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Sustainable Economic Feasibility Approach towards Cultivation of Strawberry in Jammu Region of J&K UT



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ABSTRACT

The present study was conducted in Jammu region of J&K UT. Three districts from the Jammu region were chosen purposively based on having highest cultivated area under strawberry crop in Jammu division. The list of strawberry growers of various selected districts was prepared with the help of Directorate of Horticulture, Jammu. The proportionate allocation method was used for selection of the respondents using random sampling techniques to make a total sample size of 100 respondents. Both primary and secondary data were collected to accomplish the objectives. Primary data was obtained by interviewing the respondents through a well prepared schedule cum questionnaire. The required secondary data were collected from various published sources/ agencies such as Economic Survey, Digest of Statistics, National Horticulture Board, Annual reports and other relevant government publications etc. CACP Cost concepts were used to find out the desired outcomes. The findings of the study revealed that the overall average cost of cultivation for strawberry was calculated at Rs.187693.90 per acre for Jammu region which includes the largest average share of runners (49.96%). The overall average yield and the gross returns were found out to be 2741.72kg/acre and Rs.438675.00 per acre respectively for the Jammu region. Thus the net return obtained was Rs.250981.10 per acre and the cost-benefit was found to be 1:2.34 which means strawberry cultivation is very beneficial to the farmers as if they invest one rupee, then they will get 2.34 rupees as net benefit. Strawberry farming faces challenges such as reliance on chemical inputs, water scarcity and soil erosion. This study offers valuable insights into mitigation strategies, promoting practices like integrated pest management and drip irrigation. These approaches can help farmers adopt more sustainable methods while maintaining crop yield and quality. Also various sustainable cultivating practices must be employed to mitigate the negative environmental impact of this horticultural crop.

Keywords: Strawberry, horticulture, CACP, gross returns, cost-benefit ratio, cultivation, environmental impact

Introduction

Strawberry (*Fragaria* × *ananassa*) being a non-climacteric fruit belonging to rosaceae. Strawberry harvest has a small commercial window of 7-8 days. Strawberry is grown on one million ha of land in India with a yield of 520 mt as per productivity is concerned [1]. The total area under strawberry farming in Jammu and Kashmir is roughly 152 hectares with a production of 425 million tonnes [2]. The majority of output in the Jammu and Kashmir takes place in districts such as Samba, Jammu, Kathua, Rajouri, Udhampur and Doda. Strawberry farming is extremely profitable when compared to other fruit crops as it has the potential to create more income in short period of time. Raising strawberries for profit is dependent on a mix of four factors: enhance production methods, farmer organization for marketing objectives in each producing area, market and marketing knowledge, and merchandising. Various synthetic and organic types of mulch are utilized for strawberry growth in various parts of the country, depending on climatic circumstances and raw material availability [4]. Nevertheless, strawberry production has faced many challenges that have put pressure on research teams across the world to develop new

mechanisms of adaptation to meet the increasing demand for high-quality strawberry production [5]. The biggest threats to strawberry production are extreme weather and pressure from pests and disease [6] [7]. Cultivars have been developed to curtail some of these challenges and to satisfy consumer preferences regarding fruit quality [8]. In Jammu and Kashmir, strawberry growing has proven to be a reliable source of revenue. Though, strawberry farming in Jammu and Kashmir has recently produced remarkable results, becoming a significant source of income and offering plenty of opportunity to the region's youth. The commercial demand for strawberries has grown over the past few years, resulting in increasing cultivation revenue. The government is also very interested in promoting strawberry farming in Jammu and Kashmir. The Horticulture Department offers small farmers subsidies if they want to grow strawberries. The Department of Horticulture Jammu provides incentives of Rs. 13000 per 505.85 square meters to the farmers to boost strawberry cultivation in Jammu with certain requirements like minimum of one kanal of land, land revenue record, aadhaar card, PRI recommendation, photographs and bank account [3]. The focus for growers will be on cultivars and technologies that encourage year-round, high-quality, delicious strawberries to meet the growing customer demand for locally farmed, fresh goods.

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Research Methodology

The present study was carried out in the agricultural year 2021-2022.

