Original Research Article

Economic Analysis of Seed Spice Cultivation in Gujarat, India

ABSTRACT

The present was carried out to study thecost of cultivation and returns per hectare of major seed spices in Gujarat. The study was conducted at Banaskantha district for cumin and fennel as per the second highest triennium average area of cumin and fennel and at Junagadh district for coriander as it shows the highest triennium average area of coriander respectively during the year of 2023-24.

In Gujarat for 2023-24, cumin cultivation incurred significant costs with hired labour as the largest component at 15.80 per cent, followed closely by family labour (15.65%) and rental value of owned land (13.44%). Fennel farms saw average costs of ₹ 70468.90 per hectare, peaking at ₹ 71356.01 on large farms and lowest at ₹ 67208.33 on small farms, with family labour (17.25%), irrigation (16.04%) and land rental (15.64%) as major expenses. Similarly, coriander farms had an average cost of ₹ 75939.26 per hectare, highest on large farms at ₹ 76551.63 and lowest on small farms at ₹ 74160.06, with rental value on owned land (18.95%), hired labour (16.35%), and family labour (11.74%) being significant costs. Costs increased with farm size across all crops. Cumin proved most profitable with an input-output ratio of 1:3.08, compared to fennel (1:1.48) and coriander (1:1.76) in the same period.

Keyword: Cost of Cultivation, Triennium Average area, Input-output ratio

INTRODUCTION

India has long been renowned as the land of spices. The term "spices" encompasses natural plants, vegetable products or mixtures, whether in whole or ground form, used to enhance flavour, aroma and zest in food preparation. No other nation matches India in the diversity and volume of spice production. India's dominance in spice production can be attributed to its favourable environmental conditions. The moderate Indian climate provides an ideal setting for the cultivation of a wide range of spices. Spices hold significant economic importance in India, serving both domestic consumption and export markets. Apart from flavouring foods, spices are extensively utilized in various sectors such as medicine, pharmaceuticals, perfumery and cosmetics.

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In the fiscal year 2019-20, India produced approximately 101.26 lakh tonnes of spices across 43.18 lakh hectares of land, while seed spices accounted for 19.41 lakh tonnes produced from an area of 20.19 lakh hectares during the same period. Cumin, coriander, fenugreek and fennel collectively make up about 89 per cent of the seed spice exports from the country(Bairwa *et al.*, 2022).

Gujarat ranks as the second-largest state in spice crop production. The annual production figures for spices, fruit crops and vegetable crops are approximately 8.82 lakh MT, 77.63 lakh MTand 100.50 lakh MT, respectively. Gujarat leads in the production of cumin, fennel and date palm, while ranking second in the production of banana, papaya, and lime(Vilhekar*etal*., 2018).

Cumin

Cumin(*Cuminum cyminum*) is a widely used spice with a long history in various cuisines globally. Originating from the Mediterranean region, it belongs to the Apiaceae family. Known for their unique aroma and warm, earthy flavour, cumin seeds add depth and richness to numerous dishes. These small, elongated seeds are versatile and easy to incorporate into cooking, whether used whole or ground into a powder. Cumin has become a staple ingredient in kitchens worldwide, appreciated for its distinct flavour and numerous health benefits. It is a crucial component in both traditional and contemporary recipes. Additionally, cumin possesses medicinal properties, serving as a digestive aid, carminative, uterine and nerve stimulant, astringent and anti-inflammatory agent. It's important to note that cumin production may vary annually due to factors such as weather conditions, agricultural practices and fluctuations in consumer demand. (Chand *et al.*, 2023).Cumin holds the highest area coverage among spices cultivated in Gujarat, being a winter season crop sown from mid-October to November. It occupies 51.45 per cent of the total spices area in Gujarat, making it a pivotal crop for the region. Known by various names across India such as "jeera" in Hindi and Gujarati, "Jeerji" in Kannada, "Siragum" in Tamil, "Jilakara" in Telugu and "Joerkam" in Malayalam, cumin is primarily grown as a Rabi crop.

