers for the flesh produced, also other markets such as Nirvana country in Gurugram and sabzi mandi of the Farrukhnagar block attracted localities to buy mushrooms at a good price of 150- 200 `/ Kg.

Table 1: Yield of the C. indica obtained by the benefeceries from self made and ready to harvest packets provided by IITD (2015-2017)

Mushroom Centre	Readymade packets by IITD (Kg)	Yield (Kg)	Biological efficiency (%)	Self made packets (Kg)	Yield (Kg)	Biological efficiency (%)
Yield obtained by the beneficeries in the year of 2015						
Farrukhnagar 1	15	12	80.0	42	22	52.4
Farrukhnagar 2	15	11	73.3	45	23	51.1
Farrukhnagar 3	75	55	73.3	15	8	53.3
Farrukhnagar 4	75	55	75.3	15	8	53.3
Mubarikpur	75	45	60.0	15	10	66.6
Mushedpur	75	45	60.0	15	10	66.6
Joniyavas 1	37.5	25	66.6	25	18	72.0
Joniyavas 2	37.5	27	72	25	20	80.0
Harinagar	75	39	52	10	5	50.0
Yield obtained by the benef iceries in the year of 2016						
Garhi Natha kha 1	30	25	83.3	84	65	77.3
Garhi Natha kha 2	30	22	73.3	70	60	85.7
Farrukhnagar 1	40	31	77.5	156	100	64.1
Farrukhnagar 2	40	33	82.5	154	120	77.9
Farrukhnagar 3	40	30	75.0	190	120	63.1
Joniyavas 1	40	28	70.0	90	68	75.5
Joniyavas 2	40	27	67.5	90	65	72.2
Harinagar	40	30	75.0	80	55	68.7
Mubarikpur	40	28	70.0	80	57	71.2
Yield obtained by the beneficeries in the year of 2017						
Khurrampur 1	80	65	81.2	100	62	62.0
Khurrampur2	80	62	77.5	100	70	70.0
Khurrampur3	80	60	75.0	100	65	65.0
Khurrampur4	80	56	70.0	70	55	73.3
Khurrampur5	75	45	60.0	20	14	70.0
Khera1	75	47	67.1	100	65	65.0
Khera2	75	53	70.6	100	70	70.0
Khera3	75	55	73.3	100	72	72.0
Farrukhnagar1	80	63	78.7	70	50	71.4
Farrukkhnagar2	80	68	85.0	200	140	70.0

Number of training sessions were organised about the preparation of household based value added products for the beneficiaries involved in the study. The mushrooms which could not be sold were sun dried and grinded up into a fine powder. The target population for this training was women and girls of the villages. They were skilled about the formation of fresh milky mushroom pickel. Various demonstration cum workshops were organised about the value addition of milky mushroom. To scale up the mushroom consumption, women were also taught about the blending of dried mushroom powder into the chapati dough which could help them to include the protein rich mushroom into their daily diet. In order to increase the consumption among the masses, women were provided with the receipe books published in hindi listing the various types of vegetables and snack preparation recepies. Additionally biscuits, cookies and mathris made using milky mushroom powder at IITD were also given to them for sensory evaluation and

product testing to know their likeness and acceptability of the mushroom based bakery products.

The results from the table 2 revealed the constraints in adoption of mushroom farming at small scale level. It is evident from the table that amongst the economic constraints the major constraint noticed was high cost of production primarily the initial investment (85.50%) and high cost of maintenance (81.50%) was ranked second. Whereas, inadequate finance by bank for developing large scale production unit (73.05%) was also found as one of the major constraint. The other constraints in subsequent order stood as high cost of labor (69.50%) followed by difficult loan procedure (65.5%). Considering the technical constraints, high expensive transportation service for management of raw material (88.5%) was ranked first and lack of spawn unit in the village (84.5%) was ranked second. The other constraints in order followed as lack of technical knowledge to manage the mushroom enterprise (77%), poor post-harvest management of harvested mushrooms (71.5%) and lack of availability of mushroom cultivation related literature in the village (64.50%) respectively.

Table 2: Constraints faced by respondents during adoption of mushroom technology

Constraints	Frequency	Percentage	Rank Order
Economic constraints			
High cost of production (Initial investment)	171	85.5	I
High cost of maintenance	163	81.5	II
High cost of labour	139	69.5	IV
Difficult loan procedure	131	65.5	V
Inadequate finance by bank for developing large scale production unit	147	73.5	III
Technical constraints			
Lack of spawn unit in the village	169	84.5	II
Highly expensive transportation service for management of raw material	177	88.5	I
Lack of availability of mushroom cultivation related literature in the village	129	64.5	V
Lack of technical knowledge to manage the mushroom enterprise	154	77	III
Poor post-harvest management of harvested mushrooms	143	71.5	IV
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Lack of technical knowledge to manage the mushroom enterprise	154	77	III
Poor post-harvest management of harvested mushrooms	143	71.5	IV

Table 3 highlights the major suggestions to mitigate these constraints. In order of ranking the major suggestions perceived was providing the marketing facilities at their primary level for the prompt purchase of fresh and processed mushroom (76.50%). Regular and planned supply of raw material (spawn, polypropylene bags) (73.5%) and providing technical knowledge to manage the mushroom enterprise (70.5%) were also observed as prime suggestions. In-depth exploration of these suggestions will usher in providing intervention strategy to minimize the constraints.