The elucidation of the locale of the study, collection of the data, sampling design and structure and experimental procedure and techniques adopted during the course of investigation are discussed.

a) Locale of study: The present study was conducted in Jammu region of the UT of Jammu and Kashmir.

b) Period of the study: The reference period of this study was agriculture year 2021-2022.

c) Sampling design

i) Selection of districts: Three districts from the Jammu region were selected purposively on the basis of having highest area under strawberry crop in Jammu division.

ii) Selection of Farmers: The list of strawberry growers of various selected districts was prepared with the help of Directorate of Horticulture, Jammu. The proportionate allocation method was used for selection of the respondents using random sampling techniques to make a total sample size of 100 respondents.

d) Collection of data

Both primary and secondary data were collected to accomplish the objectives. The required secondary data were collected from various published sources/ agencies such as Economic Survey, Digest of Statistics, National Horticulture Board, Annual reports, and other relevant government publications etc.

e) Cost and Returns Analysis

To meet the study's aims, CACP (Commission for Agricultural Costs and Prices) concepts were used to calculate costs and returns, such as Cost A, B, C, and so on.

Cost A₁= It includes costs and kind expenses actually incurred by cultivators which are as follows:

- (i) Wage of hired human labour
- (ii) Charges for machine labour
- (iii) Runners
- (iv) Runner's treatment
- (v) Cost of Fertilizers
- (vi) Manure
- (vii) Mulching
- (viii) Plant protection
- (ix) Irrigation charges
- (x) Interest on working capital
- (xi) Land revenue and depreciation

Cost A₂= Cost A₁ + rent paid for leased land

Cost B₁= Cost A₂ + interest on value of owned fixed capital assets.

Cost B₂= Cost B₁ + rental value of owned land

Cost C₁= Cost B₁ + imputed value of family labour.

Cost C₂= Cost B₂ + imputed value of family labour.

Cost C₃= Cost C₂ + 10 per cent of Cost C₂ (as managerial cost)

Gross returns

Gross returns from the strawberry crop per acres were obtained by the value of the main product (fruit) realized per acre from the crop. Prices of main product (fruit) used to arrive at gross returns.

Net Income/Returns

It is also called profit at Cost C. It gives an estimate of returns to the farmer for his labour and profit. It was calculated as:
Net Income = Gross returns – Cost C₂

Benefit Cost Ratio (returns per rupee)

It was calculated as:

BC Ratio = Gross Income / Cost C₂

Results and Discussion

Cost structure for strawberry cultivation

The cost structure for the strawberry crop is shown in Table 1, with the major operational costs being those for labour (both human and machine), runners, runner's treatment, fertilizers, manure, mulching, irrigation costs, and plant protection chemicals. Similar to this, the main elements of fixed cost were depreciation on agricultural equipment as land preparation was one of the most important operation step in strawberry cultivation required a lot of machinery for manipulating land, interest on fixed capital (excluding land), and rental value of owned land.

The results of both the operational cost and fixed cost and their sum total were mentioned in the Table 1. The results revealed that total cost of cultivation for strawberry was highest in district Rajouri (Rs. 257243.48 per acre) as compared to Kathua (Rs. 189028.52 per acre) and Jammu (Rs. 181935.89 per acre) with overall cost of about Rs. 87693.90 per acre for Jammu region. Among operational cost, expenditure on runners (planting material) was the dominant portion of operating costs, followed by spending on human labour, and mulch cost. Lack of locally accessible runners in nearby places is the cause of the high cost of runners. The percentage share of runners out of total operational cost was about 46.11 per cent, 46.39 per cent and 63.50 per cent in district Jammu, Kathua and Rajouri respectively and the overall was about 49.96 per cent. The operational cost accounted for 90.35 per cent, 90.02 per cent, 91.88 per cent for districts Jammu, Kathua and Rajouri respectively. However, overall cost of operational cost was found about 90.18 per cent which was about Rs. 169276.70 per acre. Although the overall fixed cost was about Rs. 18417.16 per acre constituted 9.81 % of total cost. The total cost of cultivation was found to be highest in district Rajouri which was about Rs. 257243.48 per acre and was about Rs. 189028.52 per acre and Rs. 181935.89 per acre in Kathua and Rajouri districts respectively.

Cost concept-wise analysis of strawberry cultivation.