Fennel

Fennel serves as a condiment and culinary spice, thriving in cool, dry climates while avoiding frost-prone regions due to susceptibility. Cultivation prefers well-drained loamy or black cotton soils, with rainfall during maturity risking seed quality. It is typically grown as both a kharif and rabi crop and holds significant importance as one

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of Gujarat's most essential spice crops. Fennel's botanical name is *Foeniculum vulgare*L., it is cultivated prominently in countries like Argentina, America, Germany, China, India, Indonesia, Russia, Japan and Pakistan. In India, major cultivating states include Gujarat, Rajasthan, Madhya Pradesh, Karnataka, Uttar Pradesh, West Bengal, Haryana and Andhra Pradesh. Gujarat leads in both area and production contributing 56.87 per cent of the nation's total fennel production in the year 2021-22(Source: National Horticulture Board, 2021-22). Fennel holds significant importance as a spice crop in Gujarat, accounting for 6.16 per cent of the cultivated area and 5.89 per cent of the production among all spices grown in the region. (Source:Directorate of Agriculture, Department of Agriculture, Farmer's welfare and Cooperation, GOG, 2022). In India, fennel fruits are categorized based on their place of origin for trade purposes with notable varieties including Bombay, Bihar and UP fennels. Seeds from Lucknow are esteemed for their quality and command higher prices than those from other regions.Fennel is renowned for its essential oil which emits a characteristic anise aroma, making it a popular flavouring agent in baked goods, meat and fish dishes, ice cream and alcoholic beverages. Transanethole, fenchone, estragol (methyl chavicol) and α-phellandrene are among the main constituents found in fennel seed essential oil. This essential oil is known to prevent the development of chronic liver damage, making it beneficial for conditions related to the chest, spleen, kidney and longevity.

Coriander

Coriander (*Coriandrum sativum* L.), commonly known as "Dhania," is a prominent and highly valued spice cultivated in India. Believed to be native to Mediterranean countries, coriander belongs to the *Umbelliferae* family. It is likely the first spice utilized by humans as a common flavouring agent. It is a tropical crop, best cultivated as a Rabi season crop in frost-free areas during February. The plant is a small, bushy herb with thin stems, growing 25 to 50 cm in height, featuring alternate compound leaves and a pleasant aroma. Its inflorescence is a compound umbel with five smaller umbels and its globular fruit, 3 to 4 mm in diameter, splits into two locules, each containing one seed. Key vitamins present in coriander seeds include thiamine, riboflavin, niacin and carotene. In the fiscal year 2019-20, coriander was cultivated on 529000 hectares yielding production volumes of 701000 tonnes. The contributions of coriander to the total cultivated area was12.25 per cent, while its contributions to total production was 6.92 per cent according to the Spice Board of India (2019-20).Medicinally, coriander acts as a carminative, refrigerant, diuretic and aphrodisiac

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and is used in household remedies for seasonal fever, stomach disorders and nausea. For seasoning meat products, oleoresins and coriander oil are the principal ingredients. Known by various names in India—such as Dhania in Hindi and Kothamalli in Tamil—and internationally, including Cilantro in Spanish, Coriandre in French, and Koriandr in Russian, coriander holds a prime position in culinary and medicinal applications.

METHODOLOGY

Area of study

Gujarat is the leading state in production of seed spice in whole India. It shares 9.127 per cent share of annual spices production of India in the year 2021-22 (Source: Department of Agriculture, Cooperation and Farmers Welfare, GOI)

Selection of crops

The present study was carried out for major seed spice crops grown in Gujarat. For this study cumin, fennel and coriander crops was selected. Cumin, fennel and coriander was selected based on highest triennium average of area and the data availability of input indices.

Data collection

In this study, primary data was collected for the study. From the selected farmers, primary data was collected for the cost of cultivation objective. This information was collected through personal interview with the farmers in schedule for the year 2023-24.

Sampling technique for cost of cultivation

In order to achieve the cost of cultivation objective, the multi-stage sampling technique was adopted. In the first stage, Banaskantha district for cumin and fennel was chosen purposively as second highest triennium average area of cumin and fennel crops which was common for these two spices and this area comes under the jurisdiction of SDAU, so there was data availability and accessing to this area was more unchallenging. The district of Junagadh was selected purposively for coriander as it shows the highest triennium average area of coriander while Banaskantha district does not come even in top five highest producer area for coriander so it was not selected purposively. Talukas, villages and sample farmers were selected using a multistage random sampling technique. At the subsequent stages, two talukas from each respective district and two villages from each selected taluka was chosen randomly.

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Finally, from each selected village, fifteen farmer-producers was selected on random basis as shown in Table 1.

