

Research Paper

# An Economic Analysis of Apple Cultivation in High Hills of Himachal Pradesh

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## ABSTRACT

The study was undertaken with the aim to work out the economics of apple cultivation in Himachal Pradesh. The blocks namely Rohru, Chopal, Nankhari and Anni from Shimla and Kullu districts were selected randomly and a sample of 144 units were chosen from the selected areas. Analysis of the results indicated that on an average, initial cost per hundred plants was ₹ 48097 and establishment cost ranged between ₹ 41323 and ₹ 64,530 for 2 to 6 years plants. Maintenance cost per hundred fruit-bearing plants was observed to be ₹ 106109 between 12 to 16 years in the high hills during the year 2019-2020. The net revenue calculated as ₹ 1.73 lakh and output-input ratio implied that each rupee spent would yield a profit of ₹ 1.63 in the study area.

## Highlights

- Apple is a predominant fruit crop of Himachal Pradesh and occupies a premier position in terms of area and production.
- The output input ratio of apple was worked out to be 1.63, which is considered as index of profitability.

**Keywords:** Apple cultivation, Cost analysis, Net revenue, Output-input ratio

Farmers in Himalayan region grow a variety of fruit crops, including pomes (apple and pear) and stone fruits (peach, plum, apricot, and cherry), in considerable quantities, however, apple has the preference over all other horticultural crops (Kala, 2007). It can be grown at altitudes 1500-2700 meters above mean sea level which experience 1000-1500 hours of chilling. Apple farming has emerged as an important source of earning a livelihood for small and marginal farmers. Globally, China is the leading producer of apples followed by the United States, Turkey and Poland, whereas, India ranked 5<sup>th</sup> with an average yield of about 2316 metric tonnes (FAO, 2019). Over the previous two decades, the worldwide volume of fruit production has steadily increased from 29.40 million metric tonnes to 33.63 million metric tonnes between 2010 and 2017. The area under apple cultivation in India expanded by 58 per cent from 1.95 lakh hectares in 1991-92 to 3.08 lakh ha in 2018-19 (Economic survey,

2019-20). Himachal Pradesh, Jammu-Kashmir, and Uttarakhand are the major apple producing states of India. Horticulture plays a pivotal role in the economy of Himachal Pradesh. Its role in the state's nutritional security, poverty alleviation and employment generation programmes is becoming increasingly important (Singh, 2006). The state has witnessed a major shift in area from food grain towards horticulture crops over last five years (from 2012-13 to 2017-18) (Horticulture Development in Himachal Pradesh at a Glance, 2018). The area under fruits, which was merely 792 hectares in 1950-51 with total production of 1200 tonnes, has increased to 2.32 lakh hectares during 2018-19 with production of 4.95 lakh tonnes. Apple accounts for the 49 per cent of total area and 88 percent of the

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total production among all the fruit crops grown in the state (Economic survey, 2019-20). The rapid increase in the area under apple cultivation can be attributed to higher profitability. Moreover, farmers in Himachal Pradesh are urged to develop the world's finest and most selective apple variety. The state department of horticulture assists them in the economic development of rural communities and has also created jobs (Wani and Songara, 2018). In light of this, a detailed examination of the economics of apple cultivation becomes inevitable for determining the costs, returns and margins to the apple growers for future planning and intensification of cultivation.

### Methodology

This study has been undertaken in the high hills of Himachal Pradesh. Multistage simple random sampling technique was used for the selection of households in the study area. At the first stage, Shimla and Kullu districts were selected randomly for the present investigation. At the second stage, the blocks namely Rohru, Chopal, Nankhari and Anni were selected purposively from each selected district. A block wise complete list of apple growers was prepared from the secondary data available with the Directorate of Horticulture, Government of Himachal Pradesh. In the third stage, 4 villages were chosen from each selected block. At the final stage, 9 households from each village were selected to constitute a sample of 144 apple growers for the collection of primary data. General statistical and mathematical calculation have been done for the analysis of data and procedure of cost of cultivation for the orchards has been adopted in order to take all the relevant data for calculating the economics of apple cultivation in the study area. Various items of costs and returns and their measurements are given below.

