Profitability and Constraints of Apple cultivation in Chak district of Wardak province in Afghanistan

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Abstract

Apple is commercially grown fruit crop and it is popular due to its wide range of adaptability and high nutritive value. The study was undertaken in Chak district of Wardak province in Afghanistan to examine the profitability of apple production and constraints faced by farmers in cultivation. Random sampling technique was applied for selecting sixty farmers and were Interviewed using thoroughly prepared and dually evaluated questionnaire. The cost and returns of apple cultivation has estimated. The Garret ranking technique was adopted to rank the constraints faced by the apple cultivars. The total establishment cost which is calculated for five years from transplanting of apple is 4,66,249 AFG per ha. The variable and fixed cost incurred in establishing an apple garden is 2,23,832 AFG which is accounted for 48.01 per cent of total cost per ha, and 2,42,416 AFG i.e., 51.99 per cent of fixed cost per ha. Among the five years of establishment cost, the highest cost has incurred in the primary year, i.e., 1,34,437 AFG. The annual maintenance cost per ha is 1,40,489 AFG. The variable and fixed cost incurred in maintenance of an apple garden is 72,199 AFG with (51.39 %) and 68,290 AFG (48.61 %) per ha, respectively.

The average yield across the nation reached 9.1 tons per hectare in 2019. In my study area, the average yield currently stands at 12.5 tonnes per hectare. Similarly, the return obtained over cost of cultivation by sample apple grower is 1,11,858.3 AFG per ha. The returns per Afghani of total cost of cultivation in apple garden is 1.8 and return per Afghani of variable cost is 3.5.

Major constraint of apple production in study area is low price with a mean Garrett score 67.75 followed by no access to credit with 57.21. Major marketing constraints faced by sample respondents is no cold storage facility with a Garrett score of 64.24 followed by poor transportation facility with a mean score of 63.79.

Key words: Cost and returns of Apple, constraints of apple production, Chak district, Wardak province, Afghanistan.

1. Introduction

A crucial role in Afghanistan's economic development is played by agriculture, serving as the primary livelihood for around 75 percent of rural households (Mustafa, 2017). As of 2020, data reveals that agriculture and its related sectors collectively contributed 27.01 percent to the country's Gross Domestic Product (GDP) (Anonymous, 2020). Benefiting from a diverse climate and soil composition, Afghanistan offers an exceptionally favorable setting for cultivating horticultural crops like fruits, vegetables, ornamental plants, as well as medicinal and aromatic crops (Abdullah, 2016).

Thriving in temperate climates, the apple fruit, which originated in Central Asia, has become one of the most widely consumed fruit in Afghanistan. While grapes dominate the production scene, apples secured second position, highlighting their significant role in the country's agricultural landscape (Jahrullah and Bunnel, 2013). Primarily grown in seven provinces such as Wardak, Ghazni, Kabul, Balkh, Logar, Parwan, and Uruzgan future apples also demonstrate adaptability to an additional 23 provinces, showcasing the versatility of apple trees across varied geographical landscapes (Matiullah *et al*., 2015).

In Afghanistan, apple cultivation stands out as a perennial cash crop with a five-year gestation period, requiring an average investment of 128,365.6 AFG per acre for orchard establishment. The study notes that the highest percentage of investment (36.3%) occurs in the first year, followed by 15.2% in the second year, 15.6% in the third year, 16.1% in the fourth year, and 16.8% in the fifth year. In case of the cost of cultivation per acre, the estimates are 65,020.14 AFG, 70,905.4 AFG, and 70,164.66 AFG for young (<10), medium, and old (>20) age orchards, respectively. Notably, the fixed cost remains consistent at 48,437.0 AFG for orchards of all age categories (Mohammad *et al*., 2020).

Over the years, Afghanistan has witnessed a remarkable surge in apple production, with quantities increasing from 17,380 tonnes in 2002 to an impressive 270,857 tonnes in 2020. This expansion is evident in the growing expanse of apple orchards, covering a total area of 25,643 hectares (Anonymous, 2002-20).

