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Economic analysis of production of white button mushroom (*Agaricus bisporus*) in Himachal Pradesh: A case study of Shimla district

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Abstract
Mushroom is mainly cultivated on the hills as it requires low temperature for its growth. Himachal Pradesh has now emerged as a major state of mushroom cultivation where small growers, co-operative growers societies and big farmers are engaged in mushroom production.Keeping that in viewThe study was conducted in Shimla district of Himachal Pradesh during 2017-18 for analysis, as this district is the second largest producer of mushroom in the State. A sample of 60 farmers was drawn by using simple random technique. For the construction of strata, cumulative Cube root frequency method was used. the mushroom grower were classified into three categories on the basis of number of bag, viz., Small Category (≤ 600), Medium Category (600-1200) and Large Category (>1200). The per farm operational cost was estimated Rs. 38494.52, Rs.123411.50 and Rs. 371402.47 on small, medium and large respectively. The cost B, which represent Cost a plus Interest on owned fixed cost was estimated to Rs. 42900.35 (Small), Rs. 136861.34 (Medium) and Rs. 395743.17(large) per farms. The total cost (i.e cost C_3) per farm of mushroom varied from Rs.58302.68 to Rs.463053.98. that on overall categories of farms the cost of cultivation per kg of mushroom was estimated to Rs. 73.54 which varied between Rs.65.87 in large to Rs.87.70 in small.On per 100 bags the average return in term of money value was highest in case of Largei.e. Rs. 12905.36 followed by Medium Rs. 9067.08 and SmallRs. 7606.81. On the selected farms the average output-input ratio was found 1.63 on the basis of cost C concept. It was highest in Large (1.81) and lowest in Small (1.41).

Keywords: Economic, production, white button, mushroom (*Agaricus bisporus*)

Introduction

In future the ever-increasing population, depleting agricultural land, changes in environment, water shortage, and need for quality food products at competitive rates are going to be the important issues. To meet these challenges and provide food and nutritional security to our people, it is important to diversify our agriculture and Mushroom is a great option to get out of this difficult situation. White Button mushroom is mainly cultivated in North India both under controlled and natural conditions. During winter season hundreds of seasonal growers do button mushroom production particularly in Northern States targeting big cities like Delhi, Chandigarh (Singh and Kamal, 2016) [4]. Majority of the seasonal, commercial and all export oriented units grow white button mushroom. This mushroom is having maximum acceptability in domestic markets both in fresh and canned form.

Himachal Pradesh has now emerged as a major state of mushroom cultivation where small growers, co-operative growers societies and big farmers are engaged in mushroom production. Since, it is an ideal state for development of mushroom industry; the major growing districts are Solan, Shimla, Kangra, Mandi. Kullu, Bilaspur and Sirmaur.

The total mushroom production in Himachal Pradesh during 2014-2015 was reported to be 8240 MT. (Anonymous 2014-15) [1] and out of which 80 per cent of the production was obtained from the white button mushroom (*Agaricus bisporus*). Major part of mushroom production came from private entrepreneurs showing growth rate of over 10 per cent p.a, however, the state as a whole recorded compound growth rate of 9.97 per cent p.a (Kangotra and Chauhan, 2014) [3].

Shimla is the second largest producer of mushroom next to Solan district in Himachal Pradesh. The district has 93 registered mushroom growers with estimated annual production of 1771.37 MT (Department of Horticulture Govt. of H.P 2015-16).

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Material and Methods

A simple random sampling was used for the selection of the respondents. The main objective of the study was to examine the cost structure, returns, and profits and break-even point of button mushroom production on different units and it attempts to describe the various facets of mushroom farming in study area. A complete list of registered and non-registered mushroom growers was obtained from Department of Horticulture, Govt. of Himachal Pradesh and from the supplier of spawn and manure. A sample of 60 mushroom growers was drawn by using simple random technique from the list of mushroom growers for the collection of data. For the construction of strata, cumulative cube root frequency method was used (Singh and Mangat, 1995). For the analysis of data all the mushroom growers were classified into three categories on the basis of number of bag, viz. Small Category ($\leq$ 600), Medium Category (601-1200) and Large Category (>1200)

Tabular analysis was used to examine cost structure, returns, and profits. The break-even point (BEP) is the one which 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.

$$BEP = \frac{TFC}{Py - AVC}$$

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
AVC = TVC/MO

Where

TVC = Total variable cost in rupees
MO = Total mushroom output in Kg

Results and Discussion
Level of investment

Production is the function of investment and its efficient use. It consists of capital investment on building and equipment. The data reveals that investment on buildings structures including mushroom house and store room accounted for 84.56, 87.21 and 88.32 per cent in small, medium and large category of mushroom growers, respectively. However, the overall investment on buildings was 87.14 per cent. The various items that constituted for the investment on equipment used in mushroom cultivation such as iron racks, spray pump, thermometer, exhaust fan, blower etc. constituted about 15.44, 12.79 and 11.68 per cent, on Small, Medium and large farm respectively. However, the overall expenditure on equipment was 12.86 per cent. It is concluded that the main item of investment in mushroom cultivation is building structure for placing the mushroom bags.