Table 1: Overview of multistage random survey method

Sr.no.	Name of Crop	Selection District (Basis of highest average triennium area)	Selection of Talukas	Selection of villages	Number of Farmers (180)
1	Cumin	Banaskantha	Vav	Morikha	15
				Koreti	15
			Suigam	Jelana	15
				Nesda	15
2	Fennel	Banaskantha	Kankrej	Indramana	15
				Tana	15
			Tharad	Janadi	15
				Ranesari	15
3	Coriander	Junagadh	Visavadar	Kalsari	15
				Mandavad	15
			Bhensan	Patla	15
				Ratanpara	15

Analytical procedure

As per the objectives of the study the following different statistical techniques was applied:

Cost of Cultivation and Return

The data was collected during the year 2023-24 from selected farmers regarding the cost of cultivation of cumin, fennel and coriander by multistage random sampling method.

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[A] Cost concepts

The details of cost concepts which were used in the study are as under:

Cost-A: **It includes:**

1. Value of hired human labour
2. Value of hired bullock labour
3. Value of owned bullock labour
4. Value of tractor charges
5. Value of seed/seedlings (both farms produced and purchased)
6. Value of manure and cakes (owned farm and purchased)
7. Value of fertilizers
8. Value of insecticides and pesticides
9. Irrigation charges
10. Depreciation on farm building and implements
11. Interest on working capital
12. Other paid out expenses, if any.

Cost-B: **It includes**:

Cost A + Rental value of owned land + Interest on value of owned fixed capital (excluding land)

Cost-C_1: It includes:

Cost B + imputed value of family labour

Cost- C_2: It includes:

Cost C_1 + 10 per cent of cost C_1, as managerial charges

[B] Net returns

Net return per hectare at the different costs concept was worked by deducting the respective costs from the gross monitory returns per hectare.

RESULTS AND DISCUSSION

Cost of cultivation and returns per hectare of major seed spices in Gujarat 2023-24

This section addresses the cost of cultivating selected seed spices (cumin, fennel and coriander) as borne by farmers specifically in the Banaskantha district and for coriander in the Junagadh district. The cultivation cost is crucial for determining the

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net profitability of different crops. Consequently, a detailed analysis of the per-hectare costs and various factor costs for producing cumin, fennel and coriander on farms of different sizes was conducted with the results presented in Tables 2, 3and 4.

The cost of cultivation for different categories of cumin farms in North Gujarat is detailed in Table 2. It shows that the study considered various cost components, including hired labour, family labour, seed cost, manures, plant protection chemicals, fertilizers, irrigation charges, miscellaneous charges, depreciation, interest on working capital, the rental value of owned land and interest on fixed capital. The data reveal that the average total cultivation cost per hectare for cumin farms was ₹ 81210.69. The highest expenditure was observed on large farms at ₹ 82135.02, while the lowest was on small farms at ₹ 75582.85. This discrepancy is primarily attributed to larger investments in tractors and hired labour by large-scale farmers compared to their smaller counterparts. Among the various cost components, hired labour expenses were the most significant, accounting for 15.80 per cent of the total cost. This was followed by family labour (15.65%), rental value of owned land (13.44%), tractor (11.64%), irrigation (10.97%), management cost (9.09%), insecticides and pesticides (5.49%), seeds (4.33%), fertilizers (4.14%) and others.

The analysis of various cost concepts, including cost A, cost B, cost C_1 and cost C_2 is illustrated in table 2. According to the data, cost A constituted 60.10 per cent of the total cost (cost C_2) for average cumin farms. This percentage was highest on large farms at 61.69 per cent followed by medium farms at 55.32 per cent and lowest on small farms at 52.56 per cent. Cost B represented approximately 75.26 per cent of the total cumin cultivation cost, increasing proportionately from 67.61 per cent on small farms to 76.79 per cent on large farms.

Further, Table 2 shows that the total cost of cultivation (cost C_2) per hectare for cumin was ₹ 75582.85 on small farms, ₹ 79042.78 on medium farms and ₹ 82135.02 on large farms, averaging ₹ 81210.69. The distribution of the total cost (cost C_2) across cost A, cost B and cost C_1 was approximately 60.10 per cent, 75.26 per cent and 90.91 per cent respectively. It was also observed that the costs (cost A, cost B, cost C_1 and cost C_2) escalated with the increase in farm size. The average yield on cumin farms was 9.63 quintals per hectare. It was observed that the yield was highest on large farms (9.73 quintals/ha) compared to medium (9.44 quintals/ha) and small farms (8.95 quintals/ha). Similar results were found by Kumawat (2014) on fenugreek farms,Sureshkumar (2014) on wheat farms, Jhajhriya (2015) on cumin farms, Kumar

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and Kumar (2017) on coriander farms and Chand *et al.* (2023) on cumin farms. Their studies also observed that the average total cost increased with the increase in farm size.

