Research Paper

Agricultural

An Economic Analysis of Cauliflower in Middle Gujarat

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ABSTRACT

The present investigation has analysed the costs and returns and resource use efficiency in middle Gujarat during 2012-13. Results indicated that average cost of cultivation of cauliflower per hectare was Rs.73232.95. It was highest on medium farms and lowest on large farms. On an average, Cost A formed 72.46 per cent, while Cost B accounted for 86.07 per cent of total cost. Out of total cost, human labour cost was ranked first followed by fertilizer cost , manure and cakes. These major items of expenditure contributed 97.82 per cent of total cost.

The average yield of cauliflower per hectare was observed 333.13 quintals on sample farms. The net profit per hectare over Cost C2 was Rs. 46366.49. It varied from Rs. 14939.69 on marginal farms to Rs.54405.55 on large farms. The overall input- output ratio was about 1:1.64 and it was highest on large farms and lowest on marginal farms. Production function analysis revealed Bullock labour, plant protection and irrigation exerted significant influence on the yield of cauliflower. About 96 per cent of total variation in gross income from cauliflower cultivation was explained by the explanatory variables included in the function. The study has brought to the fore that an increasing returns to scale suggesting more rational use of the inputs leading to higher returns. Looking to the cost, return, input-output ratio and resource use efficiency, it can be concluded that cauliflower cultivation was profitable vegetable crop in Middle Gujarat.

KEYWORDS : Returns to scale, resource use efficiency, input-output ratio

1. Introduction

Cauliflower is one of the most important winter vegetable crops grown extensively in tropical and temperate regions of the world. Cauliflower is not uniformly spread in all the districts of Gujarat. The major cauliflower producing districts are Anand, Baroda, Kheda, Rajkot, Sabarkantha, Banaskantha, Ahmadabad, Bhavnagar, Mehsana and Surat which together contribute about 77.34 and 82.28 per cent of total area and total production under cauliflower cultivation in the state, respectively. It is also noteworthy that in Gujarat, middle Gujarat districts contribute highest area i.e. 6349 hectares (30.07 per cent) under cauliflower cultivation with 103439 tones (26.50 per cent) of production. Efforts have been made by various researchers to focus on cost of production and marketing of vegetables in the state of Gujarat. Notably of them are Shiyani et al. (1998), Singh et al. (1993) and Parmar et al. (1994). Similar works in other states have been done by researchers including Madan et al. (1999), Radha and Prasad (2001), Tripathi et al. (2005), Sidhu et al. (2010), Bala et al. (2011) and Singh and Vashist (1999)

Objectives of the study:

- To estimate cost of cultivation and returns per hectare for cauliflower crop.
- To estimate the cost of production per quintal and input-out put ratio of cauliflower.
- To workout resource use efficiency in production system of cauliflower.

2. Sampling and Methodology

Four talukas of the Anand and Kheda districts together covered 52.37 per cent area under cauliflower in middle Gujarat. Therefore, these two districts were considered for the study. From these four talukas twelve villages were selected. Than a sample of 10 cauliflower growers was selected at random from each of the selected villages. Thus, in all 120 growers (27 marginal, 38 small, 29 medium and 26 large) were selected for the study. Costs concepts of A, B, C1 and C2 were employed to achieve the stipulated objectives. In order to determine the efficiency of resources used in the production of cauliflower, the following form of Cobb-Douglas production function was used. Gross income per hectare was considered as dependent variable and other variables as independent variables. The analysis was carried out on per hectare basis. The variables included and functional form of fitted equation is as given below.

$$Y = a \cdot x_1^{b1} \cdot x_2^{b2} \cdot x_3^{b3} \cdot x_4^{b4} \cdot x_5^{b5} \cdot x_6^{b6} \cdot x_7^{b7} \cdot U$$

......(1)

The original equation (1) was converted into log linear form and the parameters were estimated by using the ordinary least squares method.

$$\log Y = \log a + b1 \log x_1 + b2 \log x_2 + b3 \log x_3 + b4 \log x_4 + b5 \log x_5 + b6 \log x_6 + b7 \log x_7 + Ut$$

Where,

Y = Gross income of cauliflower (Rs),

X_1 = Cost of human labour (Man days),

X_2 = Cost of bullock labour (Pair days),

X_3 = Cost of manures (Rs),

X_4 = Cost of planting materials (Rs),

X_5 = Cost of fertilizers (Rs),

X_6 = Cost of plant protection chemicals (Rs),

X_7 = Irrigation charges (Rs),

a = Intercept ,

b1, b2… b8 = Regression co-efficient (output elasticity of respective inputs (Xi's))