2. Material methods

The study has undertaken in Chak district of Afghanistan. The data was collected in Wardak province of Afghanistan using a well-designed pre-tested and structured questionnaire. Primary data was collected through personal interview method. The data collection pertains to the agricultural years of 2019-20. The primary data pertains to establishment and maintenance cost of apple cultivation including material cost, labour cost, interest on working capital were collected from the sample respondents. The data on fixed cost components includes depreciation, rental value of land, land revenue, managerial cost and interest on fixed cost included in both establishment and maintenance cost of apple cultivation.

Tabular analysis

Tabular analysis was adopted to compile the general characteristic of the sample farmers, cost and return of apple cultivation, yield and revenue obtained from sample respondents, constrains in production and marketing of apple in Chak district of Wardak province in Afghanistan.

Estimation of cost and returns

To study the economics of apple cultivation, tabular analysis was employed which explained per hectare using averages and percentages expressed in Afghanistan per unit area.

Cost concepts

a) **Variable cost:** The costs vary with the level of apple production are considered as a variable cost. The items included in this category are given below.

b) **Labour cost:** The actual expenditure incurred on hired human labour and machine labour were recorded.

c) **Material cost:** The cost on purchased inputs *viz.,* seedlings, farm yard manure (FYM), fertilizers, plant protection chemicals, pruning and miscellaneous items during the production period.

d) **Interest on working capital:** The prevailing bank rate of ten per cent (commercial bank lending rate for apple orchard) is taken to work out the interest on working capital.

Fixed cost

These are the costs which do not vary with the level of production. The different items of fixed costs considered in the study are explained below:

a) **Depreciation:** Depreciation on each capital equipment and machinery owned by farmers were calculated separately using straight line method. By considering average life of the asset as indicated by each farmer.

$$\text{Annual depreciation} = \frac{\text{(Present value} - \text{Salvage value)}}{\text{(Useful years of life)}} \dots\dots\dots\dots\dots (5)$$

b) **Rental value of land:** The prevailing rental value of the land in the study area was considered.

c) **Land revenue:** This was considered according to the actual payments made by the cultivators for different categories of land.

d) **Managerial cost:** Cost accounted for the management of farm by the farmer-owner. Farmer as an owner plays a multiple role in the production system with his mental and physical involvement. Hence, 10 per cent of the working capital has been taken as managerial cost.

e) **Interest on fixed capital:** Interest on fixed capital was computed at the rate of 10 per cent per annum (commercial bank rate for fixed deposits). The interest was worked out on the values of fixed assets, after deducting depreciation for the year.

e) **Risk premium:** Risk premium is the cost paid by the farmer to overcome the risk from natural calamities. Premium cost is also considered in the cost concept. Five per cent of the 80 per cent of working capital was considered as the risk premium for commercial (horticultural) crops.

f) **Amortized cost of establishment:** Amortization is an accounting technique that reduces cumulative establishment cost at a discount rate over the economic life of the plantation. To arrive at amortized establishment cost, the following formula was used.

Amortization cost was calculated by using formula,

$$A = P \frac{r(r+1)^n}{((1+r)^n) - 1} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (6)$$

Where,

    A = Annual amortized cost

    P = Establishment cost

    n = Economic life of apple orchard (taken as 55 years)

    r = interest rate (2 %)

g) **Establishment cost:** Cost incurred by the farmers till the trees starts bearing the yield. The costs incurred under this comprises of land preparation, expenditure incurred on digging of pits, manure and silt application, planting and filling of pits, fertilizer application, pruning, plant protection chemicals application, staking, weeding, *etc.*

h) **Annual Maintenance Cost:** The annual maintenance cost includes the cost incurred once the apple starts bearing yield. This include the cost incurred by the farmer to maintain the apple annually was worked out considering both variable and fixed costs. The maintenance cost was calculated by taking the average annual maintenance cost from 6th to 8th year but the yield gets stabilized in the later years (during 6th, 7th and 8th year plants will be growing and would not have attained the stabilized yield).

Returns

a) **Gross return:** Gross return is the value of apple calculated at prevailing prices at which farmers sold apple in the study area.