**Table 1:** Costs and return analysis

Items	Criteria
Hired human labor	Hired human labor was estimated in terms of man days where 8 hours of work in a day was considered as one-man day.
Family labor	It consists of the actual work carried out by the family members for apple. The labor charges have been valued on the basis of prevailing wages paid to the hired labor.

Farm implements	Farm implements used for the production of apples have been valued equal to their depreciation in the production process. Depreciation is calculated using the straight-line method.
Farm land	The imputed rental value of land was the opportunity cost of land.
Fertilizer and plant protection cost	The fertilizers cost was calculated at the actual price paid by farmers.
Farm yard manure	Farmyard manure was valued at the prevailing market price in the locality.
Rate of interest	The rate of interest on fixed and working capital in the study area for half of the crop period.
Pro-rated establishment cost	<p>The establishment cost is distributed over the bearing life (n) using the principle of amortization at a given rate of interest. It is charged at 10 percent and is amortized during the bearing stage, with the following formula:</p> $P = E.C \frac{1}{(1 - (1 - i)^{-n})}$ <p>Where P = Amount of annual amortized cost; E.C. = Establishment cost (cost during non-bearing stage); n = number of productive life period of crop in years; i = Rate of interest.</p>
Fixed cost	It included expenditure made on various fixed components, viz., the rental value of land, depreciation, amortization cost and interest on fixed capital.
Variable cost	It included expenditure incurred on human labor, seed, manure, and fertilizers, chemicals, irrigation, interest on working capital, and other miscellaneous charges
Total cost	It is the summation of fixed and variable cost
Net Income/ Revenue	Gross returns- Total cost
Output input ratio	Net income/ Total cost

### RESULTS AND DISCUSSION

Cost of plantation, cost of maintaining the orchard in non-bearing stage, and expenses incurred during bearing stage have all been discussed in relation to the cost structure, returns and output input ratio from the apple grown in the study area. Establishment cost is the total of costs incurred during the initial investment and non-bearing stage,

from which the annual amortized cost has been calculated.

The assumption has been made in order to calculate the cost and return estimates for the apple crop i.e. first bearing of apple begins in the 7<sup>th</sup> year. Thus, cost is divided into three parts. (a) Initial expenditure, (b) Costs incurred during the non-bearing period (establishment cost), and (c) Costs incurred during the bearing stage (Maintenance cost). The study is based on primary data for the year 2019-2020.

### (a) Initial Investment

Apple is the most important fruit crop among temperate fruits. After plantation, it takes about 6 to 7 years to reach the bearing stage. The initial investment in this crop is quite high because of the costs of land construction, pit digging, manure and fertilizer application, and material costs. Growers must spend money on upkeep for around 6 years before looking for any returns (Malik and Choure, 2014). It is clear from the table 2 that total cost of

₹ 48097 was incurred as initial expenditure for the cultivation of apple during the first year in high hills of Himachal Pradesh. Total variable cost was found to be 62.78 per cent of the total cost incurred. The proportion of labour cost and material cost was worked out to be 20.23 per cent and 30.67 per cent, respectively to the total variable cost. Similar findings have been reported by Kireeti *et al.* (2014) and Sharma *et al.* (2018) in high hills of Himachal Pradesh.

### (b) Establishment cost

Establishment cost per hundred plants during non-bearing stage for various age groups of apple plantations in high hills is given in Table 3. It depicts that the total annual costs during non-bearing years increased with an increase in plantation age (Kireeti *et al.* 2014). However, the total variable cost was found to decrease over the non-bearing years, whereas fixed costs increased from 2<sup>nd</sup> year to 6<sup>th</sup> year. The total establishment cost during the non-bearing stage was varied from ₹ 41323 to ₹ 64530 from 2<sup>nd</sup> to 6<sup>th</sup> year.