Table 1: Capital investment per farm (Amount in rupees)

S. No	Particulars	Small	Medium	Large	Overall
1	Mushroom house	119025.30	370720.30	675459.00	308247.30
		(81.05)	(82.69)	(83.25)	(82.60)
2	Store room	5155.56	20243.48	41120.00	16933.33
		(3.51)	(4.52)	(5.07)	(4.54)
	Total building cost	124180.80	390963.80	716579.00	325180.60
		(84.56)	(87.20)	(88.32)	(87.14)
3	Iron racks	17263.89	45094.57	75870.00	37700.00
		(11.76)	(10.06)	(9.35)	(10.10)
4	Hygrometer	41.93	113.98	234.29	101.61
		(0.03)	(0.03)	(0.03)	(0.03)
5	Thermometer	120.17	197.76	258.61	172.99
		(0.08)	(0.04)	(0.03)	(0.05)
6	Blower	1334.07	2880.22	5802.00	2671.42
		(0.91)	(0.64)	(0.72)	(0.72)
7	Exhaust fan	2210.74	7426.09	10500.00	5591.5
		(1.51)	(1.66)	(1.29)	(1.5)
8	Spray pump	135.19	175.22	364.00	188.67
		(0.09)	(0.04)	(0.04)	(0.05)
9	Weighing balance	1574.44	1476.30	1748.50	1565.83
		(1.07)	(0.33)	(0.22)	(0.42)
	Total cost of equipments	22680.44	57364.13	94777.39	47992.01
		(15.44)	(12.80)	(11.68)	(12.86)
	Total capital investment (Rs.)	146861.20	448327.90	811356.40	373172.7
		(100.00)	(100.00)	(100.00)	(100.00)

Figure in parentheses and percentage to total investment

Cost and Return of Mushroom Cultivation
Cost of mushroom cultivation

The cost of cultivation of mushroom was computed on the basis of standard farm management cost concept viz., Cost A, B and C for different categories of mushroom farms and presented in Table2.

The average cost of mushroom cultivation for different farm categories on per 100 bag basis was worked out and presented in Table 1. The per 100 bags total cost of cultivation ranges from Rs. 18475.94 in case of small category mushroom growers to Rs. 15912.51 in case of large category of mushroom growers. This clearly indicates that as the number of bag increases, cost of cultivation decreases. This shows the large scale production efficiency.

Table 2: Per hundred bags cost of mushroom cultivation among different categories of mushroom grower in the study area (Rs. 100 bag)

	Small	Medium	Large	Overall
Cost A_1				
Compost bag and spawn	7938.86	7840.21	7525.77	7832.20
Carriage charges	1492.84	1365.07	612.37	1297.12
Hired human labour	123.24	1091.79	2381.31	870.86
Electricity and water charges	433.68	440.64	375.26	426.61
Miscellaneous	49.65	19.02	8.18	30.99
Depreciation on mushroom house	826.83	913.15	634.90	827.93
Depreciation on implement	931.13	904.60	864.87	909.91
Interest on working capital	402.60	386.59	360.31	389.42
Total cost A_1	12198.79	12961.08	12762.97	12585.03
Cost A_2				
Cost A_1	12198.79	12961.08	12762.97	12585.03
Rent paid for leased in land	-	-	-	-
Total Cost A_2	12198.79	12961.08	12762.97	12585.03
Cost B_1				
Cost A_1	12198.79	12961.08	12762.97	12585.03
Interest on owned fixed cost	1396.2	1412.55	836.45	1309.17
Total Cost B_1	13594.99	14373.62	13599.42	13894.21
Cost B_2				
Cost B_1	13594.99	14373.62	13599.42	13894.21
Rental value of own land	-	-	-	-
Rent paid for leased in land	-	-	-	-
Total cost B_2	13594.99	14373.62	13599.42	13894.21
Cost C_1				
Cost B_1	13594.99	14373.62	13599.42	13894.21
Imputed value of family labour	3201.32	1920.73	866.49	2321.29
Total cost C_1	16796.31	16294.35	14465.92	16215.49
Cost C_2				
Cost B_2	13594.99	14373.62	13599.42	13894.21
Imputed value of family labour	3201.32	1920.73	866.49	2321.29
Total cost C_2	16796.31	16294.35	14465.92	16215.49
Cost C_3				
Cost C_2	16796.31	16294.35	14465.92	16215.49
Value of management input (10% of cost C_1)	1679.63	1629.43	1446.59	1621.54
Total cost	18475.94	17923.79	15912.51	17837.04

Per farm cost and returns from mushroom production

It is observed from Table 3 that on overall categories of farms the cost of cultivation per kg of mushroom was estimated to Rs.73.54 which varied between Rs.65.87 in large to Rs.87.70 in small. The higher cost of cultivation per kg of mushroom on small grower indicates that the small grower were not in position to properly utilize the fixed assets required for the cultivation of mushroom, hence scope of increasing the number of bags is there to optimally utilize the space and other investments.

