

Economic Feasibility of Dragon Fruit Cultivation under Pole system in Punjab

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Abstract

This study aimed to evaluate the economic viability of dragon fruit cultivation under the pole system in Punjab. For this study, primary data were gathered from 50 purposively selected dragon fruit growers, out of which 37 dragon fruit growers cultivating dragon fruit under the pole system were selected. These were subsequently classified into orchards up to four years (24 growers) and more than four years (13 growers). Financial feasibility was evaluated using annual amortization of cost, Net Present Value (NPV), Benefit-Cost Ratio (B:C), Internal Rate of Return (IRR) and payback period. The establishment cost of dragon fruit cultivation was estimated at Rs 5.09 lakh per acre, representing the majority of the initial establishment cost. The financial assessment showed that orchards up to four years recorded a negative net present value of Rs 5.24 lakh and a benefit-cost ratio of 0.43, indicating that the investment remained unfeasible during the establishment phase. However, orchards more than four years generated net present value of Rs 6.85 lakh, a benefit-cost ratio of 1.65, an internal rate of return of 33 per cent and a payback period of 3.9 years, indicating economic viability after the bearing stage. The projected analysis over the 20-year economic life of the orchard further confirmed its long-term profitability, with net present value of Rs 15.78 lakh per acre, benefit-cost ratio of 2.46 and an internal rate of return of 72 per cent. The study concluded that despite of high initial establishment cost, dragon fruit cultivation under the pole system is a financially viable and profitable long-term investment for farmers in Punjab.

Keywords: Dragon fruit, Economic feasibility, Pole system, Net Present Value, Benefit-cost ratio, Internal rate of return, Payback period, Punjab

JEL Classification: Q12, Q14, O13

Introduction

Dragon fruit (*Hylocereus spp* and *selenicereus spp.*), also known as Pitaya, is a vine cactus plant belonging to Cactaceae family (Hossain *et al.*, 2021). Dragon fruit was originated in the tropical regions of Mexico and Central America and has been extensively cultivated in Vietnam and other Southeast Asian countries (Pavan *et al.*, 2025). Dragon fruit can grow in tropical climates and temperature ranging from 20°C to 30°C (Thokchom *et al.*, 2019) and can also be cultivated in the lower hills and sub-tropical regions of Nepal, reaching height of 800 m (Dhakal *et al.*, 2021). Being cacti crop, this requires less water, nutrients and also low maintenance comparative to other crops. This crop becomes globally significant due to its withstanding power against abiotic stress, pest resistance and low input requirement, making suitable for cultivation on marginal land (Wakuchare *et al.*, 2020, Balaji *et al.*, 2025). The estimated economic life of dragon fruit was 20 years and can give multiple harvests throughout the year. Due to its attractive appearance, colour

and excellent pulp, it is becoming more and more well- liked among cultivars. Its pulp can also be processed in the form of jam, jelly, ice cream, juice, wine and many more products (Kakade *et al.*, 2023). Fruit peel is rich in pectin and can be extracted by various methods (Thirugnanasambandham *et al.*, 2014) and can also be used as colouring agent and as raw material for food colour industries.

This fruit has very high nutritional value, relatively rich in antioxidants. Fresh fruit contains 82.5-83 percent moisture, 0.16-.23 percent protein, 0.021-0.61 percent fat, 0.70-0.9 percent fiber. The 100 g of this fresh fruit contains 6.3 to 8.8 mg of calcium, 30.2 to 36.1 mg of phosphorus, 0.5-.61 mg of iron and 8 to 9 mg of vitamin C (Ghosh *et al.*, 2022). This fruit also helps in preventing various chronic diseases like colon cancer, diabetes, reduces cholesterol and helps in controlling blood pressure, studies revealed that glucose found in dragon fruit helps in controlling blood pressure for diabetic patient. It is rich in vitamin C, phosphorus and calcium, it helps in bone strengthening and also helps in tissue formation and forms healthy teeth. Dragon fruit is also packed with Vitamin B group which possess an important

role in health benefit, Vitamin B₁ helps in increasing energy whereas Vitamin B₂ in dragon fruit act as multivitamin and Vitamin B₃ helps in lowering bad cholesterol level as well as it also helps in improving eyesight and prevents hypertension (Kakade *et al.*, 2023).

Dragon fruit is primarily grown in Vietnam, Thailand, Colombia, Costa, Rica and Nicaragua (Arivalagan *et al.*, 2019). But this crop is widely and rapidly spreading due to its high nutritional and medicinal values (Chongloi *et al.*, 2022). During late 1990s, dragon fruit was introduced in India from merely 4 hectares in 2005 to 3,000 hectares by 2020 (ICAR-NIASM). In Punjab, dragon fruit cultivation is gradually gaining attention as a potential crop. This crop is capturing the interest of farmers seeking better returns. This crop provides an opportunity to shift towards high-value crop and improve farmers income. The area under dragon fruit in Punjab is 0.09 thousand hectares with annual production of 0.72 metric tonnes (Anonymous, 2026). Given the increasing importance of dragon fruit as a high-value horticultural crop in Punjab and the limited empirical evidence on its economic feasibility, the present study was undertaken to analyze the cost and return structure of dragon fruit cultivation.