The cost of cultivation for different categories of fennel farms in North Gujarat is detailed in Table 3. The data reveal that the average cost of cultivation per hectare for fennel farms was ₹ 70468.90. This cost peaked at ₹ 71356.01 on large farms and was lowest at ₹ 67208.33 on small farms. Among the various components of cash expenditure, family labour ranked highest, accounting for 17.25 per cent of the total cost. This was followed by expenditures on irrigation (16.04%), rental value of owned land (15.64%), hired labour (14.27%), tractor (11.29%), management cost (9.09%), fertilizer (4.59%), interest on working capital (2.66%) and others.

The analysis of various cost concepts, including cost A, cost B, cost C_1, and cost C_2 is illustrated in table 3. According to the data, cost A constituted 55.86 per cent of the total cost (cost C_2) for average fennel farms. This percentage was highest on large farms at 57.78 per cent, followed by medium farms at 53.30 per cent and lowest on small farms at 48.27 per cent. Cost B represented approximately 73.66 per cent of the total cumin cultivation cost, increasing proportionately from 65.01 per cent on small farms to 75.76 per cent on large farms.

Further, table 3 shows that the total cost of cultivation (cost C_2) per hectare for fennel was ₹ 67208.33 on small farms, ₹ 69268.17 on medium farms and ₹ 71356.01 on large farms, averaging ₹ 70462.90. The distribution of the total cost (cost C_2) across cost A, cost B and cost C_1 was approximately 55.86 per cent, 73.66 per cent and 90.91 per cent respectively. It was also observed that the costs (cost A, cost B, cost C_1, and cost C_2) escalated with the increase in farm size. The average yield on fennel farms was 13.87 quintals per hectare. It was observed that the yield was highest on large farms (13.97 quintals/ha) compared to medium (13.89 quintals/ha) and small farms (13.29 quintals/ha). Similar result was also found by Kantariya*et al.* (2018) on onion farms where yield increased per hectare with increase in farm land holding.

The cost of cultivation for different categories of coriander farms in Junagadh district is detailed in Table 4. The data reveal that the average total cultivation cost per hectare for coriander farms was ₹ 75939.26. The highest expenditure was observed on large farms at ₹ 76551.63 while the lowest was on small farms at ₹ 74160.06. This discrepancy is primarily attributed to larger investments in rental value on owned land and hired labour by large-scale farmers compared to their

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smaller counterparts. Among the various cost components, rental value on owned land expenses were the most significant accounting for 18.95 per cent of the total cost. This was followed by hired labour (16.35%), family labour (11.74%), tractor (11.51%), irrigation (9.99%), management cost (9.09%), fertilizer (5.07%), seeds (4.18%), insecticides and pesticides (3.97), manure (3.83%) and others.

The analysis of various cost concepts, including cost A, cost B, cost C_1, and cost C_2, is illustrated in table 4. According to the data, cost A constituted 58.43 per cent of the total cost (cost C_2) for average coriander farms. This percentage was highest on large farms at 59.81 per cent followed by medium farms at 56.99 per cent and lowest on small farms at 56.12 per cent. Cost B represented approximately 79.17 per cent of the total coriander cultivation cost, increasing proportionately from 74.58 per cent on small farms to 81.25 per cent on large farms.

Further, table 4 shows that the total cost of cultivation (Cost C_2) per hectare for coriander was ₹ 74160.06 on small farms, ₹ 75632.09 on medium farms and ₹ 76551.63 on large farms, averaging ₹ 75939.26. The distribution of the total cost (cost C_2) across cost A, cost B, and cost C_1 was approximately 58.43 per cent, 79.17 per cent and 90.91 per cent. respectively. It was also observed that the costs (cost A, cost B, cost C_1, and cost C_2) escalated with the increase in farm size. The average yield on coriander farms was 17.67 quintals per hectare. It was observed that the yield was highest on large farms (18.24 quintals/ha) compared to medium (17.04 quintals/ha) and small farms (16.87 quintals/ha). Similar results were also found by Meena*et al.*(2013) on garlic farms and Jorwar*et al.*(2018) on chilli farms in which cost of cultivation increased with increase in farm size.

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Table 2: Details of cost of cultivation of cumin crop per hectare in Gujarat for the year 2023-24.

