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Upshot of Biotechnological Innovation in Mushroom Cultivation for Self Employment and Women Empowerment

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Abstract: *Wild and cultivated mushrooms has been used as a food and medicine since time immemorial. Mushroom cultivation was an short term agribusiness, here in this research paper I focused the upshot of biological innovation in mushroom cultivation for women empowerment. The Mushroom cultivation training has given to the women of Naruvamoodu village. Cultivation techniques of tropical mushroom Pleurotus eous, P. florida and calocybe indica were introduced to trainees. Various innovation methods of bioconversion of agriculture waste for the production of mushroom have been introduced . According to yield result, the substrate paddy straw compost is ideal for the cultivation of all three mushroom. The agriculture saw dust compost was gave nearly similar yield with paddy straw substrate. However the other substrate such as coconut leaves, coco peat give comparatively less yield . The outcome of knowledge of respondents about spawn production, methods of compost making for mushroom cultivation, value added products of mushroom was revealed that, The knowledge gained by respondents after in all training was more satisfactory in all aspect, The reason behind the satisfactory change in perception level might be due to their educational background keen interest of participants and methods followed for technology transfer to the trainees*

Key Words: *Mushroom cultivation, bio technological innovation, bioconversion, agriculture waste.*

1. INTRODUCTION:

Mushrooms, either we called 'white vegetables' or 'boneless vegetarian meat' contain plenty amounts of proteins, vitamins, fibers and medicines. Mushroom contains 20-35% protein (dry weight) . Mushrooms contain a large array of nutrients and other natural phytochemicals that have wide ranges of nutritional and health benefits [1]. Their medicinal values include wound-healing, immunity-enhancement, and tumor-retarding effects [2,3]. Mushroom offers prospects for converting lignocellulosic residues from agricultural fields and forests into protein rich biomass [4]. Such processing of agro waste not only reduces environmental pollution but the by product of mushroom cultivation is also a good source of manure, animal feeds and soil conditioner The cultivation of oyster mushroom and milky mushroom is relatively simple and it can be a homestead project. The agro- climatic conditions prevailing in Kerala is conducive for mushroom cultivation, the temperature is 20-30 ^{0}C and relative humidity is 70-80% . Mushroom has a huge domestic and foreign market. In the domestic market also the availability of mushroom is limited to cities and big towns only. Mushrooms can be not only in raw form but also in dried form, and it has huge international demand. The rapid growth and market expansion of the mushroom business in China is a great example of rural development driven by bio-innovation and technological diffusion [5]. It is also an excellent example of rural economic development and poverty alleviation as well as typical recycle-economy and sustainable agriculture and forestry.

Koonpura (Mushroom farmers and by products producers welfare society, Thiruvananthapuram),a first mushroom Society of Kerala, which gives an opportunity to farmers who are interested in an additional enterprise. The institute gave mushroom cultivation and product development training to women farmers and made them as entrepreneur, Also, the host institute (koonpura) has buy back facility. Moreover in 2016 Koonpura obtained a project from Kerala state council for science technology and environment (KSCSTE) – under Biotechnology innovations for rural development (BIRD). The objective of the current study is to is to analyze the use of biotechnological process and tools for creating employment opportunities in rural areas.

2. MATERIALS AND METHOD:

The current work was executed to Naruvamoodu, it is a small Village/hamlet in Thiruvananthapuram district of Kerala State, India.

3. MATERIALS:

The wormer mushroom *Pleurotus florida, Pleurotus eous* (Oyster mushroom) and *Calocybe indica* (Milky mushroom) are the research material have been introduced to the trainees. The un-employed women are the participants of this training program. The trainings were imparted on skill development, It cover all topics related to mushroom.

Regarding introduction to mushroom, importance of the medicinal mushroom (*Ganoderma* sps, *Lentinula edodes* etc.) and its products available in market, value addition products, cultivation of various edible mushroom i.e. *Pleurotus* sps. and *Calocybe indica* (Milky mushroom), Pest control & management. More emphasis has been focused on the practical aspects . Preparation of mushroom culture tube. preparation of spawn of mushrooms and cultivation of mushroom etc., The cultivation of mushroom were done in Koonpura as the part of low cost mushroom production technology.

3.1. Dissemination of Bio technological innovation:

The biotechnological innovation such as bioconversion of agricultural waste for the cultivation of mushroom has been introduce to the trainees.

3.2. Mushroom cultivation method using agricultural waste compost:

The agriculture waste such as coconut leaves, coco peat has composted by adopting Rajapakse (6) method. Trainees were involved in the compost preparation. After the process, the compost was then packed in small poly propylene bag (1500g), tied with rubber bands, and sterilized. After sterilization, the bags were allowed to cool in the laboratory and each bag was inoculated with spawn (1% total weight). The inoculated substrate bags were incubated. After full ramification, the bags were exposed in the growth room by removing the rubber bands and opening the top of bags. Watering was adequately done to increase the relative humidity of the environment to enhance sporophore emergence. Our results of mushroom harvest enlighten around 15 families. It is a short return agricultural business and they got immediate benefit. Apart from the training, field visit were conducted frequently to upgrade their skills, and to motivate them. More frequent visits were also conducted to the mushroom unit established. The trainees were interacted personally for the feedback, study purpose. The feedback were taken regarding mushroom unit established in their home. Survey was conducted and studied to analyze, the stability of the formers like did they continue the enterprises of mushroom cultivation for the next successive years etc., .