Gross return = Average sale price x total output sold

b) **Returns over variable cost:** Calculated by subtracting total variable cost from gross return.

c) **Returns over total cost of cultivation:** Calculated by subtracting variable and fixed cost components from the gross returns.

d) **Returns per Afghani of variable cost:** It was calculated by dividing gross return by variable cost.

$$\text{Returns per Afghani of variable expenditure } = \frac{\text{Gross return}}{\text{Total variable cost}} \dots \dots (7)$$

e) **Returns per Afghani of expenditure:** It was calculated by dividing gross return by cost of cultivation cost.

$$\text{Returns per Afghani of expenditure } = \frac{\text{Gross return}}{\text{Total cost of cultivation}} \ldots \ldots . . (8)$$

Garrett Ranking Technique

This technique was used to evaluate the problems faced by the respondents in production and marketing of apple from Afghanistan and traders in the orders of merit given by the respondents were converted into rank by using the equation 9 below. To find out the most significant factor which influences the respondents, Garrett's ranking technique was used. As per this method, respondents have been asked to assign the rank for all factors and the outcomes of such ranking have been converted into score value. In this analysis, rank one means most important constraint and last rank means less important constraint. In the next stage, rank assigned to each constraint by each individual farmer was converted into per cent position with the help of the following formula,

Garrett's formula for converting ranks into per cent was given by

$$\text{Per cent position} = 100 \ \frac{(R_{ij} - 0.5)}{N_j} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (9)$$

Where,

R_{ij} = Rank given for i^{th} factor by j^{th} individual

N_j = Number of factors ranked by j^{th} individual

The per cent position of each rank then converted into scores referring to the table given by Garret. For each factor, the scores of individual respondents were added together and divided by the total number of the respondents for whom scores were added. These mean scores for all the factors were arranged in descending order, ranks were given and most important factors were identified.

Kendall's coefficient of concordance analysis (Kendall' W)

Kendall's W which gives the degree of association or agreements among the ranks assigned by different respondent on different objects or attributes was applied to the sampled farmers to examine the level of agreement among them gives the ranking of the constraints faced by the production period. Kendall's W is calculated by equation (10):

$$W = \frac{12S}{p^2(n^3 - n) - p^T} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . (10)$$

Where, S is the sum-of-squares from row sums of ranks Ri, as expressed in Equation 11. n is the number of objects; p is the number of respondent farmers and 'T' is a correction factor for tied ranks by Equation (12).

$$S' = \sum_{i=1}^{n} Ri^2 = SSR \ldots \ldots \ldots . \ldots \ldots \ldots \ldots \ldots . . \ldots \ldots \ldots \ldots \ldots . (11)$$

$$T = \sum_{i=1}^{n} t_k^3 - t_k \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

where S is the sum-of-squares from row sums of ranks Ri, 'm' is the number of groups and t_k is the number of tied ranks in each (k) of 'm' groups.

3. Results and Discussion

The required data were collected, analyzed, and interpreted in the context of the study's goal. The obtained results are displayed and discussed below. This chapter analyzes the cost and return structure of apple cultivation in Afghanistan's Chak district, with apple production as the dependent variable and fertilizers, pesticides, and labor as independent variables. The findings are based on primary data collected directly from the study area.

Cost and return of apple production in Chak district of Afghanistan

Apple holds paramount importance among temperate fruits, with investments in its cultivation classified into establishment and maintenance costs. The detailed breakdown of establishment costs includes variable costs (seedlings, chemical fertilizers, manure, plant protection chemicals) and fixed costs (rental value of land, depreciation). The estimation covers the period from planting up to five years, recognizing the critical role of proper orchard establishment for optimal growth, productivity, and future profitability, especially as bearing commences from the 6th year. Apple trees are considered highly yielding between 15-30 years, with yields declining after 30-35 years in Afghanistan.

Establishment cost of apple garden in Chak district of Afghanistan

Table 1 depicts the details of establishment cost (Fig 1.) of apple garden which is distributed across first five years after plantation of apple seedlings.

The input cost for establishing an apple orchard was 117,614 AFG per hectare, constituting 25.23% of the total establishment cost. The primary expenses included seedlings (9.98%), chemical fertilizers (8.97%), FYM (6.29%), and 1.48% for plant protection during the non-bearing period.