Particulars	Small farmers			Medium farmers			Large farmers			Average farmers		
	Physical unit	Value (₹)	Percent to total cost	Physical unit	Value (₹)	Percent to total cost	Physical unit	Value (₹)	Percent to total cost	Physical unit	Value (₹)	Percent to total cost
Hired labour (man days)	20.35	6717.29	8.89	26.72	8796.32	11.13	42.98	14222.19	17.32	38.81	12832.48	15.80
Bullock labour (pair days)	1.64	1966.04	2.60	1.37	1644.49	2.08	0.65	785.56	0.96	0.84	1005.11	1.24
Seeds (kg)	12.93	3166.36	4.19	13.22	3434.02	4.34	13.97	3558.31	4.33	13.78	3513.68	4.33
Manure (tonnes)	1.29	1293.45	1.71	1.78	1781.53	2.25	1.87	1869.63	2.28	1.82	1820.64	2.24
Fertilizer (kg)	-	3212.92	4.25	-	3279.99	4.15	-	3389.19	4.13	-	3359.75	4.14
N	81.75			85.72			86.43			86.04		
P	41.65			42.03			43.89			43.43		
K	0.00			0.00			0.00			0.00		
Irrigation	-	8614.35	11.40	-	8672.12	10.97	-	8987.76	10.94	-	8910.59	10.97
Insecticide/pesticide	-	3975.19	5.26	-	4299.66	5.44	-	4528.74	5.51	-	4456.30	5.49
Tractor and machinery charges		8337.55	11.03		8855.99	11.20		9672.70	11.78		9451.56	11.64
Miscellaneous cost	-	448.39	0.59	-	685.20	0.87	-	1001.59	1.22	-	913.83	1.13
Depreciation	-	468.26	0.62	-	593.52	0.75	-	701.90	0.85	-	669.27	0.82
Interest on working capital	-	1527.99	2.02	-	1681.71	2.13	-	1948.70	2.37	-	1877.33	2.31
Cost A	**-**	**39727.79**	**52.56**	**-**	**43724.56**	**55.32**	**-**	**50666.25**	**61.69**	**-**	**48810.54**	**60.10**
Rental value owned land	-	10542.40	13.95	-	10746.81	13.60	-	10979.25	13.37	-	10913.01	13.44
Interest on fixed capital	-	833.38	1.10	-	1386.98	1.76	-	1424.92	1.73	-	1383.85	1.70
Cost B	**-**	**51103.58**	**67.61**	**-**	**55941.76**	**70.77**	**-**	**63070.43**	**76.79**	**-**	**61122.06**	**75.26**
Family labour (man days)	52.69	17608.11	23.30	47.11	15915.31	20.14	34.39	11597.77	14.12	37.69	12705.84	15.65
Cost C_1	**-**	**68711.68**	**90.91**	**-**	**71857.07**	**90.91**	**-**	**74668.20**	**90.91**	**-**	**73827.90**	**90.91**
Management cost (10 % cost C1)		6871.17	9.09		7185.71	9.09		7466.82	9.09		7382.79	9.09
Cost C_2	**-**	**75582.85**	**100.00**	**-**	**79042.78**	**100.00**	**-**	**82135.02**	**100.00**	**-**	**81210.69**	**100.00**
Production	-	-	-	-	-	-	-	-	-	-	-	-
Main product (Qtl.)	8.95	-	-	9.44	-	-	9.73	-	-	9.63	-	-
Farm Harvest Price (₹ /qtl)	25070.00			25628.57			26537.07			25963.66		
Gross Income (₹)	**-**	**224486.85**	**-**	**-**	**241839.56**	**-**	**-**	**258111.53**	**-**	**-**	**250045.07**	**-**

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Table3: Details of cost of cultivation of fennel crop per hectare in Gujarat for the year 2023-24.