The data presented in Table 2 represents the cost incurred on strawberry cultivation in various districts and overall strawberry growers for the cultivation of strawberry per acre in Jammu region. Thus per acre cost-A₁ in the districts of Jammu, Kathua, and Rajouri was approximately Rs. 147080.16, Rs. 155148.35, and Rs. 231201.90, respectively, with an overall average of Rs. 155898.69 on all farms. The other various cost concepts that were worked out on a per acre basis and presented in Table 2 in order to have a detailed view of the cost of strawberry cultivation. Runners cost, human labour, mulching, machine labour were the main components of Cost-A₁. Cost-A₂ incurred for cultivation in selected districts were the same as that of Cost-A₁ because rent paid for leased land was found zero in the three selected districts. Likewise, per acre, Cost-B₁ was Rs. 147915.46, Rs. 156046.15 and Rs. 232195.98 respectively whereas cost-B₂ was Rs. 153915.46, Rs. 161046.15 and Rs. 237195.98 respectively.

On all farm, per acre cost- B₁ and cost-B₂ was about Rs. 156775.69 and Rs.162025.69. The table 4.5 further disclosed that per acre cost- C₁ was found to be Rs.175935.88, Rs.184028.52 and Rs.252243.48 respectively in case of district Jammu, Kathua and Rajouri per acre cost- C₂ was Rs.1819335.89, Rs.189028.52 and Rs.257243.48 respectively. After calculating the management cost, which is equal to 10% of cost-C₂, the per-acre costs-C₃ for the districts of Jammu, Kathua, and Rajouri were found to be Rs. 200129.47, Rs. 218931.38, and Rs.282967.83, respectively with an overall average of Rs. 206463.29 per acre on all farms.

Cost and return structure of strawberry cultivation

The total costs incurred, gross returns, net returns, and cost benefit ratios realized on an acre basis in the respective districts in the study area were analysed and presented in Table 3, which showed that the total cost per acre was higher for farms in district Rajouri (Rs.257243.48 /acre) as compared to farms in district Jammu (Rs.181935.88/acre) and district Kathua (Rs.189028.52/acre). Meanwhile, the average price per acre across all farms was Rs.187693.90. Farms in the district of Jammu had the highest gross returns, which came to around (Rs.454630.40/ acre), followed by those in the district of Kathua (Rs.449361.70/ acre), and lowest in farms in the district of Rajouri (Rs.438675.00/acre), respectively.

Farms in the district of Jammu had the highest net returns per acre (Rs. 272694.52/ acre), followed by those in the district of Kathua (Rs. 260333.18/ acre). Gross returns and net returns were, respectively, Rs. 438675.00 per acre and Rs. 250981.10 per acre across all farms, with a cost-benefit ratio of 1:2.34.

Returns over various costs of strawberries on sampled farms under study

The cost-based economics of strawberries are shown in Table 4, which shows that the per-acre net returns of strawberry production over costs A₁, A₂, B₁, B₂, C₁, C₂, and C₃ were, respectively, Rs. 282776.31, Rs. 282776.31, Rs. 281899.31, Rs. 276649.31, Rs. 256231.10, Rs. 250981.10, and Rs. 232211.71 on all farms. The returns on investment per rupee were Rs.2.81, Rs.2.81, Rs.2.79, Rs.2.70, Rs.2.40, Rs. 2.33, and Rs.2.12 for all farms over cost-A₁, cost-A₂, cost-B₁, cost-B₂, cost-C₁, cost-C₂, and cost-C₃, respectively.

Farms in the district of Jammu had the greatest cost-C₂ returns per rupee (Rs.2.58), followed by those in the district of Kathua (Rs.2.37) and then in the district of Rajouri (Rs.1.45). It was discovered that all farms, across all districts, saw a decline in net returns and returns per rupee from cost-A₁ to cost-C₃.

