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Profitability of white button mushroom (*Agaricus bisporus*) in Himachal Pradesh

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Abstract
The purpose of the study was to determine the profitability of white button mushroom cultivation in Himachal Pradesh. Shimla, Solan, Mandi, and Kangra districts were chosen as commercial mushroom cultivation in Himachal Pradesh is mostly confined to these areas. A sample of 215 farmers from these areas were chosen using simple random sampling. The cost of white button mushroom cultivation per 100 bags was found to be ₹19,457.83. The projected net returns per 100 bags were ₹16,440.39, and the output-input ratio meant that each rupee spent in the research area would provide a profit of 1.84. The findings showed that growing white button mushrooms in the research area is a profitable venture.

Keywords: White, button mushroom, *Agaricus bisporus*

Introduction
Agriculture is the backbone of economy which accelerates the economic development of the nation. Diversification of agriculture is becoming increasingly important for emerging countries, as farming basic staples like grains and pulses alone is insufficient to promote economic development, despite the requirement to maintain food security for the population. As a result, diversification with commercial crops is now a significant approach for increasing agricultural earnings while reducing the risk of crop failure. Diversification has occurred in Indian agriculture, both across and within the agricultural, livestock, and fishery sectors. Other reasons that promote agricultural diversification include farmer initiative to diversify their farm enterprise for monetary demands as well as to offset the hazards associated with mono-cropping, technical change, and purposeful policy measures. Mushrooms are one of the world's most interesting life forms. They are neither plants nor animals, but rather belong to their own kingdom, with each species having its distinct texture, flavour, and therapeutic characteristics. Their distinct properties make them increasingly in demand in a variety of locations around the globe. In a country like India, mushroom growing can help with a variety of issue. Globally, China is the largest producer of mushrooms in the world followed by USA, Netherlands, Poland and Spain (FAO, 2021) [1]. White button mushroom (*Agaricus bisporus*), is the most widely cultivated and popular species in the world and contributes around 31 per cent of world and 85 per cent of total production in India (Sharma *et al.*, 2017) [9]. The annual production of mushroom in India is 2,01,088 tonnes (DMR, 2019). Himachal Pradesh has emerged as a pioneer state in the cultivation of mushroom where small growers, co-operative growers' societies and big farmers are engaged in mushroom production. The total mushroom production in Himachal Pradesh during 2019-2020 was reported to be 14,732 tonnes (DMR, 2019) and out of which 80 per cent of the production was obtained from the white button mushroom (*Agaricus bisporus*). Thus, mushroom cultivation is a profitable venture as the growing of mushrooms can be performed in room and requires small area and hence huge investment in land is not required. In addition to that**,** the use of modern technology ensures high yield, low cost of production and round the year production. In light of this, a comprehensive assessment of mushroom profitability was conducted in order to establish the costs, returns, and margins to mushroom growers, which is critical for improving and stabilizing farm revenue in the research area.

Methodology
The commercial mushroom cultivation in Himachal Pradesh is mainly confined to four districts *viz*. Shimla, Solan, Mandi and Kangra (DMR, 2019), therefore all these four districts

were selected for the present study. Simple random sampling technique was used for the selection of the respondents. A complete list of registered and non-registered mushroom growers was obtained from the Department of Horticulture, Govt. of Himachal Pradesh and the compost supplier from four selected districts. A list of 80 mushroom growers from Solan, 80 mushroom growers from Kangra, 60 mushroom growers from Shimla and 38 mushroom growers was obtained. A sample size of 70-80 percent of the farmers were selected randomly as a representative of the mushroom growing population. Therefore, a sample of 70, 65, 45 and 35 mushroom growers were drawn using simple random sampling technique from Solan, Kangra, Shimla and Mandi district, respectively. As a result, 215 mushrooms were finally chosen from the study area to conduct research. The analysis of data was carried out using general statistical and mathematical calculations, and a process of cost of cultivation was devised in order to collect all important data required to analyze the profitability of mushroom cultivation in the research region. The cost and return items, as well as their measures, are listed below.

Items	Criteria
Compost	The substratum in which the spawn (mushroom seed) grows and on which the mushroom eventually develops is known as compost. It is usually prepared by decomposing wheat straw together with common fertilizers. There are several formulae of ingredients for preparation of compost
Spawn	Mushroom spawn is used to transfer mycelium onto any material from which mushrooms will grow.
Casing	The practice of coveting uniformly the spawn impregnated compost surface with a suitable soil mixture is called casing, which ought to retain moisture and support the growing pinheads and help them to become button at a quick rate of growth.
Fixed cost	The fixed costs are those costs which do not vary with the level of output. These costs consist of depreciation of fixed assets and interest on fixed investment which were used in mushroom cultivation.
Variable cost	Variable cost includes the expenditure on labour and material input cost and interest on working capital etc. also included under variable cost.
Hired human labour	Hired human labour cost was estimated in terms of man-days where in 8 hours of work in a day was considered as one man day. The man days were valued at ₹ 300 per man day
Family labour	Family labour cost was imputed value on the basis of charges paid to hired labour.
Depreciation	The amount of depreciation for implements was calculated by the straight line method i.e., by dividing the original cost less junk value of implement by its expected life.
Interest on working capital	Interest on working capital is charged at the rate of 9 per cent per annum for half of the production period i.e. for 2 months because the production period of mushroom crop is about 4 months
Interest on fixed capital	The interest on the value of fixed capital investment at the rate of 9 per cent per annum was accounted while computing the fixed costs