During the establishment period, a total of 196 mandays and 21.5 machine hours were needed, with the majority of human labor utilized for weeding (55 mandays), followed by chemical fertilizer application (45 mandays), and irrigation, watch, and ward (34 mandays). The highest machine hours were allocated to inter cultivation (17 machine hours) and land preparation (4.5 machine hours). In the fifth year, labor requirements peaked at 57 mandays and 4 machine hours due to activities like chemical fertilizer application, plant protection, pruning, inter cultivation, and irrigation. Labor costs constituted 18.42% of the establishment period, with machine labor cost being highest in the first year at 6,000 AFG due to land preparation and inter cultivation operations.

The total labor cost for the establishment period of the apple orchard was 85,870 AFG per hectare, constituting 18.42% of the total establishment cost. Weeding incurred the highest labor cost at 19,250 AFG (4.13%), followed by the application of chemical fertilizer (3.38%), inter cultivation (2.92%), and irrigation, watch, and ward (2.55%). The fifth year had the highest labor cost at 23,150 AFG, driven by major operations such as application of manures, weeding, chemical fertilizer, irrigation, and inter cultivation. The average labor cost for the other four years of the establishment period was 15,680 AFG.

The total cost per ha in establishing apple plantation for the entire five years was estimated to be 4,66,249 AFG (Table 1). Out of the total cost, variable cost accounted for 48.01 per cent (2,23,832 AFG) and fixed cost accounted for 51.99 per cent (2,42,416 AFG). Among the five years of establishment, the highest cost was incurred in the first year with (1,34,437 AFG) followed by (fourth year) 97,093 AFG. Among the fixed cost, the rental value of land (42.90 %) and managerial cost (4.36 %) were the major cost items. According to (Mohammad *et al*., 2020), variable costs constituted 72.60%, surpassing fixed costs at 27.39% in the cost of apple cultivation per acre in Kabul province, Afghanistan.

Table 1: Establishment cost of apple orchard cultivation in Chak district of Afghanistan   **(AFG per ha)**