Data Sources and Methodology

The study was conducted in Punjab during the agricultural year 2025–26 to examine the economic feasibility of dragon fruit cultivation in the state. The study was based

on primary data collected from 50 dragon fruit growers selected through a multistage purposive sampling technique from different parts of Punjab. A list of dragon fruit growers was obtained from Krishi Vigyan Kendras (KVKs), the Department of Fruit Science, Punjab Agricultural University, Ludhiana, Agricultural Development Officers, Horticultural Development Officers and other concerned officials. From 50 dragon fruit growers 37 dragon fruit grower's cultivating dragon fruit under pole system were selected from 17 districts, 28 blocks and 34 villages (Table 1).

Analytical Framework

To evaluate the economic feasibility of dragon fruit, financial indicating performances i.e. Annual Amortization of Cost, Net Present Value, Internal Rate of Returns, Benefit-Cost Ratio and payback period were employed. Additionally, Likert scale was also used to identify production and marketing constraints and ranking was done from one to five according to the constraints.

Annual Amortization of Cost

In this analysis, the annual amortization of cost was calculated from establishment cost of dragon fruit farm, assuming the rate of interest 12 per cent per annum and the life expectancy of 20 years. Thus, annual amortization was worked out by using the compounding cost formula and by adding it to maintenance cost for estimating the annual cost of cultivation.

Table 1: Sampling design of dragon fruit growers under pole system

Districts	Blocks	Villages	No. of farmers
Ludhiana	4	6	6
Jalandhar	1	1	1
Hoshiarpur	2	2	3
Gurdaspur	3	4	4
Amritsar	1	1	1
Barnala	1	1	2
Faridkot	2	2	2
Tarn taran	2	2	2
Ferozpur	1	2	2
Fatehgarh sahib	2	2	2
Mansa	1	1	1
Patiala	2	4	4
Rupnagar	1	1	1
SBS Nagar	1	1	1
Nawanshahr	1	1	1
Pathankot	1	1	1
Sangrur	2	2	3
Total	28	34	37

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

Where,

A = Amortized cost (in Rs.)

P = Establishment cost (in Rs.)

r = Interest rate (12 per cent per annum)

n = Economic life of the orchard (20 years)

Net Present Value (NPV)

Net present value (NPV) measures the difference between the present value of returns and the present value of costs over the life of the project, it considers the time value of money and helps in understanding whether the investment generates net gains. A positive net present value indicate that the investment is profitable.

$$\text{Net Present Value (NPV)} = \sum_{j=0}^n \frac{R_j}{(1+i)^j} - \sum_{j=0}^n \frac{C_j}{(1+i)^j}$$

Where,

i = Rate of interest used for discounting

R_j = Gross returns in the jth year

C_j = Cost in the jth year

j = 0, 1, 2, 3, . . . , n

Internal Rate of Return (IRR)

Internal Rate of Return (IRR) represents the rate of return at which the present value of benefits becomes equal to the present value of costs. It shows the earning potential of the investment in percentage terms. The project is considered viable if the IRR is higher than the prevailing rate of interest.

$$\text{IRR} = (\text{Lower discount rate}) + \frac{(\text{Difference between two discount rate}) \times \text{Net present value at lower discount rate}}{(\text{Absolute difference between NPV at two different rate})}$$

Benefit-Cost Ratio

Benefit-Cost Ratio (BCR) expresses the relationship between the total discounted benefits and total discounted costs. It indicates the returns per unit of investment. A BCR greater than one suggests that benefits exceed the costs, making the investment economically feasible.

$$\text{B: C ratio} = \frac{\sum_{j=0}^n \frac{R_j}{(1+i)^j}}{\sum_{j=0}^n \frac{C_j}{(1+i)^j}}$$

Where

i = Rate of interest used for discounting

R_j = Gross returns in the jth year

C_j = Cost in the jth year

j = 0, 1, 2, 3, . . . , n

Payback period

Payback period means how much time it takes for a farmer to get back the money they invested in the dragon fruit farm from its own returns. In other words, it indicates the number of years by which the net returns get equals to the cost of orchard.

$$\text{Payback period} = \text{Last full year before recovery} + \frac{\text{Unrecovered investment at start of year}}{\text{"Cash flow during the recovery year"}}$$

Results and Discussion

This study provides a detailed evaluation of the economic feasibility and operational challenges associated with dragon fruit cultivation in Punjab. This analysis considers key financial indicators such as Annual amortization cost, net present value, internal rate of returns, benefit-cost ratio and payback period while addressing production and marketing constraints using likert scale methodology.

Basic characteristic of dragon fruit growers

The basic characteristics of dragon fruit growers were described in Table 2. The average age of dragon fruit growers came out to be 43.97 years and the average family size of the dragon fruit growers were 5.57 and average years of schooling of dragon fruit growers were 16.29. The average operational land holding was 15.51 acres out of which only average of 1.39 acres was under dragon fruit.