Conclusions

The overall cost of cultivation per acre found in Jammu region was about Rs.187693.90. The cost incurred on cost of runners (plant material) was found to be the highest among all the selected three districts under study. On an average about 2741.72 kilos per acre yield was found in the Jammu region as a whole. The overall gross returns for Jammu region were found to be Rs.438675.80 per acre. The overall cost-benefit ratio for the Jammu region was calculated to be 1: 2.34. As it is evident from the results that strawberry farming is a very lucrative opportunity for farmers in India and at the same time, it is necessary to recognize and address the environmental impacts of this crop. Fortunately, there are ways to mitigate these impacts and promote sustainable strawberry farming practices for example for reducing the use of chemical inputs, such as fertilizers, pesticides, and herbicides, farmers can adopt integrated pest management techniques, crop rotation, and cover cropping to minimize the need for agrochemicals, use drip irrigation and rainwater harvesting to optimize water usage and minimize wastage, soil conservation practices such as no-till farming and intercropping can help to maintain soil health and reduce erosion, etc.

Recommendations

Strawberry being a high value crop, giving an overall higher cost benefit ratio in Jammu Region of **1:2.34**, the area under such crops should be extended in order to increase the incomes of the farmers. Jammu region has eminence potential to become the larger production hub of strawberry in Jammu and Kashmir. The adoption of strawberry farming in the region would help the farmers to get the better remuneration and through which, they would able to double their income. Adoption of sustainable farming practices, strawberry farmers can benefit not only financially, but also environmentally. A sustainable approach can ensure long-term success and viability for farmers, while also preserving the natural resources and ecosystems.

Future Scope: Further research could explore the long-term effects of these sustainable practices on biodiversity and soil health, as well as their economic viability for farmers.

Conflict of Interest: The authors declare no conflicts of interest related to this study.

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Table 1 Cost structure-wise cost of cultivation of strawberry in all sampled farms (Rs./Acre)

Sr. No.	Particulars	Jammu	Kathua	Rajouri	Overall
A.	Operational cost				
1	Machine Labour	6087.86 (3.34)	5702.97 (3.01)	5563.78 (2.16)	2745.17 (1.46)
2	Human Labour				
	Hired	11885.90 (6.53)	18251.80 (9.65)	16129.03 (6.26)	14757.87 (7.86)
	Owned	28020.42 (15.40)	27982.37 (14.80)	20047.50 (7.79)	25668.19 (13.67)
3	Runners	83904.00 (46.11)	87692.32 (46.39)	163354.80 (63.50)	93773.44 (49.96)
4	Runner's Treatment	699.52 (0.39)	657.98 (0.34)	369.03 (0.14)	625.78 (0.33)
5	Fertilizers	1383.59 (0.76)	2452.79 (1.29)	2434.96 (0.94)	2165.25 (1.15)
6	Manure	8019.20 (4.40)	9543.19 (5.04)	8739.78 (3.39)	8653.12 (4.61)
7	Mulching	18000.00 (9.89)	12000.00 (6.34)	12000.00 (4.66)	14929.69 (7.95)
8	Irrigation charges	796.81 (0.43)	473.95 (0.25)	413.65 (0.16)	620.64 (0.33)
9	Plant protection	985.6 (0.54)	608.92 (0.32)	0.00 (0.00)	481.25 (0.25)
10	Interest on working capital @7%	4611.68 (2.53)	4808.43 (2.54)	7315.17 (2.84)	4856.32 (2.58)
Sub-total (1 to 10)		164394.59 (90.35)	170174.71 (90.02)	236367.70 (91.88)	169276.70 (90.18)
B.	Fixed cost				
1	Rental value of land	6000.00 (3.29)	5000.00 (2.64)	5000.00 (1.94)	5250.00 (2.79)
2	Rent paid on leased inland	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
3	Depreciation	10706.00 (5.88)	12956.00 (6.85)	14881.70 (5.78)	12290.16 (6.54)
4	Interest on fixed capital @ 11%	835.30 (0.45)	897.80 (0.47)	994.08 (0.38)	877.00 (0.46)
	Sub-total (1 to 4)	17541.30 (9.64)	18853.80 (9.97)	20875.78 (8.11)	18417.16 (9.81)
Total cost (A) + (B)		181935.89 (100.00)	189028.52 (100.00)	257243.48 (100.00)	187693.90 (100.00)

Table 2 Concept-wise Cost of Cultivation of Strawberry on sampled farms (Rs/Acre)