The average return in term of money value was Rs. 82305.56, Rs. 257000.00 and Rs. 838600.00 insmall, medium and large respectively. The overall average return of mushroom was worked out to Rs. 275320.83.

Break even analysis revealed that Small farmer if produced 168.56 kg mushroom did not gain profit or loss under given total cost. However medium and Large the break-even output was worked out to 499.19 Kg and 984.15 Kg respectively.

To estimate returns per rupee invested is very important criterion to estimate profitability from a particular enterprise. On the selected farms the average output-input ratio was worked out to 1.63 on the basis of cost C concept. It was highest in large farm (1.81) and lowest in small farm (1.41) this clearly depicted that large farm were more efficiently operated as compared to the small and medium farms in the study area. Return over per rupee working cost was found more than double in all the farm categories.

Table 3: Per farm Cost and returns from mushroom production in study area

Particulars	Small	Medium	Large	Overall
Average number of bags	315.00	952.00	2910.00	992.00
Cost of cultivation (Rs./farm)	58302.68	170664.92	463053.98	168833.42
Total yield in (Kg)	664.81	2152.17	7030.00	2295.83
Per Kg cost of mushroom production	87.70	79.30	65.87	73.54
Gross returns	82305.56	257000.00	838600.00	275320.83
Net returns	24002.88	86335.08	375546.02	106487.41
Break even output (Kg)	168.56	499.19	984.15	458.03
Output- input ratio	1.41	1.51	1.81	1.63

Per hundred bags Returns from mushroom production

From the Table 4, it was observed that the average production was recorded highest in case of large farm i.e. 241.58 Kg

followed by medium farm 26.03 Kg and small farm210.68 Kg. In case of overall farms, the average production was estimated 221.71 Kg.

Table 3: Net returns per hundred bags on different categories of mushroom Farms (Per 100 bag)

Category	Small	Medium	Large	Overall
Total yield	210.68	226.03	241.58	221.71
Gross farm income	26082.80	26990.90	28817.90	26886.70
Total cost	18475.90	17923.80	15912.50	17837.00
Net farm income	7606.81	9067.08	12905.40	9049.67

The average return in term of money value was highest in case of large farmRs. 12905.36 followed by medium farm Rs. 9067.08 and small farm Rs. 7606.81. The overall average return from mushroom was worked out to Rs. 9049.67. It can be observed from the table that with increase in the farm size cost of mushroom production for per 100 bags is decreasing and net farm income is increasing.

Conclusion
From the analysis of data presented in the preceding sections, the following conclusions emerge:
Investment pattern showed investment on buildings structures including mushroom house and store room accounted for 84.56, 87.21 and 88.32 per cent in small, medium and large category of mushroom growers, respectively. However, the overall investment on buildings was 87.14 per cent of the total investment. It is concluded that the main item of investment in mushroom cultivation is building structure for placing the mushroom bags. Mushroom contributed maximum in total farm income in case of Medium andlarge i.e. 43.44 per cent and 72.18 per cent respectively. At overall its contribution was found 49.42 per cent to the total farm income. The per farm operational cost was estimated Rs. 38494.52, Rs. 123411.50 and Rs. 371402.47 on Small, Medium and large respectively. The cost B, which represent Cost a plus Interest on owned fixed cost was estimated to be Rs. 42900.35 (Small), Rs. 136861.34 (Medium) and Rs. 395743.17(large) per farms. The total cost (i.e. cost C_3) per farm of mushroom varied from Rs.58302.68 in Small to Rs.463053.98 in large resulting to increase with increase in size of mushroom farm. On overall categories of farms the cost of cultivation per kg of mushroom was estimated to Rs. 73.54 which varied between Rs.65.87 in Large to Rs.87.70 in Small. Thus resulted to economy of scale as size of farm increases the cost per Kg comes down
On per 100 bags the average return in term of money value was highest in case of Large i.e. Rs. 12905.36 followed by MediumRs. 9067.08 And Small Rs. 7606.81. The overall average return of mushroom was worked out to Rs. 9049.67. This shows that large scale growers were efficiently using their resource to earn higher returns as compared to small and medium scale growers.

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