3.3. Change in perception level of respondents.

Change in perception level of respondents was studied (7) by before and after training. It was calculated from the difference of scores obtained in pre and post knowledge test of trainees. The data were tabulated and statistically analyzed .

$$\text{Change of Knowledge} = \frac{\text{After training- before training} \times 100}{\text{Total respondents}}$$

4. RESULT AND DISCUSSION:

A total of 15 women from Naruvamoodu village in Thiruvananthapuram District of Kerala State, India, have been participated in this current project implementation. This village is located at 10 KM towards East from Thiruvananthapuram district and 2 KM from Nemom. The mean minimum and maximum temperature is 24°C to 29°C. The 74% humidity is an ideal climate for the mushroom cultivation.

4.1. About the trainees:

Age: The trainees between the age group of 28-50, preferably economically struggled family women , including widows and single mothers are there in the group. Most of them belongs to agriculture families.

4.2. Education

The educational level(figure 1) revealed that out of total trainees 53 % women are high school qualified, 33% of them were middle school and 13% are higher secondary qualified . As per data, All of them were literate.

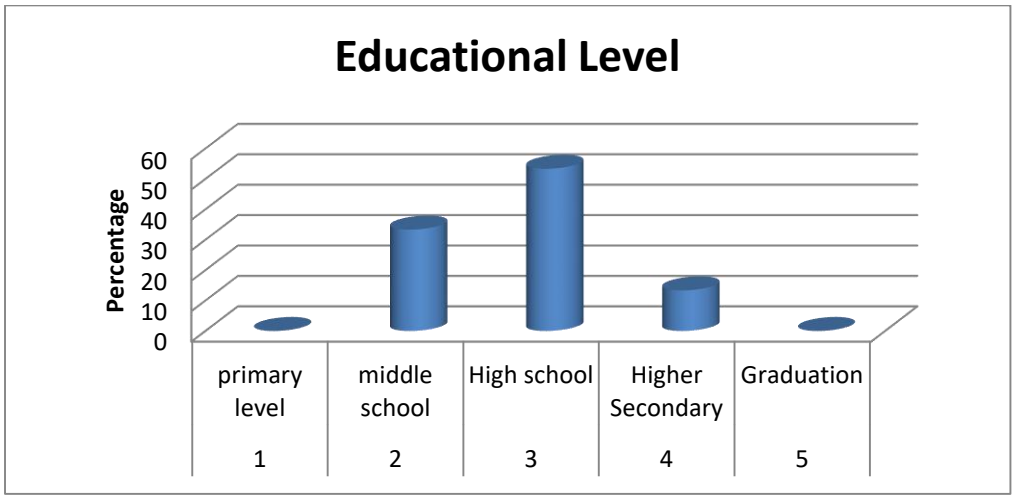

Figure 1. Educational range of trainees

4.3. Effect of bio- technological innovation:

The agriculture compost beds, and paddy straw beds were inoculated with mushroom. In order to find out the effective bag, morphological observations and yield of the mushroom from each bags were recorded. The results indicated that the mushroom *P. eous* The second harvest will be another 2 or 3 days. Were as in agriculture waste (coconut leaves, coco peat) compost beds spawn running was completed within 8 days and pinheads appeared on the 13th – 15th. Pinheads turned into leaf like on 18 th day and the first harvest was made at 18 th day. However in mushroom *P. florida* pinheads appeared on the 25th – 28th day. Pinheads turned into leaf like on 32 nd day and the first harvest was made at 34 th day in paddy straw. In agriculture waste (coconut leaves, coco peat, saw dust) compost beds spawn running was completed with in 24 days and pinheads appeared on the 32nd day and Pinheads turned into leaf like on 38 th day and the first harvest was made at 39 th day.Furthermore in milky mushroom *Calocybe indica* pinheads appeared on 28th day. Pinheads turned into small umbrella like on 32 nd day and the first harvest was made at 38 th day with paddy straw substrate . In agriculture waste (coconut leaves, coco peat, saw dust) compost beds spawn running was completed with in 32 days and pinheads appeared on the 36nd day and Pinheads turned into small cap on 38 th day and the first harvest was made at 40 th day. In view of the above data, the agriculture waste such as Coconut leaves, Coco peat, Saw dust compost beds generate delayed fruiting body initiation than the traditional paddy straw substrate. The substrate paddy straw was suitable substrates for early harvests compared to other substrates tested. The yield data showed that the agriculture substrate such as coconut leaves, coco peat, saw dust compost beds gave a significantly higher *Pleurotus florida* mushroom production of 915g, 890g, 985g/fresh wt (Figure 2).