| Sl. No.	Particulars	Units	1st year		2nd year		3rd year		4th year		5th year		Total cost of establishment		% to the total
			Qty	AFG	Qty	AFG	Qty	AFG	Qty	AFG	Qty	AFG	Qty	AFG	
I	**Variable cost**														
	Material inputs														
1	Seedling	No	443	45,484	10	1,026	-	-	-	-	-	-	453	46,510	9.98
2	Farm yard manure	Tractor load	5	6,235	4	4,988	4	4,988	5	5,611	6	7,482	24	29,304	6.29
3	Chemical fertilizers														
3.1	DAP	Kg	50	3,000	50	3,000	75	4,500	100	6,000	150	9,000	425	25,500	5.47
3.2	Urea	Kg	100	2,400	100	2,500	150	3,600	150	3,600	175	4,200	575	16,300	3.50
4	Plant protection Chemicals	-	-	-	-	1,500	-	1,600	-	1,800	-	2,000	-	6,900	1.48
A	**Sub total**	-	-	**57,119**	-	**11,514**	-	**13,088**	-	**15,211**	-	**20,682**	-	**1,17,614**	**25.23**
	Per cent	-	-	49	-	10	-	11	-	13	-	18	-	100	-
	Labour used														
1	Land preparation	mandays	5	1,750	-	-	-	-	-	-	-	-	5	1,750	0.38
		Machine hrs.	4.5	3,600	-	-	-	-	-	-	-	-	4.5	3,600	0.77
2	Planting of seedling	mandays	6	2,170	-	-	-	-	-	-	-	-	6	2,170	0.47
3	Manuring	mandays	5	1,750	5	1,750	6	2,100	7	2,450	8	2,800	31	10,850	.33
4	Chemical fertilizer application (DAP, Urea)	mandays	6	2,100	6	2,100	9	3,150	10	3,500	14	4,900	45	15,750	3.38
5	Weeding	mandays	6	2,100	10	3,500	12	4,200	12	4,200	15	5,250	55	19,250	4.13
6	Inter cultivation operation	machine hrs.	3	2,400	3	2,400	3	2,400	4	3,200	4	3,200	17	13,600	2.92