Particulars	Small farmers			Medium farmers			Large farmers			Average farmers		
	Physical unit	Value (₹)	Percent to total cost	Physical unit	Value (₹)	Percent to total cost	Physical unit	Value (₹)	Percent to total cost	Physical unit	Value (₹)	Percent to total cost
Hired labour (man days)	17.16	5515.87	8.21	26.74	8610.56	12.42	34.71	11241.68	15.75	31.09	10055.19	14.27
Bullock labour (pair days)	0.55	629.96	0.94	0.13	157.48	0.23	0.08	94.54	0.13	0.15	171.64	0.24
Seeds (kg)	2.38	659.72	0.98	2.61	759.51	1.10	2.82	823.05	1.15	2.73	791.33	1.12
Manure (tonnes)	1.41	1413.69	2.10	1.54	1535.43	2.22	1.65	1651.79	2.31	1.60	1601.16	2.27
Fertilizer (kg)	-	2955.36	4.40	-	3098.43	4.47	-	3319.15	4.65	-	3233.87	4.59
N	74.87			77.24			83.47			81.26		
P	36.51			37.73			38.96			38.43		
K	0.00			0.00			0.00			0.00		
Irrigation	-	10528.27	15.67	-	11067.91	15.97	-	11498.16	16.11	-	11300.04	16.04
Insecticide/pesticide	-	1056.55	1.57	-	1404.20	2.03	-	1469.71	2.06	-	1407.08	2.00
Tractor and machinery charges		7423.61	11.05		7660.10	11.05		8131.30	11.40		7957.67	11.29
Miscellaneous cost	-	322.42	0.48	-	423.23	0.61	-	589.99	0.83	-	526.44	0.75
Depreciation	-	391.32	0.58	-	442.36	0.64	-	446.92	0.63	-	439.28	0.62
Interest on working capital	-	1544.84	2.30	-	1757.96	2.54	-	1963.31	2.75	-	1874.44	2.66
Cost A	**-**	**32441.62**	**48.27**	**-**	**36917.19**	**53.30**	**-**	**41229.61**	**57.78**	**-**	**39363.34**	**55.86**
Rental value owned land	-	10664.68	15.87	-	10956.64	15.82	-	11102.36	15.56	-	11021.90	15.64
Interest on fixed capital	-	586.43	0.87	-	1398.09	2.02	-	1725.25	2.42	-	1525.52	2.16
Cost B	**-**	**43692.73**	**65.01**	**-**	**49271.91**	**71.13**	**-**	**54057.21**	**75.76**	**-**	**51910.77**	**73.66**
Family labour (man days)	53.72	17405.75	25.90	42.06	13699.15	19.78	33.28	10811.89	15.15	37.40	12151.87	17.25
Cost C_1	**-**	**61098.49**	**90.91**	**-**	**62971.06**	**90.91**	**-**	**64869.10**	**90.91**	**-**	**64062.64**	**90.91**
Management cost (10 % cost C1)		6109.85	9.09		6297.11	9.09		6486.91	9.09		6406.26	9.09
Cost C_2	**-**	**67208.33**	**100.00**	**-**	**69268.17**	**100.00**	**-**	**71356.01**	**100.00**	**-**	**70468.90**	**100.00**
Production	-	-	-	-	-	-	-	-	-	-	-	-
Main product (Qtl.)	13.29	-	-	13.89	-	-	13.97	-	-	13.87	-	-
Farm Harvest Price (₹ /qtl)	7247.06			7421.88			7766.67			7527.50		
Gross Income (₹)	**-**	**96325.49**	**-**	**-**	**103117.31**	**-**	**-**	**108472.27**	**-**	**-**	**104409.82**	**-**

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Particulars	Small farmers			Medium farmers			Large farmers			Average farmers		
	Physical unit	Value (₹)	Percent to total cost	Physical unit	Value (₹)	Percent to total cost	Physical unit	Value (₹)	Percent to total cost	Physical unit	Value (₹)	Percent to total cost
Hired labour (man days)	25.79	8457.34	11.40	36.00	11087.91	14.64	43.44	14065.50	18.39	37.62	12414.21	16.35
Bullock labour (pair days)	0.60	773.81	1.04	0.22	289.90	0.38	0.08	120.19	0.16	0.18	250.87	0.33
Seeds (kg)	18.75	3059.03	4.12	19.05	3160.54	4.28	19.41	3210.04	4.20	19.21	3176.26	4.18
Manure (tonnes)	3.47	3472.22	4.68	2.84	2844.45	3.76	2.83	2830.91	3.70	2.91	2905.83	3.83
Fertilizer (kg)	-	4325.89	5.83	-	3909.45	5.17	-	3715.75	4.86	-	3850.02	5.07
N	82.80			78.15			74.27			76.56		
P	64.04			55.41			51.07			54.00		
K	0.00			0.00			0.00			0.00		
Irrigation	-	7103.17	9.58	-	7397.13	9.78	-	7800.48	10.20	-	7583.62	9.99
Insecticide/pesticide	-	2549.60	3.44	-	3001.87	3.97	-	3123.00	4.08	-	3018.03	3.97
Tractor and machinery charges		7545.63	10.17		8701.06	11.50		9018.23	11.79		8746.52	11.51
Miscellaneous cost	-	99.21	0.13	-	286.78	0.38	-	300.48	0.39	-	273.68	0.36
Depreciation	-	322.50	0.43	-	338.08	0.45	-	345.18	0.45	-	340.22	0.45
Interest on working capital	-	1600.60	2.16	-	1657.89	2.19	-	1759.16	2.30	-	1706.52	2.25
Cost A	**-**	**41615.56**	**56.12**	**-**	**43105.23**	**56.99**	**-**	**45788.90**	**59.81**	**-**	**44369.61**	**58.43**
Rental value owned land	-	13237.43	17.85	-	14243.03	18.83	-	14721.29	19.23	-	14392.23	18.95
Interest on fixed capital	-	452.15	0.61	-	1135.43	1.50	-	1685.36	2.20	-	1358.77	1.79
Cost B	**-**	**55305.14**	**74.58**	**-**	**58483.69**	**77.33**	**-**	**62195.56**	**81.25**	**-**	**60120.62**	**79.17**
Family labour (man days)	29.17	12113.10	16.33	28.09	10272.76	13.58	27.54	7396.83	9.66	27.91	8915.07	11.74
Cost C_1	**-**	**67418.24**	**90.91**	**-**	**68756.44**	**90.91**	**-**	**69592.39**	**90.91**	**-**	**69035.69**	**90.91**
Management cost (10 % cost C1)		6741.82	9.09		6875.64	9.09		6959.24	9.09		6903.57	9.09
Cost C_2	**-**	**74160.06**	**100.00**	**-**	**75632.09**	**100.00**	**-**	**76551.63**	**100.00**	**-**	**75939.26**	**100.00**
Production	-	-	-	-	-	-	-	-	-	-	-	-
Main product (Qtl.)	16.87	-	-	17.04	-	-	18.24	-	-	17.67	-	-
Farm Harvest Price (₹ /qtl)	7255.77			7748.26			7752.04			7585.36		
Gross Income (₹)	**-**	**122369.12**	**-**	**-**	**13199.78**	**-**	**-**	**140916.69**	**-**	**-**	**134028.85**	**-**