Profitability Analysis

In the study, the CACP (Commission for Agricultural Costs and Prices) cost concepts were utilized to calculate the cost of cultivation and farm income metrics.

Cost analysis: The following farm management cost concepts were used for cost analysis of mushroom in the study

Cost A_1 included

1. Spawned compost
2. Hired human labour
3. Electricity and water charges
4. Depreciation on mushroom house
5. Depreciation on implement
6. Interest on working capital
7. Miscellaneous

Cost B_1: Cost A_1+ interest on the fixed capital

Cost B_2: Cost B_1 + rental value of owned land

Cost C_1: Cost B_1 + imputed value of family labour

Cost C_2: Cost B_2 + imputed value of family labour

Cost C_3: Cost C_2 + value of management input (10% of Cost C_2)

Farm income measures

In order to determine the returns, the following concepts were used:

Farm Business Income: Gross income – Cost A_1
Family Labour Income: Gross income – Cost B_2
Net Farm Income: Gross income – Cost C_3
Farm Investment Income: Farm Business Income – Imputed value of family labour

Break-even analysis

The point at which the two curves, i.e., total cost curve and total revenue curve intersect is called the break-even point (BEP). The break-even point indicates the level of production at no profit and no loss. In other words, the quantity at which all costs allocated to a product are equal to all revenue from its sale is known as break-even point.

$$BEP = \frac{TFC}{P_y - AFC}$$

Where,
BEP = Break-even point in terms of physical units of production
TFC = Total fixed cost in rupees
P_y = Price of mushroom output in rupees per kg

Results and Discussion

Cost of mushroom cultivation

The cost of cultivation is a subject of attention to a wide range of users of cost data and it assumes particular importance in the area of planning. It relates to a specific time period, within which the value of resource services is transformed into the desired output or product. The subject of cost of cultivation is

thus of crucial importance to farm planners and policy makers. This section deals with the economic viability of cultivation in the study area. The efficacy of data on cost of cultivation of commodities for planning is recognized, as these data assist experts in making realistic recommendations aimed at better allocation of existing resources and increasing crop production quality. Table 1 shows the highest share of cost was found on spawned compost bag 40.81 per cent of the total cost while carriage charges, electricity and water charges, hired human labour and miscellaneous cost accounted for 10.98 per cent of the total cost of cultivation respectively. Depreciation cost on investment workout to be 15.15 percent and interest of fixed investment 18.64 percent of total cost of cultivation.

Table 1: Cost of cultivation of white button mushroom in the study area

Particulars	**Costs (₹ /100 bag)**
Cost A_1	
Spawned Compost bag	7941.53 (40.81)
Carriage charges	1419.33 (7.29)
Hired human labour	201.14 (1.03)
Electricity and water charges	426.37 (2.19)
Miscellaneous	91.37 (0.46)
Depreciation on mushroom house	1438.47 (7.39)
Depreciation on implement	1510.86 (7.76)
Interest on working capital	330.57 (1.70)
Cost A_1	13359.64 (68.66)
Interest on fixed capital	3625.97 (18.64)
Cost B_1 = (Cost A_1+ Interest on fixed capital)	16985.61 (87.29)
Cost B_2 = (Cost B_1 + Rental value of owned land)	16985.61 (87.29)
Imputed value of family labour	703.33 (3.98)
Cost C_1 =(Cost B_1+ Imputed value of family labour)	17688.94 (91.27)
Cost C_2 = (Cost B_2+ Imputed value of family labour)	17688.94 (90.91)
Value of management input(10% of cost C_2)	1768.89 (9.09)
Cost C_3= (Cost C_2+ Value of management input (10% of cost C_2)	19457.83 (100.00)