$\sum_{i=1}^{n} bi$ = Returns to scale (sum of regression co-efficient), and

Ut = Error term with usual assumptions

3. Results and discussion

3.1 Cost Structure

The details about component wise costs for cauliflower cultivation on different size of farms per hectare are studied and presented in Table 1. The table indicates that the average total cost of cultivation per hectare of cauliflower farms was Rs. 73232.95. It was highest in

medium farms (Rs. 74577.4) This was mainly on account of more investment on human labour and bullock labour and also on depreciation and interest on fixed capital incurred by marginal farmers as compared to other categories of farms. On an overall basis among the different items of cash expenditure, the cost of human labour ranked first with 15.81 per cent of the total cost as cauliflower requires more number of labours for picking, weeding and also application of irrigation to the crop. The highest not payable but accounted expenditure was rental value of owned land (9.27 per cent) followed by managerial costs (9.09 per cent), interest on fixed capital (4.33 per cent) and interest on working capital (2.29 per cent)

Table1:Break-upoftheTotalCostofCul   tivationforCauliflower(Rs./hectare)

Sr. No.	Item	Category of farm				
		Marginal	Small	Medium	Large	Overall
1	Human Labour	11223.53 (15.06)	10417.29 (14.35)	9593.04 (12.86)	9854.18 (13.64)	10034.05 (15.81)
	(a) Family	4915.29 (6.60)	4041.88 (5.57)	3241.30 (4.34)	3109.62 (4.30)	3508.40 (4.83)
	(b) Hired	6308.24 (8.46)	6375.41 (8.78)	6351.74 (8.51)	6744.56 (9.33)	6525.66 (8.98)
2	Bullock labour	1823.53 (2.44)	1916.78 (2.64)	2028.26 (2.71)	1997.47 (2.76)	1972.11 (2.71)
3	Tractor charges	5670.59 (7.61)	6319.46 (8.71)	6576.09 (8.81)	5902.53 (8.17)	6140.03 (8.45)
4	Saplings charges	7574.12 (10.16)	7011.01 (9.66)	7062.61 (9.47)	7206.33 (9.97)	7163.74 (9.86)
5	Manures and cakes	7336.47 (9.84)	8273.83 (11.40)	8646.09 (11.60)	8101.27 (11.21)	8204.41 (11.29)
6	Irrigation charges	4817.41 (6.46)	5644.13 (7.77)	5697.91 (7.64)	6055.80 (8.38)	5760.96 (7.93)
7	Fertilizer	9166.71 (12.30)	8456.38 (11.65)	8637.22 (11.58)	9632.38 (13.33)	9088.45 (12.51)
8	Plant protection chemicals	4396.47 (5.90)	3945.50 (5.43)	6341.74 (8.50)	4343.29 (6.01)	4778.52 (6.57)
9	Miscellaneous	1093.53 (1.46)	993.29 (1.36)	1362.17 (1.82)	825.32 (1.14)	1023.43 (1.40)
10	Depreciation	1253.96 (1.68)	935.93 (1.29)	671.68 (0.90)	971.57 (1.33)	913.96 (1.24)
11	Interest on working capital	1663.99 (2.23)	1651.16 (2.27)	1770.52 (2.37)	1645.84 (2.27)	1666.47 (2.29)
12	Interest on fixed capital	2760.21 (3.70)	3678.38 (5.07)	2771.72 (3.71)	3194.79 (4.42)	3145.50 (4.33)
13	Rental value of owned land	8931.37 (11.99)	6712.53 (9.25)	6638.59 (8.90)	6327.00 (8.76)	6738.73 (9.27)
14	Managerial cost	6771.19 (9.09)	6595.57 (9.09)	6779.76 (9.09)	6565.08 (9.09)	6602.59 (9.09)
15	Total	74483.08 (100.00)	72551.24 (100.00)	74577.4 (100.00)	72622.81 (100.00)	73232.95 (100.00)

Note   : Figures in parentheses indicate percentage to total.

3.2 Estimates of Different Costs

It could be inferred from Table 2 that overall per hectare Cost A was found to be Rs. 52633.23. The highest per hectare Cost A was Rs. 55146.03 on medium farms and lowest Rs. 51105.01 on marginal farms.