Table 2: Basic characteristics of dragon fruit growers

Particulars	Value
Average age (years)	43.97
No. of schooling years	16.29
Family size (No.)	5.57
Operational Holdings	15.51
Area under dragon fruit	1.39

Establishment cost of dragon fruit orchard

Establishment cost of dragon fruit cultivation under pole system in Punjab was estimated and presented in Table 3. The total cost incurred for establishment of dragon fruit orchard was Rs 5.09 lakh. Among all the components, cement poles and rings contributed the major portion, accounting for Rs 3.25 lakh, followed by planting material used in the form of cuttings covered Rs 1.16 lakh. The expenditure on installing drip irrigation was Rs 25,248, while the installation cost of cement poles and rings was Rs 11,854.95 followed by plantation cost of Rs 11,125 respectively. The cost on transportation of planting material was Rs 10,317, whereas land preparation and farm yard manure stood at Rs 5,308.02 and Rs 5,287.39 respectively.

Establishment of a dragon fruit orchard requires substantial initial investment. The findings of the present

study are consistent with those of Akhil *et al.*, (2024), reported that dragon fruit cultivation involves high establishment costs. Similarly, Mehta *et al.*, (2023) found that cement poles and rings accounted for a significant share of the establishment cost, making them the major component of the overall establishment cost.

Classification of dragon fruit cultivation under pole system on the basis of age

Since the age of dragon fruit orchards under pole system varied considerably and had a significant effect on cost and return structure, the analysis was carried out by classifying the orchards into two groups: up to four years and more than four years. In addition to this, expected 20 years were also estimated to evaluate the long-term economic viability under pole system.

Operational cost of dragon fruit farm per acre under pole system (up to 4 years)

The results presented in Table 4 shows the operational cost of dragon fruit cultivation under pole system. The total operational cost increased from Rs 4,501.03 in first year to Rs 33,551.67 in fourth year. The major portion was contributed by manures and fertilizers with average cost of Rs 4,629.77 followed by expenditure on plant protection of an average of Rs 4,209.55. Average cost incurred on intercultural practices was Rs 4,088.89, followed by harvesting cost which accounted for an average of Rs 4,473.61. The least average share of operational cost was observed for training, pruning and miscellaneous cost which was Rs 1,806.81 and Rs 945.83.

Cost and returns from dragon fruit cultivation (up to 4 years) under pole system

Cost and return structure of dragon fruit cultivation under pole system during first four years are depicted in Table 5. The total cost of dragon fruit cultivation increased from Rs 1.13 lakh in first year to 1.56 lakh in fourth year. The rental value of land increased from Rs 40 thousand

to Rs 50 thousand, respectively. The amortized fixed cost remained constant throughout the year. The expenditure on operational cost increased from Rs 4,501.03 in the first year to Rs 33,551.67 in the fourth year.

During first year, no yield was obtained as plants were still in the establishment phase. Productivity commenced from second year at 3.52 quintals per acre and increased to 11.07 quintals per acre in third year and 20.90 quintals per acre in fourth year. Although market price declined from Rs 20,222.22 per quintal in second year to Rs 14,708.33 per quintal in fourth year. This decline in prices is mainly attributed to increased market arrivals, increased production and changes in demand and supply conditions. Gross returns increased from Rs 71,086.73 to Rs 3.07 lakh in fourth year due to increase in productivity. Net returns remained negative during first two years, later it increased from Rs 55,638.33 to Rs 1.52 lakh in the fourth year.

Financial analysis of dragon fruit cultivation (up to 4 years) under pole system

The financial analysis of dragon fruit cultivation under the pole system up to the fourth year is presented in Table 6. The total cost of cultivation increased from Rs 1.13 lakh in the first year to Rs 1.56 lakh in the fourth year, while gross returns increased from Rs 71,086.73 in the second year to Rs 3.07 lakh in the fourth year. The discounted returns and discounted costs were estimated at Rs 3.91 lakh and Rs 9.15 lakh, respectively. The benefit-cost ratio was 0.43 and net present value remained negative for first four years.

Operational cost of dragon fruit farm per acre under pole system (more than 4 years)

The operational cost of dragon fruit cultivation is depicted in Table 7. The total operational cost increased from Rs 4,103.72 in first year to Rs 33,526.35 sixth year. Among all the operational cost components, plant protection cost has the highest average annual expenditure of Rs 6,961.97, followed by manures and fertilizers with an average cost of Rs 4,408.12. The average expenditure on intercultural

Table 3: Establishment cost of dragon fruit cultivation under pole system in Punjab, 2025-26

Particulars	Value (Rs.)	(Rs/acre)
		Per cent
Land preparation	5308.02	1.04
Farm Yard Manure	5287.39	1.04
Planting material	115630.63	22.70
Transportation of plants	10317.57	2.03
Cement poles and rings	324701.89	63.73
Cement poles and rings installation cost	11854.95	2.33
Plantation cost	11125.23	2.18
Cost on installation of drip irrigation	25248.00	4.96
Total (Rs)	509473.68	100.00

Table 4: Operational cost of dragon fruit cultivation (up to 4 years) under pole system in Punjab, 2025-26