**Table 2:** Initial cost of apple per 100 plants in high hills of Himachal Pradesh

Items	Unit	Quantity	Value (₹)	%
<b>Labor cost</b>				
Bush clearing/burning	Man Days	2.15	688.00	1.43
Digging of pits	Man Days	15.50	4960.00	10.31
Planting	Man Days	5.85	1872.00	3.89
FYM	Man Days	3.65	1168.00	2.43
Others	Man Days	3.25	1040.00	2.16
Sub-total		<b>30.40</b>	<b>9728.00</b>	<b>20.23</b>
Family labor	Man Days	9.05	2896.00	6.02
Hired labor	Man Days	21.35	6832.00	14.20
<b>Material cost</b>				
Planting material	Number	100	8550.00	17.78
FYM	Q	23.75	4750.00	9.88
Fertilizer	Q	0.55	797.50	1.66
Miscellaneous	₹		650.00	1.35
Sub-total			<b>14747.50</b>	
Interest on working capital	₹	@6.65 %	1402.67	2.92
Risk margin	₹	@10 %	2157.95	4.49
Managerial cost	₹	@10 %	2157.95	4.49
Sub-total			<b>5718.57</b>	<b>11.89</b>
Total variable cost			<b>30194.07</b>	<b>62.78</b>
Land revenue	₹		31.25	0.06
Depreciation	₹		3727.81	7.75
Rental value of land	₹		13768.28	28.63
Interest on fixed capital	₹	@10%	375.91	0.78
<b>Total fixed cost</b>	₹		<b>17903.25</b>	<b>37.22</b>
Total cost	₹		<b>48097.31</b>	<b>100.00</b>