	Particulars	Jammu	Kathua	Rajouri	Over all
COST-A ₁	Hired labour	11885.90	18251.80	16129.03	14757.87
	Machine labour	6087.86	5702.97	5563.78	2745.17
	Runners	83904.00	87692.32	163354.80	93773.44
	Runners treatment	699.52	657.98	369.03	625.78
	Fertilizers	1383.59	2452.79	2434.96	2165.25
	Manure	8019.20	9543.19	8739.78	8653.12
	Mulching	18000.00	12000.00	12000.00	14929.69
	Plant protection	985.6	608.92	0.00	481.25
	Irrigation charges	796.81	473.95	413.65	620.64
	Interest on working capital (@ 7 %)	4611.68	4808.43	7315.17	4856.32
	Depreciation charges	10706.00	12956.00	14881.70	12290.16
	Land revenue	0.00	0.00	0.00	0.00
Total cost-A₁		147080.16	155148.35	231201.90	155898.69
COST-A ₂	Cost-A ₁	147080.16	155148.35	231201.90	155898.69
	Rent paid for leased in land	0.00	0.00	0.00	0.00
Total Cost-A₂		147080.16	155148.35	231201.90	155898.69
COST-B ₁	Cost-A ₁	147080.16	155148.35	231201.90	155898.69
	Interest on fixed capital(excluding land) @ 10 %	835.30	897.80	994.08	877.00
Total Cost-B₁		147915.46	156046.15	232195.98	156775.69

COST-B ₂	Cost-B ₁	147915.46	156046.15	232195.98	156775.69
	Rental value of owned land	6000.00	5000.00	5000.00	5250.00
	Rent paid for leased in land	0.00	0.00	0.00	0.00
Total Cost-B₂		153915.46	161046.15	237195.98	162025.69
COST-C ₁	Cost-B ₁	147915.46	156046.15	232195.98	156775.69
	Family labour	28020.42	27982.37	20047.50	25668.19
	Total cost-C₁	175935.88	184028.52	252243.48	182443.90
COST-C ₂	Cost-B ₂	153915.46	161046.15	237195.98	162025.69
	Family labour	28020.42	27982.37	20047.50	25668.19
	Total Cost-C₂	181935.89	189028.52	257243.48	187693.90
Cost-C ₃	Cost-C ₂	181935.89	189028.52	257243.48	187693.90
	Cost of management(10% of Cost-C ₂)	18193.59	18902.85	25724.35	18769.39
	Total Cost-C₃	200129.47	218931.38	282967.83	206463.29

Table 3. Costs and returns structure of strawberry cultivation (Rs./Acre)

Sr. No.	Particulars	Jammu	Kathua	Rajouri	Overall
1.Costs	Total variable cost	164394.58	180174.73	236367.70	173468.97
	Total Fixed cost	17541.30	18853.80	20875.78	18417.16
	Total cost	181935.88	189028.52	257243.48	187693.90
2. Returns					
i.	Yield(kg/acre)	2841.44	2811.83	2346.23	2741.72
ii.	Gross return	454630.40	449361.70	375397.80	438675.00
iii.	Net Return	272694.52	260333.18	118154.32	250981.10
Cost – Benefit Ratio		1: 2.50	1: 2.38	1: 1.46	1: 2.34

Table 4. Returns over various costs of strawberry cultivation (Rs./Acre)

Particulars	Jammu	Kathua	Rajouri	All farm
Net returns over different cost (Rs./acre)				
Cost A ₁	307550.24	294213.35	144195.90	282776.31
Cost A ₂	307550.24	294213.35	144195.90	282776.31
Cost B ₁	306714.94	293315.55	143201.82	281899.31
Cost B ₂	300714.94	288315.55	138201.82	276649.31
Cost C ₁	278694.52	265333.18	123154.32	256231.10
Cost C ₂	272694.51	260333.18	118154.32	250981.10
Cost C ₃	254500.93	230430.32	92429.97	232211.71
Returns per rupee over different cost				
Cost A ₁	3.09	2.89	1.62	2.81
Cost A ₂	3.09	2.89	1.62	2.81
Cost B ₁	3.07	2.87	1.61	2.79
Cost B ₂	2.95	2.79	1.58	2.70
Cost C ₁	2.58	2.44	1.48	2.40
Cost C ₂	2.49	2.37	1.45	2.34
Cost C ₃	2.27	2.05	1.32	2.12

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