Particulars	Years				Total	Average cost per annum	Per cent
	I st	II nd	III rd	IV th			
Manures and fertilizers	1724.64	3679.17	6034.72	7080.56	18519.08	4629.77	24.91
Plant protection cost	1145.83	2815.28	5536.81	7340.28	16838.19	4209.55	22.65
Training and pruning	-	652.08	1794.03	2974.31	5420.42	1806.81	7.29
Intercultural practices	1384.72	3001.39	5257.64	6711.81	16355.56	4088.89	22.00
Harvesting cost	-	1530.56	3993.06	7897.22	13420.83	4473.61	18.05
Miscellaneous cost	245.83	835.42	1154.58	1547.50	3783.33	945.83	5.09
Total variable cost	4501.03	12513.89	23770.83	33551.67	74337.42	18584.35	100.00

Table 5: Cost and returns from dragon fruit cultivation (up to 4 years) under pole system in Punjab, 2025-26

Particulars	Years			
	I st	II nd	III rd	IV th
Rental Value of land	40000.00	40000.00	45000.00	50000.00
Amortized fixed cost	68207.74	68207.74	68207.74	68207.74
Operational cost	4501.03	12513.89	23770.83	33551.67
Interest on operational cost @12% p.a	540.12	1501.67	2852.50	4026.20
Total cost	113248.89	122223.29	139831.07	155785.60
Productivity (qtl/acre)	-	3.52	11.07	20.90
Price (qtl ⁻¹)	-	20222.22	17656.25	14708.33
Gross returns	-	71086.73	195469.40	307465.45
Net returns	-113248.89	-51136.57	55638.33	151679.85

Table 6: Financial analysis of dragon fruit cultivation (up to 4 years) under pole system, in Punjab, 2025-26

(Rs/acre)						
Years	Total Cost	Gross Returns	Cash Flow	Discount Factor	Discounted Returns	Discounted Cost
0	517923.95	-	-517923.95	1.00	-	517923.95
1	113248.89	-	-113248.89	0.89	-	101115.08
2	122223.29	71086.73	-51136.57	0.80	56669.90	97435.66
3	139831.07	195469.40	55638.33	0.71	139131.26	99528.99
4	155785.60	307465.45	151679.85	0.64	195399.85	99004.57
				Total	391201.02	915008.25
NPV = Rs -523807.23 B:C = 0.43						

practices was Rs 3054.70, while harvesting cost amounted Rs 2,612.82. The average annual cost incurred on training and pruning was Rs 1,170.13 whereas miscellaneous expenses accounted for an average of Rs 945.84. The rising operational cost over the years showed increasing requirement of inputs and crop management practices as the orchard age increases and increased productivity. Similar pattern was observed by Jadhav *et al.*, (2025) and Dewi *et al.*, (2023) where plant

protection cost has the highest share of the total operational cost expenditure.

Cost and returns from dragon fruit cultivation (more than 4 years) under pole system

The total cost of dragon fruit cultivation under the pole system increased steadily with the age of the orchard, rising from Rs 1.13 lakh in the first year to Rs 1.56 lakh in the sixth

Table 7: Operational cost of dragon fruit cultivation (more than 4 years) under pole system in Punjab, 2025-26
(Rs/acre)

Particulars	Years						Average cost per annum	Per cent
	I st	II nd	III rd	IV th	V th	VI th		
Manures and fertilizers	1564.10	2820.51	3953.85	4871.79	6123.08	7115.38	4408.12	23.01
Plant protection cost	1602.56	4069.23	5825.64	7797.44	10207.69	12269.23	6961.97	36.35
Training and pruning	-	432.82	797.44	1491.03	1940.51	2358.97	1170.13	6.11
Intercultural practices	723.08	2044.87	2805.13	3441.03	4183.33	5130.77	3054.70	15.95
Harvesting cost	-	948.72	2102.56	3335.90	4282.05	5007.69	2612.82	13.64
Miscellaneous cost	213.98	409.46	748.39	1211.83	1447.09	1644.30	945.84	4.94
Total operational cost	4103.72	10725.62	16233.00	22149.00	28183.76	33526.35	19153.58	100.00

year. The rental value of land increased from Rs 40,000.00 in the first year to Rs 50,000.00 from the fifth year onwards, whereas the amortized fixed cost remained constant at Rs 68,207.74. The operational cost increased from Rs 4,103.72 in the first year to Rs 33,526.35 per acre in the sixth year. During first year there was no yield obtained. In the second year 5.20 quintal per acre of yield was obtained and increased continuously to 52.03 quintal per acre in the sixth year. The sale price declined from Rs 25,416.67 per quintal in the second year to Rs 15,576.92 per quintal in the sixth year. Despite of the decline in price, gross returns increased from Rs 1.32 lakh in the second year to Rs 8.10 lakh in the sixth year due to the increased productivity. The net returns increased from Rs 9,446.24 in the second year to Rs 6.55 lakh in the sixth year, showing dragon fruit cultivation under the pole system became increasingly profitable as the orchard matured. Dewi *et al.*, (2023) observed, profitability remained low during initial years because of high establishment cost and limited production. Kikon *et al.*, (2021) found, dragon

fruit started giving returns after entering into full bearing stage.

Financial analysis of dragon fruit cultivation (more than 4 years) under pole system

In the Table 9 financial analysis of dragon fruit cultivation under pole system is depicted. The financial indicator net present value was evaluated at Rs 6.85 lakh, benefit-cost ratio of 1.65 was computed which means for every one rupee spent on the project it generated Rs 1.65 in total benefits and internal rate of returns of 33 per cent was observed, which was higher than the assumed rate of interest. This reflected the profitability of dragon fruit cultivation under pole system.