**Table 3: Establishment cost of apple per 100 plants in high hills of Himachal Pradesh (₹)**

Variable cost	Age of plantation in years				
	2	3	4	5	6
<b>Labor cost</b>					
Preparation and maintenance of basins	2144.00 (5.19)	2144.00 (4.66)	2224.00 (4.27)	2224.00 (3.76)	2320.00 (3.60)
Intercultural operation	720.00 (1.74)	720.00 (1.56)	800.00 (1.54)	960.00 (1.62)	1008.00 (1.56)
Gap Filling	448.00 (1.08)	448.00 (0.97)	400.00 (0.77)	400.00 (0.68)	—
FYM and fertilizer application	1066.67 (2.58)	1230.77 (2.67)	1600.00 (3.08)	1777.78 (3.01)	2000.00 (3.10)
Plant protection	768.00 (1.86)	800.00 (1.74)	880.00 (1.69)	896.00 (1.52)	960.00 (1.49)
Others	850.00 (2.06)	850.00 (1.85)	850.00 (1.63)	850.00 (1.44)	850.00 (1.32)
Sub-total	<b>5996.67 (14.51)</b>	<b>6192.77 (13.46)</b>	<b>6754.00 (12.98)</b>	<b>7107.78 (12.02)</b>	<b>7138.00 (11.06)</b>
Family Labor	2684.67 (6.50)	2880.77 (6.26)	3330.00 (6.40)	3523.78 (5.96)	3810.00 (5.90)
Hired labor	3312.00 (8.01)	3312.00 (7.20)	3424.00 (6.58)	3584.00 (6.06)	3328.00 (5.16)
<b>Material cost</b>					
Planting material	1282.50 (3.10)	1282.50 (2.79)	975.00 (1.87)	975.00 (1.65)	—
FYM	6050.00 (14.64)	6200.00 (13.47)	6650.00 (12.78)	7450.00 (12.60)	7850.00 (12.16)
Fertilizer	1160.00 (2.81)	1305.00 (2.84)	1450.00 (2.79)	1595.00 (2.70)	1710.00 (2.65)
Chemicals	385.00 (0.93)	385.00 (0.84)	575.00 (1.11)	660.00 (1.12)	745.00 (1.15)
Others	400.00 (0.97)	400.00 (0.87)	560.00 (1.08)	720.00 (1.22)	720.00 (1.12)
Sub-total	<b>9277.50 (22.45)</b>	<b>9572.50 (20.80)</b>	<b>10210.00 (19.63)</b>	<b>11400.00 (19.28)</b>	<b>11025.00 (17.09)</b>
Interest on working capital (@6.5%)	818.32 (1.98)	837.49 (1.82)	886.21 (1.70)	973.96 (1.65)	932.95 (1.45)
Risk margin (@10% of working capital)	1258.95 (3.05)	1288.45 (2.80)	1363.40 (2.62)	1498.40 (2.53)	1435.30 (2.22)
Managerial cost (@10% of working capital)	1258.95 (3.05)	1288.45 (2.80)	1363.40 (2.62)	1498.40 (2.53)	1435.30 (2.22)
Total variable cost	<b>18610.39 (45.04)</b>	<b>19179.66 (41.67)</b>	<b>20577.01 (39.55)</b>	<b>22478.54 (38.02)</b>	<b>21966.55 (34.04)</b>
<b>Fixed cost</b>					
Land revenue	31.25 (0.08)	31.25 (0.07)	31.25 (0.06)	31.25 (0.05)	31.25 (0.05)
Depreciation	3727.81 (9.02)	3727.81 (8.10)	3727.81 (7.17)	3727.81 (6.30)	3727.81 (5.78)
Interest on fixed capital	375.91 (0.91)	375.91 (0.82)	375.91 (0.72)	375.91 (0.64)	375.91 (0.58)
Rental value of land	13768.28 (33.32)	13768.28 (29.91)	13768.28 (26.46)	13768.28 (23.29)	13768.28 (21.34)
Interest on past establishment cost	4809.73 (11.64)	8942.07 (19.43)	13544.57 (26.03)	18747.05 (31.71)	24659.93 (38.21)
Total fixed cost	<b>22712.98 (54.96)</b>	<b>26845.31 (58.33)</b>	<b>31447.81 (60.45)</b>	<b>36650.29 (61.98)</b>	<b>42563.18 (65.96)</b>
Total cost	<b>41323.36 (100.00)</b>	<b>46024.98 (100.00)</b>	<b>52024.82 (100.00)</b>	<b>59128.83 (100.00)</b>	<b>64529.72 (100.00)</b>

Figures in parentheses represent percent of the total cost.

**Table 4: Maintenance cost of apple per 100 plants in high hills of Himachal Pradesh (₹)**

Variable cost	Age class of plantation in years		
	07-11	12-16	17-21
<b>Labor cost</b>			
Preparation and maintenance of basins	2640.00 (2.78)	2640.00 (2.49)	2640.00 (2.37)
Intercultural operation	1345.00 (1.42)	1485.00 (1.40)	1425.00 (1.28)
FYM and fertilizer application	2140.50 (2.26)	2250.50 (2.12)	1790.00 (1.61)
Watch and ward	2720.00 (2.87)	3360.00 (3.17)	3040.00 (2.73)
Harvesting	1480.00 (1.56)	2245.00 (2.12)	2025.00 (1.82)
Grading	1315.00 (1.39)	1950.00 (1.84)	1575.00 (1.42)
Carrying cost	1625.00 (1.71)	1960.00 (1.85)	1765.00 (1.59)
Others	950.65 (1.00)	1015.50 (0.96)	825.50 (0.74)
Sub-total	14216.15 (14.98)	<b>16906.00 (15.93)</b>	<b>15085.50 (13.56)</b>
Family labor	8440.50 (8.89)	9955.50 (9.38)	8955.00 (8.05)
Hired labor	5775.65 (6.09)	6950.50 (6.55)	6130.50 (5.51)
<b>Material cost</b>			
FYM	8500.00 (8.96)	9250.00 (8.72)	8750.00 (7.86)
Fertilizer	1955.50 (2.06)	2420.25 (2.28)	2060.55 (1.85)
Others	1075.50 (1.13)	1510.25 (1.42)	1215.50 (1.09)
Sub-total	<b>11531.00 (12.15)</b>	<b>13180.50 (12.42)</b>	<b>12026.05 (10.81)</b>