Table 4: Details of cost of cultivation of coriander crop per hectare in Gujarat for the year 2023 -24. n=60

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Gross and net returns, per quintal cost of production and input-output ratio of major seed spice crops

The details of gross income, net returns per hectare, cost of production (₹ /quintal) and input-output ratio for cumin, fennel and coriander are calculated against different cost measures and delineated in Table 5, 6 and 7. The average gross returns per hectare on cumin farms were ₹ 250045.07, fluctuating from ₹ 224486.85 on small farms to ₹ 258111.53 on large farms.

The average net returns per hectare over operational costs (cost A) were ₹ 201229.16 on the sampled farms. Net returns for cumin farms based on cost B, cost C_1 and Cost C_2 were ₹ 188932.30, ₹ 176226.46 and ₹ 168844.59 per hectare respectively. It is evident from the table that the net returns per hectare over cost C_2 ranged from ₹ 148802.39 on small farms to ₹ 175976.51 on large farms, with an average of ₹ 168844.59. The benefit-cost ratio observed was found to be highest on large size of farms (1:3.14) as compared to medium farms (1:3.06) and small farms (1:2.97).

The average gross returns per hectare on fennel farms were ₹ 104409.82, fluctuating from ₹ 96325.49 on small farms to ₹ 108472.27 on large farms. The average net returns per hectare over operational costs (cost A) were ₹ 65051.93 on the sampled farms. Net returns for fennel farms based on cost B, cost C_1, and cost C_2 were ₹ 52504.50, ₹ 40352.63 and ₹ 33946.92 per hectare respectively. It is evident from the table that the net returns per hectare over cost C_2 ranged from ₹ 29117.16 on small farms to ₹ 37116.26 on large farms with an average of ₹ 33946.92. The benefit-cost ratio observed was found to be highest on large size of farms (1:1.52) as compared to medium farms (1:1.49) and small farms (1:1.43).

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Particulars	Different Cost	Category of farms

Table. 5: Gross and net returns, per quintal cost of production and input-outputratio of cumin crop

		Small	Medium	Large	Average
Gross return (₹ /ha)	-	224486.85	241839.56	258111.53	250045.07
Net returns (₹ /ha)	Cost A	184666.69	198115.00	207445.28	201229.16
	Cost B	173290.90	185981.21	195041.10	188932.30
	Cost C_1	155682.80	170065.90	183443.33	176226.46
	Cost C_2	148802.39	162888.53	175976.51	168844.59
Cost of production (₹ /qtl)	Cost A	4446.99	4633.64	5209.12	5068.86
	Cost B	5717.41	5919.50	6484.42	6345.70
	Cost C_1	7683.82	7606.10	7676.82	7665.02
	Cost C_2	8452.21	8366.71	8444.50	8431.53
Input-output ratio	Cost A	1:5.64	1:5.53	1:5.09	1:5.12
	Cost B	1:4.38	1:4.32	1:4.09	1:4.09
	Cost C_1	1:3.26	1:3.37	1:3.46	1:3.39
	Cost C_2	1:2.97	1:3.06	1:3.14	1:3.08