Payback period of dragon fruit cultivation (more than 4 years) under pole system

The payback period analysis indicated that the cumulative cash flow remained negative from the year of establishment up to the third year. The cumulative discounted cash flow turned positive in the fourth year, reaching Rs 13,936.16,

Table 8: Cost and returns from dragon fruit cultivation (more than 4 years) under pole system

(Rs/acre)

Particulars	Years					
	I st	II nd	III rd	IV th	V th	VI th
Rental value of land	40000.00	42500.00	45000.00	47500.00	50000.00	50000.00
Amortized fixed cost	68207.74	68207.74	68207.74	68207.74	68207.74	68207.74
Operational cost	4103.72	10725.62	16233.00	22149.01	28183.76	33526.35
Interest on operational cost @12% PA	492.45	1287.07	1947.96	2657.88	3382.05	4023.16
Total cost	112803.91	122720.43	131388.70	140514.63	149773.55	155757.25
Productivity (qtl/acre)	-	5.20	20.48	35.13	41.78	52.03
Price (qtl ⁻¹)	-	25416.67	23153.85	20692.31	17884.62	15576.92
Gross returns	-	132166.67	474119.53	726883.63	747255.92	810399.41
Total net returns	-112803.91	9446.24	342730.83	586369.00	597482.36	654642.16

Table 9: Financial analysis of dragon fruit cultivation (more than 4 years) under pole system in Punjab, 2025-26 (Rs/acre)

Year	Total Cost	Gross Returns	Cash Flow	Discount Factor	Discounted Returns	Discounted Cost
0	509473.68	0.00	-509473.68	1.00	0.00	509473.68
1	112803.91	0.00	-112803.91	0.89	0.00	100717.77
2	122720.43	132166.67	9446.24	0.80	105362.46	97831.97
3	131388.70	474119.53	342730.83	0.71	337468.91	93519.88
4	140514.63	726883.63	586369.00	0.64	461947.69	89299.59
5	149773.55	747255.92	597482.36	0.57	424013.08	84985.54
6	155757.25	810399.41	654642.16	0.51	410573.56	78911.47

NPV = Rs 684625.79 B:C = 1.65 IRR = 33%

Table 10: Payback period of dragon fruit cultivation (more than 4 years) under pole system in Punjab 2025-26 (Rs/acre)

Year	Discounted Net Returns @12%	Cumulative Cash Flow
0	-509473.68	-509473.68
1	-100717.77	-610191.45
2	7530.48	-602660.97
3	243949.03	-358711.94
4	372648.10	13936.16
5	339027.54	352963.70
6	331662.09	684625.79
Payback Period		3.9

and continued to increase to Rs 6.84 lakh by the sixth year. The estimated payback period was 3.9 years, indicating that the initial investment in dragon fruit cultivation under the pole system could be recovered within approximately four years of establishment. This reflects the long-term financial viability of the enterprise despite of its high initial investment.

Expected 20 years cost and returns from dragon fruit cultivation

As the study included dragon fruit plantations of different age groups, substantial variations were observed in the cost structure across 37 sampled dragon fruit growers under pole system. Therefore, estimation based on pooled data were unreliable. Thus, the data from dragon fruit growers with plantations of up to four years and more than four years were pooled to estimate the expected costs by considering 20 years expected life of the dragon fruit.

Expected operational cost of dragon fruit cultivation under pole system

The operational cost of dragon fruit cultivation under pole system over a year of 20 years is depicted in Table 11. The operational cost showed an increasing trend from first year to ninth year increased from Rs 1,588.89 to Rs

57,683.63. Later from tenth year to fifteenth year, it remained near about same from Rs 52,925.11 to Rs 54,228.72. After this operational cost declined to Rs 43,486.14 in the twentieth year. This increase in operational cost was mainly due to expenditure on manures and fertilizers, plant protection, intercultural practices, training and pruning and harvesting as the orchard reached its productive stage. The subsequent decline in later years showed a reduction in input use and harvesting requirement as the orchard aged.

Among various operational cost components, plant protection cost has the major share throughout 20 years of period, increasing from Rs 578.70 in first year to Rs 15,671.60 in ninth year. From tenth year to fifteenth year it remained constant at Rs 14,246.91 after this it declined to Rs 10,827.65 in twentieth year. Similarly, expenditure on manures and fertilizers increased from Rs 564.81 to Rs 12,252.48 from first year to ninth year and then remained constant from tenth year to fifteenth year at Rs 11,138.62 and later it started to decline and reached at Rs 8,465.35 in twentieth year. Harvesting cost was zero in first year as there was no yield in the year of establishment. Harvesting cost increased from Rs 342.59 in the second year to 11,888.32 in the ninth year. In tenth year, it was Rs 10,807.56 and

Table 11: Expected operational cost of dragon fruit cultivation under pole system (Expected age = 20 years)**(Rs/acre)**