Interest on working capital (@10% for 6 months)	1124.93 (1.19)	1308.52 (1.23)	1180.18 (1.06)
Risk margin (@10% of working capital)	1730.67 (1.82)	2013.10 (1.90)	1815.66 (1.63)
Managerial cost (@10% of working capital)	1730.67 (1.82)	2013.10 (1.90)	1815.66 (1.63)
Total variable cost	<b>30333.41</b> (31.96)	<b>35421.22</b> (33.38)	<b>31923.04</b> (28.69)
<b>Fixed cost</b>			
Land revenue	31.25 (0.03)	31.25 (0.03)	31.25 (0.03)
Depreciation	3727.81 (3.93)	3727.81 (3.51)	3727.81 (3.35)
Interest on fixed capital	375.91 (0.40)	375.91 (0.35)	375.91 (0.34)
Rental value of land	13768.28 (14.51)	13768.28 (12.98)	13768.28 (12.37)
Pro-rated establishment cost	46669.35 (49.17)	52784.56 (49.75)	61457.29 (55.23)
Total fixed cost	<b>64572.60</b> (68.04)	<b>70687.80</b> (66.62)	<b>79360.53</b> (71.31)
Total cost of cultivation	<b>94906.01</b> (100.00)	<b>106109.02</b> (100.00)	<b>111283.57</b> (100.00)

Figures in parentheses represent percent to the total cost.

### (c) Maintenance cost

Since the life cycle data based on cross sectional information on apple plantation was not available during fruit-bearing years, therefore, cash flow analysis was not attempted. Instead, the cost and returns analysis was carried out on an average age basis in the bearing stage of sampled apple orchards. The detailed analysis of maintenance cost of apple during bearing stage in the study region for the apple orchards is given in the Table 4. The maintenance cost has been spread from 7 to 21 years of bearing life on prorated basis using interest rate of 10 per cent. The total maintenance cost was worked out to be ₹ 1.06 lakh per hundred plants for 7-12 years' plantation. The proportion of fixed cost (66.62%) was found high as compared to variable cost (33.38%) in the study area. Among the fixed costs, prorated establishment cost (49.50%) and rental value of land (12.98%) accounted for the maximum proportion of the fixed costs in the area under study.

### (d) Returns analysis

The table 5 represents the returns from the apple cultivation in the study area. The gross returns and net returns from apple were worked out ₹ 2, 32,711 and ₹ 1, 73, 037 per hundred plants whereas, yield was found to be around 50 quintals for the selected period. However, the output input ratio was worked out to be 1.63, which is considered as index of profitability. It implied that each rupee spent would yield a profit of ₹ 1.63 in the study area. Therefore, the findings of the study put forth that farmers in

high hills are mainly dependent on horticultural crop especially in apple for their well-being, as it is major and long term source of income.

**Table 5:** Return analysis of apple in high hills of Himachal Pradesh

Crop	Apple
Total cost (₹)	106109.02
Gross returns (₹)	232711.10
Yield (q)	49.95
Net returns (₹)	173036.70
Output input ratio	1.63

### CONCLUSION

In comparison to other agriculture food crops, apple cultivation is a lucrative economic practice in Himachal Pradesh. It's a time-consuming, farm-based, and commercially appealing economic operation. The importance of apple to the economic development of hills can't be over emphasized. The apple cultivation is considered to best way to utilize the natural resources of the hills which gives significantly more remuneration than the field crops and generates more income and employment and thus turns has resulted in the farming shifting their area from field crops to horticulture. If achieved in a systematic manner, the income earned from this crop is much higher than any other horticulture crop. Thus, in the high hills of Himachal Pradesh state a net income of 1.63 unit is obtained with an investment of 1.00 unit from apple production, but this is a small amount as compared to other apple-producing countries around the world.

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