7	Pruning	mandays	-	-		-	3	1,050	5	1,750	12	4,200	20	7,000	1.50
8	Irrigation, watch and ward	mandays	6	2,100	6	2,100	6	2,100	8	2,800	8	2,800	34	11,900	2.55
B	**Sub total**	-	-	**17,970**	-	**11,850**	-	**15,000**	-	**17,900**	-	**23,150**	-	**85,870**	**18.42**
	(A+B)	-	-	**75,089**	-	**23,364**	-	**28,088**	-	**33,111**	-	**43,832**	-	**2,03,484**	**43.64**
C	Interest on working capital @ 10% per annum	-	-	7,508.90	-	2,336.40	-	2,808.80	-	3,311.10	-	4,383.20	-	20,348.40	4.36
D	**Total variable cost (A+B+C)**	-	-	**82,598**	-	**25,700**	-	**30,897**	-	**36,422**	-	**48,215**	-	**2,23,832**	**48.01**
II	**Fixed cost**														
1	Rental value of land	-	-	40,000	-	40,000	-	40,000	-	40,000	-	40,000	-	2,00,000	42.90
2	Depreciation	-	-	300	-	350	-	380	-	400	-	450	-	1,880	0.40
3	Managerial cost @10% of working capital	-	-	7,509	-	2,336	-	2,809	-	3,311	-	4,383	-	20,348	4.36
4	Interest on fixed capital @ 10% per annum	-	-	4030	-	4035	-	4038	-	4040	-	4045	-	20,188	4.33
E	**Total fixed cost**	-	-	**51,839**	-	**46,721**	-	**47,227**	-	**47,751**	-	**48,878**	-	**2,42,416**	**51.99**
F	**Total cost (D+E)**	-	-	**1,34,437**	-	**72,422**	-	**78,124**	-	**84,173**	-	**97,093**	-	**4,66,249**	**100.00**
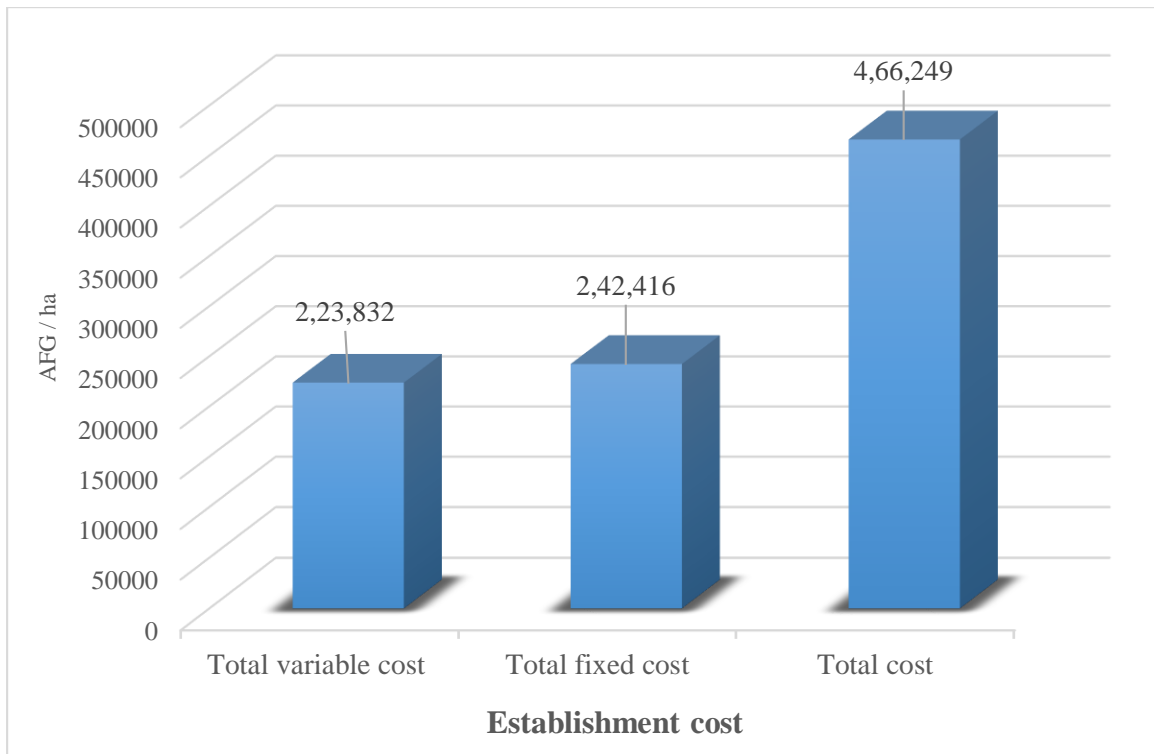
Fig. 1: Establishment cost in apple cultivation
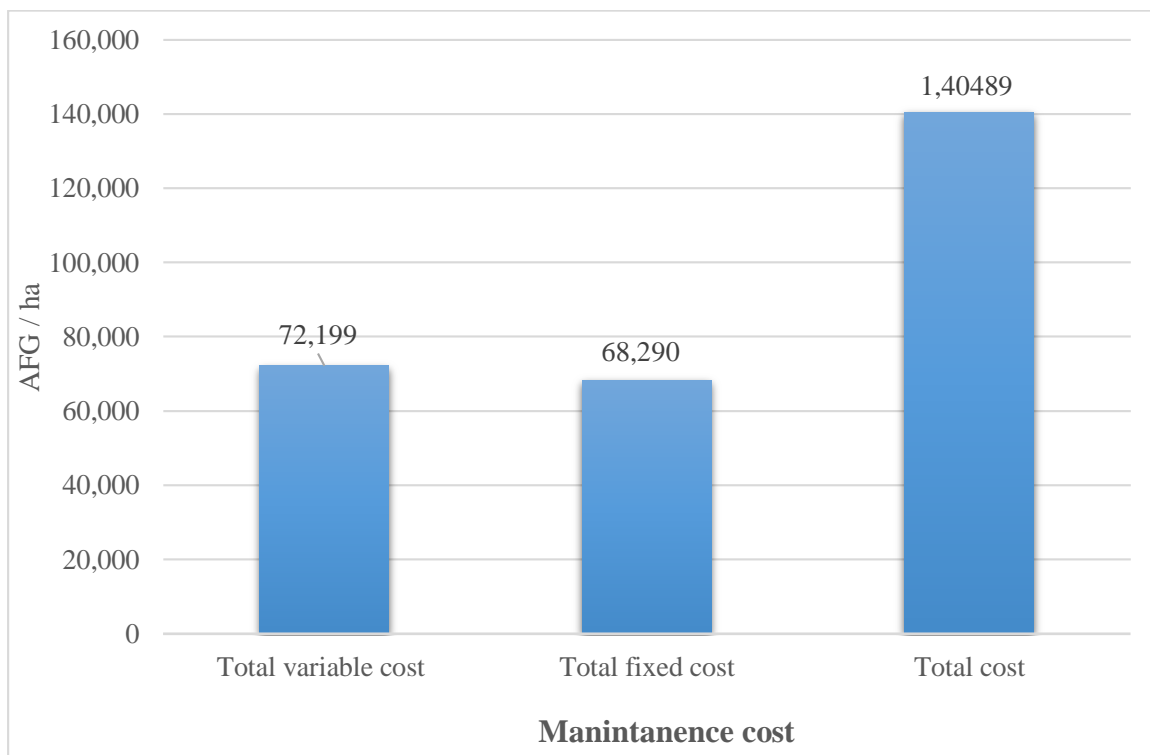
Fig. 2: Maintenance cost in apple cultivation