Years	Manures and fertilizers	Plant protection cost	Training and pruning	Intercultural practices	Harvesting cost	Miscellaneous cost	Operational cost
1	564.81	578.70	0.00	261.11	0.00	184.26	1588.89
2	1018.52	1469.44	156.30	738.43	342.59	352.59	4077.87
3	2529.63	2790.09	287.96	1883.78	759.26	676.89	8927.62
4	4098.20	4565.77	946.85	3155.86	2164.86	1104.50	16036.04
5	6065.77	7177.93	1845.50	4880.18	4094.59	1429.10	25493.06
6	7092.79	9072.07	2758.11	6156.31	6881.98	1689.82	33651.08
7	7797.03	9972.84	3031.96	6767.56	7565.29	1950.54	37085.23
8	10024.76	12822.22	3898.23	8701.15	9726.80	2211.26	47384.43
9	12252.48	15671.60	4764.51	10634.74	11888.32	2471.98	57683.63
10	11138.62	14246.91	4331.37	9667.95	10807.56	2732.70	52925.11
11	11138.62	14246.91	4331.37	9667.95	10807.56	2993.42	53185.83
12	11138.62	14246.91	4331.37	9667.95	10807.56	3254.14	53446.56
13	11138.62	14246.91	4331.37	9667.95	10807.56	3514.86	53707.28
14	11138.62	14246.91	4331.37	9667.95	10807.56	3775.59	53968.00
15	11138.62	14246.91	4331.37	9667.95	10807.56	4036.31	54228.72
16	10024.76	12822.22	3898.23	8701.15	9726.80	4297.03	49470.20
17	9356.44	11967.40	3638.35	8121.08	9078.35	4557.75	46719.37
18	9133.67	11682.47	3551.72	7927.72	8862.20	4818.47	45976.25
19	8688.12	11112.59	3378.47	7541.00	8429.90	5079.19	44229.27
20	8465.35	10827.65	3291.84	7347.64	8213.75	5339.91	43486.14

remained same till fifteenth year and declined to Rs 8,213.75 in twentieth year. Same trend was followed by training and pruning, intercultural operations and miscellaneous cost. Overall, the operational cost reflected the growth, peak productivity, stagnation and ageing phases of the dragon fruit cultivation under pole system.

Expected cost and return of dragon fruit cultivation under pole system

The expected cost and returns of dragon fruit cultivation under pole system over 20 years. The total cost increased from Rs 1.09 lakh in the first year to 1.72 lakh in the fifteenth year this increase was due to increase in total operational cost and declined in later years. The amortized fixed cost remained constant at Rs 68,207.74. The rental value of land increased from Rs 40,000 in the fifth year to Rs 50,000 from the fifth year onwards. The dragon farm started giving yield from second year with a productivity of 1.83 quintals per acre and increased up to 50.00 quintals per acre during ninth year, showing peak bearing stages and gradually declined to 38.00 quintals per acre during twentieth year. The sale price varied over the years, Rs 25,666.67 per quintal in the second year

to Rs 10,000 per quintal during thirteenth to twentieth year. Gross returns increased from Rs 46,893.69 in the second year to Rs 7.15 lakh in the ninth year and remained constant at Rs 6.00 lakh from tenth to twelfth year and declined to 3.8 lakh in the twentieth year. Net returns became positive from third year onwards and became positive from third year onwards and increased to 5.4 lakh in the ninth year and declined to 2.18 lakh in the twentieth year.

Expected financial analysis of dragon fruit cultivation under pole system

A perusal of Table 13 shows the expected financial analysis of dragon fruit cultivation under pole system over an economic life of 20 years. The investment required during initial years resulted in negative cash flows of Rs 1.09 lakh in the first year and Rs 67,891.91 in the second year due to absence of returns and low initial productivity. From the third year, dragon fruit cultivation generated positive cash flow which increased gradually and reached at maximum of Rs 5.39 lakh in the ninth year. After this cash flow gradually declined with the age of the orchard but remained positive throughout the remaining years. The decreased discount

Table 12: Expected cost and Return of dragon fruit cultivation under pole system (Expected age = 20 years)
(Rs/acre)

Years	Rental Value of Land	Amortized Fixed Cost	Operational Cost	Total Cost	Productivity (Quintal/acre)	Price	Gross Returns	Net Returns
1	40000.00	68207.74	1588.89	109796.63	0.00	0.00	0.00	-109796.63
2	42500.00	68207.74	4077.87	114785.61	1.83	25666.67	46893.69	-67891.91
3	45000.00	68207.74	8927.62	122135.36	7.19	24423.08	175714.14	53578.78
4	47500.00	68207.74	16036.04	131743.77	14.62	25023.81	365911.22	234167.44
5	50000.00	68207.74	25493.06	143700.80	21.86	17553.57	383743.21	240042.41
6	50000.00	68207.74	33651.08	151858.82	31.84	14305.56	455470.85	303612.03
7	50000.00	68207.74	37085.23	155292.97	35.00	14000.00	490000.00	334707.03
8	50000.00	68207.74	47384.43	165592.17	45.00	13000.00	585000.00	419407.83
9	50000.00	68207.74	57683.63	175891.37	55.00	13000.00	715000.00	539108.63
10	50000.00	68207.74	52925.11	171132.85	50.00	12000.00	600000.00	428867.15
11	50000.00	68207.74	53185.83	171393.57	50.00	12000.00	600000.00	428606.43
12	50000.00	68207.74	53446.56	171654.29	50.00	12000.00	600000.00	428345.71
13	50000.00	68207.74	53707.28	171915.01	50.00	10000.00	500000.00	328084.99
14	50000.00	68207.74	53968.00	172175.73	50.00	10000.00	500000.00	327824.27
15	50000.00	68207.74	54228.72	172436.46	50.00	10000.00	500000.00	327563.54
16	50000.00	68207.74	49470.20	167677.94	45.00	10000.00	450000.00	282322.06
17	50000.00	68207.74	46719.37	164927.11	42.00	10000.00	420000.00	255072.89
18	50000.00	68207.74	45976.25	164183.98	41.00	10000.00	410000.00	245816.02
19	50000.00	68207.74	44229.27	162437.01	39.00	10000.00	390000.00	227562.99
20	50000.00	68207.74	43486.14	161693.88	38.00	10000.00	380000.00	218306.12