Table 3: Suggestions as given by respondents to mitigate the constraints

Suggestions	Frequency	Percentage	Rank order
Marketing facilities be provided at village level for the purchase of fresh and processed mushroom	153	76.5	I
Providing technical knowledge to manage the mushroom enterprise	141	70.5	III
There should be regular and planned supply of raw material (spawn, polypropylene bags)	147	73.5	II
Information on subsidies should be easily assessable	131	65.5	V
Packaging material for the mushroom be made available	135	67.5	IV
Loan sanction procedure should be easy	81	40.5	IX
Desired chemicals be made available	121	60.5	VI
Reduction of thatch house installation cost	99	49.5	VIII
Providing mushroom literature in village	117	58.5	VII
Small scale spawn industries be encouraged at village level	74	37	X

The results of our study also indicated that by utilizing wheat straw a very economic substrate to cultivate milky mushroom, the farmers earned surplus profit. The economics calculated (table 4) for a farmer per year displayed that the venture is highly profitable and a farmer could gain steady revenues from ` 34 - 93 thousand per year. Average production cost of mushroom per farm was ` 26430 and revenue was 60000-120000 (by selling mushrooms at 100-200 `/Kg). The benefit cost ratio was about 2.27. Marketing costs and margins are relatively higher than those of other agricultural products.

Table 4: Economics of the C. indica cultivation per farmer per year in district Gurugram Haryana

Raw material	Units	Cost (`)
Wheat straw	1000 kg (@` 10/Kg)	10000
Spawn (@10%)	100kg (@`70/Kg)	7000
Polythene bags	4kg (@`160/Kg)	640
Casing material	100kg (@`7/kg)	700
Others	Expenditures Including Formaline, water, newspapers etc.	1000
Packing	@5/Kg	3000
Rent	3 months (@` 500/month)	1500
Labour	7 working days (@` 370/day)	2590
Inputs Total		26430
Total mushroom production	600 Kg (marketing @ `100-`200/Kg)	~60000-120000
Net profit (output - input)		~33570-93570

CONCLUSION

The study concluded that 25 per cent of the population was interested to take part in training programs and were ready to accept this venture as one of the income generating activity. Considering the economic constraints the major constraint noticed was high cost of production. Under technical constraints, high expensive transportation service for management of raw material (88.5%) was ranked first. The study recommends major suggestions perceived as providing the marketing facilities at their primary level for the prompt purchase of fresh and processed mushroom.

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REFERENCES

Gopalan C. 2013.The changing nutrition scenario. Indian Journal of Medical Research 138 (3): 392–397.

Krishnamoorthy AS, Muthuswamy MT, Nakkeeran S. 2000. Technique for commercial production of milky mushroom Calocybe indica P&C. *Indian Journal of Mushroom Research* 18: 19–23.

Prasad S, Rathore H, Sharma S and Yadav AS 2015 Medicinal mushrooms as a source of novel functional food. *International Journal Food Science Nutrition and Dietician* 04(5): 221-225.

Purkayastha RP. 1985. Cultivation of Calocybe indica (P & C). *Indian Journal of Mushroom Research*10-17.

Rathore H, Prasad S and Sharma S. 2017. Mushroom nutraceuticals for improved nutrition and better human health: A review. Pharma Nutrition 05: 35–46.

Rathore H, Prasad S, Sharma S. 2016. Oyster and Milky Mushroom: Cultivation and Benefits: In Mushroom in India (Diversity, Improvement, Cultivation, Medicinal Uses and Value addition for Rural Development), pp 262, IIT Delhi.

Rathore H, Sharma S, Prasad S and Sharma S 2018. Selenium bioaccumulation and associated nutraceutical properties in Calocybe indica mushroom cultivated on Se-enriched wheat straw. *Journal of Biosciences and Bioengineering (in press).*

Sharma S, Prasad S, Rathore H. 2016. Cultivation of mushroom on non-traditional biomass: In Mushroom in India (Diversity, Improvement, Cultivation, Medicinal Uses and Value addition for Rural Development). pp. 262, IIT Delhi.

Singh M and Kamal S. 2016. Mushroom cultivation in India status and scope. In: Mushroom in India (Diversity, Improvement, Cultivation, Medicinal Uses and Value addition for Rural Development). Pp. 262, IIT Delhi.

Zhang Y, Geng W, Shen Y, Wang Y and Dai YC. 2014. Edible mushroom cultivation for food security and rural development in China: bio-innovation, technological dissemination and marketing. *Sustainability,* 6: 2961-2973.