Table 2: Annual maintenance cost of apple orchards cultivation in Chak district of Afghanistan   **(AFG per ha)**

Sl. No.	Particulars	Units	per unit cost	6th year		7th year		8th year		Average		% to the total
				Qty	AFG	Qty	AFG	Qty	AFG	Qty	AFG	
I	**Variable cost**											
	Material input											
1	Farm yard manure	Tractor load	1247	7.1	8,854	7.5	9,353	8	9976	7.53	9,394	6.69
2	Chemical fertilizers											
2.1	DAP	Kg	-	150	9,000	150	9,000	175	10,500	158	9,500	6.76
2.2	Urea	Kg	-	175	4,200	200	4,800	200	4,800	192	4,600	3.27
3	Plant protection Chemicals	-	-	-	5,795	-	7,045	-	7,910	-	6,917	4.92
4	Growth harmonics	-	-	-	500	-	500	-	650	-	550	0.39
5	Miscellaneous	-	-	-	1,000	-	1,000	-	1,000	-	1,000	0.71
A	**Sub total**	-	-	-	**29,349**	-	**31,698**	-	**34,836**	-	**31,961**	**22.75**
	Labour used											
1	Inter cultivation	mandays	350	4	1,400	4	1,400	5	1,750	4	1,517	1.08
		machine hrs.	800	3	2,400	3	2,400	3	2,400	3	2,400	1.71
2	Manuring	mandays	350	6	2,100	6	2,100	6	2,100	6	2,100	1.49
3	Chemical fertilizer application	mandays	350	10	3,500	10	3,500	10	3,500	10	3,500	2.49
4	Application of plant protection chemicals	mandays	350	8	2,800	8	2,800	8	2,800	8	2,800	1.99
5	Pruning	mandays	350	10	3,500	12	4,200	15	5,250	12	4,317	3.07
6	Weeding	mandays	350	11	3,850	11	3,850	11	3,850	11	3,850	2.74
7	Irrigation	mandays	350	5	1,750	5	1,750	5	1,750	5	1,750	1.25
8	Watch and ward	mandays	350	20	7,000	20	7,000	25	8,750	22	7,583	5.40
9	Harvesting	mandays	350	6	2,212	9	3,318	17	6,045	11	3,858	2.75
B	**Sub total**	-	-	-	**30,512**	-	**32,318**	-	**38,195**	-	**33,675**	**23.97**
	A+B	-	-	-	**59,861**	-	**64,016**	-	**73,031**	-	**65,636**	**46.72**
C	Interest on working capital@10 % per annum	-	-	-	5,986	-	6,402	-	7,303	-	6,564	4.67
D	**Total variable cost (A+B+C)**	-	-	-	**65,847**	-	**70,417**	-	**80,334**	-	**72,199**	**51.39**

Sl. No.	Particulars	Units	per unit cost	6th year		7th year		8th year		Average		% to the total
				Qty	AFG	Qty	AFG	Qty	AFG	Qty	AFG	
II	**Fixed Cost**											
1	Depreciation	-	-	-	600	-	655	-	700	-	652	0.46
2	Rental value of land	-	-	-	40,000	-	40,000	-	40,000	-	40,000	28.47
3	Land revenue	-	-	-	300	-	300	-	300	-	300	0.21
4	Managerial cost @10% of working capital	-	-	-	5,986	-	6,402	-	7,303	-	6,564	4.67
5	Interest on fixed capital (10) %	-	-	-	4,090	-	4,096	-	4,100	-	4,095	2.91
6	Risk premium@ 5% of 80% of working capital	-		-	2,394	-	2,561	-	2,921	-	2,625	1.87
7	Amortized establishment cost	-	-	-	14,054	-	14,054	-	14,054	-	14,054	10.00
E	**Total fixed cost**	-	-	-	**67,425**	-	**68,067**	-	**69,378**	-	**68,290**	**48.61**
F	**Total cost (D+E)**	-	-	-	**1,33,271**	-	**1,38,484**	-	**1,49,712**	-	**1,40,489**	**100.00**

Annual maintenance cost of apple orchards cultivation in Chak district of Afghanistan

Maintenance costs, commencing from the sixth year onward until the end of the economic life, encompass ongoing expenses for the apple orchard. These costs entail labor, material expenses, and fixed costs associated with maintaining the orchard (Fig. 2). In maintenance costs, human labor constitutes the largest share at (23.9 7%), reflecting the prevalent use of traditional cultivation methods in the country with minimal machinery involvement. Among variable costs, the highest labor expenditure is allocated to irrigation and watch and ward, accounting for (6.6 5 %) of maintenance costs. Highest material input expenditure 14,100 AFG for chemical fertilizers, constituting (10.03 %) of maintenance costs. Followed by manures 9,394 AFG, plant protection chemicals 6,917 AFG, and growth hormones 550 AFG at (6.69 %), (4.92 %), and (0.39 %), respectively, of total maintenance costs.

Among fixed cost, rental value of land constituted the highest share respectively 28.47 per cent of the maintenance cost, followed by amortized establishment cost 10.00 per cent, managerial cost 4.67per cent, interest on fixed capital, interest on working capital with, 2.91and 1.87 per cent respectively of the maintenance cost.

The total per ha maintenance cost incurred in apple cultivation for different years worked out to be 1,40,489 AFG. Out of which, variable costs 72,199 AFG accounted for or 51.39 per cent and fixed cost 68,290 AFG had a share of 48.61 per cent.