factor from 0.89 in the first year to 0.10 in the twentieth year, showed time value of the money. The discounted returns increased from Rs 37,383.37 in the first year to Rs 2.58 lakh in the ninth year and later declined to Rs 39,393.37 in the twentieth year. Similarly, discounted cost increased from Rs 98,032.70 in the first year to 16,762.28 in the twentieth year due to discounting. The net present value was estimated at Rs 15.77 lakh indicating net benefits over the 20 years of economic life. The benefit-cost ratio of 2.46 was evaluated showing that every rupee invested generated a return of Rs 2.46 whereas the internal rate of returns 72 per cent which was considerably high than the assumed discount rate. This showed that dragon fruit cultivation under pole system was financially sound and profitable investment over its 20 year of economic life.

Similar study was done by Kikon *et al.*, (2021) for 20 years, similar observation was made, positive net present value (Rs 2.08,29,478.00) was evaluated benefit-cost ratio of 2.04 and internal rate of return of 11.78 was analyzed, which clearly indicated the sound financial position of dragon fruit cultivation.

Conclusions and Policy Implications

The results indicated that dragon fruit cultivation requires a high establishment investment of Rs 5.09 lakh per acre, with major expenditure on cement poles and rings. Operational costs increased with the increase in the age of the orchard. The major expenditure was attributed by manures and fertilizers followed by plant protection, intercultural operations and harvesting. The projected analysis over 20 years confirmed the long-term profitability of dragon fruit cultivation. Gross returns increased from Rs 46,893.69 per acre in the second year to Rs 7.15 lakh per acre in the ninth year and gradually declined to 3.80 lakh in the twentieth year. Net returns remained positive from the third year onwards and reached a maximum of Rs 5.39 lakh per acre in the ninth year and declined to 2.18 lakh in the twentieth year. The financial analysis revealed a net present value of Rs 15.78 lakh per acre, a benefit-cost ratio of 2.46 and an internal rate of return of 72 per cent, while the estimated payback period was 3.9 years. These indicators reflected that dragon fruit cultivation under pole system was financially viable and profitable long-term investment. Overall results highlighted

Table 13: Expected financial analysis of dragon fruit cultivation under pole system (Expected age = 20 years)
(Rs/acre)

Years	Total Cost	Gross Returns	Cash Flow	Discount Factor	Discounted Returns	Discounted Cost
1	109796.63	0.00	-109796.63	0.89	0.00	98032.70
2	114785.61	46893.69	-67891.91	0.80	37383.37	91506.38
3	122135.36	175714.14	53578.78	0.71	125069.85	86933.54
4	131743.77	365911.22	234167.44	0.64	232543.19	83725.55
5	143700.80	383743.21	240042.41	0.57	217746.20	81539.69
6	151858.82	455470.85	303612.03	0.51	230755.71	76936.40
7	155292.97	490000.00	334707.03	0.45	221651.12	70246.65
8	165592.17	585000.00	419407.83	0.40	236271.69	66879.90
9	175891.37	715000.00	539108.63	0.36	257836.17	63428.19
10	171132.85	600000.00	428867.15	0.32	193183.94	55100.20
11	171393.57	600000.00	428606.43	0.29	172485.66	49271.56
12	171654.29	600000.00	428345.71	0.26	154005.06	44059.38
13	171915.01	500000.00	328084.99	0.23	114587.10	39398.48
14	172175.73	500000.00	327824.27	0.20	102309.91	35230.57
15	172436.46	500000.00	327563.54	0.18	91348.13	31503.50
16	167677.94	450000.00	282322.06	0.16	73404.75	27351.90
17	164927.11	420000.00	255072.89	0.15	61170.62	24020.70
18	164183.98	410000.00	245816.02	0.13	53316.23	21350.42
19	162437.01	390000.00	227562.99	0.12	45281.64	18860.04
20	161693.88	380000.00	218306.12	0.10	39393.37	16762.28
					2659743.70	1082138.04
NPV = Rs 1,577,605.66 IRR = 72% B:C = 2.46						

that there is need of capital subsidies, concessional long-term credit and strengthening extension services for sustainable expansion of dragon fruit cultivation in Punjab.