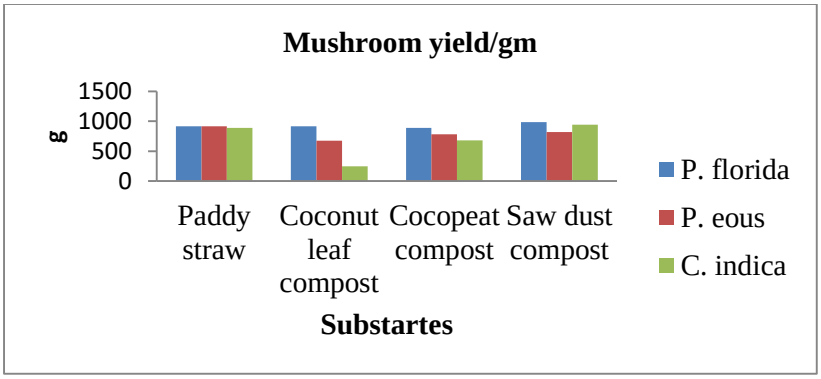

Figure 2. Yield of Mushroom in various substrates

However the mushroom *P.eous* yield was closely related to *P. florida*, The yield of 675, 780, 820 g fresh wt of mushroom from the agriculture substrate such as coconut leaves, coco peat, saw dust compost has been obtained, The control traditional paddy straw substrate gave 915g yield. According to the observation the highest yield was obtained from paddy straw substrate. The mushroom *C. indica* yield 250, 680, 940 g/ fresh wt from agriculture substrate such as coconut leaves, coco peat, saw dust compost. The 890 g mushroom was obtained from paddy straw substrate . Highest *C. indica* yield was obtained from saw dust compost. Paddy straw alone as 917g/F.wt, compared to the other the sawdust compost give relatively higher yield than other substrate. According to the previous reports (8) Mycelial growth was influenced by substrate that was used as a growth medium of fungus, if we compare the results our current harvest is higher than the reference (6,9). The reason may be the innovation steps involved in the present composting. Biological efficiency was determined as the percentage conversion of dry substrate to oyster mushroom fresh weight (Figure 3), the sawdust compost beds show higher biological efficiency (89.5%).

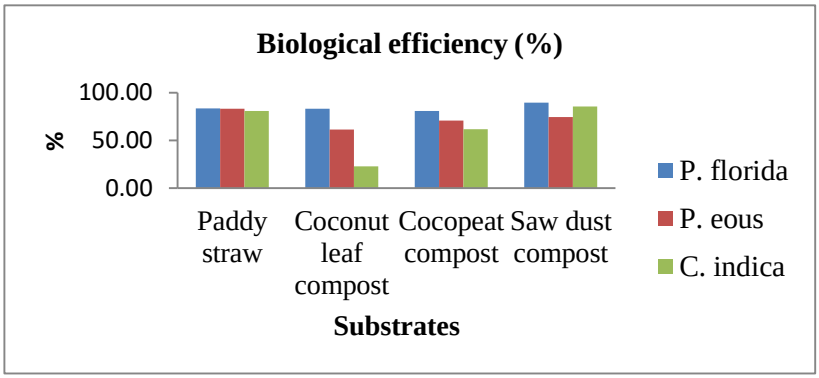

Figure 3. Biological efficiency

4.4. Change in perception level of respondents:

Change in perception level of respondents before and after training was shown in Table 1, Figure 5. The trainees extend their knowledge towards mushroom production. As per table 1 the knowledge of respondents about Spawn production, Methods of compost making for mushroom cultivation, Value added products of mushroom was zero, But in post training they got 100% knowledge, likely they attain(93.3%) knowledge in methods of mushroom production. The knowledge gained by respondents after in all training was more satisfactory in all aspect, The reason behind the satisfactory change in perception level might be due to well educational background keen interest of participants and method followed for technology transfer to the trainees. The obtained response was show resemblance with the previous reports(7).

Figure 5. respondents of trainees

Table 1. change in perception level of respondents for mushroom production.

S. No	Data	Pre-test Knowledge before training(%)	Post-test Knowledge before training(%)	Change in perception level (%)
1	Knowledge of mushroom identification	40.00	86.67	46.67
2	Nutritional and medicinal values of mushroom	73.33	100.00	26.67
3	Methods of mushroom production	6.67	100.00	93.33
4	Methods of compost making	0.00	100.00	100.00
5	Pest and disease control	20.00	88.00	68.00
6	Profitability of mushroom	73.33	100.00	26.67
7	Harvesting and storage process	20.00	86.67	66.67
8	Spawn production	0.00	100.00	100.00
9	Value added products of mushroom	0.00	100.00	100.00
10	Awareness of loans, schemes and subsides for establishment of mushroom production unit	86.67	100.00	13.33

6. CONCLUSION:

The biotechnological innovation were disseminated to the mushroom trainees . The observe result emphasize that the composting methods inspired them greatly. Even though mushroom production is a simple and less economic agribusiness the current innovation implementation was still reduce the investment cost. Also, the local substrate conversion was attract the women's well, that is one of the reason behind the satisfactory change in perception level. It also, provided an opportunity to strengthen the link between farmers and scientist which helped in technology dissemination and overall development of weaker section

7. ACKNOWLEDGEMENT:

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