The average gross returns per hectare on coriander farms were ₹ 134028.85 fluctuating from ₹ 122369.12 on small farms to ₹ 141390.90 on large farms. The average net returns per hectare over operational costs (cost A) were ₹ 89659.23 on the sampled farms. Net returns for coriander farms based on cost B, cost C_1 and cost C_2 were ₹ 73908.23, ₹ 64993.16 and ₹ 58089.59 per hectare respectively. It is evident from the table that the net returns per hectare over cost C_2 ranged from ₹ 48209.06 on small farms to ₹ 64894.99 on large farms, with an average of ₹ 58089.59. The benefit-cost ratio observed was found to be highest on large size of farms (1:1.85) as compared to medium farms (1:1.75) and small farms (1:1.65).

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Table. 6: Gross and net returns, per quintal cost of production and input-output ratio of fennel crop

Particulars	Different Cost	Category of farms			
		Small	Medium	Large	Average
Gross return (₹ /ha)	-	96325.49	103117.31	108472.27	104409.82
Net returns (₹ /ha)	Cost A	63883.87	66200.13	67242.66	65051.93
	Cost B	52632.76	53845.40	54415.06	52504.50
	Cost C_1	35227.00	40146.25	43603.17	40352.63
	Cost C_2	29117.16	33849.15	37116.26	33946.92
Cost of production (₹ /qtl)	Cost A	2440.75	2657.12	2952.06	2837.53
	Cost B	3287.23	3546.35	3870.52	3742.15
	Cost C_1	4596.75	4532.35	4644.66	4618.25
	Cost C_2	5056.43	4985.58	5109.12	5080.07
Input-output ratio	Cost A	1:2.97	1:2.79	1:2.63	1:2.65
	Cost B	1:2.20	1:2.09	1:2.01	1:2.01
	Cost C_1	1:1.58	1:1.64	1:1.67	1:1.63
	Cost C_2	1:1.43	1:1.49	1:1.52	1:1.48

Table. 7: Gross and net returns, per quintal cost of production and input-output ratio of coriander crop

Particulars	Different Cost	Category of farms			
		Small	Medium	Large	Average
Gross return (₹ /ha)	-	122369.12	131995.78	141390.90	134028.85
Net returns (₹ /ha)	Cost A	80753.57	88890.55	95652.65	89659.23
	Cost B	67063.98	73512.09	79245.99	73908.23
	Cost C_1	54950.89	63239.34	71849.16	64993.16
	Cost C_2	48209.06	56363.69	64894.99	58089.59
Cost of production (₹ /qtl)	Cost A	2467.56	2530.31	2507.69	2511.10
	Cost B	3279.27	3433.04	3407.22	3402.52
	Cost C_1	3997.50	4036.06	3812.77	3907.07
	Cost C_2	4397.26	4439.67	4194.04	4297.78
Input-output ratio	Cost A	1:2.94	1:3.06	1:3.09	1:3.02
	Cost B	1:2.21	1:2.26	1:2.28	1:2.23
	Cost C_1	1:1.82	1:1.92	1:2.03	1:1.94
	Cost C_2	1:1.65	1:1.75	1:1.85	1:1.76

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CONCLUSIONS

In cumin cultivation in Gujarat for 2023-24, hired labour expenses were the most significant, accounting for 15.80 per cent of the total cost.In 2023-24, average cultivation costs per hectare for fennel farms in Gujarat were ₹ 70468.90, peaking at ₹ 71356.01 on large farms and lowest at ₹ 67208.33 on small farms. Family labour was the largest expense at 17.25 per cent, followed by irrigation (16.04%) and rental value of owned land (15.64%). In 2023-24, coriander farms in Gujarat had an average cultivation cost of ₹ 75939.26 per hectare, with costs peaking at ₹ 76551.63 on large farms and lowest at ₹ 74160.06 on small farms. Rental value on owned land was the largest expense at 18.95 per cent, followed by hired labour (16.35%) and family labour (11.74%). Costs generally increased with increase in farm size in all these crops; cumin, fennel and coriander. Cumin stood the most profitable crop for Gujarat farmers in 2023-24 as input-output ratio stood at 1:3.08 as compared to fennel farmers in which it is 1:1.48 and coriander farmers in which it is 1:1.76.

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