Consistent with (Mohammad *et al.*,2020) study in Kabul province, apple cultivation costs were 183,228 AFG per hectare, gross income reached 260,666 AFG per hectare, resulting in a net return of 102,254 AFG per hectare.

Returns from apple cultivation in Chak district of Afghanistan

The total cultivation cost for sample apple farmers was 140,489 AFG per hectare, with variable and fixed costs accounting for 72,199 AFG and 68,290 AFG, respectively. Apple yields start in the sixth year and continue for 50 years, with an annual average yield of 12.5 tonnes per hectare (refer to Table 3). Gross returns from apple cultivation were 252,347 AFG per hectare, resulting in a net income of 111,858 AFG per hectare. Returns per Afghani of cultivation cost were 1.80 AFG, compared to 3.5 AFG over variable costs. Aligning with (Ghulam YK, 2015) research on apple orchards in Mastung district, Baluchistan, Pakistan, the average net income per acre was Rs. 1,48,705, gross incomes reached Rs. 2,68,800, with total expenditures amounting to Rs. 1,20,094.58 in Mastung, Baluchistan.

Table 3: Cost and returns from apple cultivation in Chak district of Afghanistan

(AFG per ha)

Sl. No.	Particulars	Total cost AFG
1	Variable cost	72,199
2	Fixed cost	68,290.0
3	Total cost of cultivation	1,40,489.1
4	Yield (t / ha)	12.5
5	Price per (t)	20,252.6
6	Gross returns	2,52,347.4
7	Returns over variable cost	1,80,148.3
8	Returns over cost of cultivation	1,11,858.3
9	Returns per Afghani of variable cost	3.5
10	Returns per Afghani of total cost of cultivation	1.8

Constraints faced by farmers in production of apple in Chak district of Afghanistan

Production constraints for sample apple farmers, outlined in Table 4, are led by the low domestic price of apples with a mean score of 67.75, followed by no access to credit (57.21), insecurity in potential

apple production areas (44.83), lack of cold storage and processing facilities (43.9), and poor knowledge on orchard management (33.51).

Table 4: Constraint in production of apple in Chak district of Afghanistan

Sl. No.	Factors	Garrett score	Rank
1	Low domestic price of apple	67.75	1
2	No access to credit	57.21	2
3	Insecurity in potential apple production areas	44.83	3
4	Lack of cold storage and processing facilities	43.9	4
5	Poor knowledge of apple grower	33.51	5

Kendall's coefficient of concordance (Kendall's W) for the issues in Table 4. is 0.6766, indicating approximately 67.67% agreement among about 41 respondents. This consensus underscores that low domestic apple prices, lack of credit access, insecurity in potential apple production areas, and insufficient cold storage and processing facilities are identified as significant constraints in apple production in Chak district, Wardak province, Afghanistan. (Mohammad *et al*., 2020) underscored constraints faced by Afghan apple growers, with non-availability of credit (54.95%), fluctuating prices (52.36%), lack of technical information (49.08%), non-availability of quality planting material (46.53%), and water scarcity (45.55%) being prominent concerns.

Conclusion

The present study revealed that the establishment cost for an apple garden in Afghanistan is 4,66,249 AFG per hectare, with variable and fixed costs comprising 48.01% and 51.90%, respectively. The first year incurs the highest cost at 1,34,437 AFG. Annual maintenance cost is 1,40,489 AFG per hectare, with variable and fixed costs at 51.39% and 48.61%. Labor cost dominates variable costs (23.97%), while land rental is the major fixed cost (28.47%). The average yield is 12.5 tonnes per hectare, yielding a return over the cost of cultivation of 1,11,858.3 AFG per hectare. The return per Afghani of total cost is 1.8, and for variable cost, it is 3.5, indicating profitability and providing valuable insights for apple growers in making informed decisions. The primary constraint affecting apple production in the Chak district is the low domestic price of apples, as indicated by a mean Garrett score of 67.75. This is closely followed by the lack of access to credit, with a score of 57.21. The Kendall's coefficient of

concordance, calculated at 0.6766, suggests a substantial agreement among approximately 41 respondents on the ranking of these constraints.

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