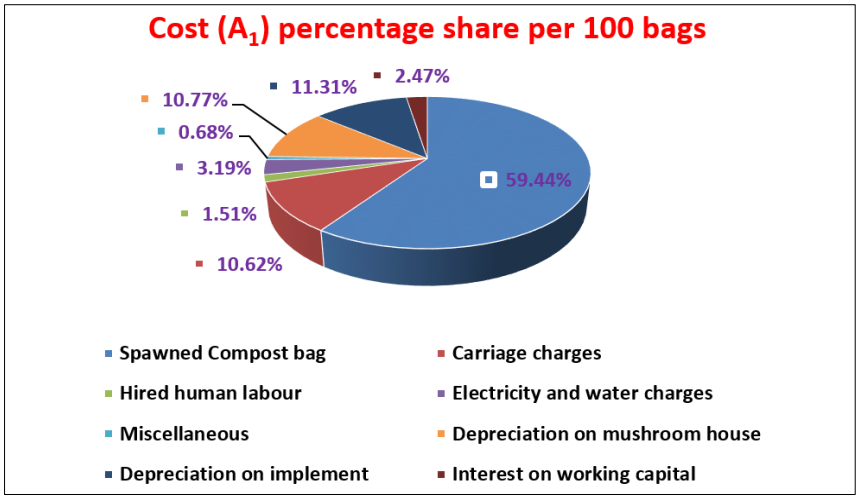

Fig 1: Percentage share of cost (C_1) per 100 bags of mushroom

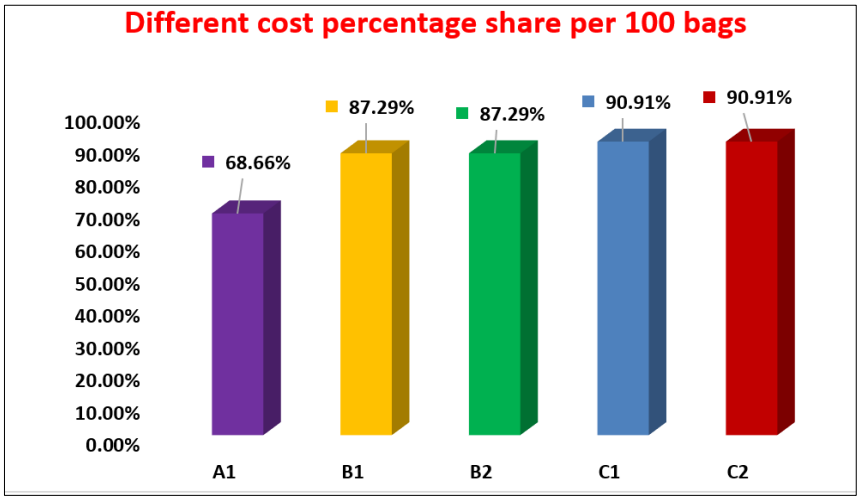

Fig 2: Percentage share of different types of cost per 100 bags of mushroom

Cost and return in white button mushroom

The cost of mushroom production per 100 bags was calculated and presented in Table 2. The perusal of the table shows that the gross returns from 100 bags are ₹ 35,898.22 while the net returns are ₹ 16,440.39. The per kg cost of mushroom production was found ₹ 72.05 which was found decreasing with the size of farm.

Table 2: Cost and return in white button mushroom

Particulars	Per 100 bags
Total Cost of cultivation (₹)	19,457.83
Yield (kg)	270.05
Gross Returns (₹)	35,898.22
Net Returns (₹)	16,440.39
Cost of production (₹/ kg)	72.05

Profitability measures in white button mushroom

Determining the profitability of a programme, as well as its income and employment consequences, is required for financial institutions to offer loans for new initiatives based on profitability information and anticipated risk. In this section, the results of the profitability measures of mushroom in the study area has been calculated by analyzing data on profitability measures and is presented in Table 3. The table revealed that the gross returns from white button mushroom and family labour income was ₹ 35,898.22 and 16,440.39, respectively. The break-even point (per kg) of white button mushroom was estimated as 79.90. The output-input ratio was calculated to be 1.84, which means that a ₹ 1.00 investment in white button mushrooms in the research area yielded a ₹ 1.84 return.

Table 3: Profitability in white button mushroom

Particulars	Per 100 bags
Yield (kg)	270.05
Gross Return (₹)	35,898.22
Farm Business income (₹)	22538.58
Family Labour income (₹)	18912.61
Farm Income (₹)	16440.39
Farm investment income (₹)	21835.25
BEP (kg)	79.90
Output-Input ratio	1.84

Conclusions

Himachal Pradesh has a conducive environment for growing mushrooms all year without spending a fortune on temperature and humidity control (Chauhan and Sharma, 2015) [4]. The current study found that mushroom cultivation is now one of the potential sources of jobs and income generation in the state and it can provide gainful employment to unemployed youth, retirees and women in both rural and urban regions. Mushroom cultivation is a profitable economic practice in Himachal Pradesh. It is a labor-intensive and commercially enticing business. Mushroom cultivation is thought to be the finest method to exploit the natural resources because it pays much more than field crops and creates more money and jobs, which has led to farmers moving their focus from field crops to horticulture. The income earned from this crop is substantially more than any other horticulture crop if attained in a methodical manner. A net income of 1.84 unit is achieved in Himachal Pradesh's obtained with a 1.00 unit investment from white button mushroom, although this is a modest amount in comparison to other mushroom producing countries throughout the world.

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