References

- Akhil N K, Prahadeeswaran M, Shivakumar K M, Sivakumar V, and Selvi R G 2024. Exploring the dynamics of dragon fruit production and its constraints in southern states of India. *Plant Science Today*, **11**: 1-9. <https://doi.org/10.14719/pst.5592>
- Anonymous 2026. State-wise area and production of dragon fruit in India. India Stat <https://www.indiastat.com/>
- Anonymous 2025. Area and Production of Horticulture crops. Ministry of agriculture and farmers welfare, Government of India. <https://www.agriwelfare.gov.in>
- Arivalagan M, Sriram S, Karunakaran G 2019. Dragon fruit country report from India. FFTC Agricultural Policy Platform (FFTC-AP): 1-8. <https://ap.fttc.org.tw/article/1603>
- Balaji M, Das U and Vashishth R 2025 Dragon fruit (*Hylocereus* spp.) as a potential crop for nutraceutical properties, livelihood enhancement and climate change mitigation. *Cogent Food & Agriculture* **11**:2544956 (Abstr.). <https://doi.org/10.1080/23311932.2025.2544956>
- Chongloi L, Gunnaiah R, Hipparagi K, Guranna P, Prakasha D P, Chittapur R and Vishweshwar S 2022. Economic analysis of micropropagation of dragon fruit (*Hylocereus undatus* (Haw.) Britton and Rose). *International Journal of Plant & Soil Science* **34**:1267-1275. <https://www.sdiarticle5.com/review-history/91310>
- Dhakal A R, Mahatara B, Parajuli S, Budhathoki S, Paudel S, Regmi S 2021. Farmers' knowledge level and readiness in adoption of dragon fruit (*Hylocereus* Sp.) in Chitwan District, Nepal. *Food and Agriculture Economics Review (FAER)* **1**:57-63. <https://doi.org/10.26480/faer.01.2021.57.63>
- Dewi T R, Wardani I, and Solikah U N 2023. Feasibility analysis of dragon fruit (*Hylocereus polyrhizus*) farming in the organic village of Beji village, Wonogiri Regency. *International Journal of Economics, Business and Accounting Research* **7**: 1-7. <https://jurnal.stie-aas.ac.id/index.php/IJEBAR>

- Ghosh M K, Jahan M L, Farjana F, Hasan M Z and Nahian K A 2023. Possibilities and challenges of dragon fruit in Chapainawabganj region of Bangladesh from the growers perspective. *Turkish Journal of Agriculture-Food Science and Technology* **11** :682-693. <https://doi.org/10.24925/turjaf.v11i4.682-693.5517>
- Hossain F M, Numan S M N and Akhtar S 2021. Cultivation, nutritional value, and health benefits of dragon fruit (*Hylocereus* spp.): A Review. *International Journal of Horticultural Science and Technology*, **8**: 259-269. <http://ijhst.ut.ac.ir/>
- Jadhav R R, Tawale J B, Shelke R D, Kamble S H and Pawar A 2025. Constraints faced by dragon fruit growers in the production and marketing of dragon fruit in Latur district of Maharashtra. *International Journal of Research in Agronomy* **8**:70-72. <https://www.doi.org/10.33545/2618060X.2025.v8.i8Sb.3485>
- Kakade V D, Morade A, Chavan S, Jadhav S, Salunkhe V, Boraiah K M and Kadam D 2023. Dragon fruit cultivation for doubling the farmers income. In: Climate Change and Abiotic Stresses Management Solutions for Enhancing Water Productivity, Production Quality and Doubling Farmers Income in Scarcity Zones. pp 63.
- Kikon P L, Kashyap D, Choudhury J, Devi H A and Devi R R 2021. Investment feasibility analysis of dragon fruit farming. *International Journal of Agricultural Sciences*, **17**: 265-270. <https://doi.org/10.15740/HAS/IJAS/17.2/265-270>
- Thirugnanasambandham K, Sivakumar V and Prakash Maran J 2014. Process optimization and analysis of microwave assisted extraction of pectin from dragon fruit peel, *Carbohydrate Polymers* **112**: 622-626, <https://doi.org/10.1016/j.carbpol.2014.06.044>
- Mehta A, Khatiwada R, Lamichhane P, Mandal A, Chaudhary P K and Aryal S 2024. Dragon fruit cultivation, profitability, and production efficiency in Southern Terai, Nepal. *International Journal of Horticultural Science and Technology* **11**: 469-480. <http://ijhst.ut.ac.ir/>
- Pavan P R, Kerutagi M, Prakasha D P, Sabarad A, Pattepur S, Anjappa P and Naika M 2025. Financial feasibility and profitability analysis of dragon fruit cultivation. *International Journal of Research in Agronomy* **12**: 1-9 <https://doi.org/10.14719/pst.8018>
- Thokchom A, Hazarika BN, Angami T 2019. Dragon fruit: an advanced potential crop for Northeast India. *Agriculture & Food. e-Newsletter* **1**: 253–254. <http://www.agrifoodmagazine.co.in/>
- Wakchaure G C, Kumar S, Meena K K, Rane J and Pathak H 2020. Dragon fruit cultivation in India: Scope, marketing, constraints and policy issues. National Institute of Abiotic Stress Management, Pune, Maharashtra, India. pp 54.

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