Table 2: Estimation of Different Costs

Category of farm	Different costs (` per hectare)			
	Cost A	Cost B	Cost C$_1$	Cost C$_2$
Marginal	51105.01 (70.36)	62517.45 (86.07)	66025.85 (90.90)	72628.44 (100.00)
Small	51522.87 (71.01)	61913.78 (85.33)	65955.66 (90.90)	72551.22 (100.00)
Medium	55146.03 (73.94)	64556.34 (86.56)	67797.64 (90.90)	74577.41 (100.00)
Large	53019.35 (73.41)	62541.15 (86.60)	65650.77 (90.90)	72215.84 (100.00)
Overall	52633.23 (72.46)	62517.45 (86.07)	66025.85 (90.90)	72628.44 (100.00)

Figure in parenthesis indicate percentages to Cost-C2

Further, the study also showed that Cost B and Cost C1 accounted for about 86.07 and 90.90 per cent of the Cost C2. Overall, Cost C2 was observed to be Rs. 72628.44 per hectare which was highest on medium farms (Rs. 74577.41 per hectare) and lowest on large farms (Rs.72215.84 per hectare). Higher costs on medium farms are associated with intensive use of human labour and bullock labour and also on depreciation and interest on fixed capital as compared to other categories of farms. Decreasing trend was observed as category of farms increased from marginal to large in total cost (Cost C2) except medium category of cauliflower cultivators. It was might be due to adoption of new technical knowledge.

Yield, Price, Gross Income and Net Gains

A perusal of Table 3 reveals that the average yield of cauliflower was 333.13 quintals per hectare. It ranged from 286.24 quintals on marginal farms to 348.00 quintals on medium farms. Higher yield level on medium farms may be due to optimum level of inputs utilized by them along with timely weeding operations and proper selection of varieties of cauliflower, which affect the output to a greater extent, as compared to other farms. The variation in the yield might be due to the different times of sowing, types of land and use of hybrid variety etc.

Table 3: Yield Level, Farm Harvest Price and Gross Income per Hectare

Category of farm	Yield (quintal)	Harvest price (Rs./quintal)	Value of gross output (Rs.)
Marginal	286.24	312.41	89422.77
Small	316.51	354.34	112152.18
Medium	348.00	367.24	127799.52
Large	342.41	369.80	126621.39
Overall	333.13	357.20	118994.93

As can be seen from Table 3 per quintal average farm harvest price received by the cauliflower growers was Rs. 357.20. The large size growers realized higher prices per quintal i.e.Rs. 369.80.. Generally, large and medium farm growers sell their produce at higher prices compared to small and marginal farms, which was mainly due to time of sale and agencies to which the produce was sold.

The overall average gross returns per hectare on cauliflower farms amounted to Rs. 118994.93 and it varied from Rs. 89422.77 on marginal farms to Rs. 127799.52 on medium farms. Thus gross income increased with an increase in size of the farms, except medium farms.

An analysis of per hectare net return as given in Table 4 shows that net returns over operational cost (Cost A) was the highest (Rs. 73602.04) on large farms and the lowest (Rs. 38317.16) on marginal farms with on an average of Rs. 66361.70 on sample farms. Net returns from cauliflower farms on the basis of Cost B, Cost C1 and cost C2 was Rs. 56477.47, Rs. 52969.08 and Rs. 46366.49 per hectare, respectively. It is apparent from the analysis that per hectare net returns on cauliflower farms over Cost C2 ranged from Rs. 14939.69 on marginal farms to Rs. 54405.55 on large farms with an average of Rs. 46366.49. Net income over different costs on cauliflower farms increased with increase in the size of farms.

Table 4: Net gains over different costs per hectare

Category of farm	Net gains over different costs (Rs/hectare)			
	Cost A	Cost B	Cost C$_1$	Cost C$_2$
Marginal	38317.76	26626.17	21710.88	14939.69
Small	60629.31	50238.40	46196.52	39600.95

Medium	72653.49	63243.18	60001.88	53222.11
Large	73602.04	64080.25	120056.32	54405.55
Overall	66361.70	56477.47	52969.08	46366.49

The overall per hectare farm business income, family labour income and farm investment income as given in Table 4 was found to be Rs.66361.70, Rs. 56477.47 and Rs.56250.72, respectively. The net profit per hectare (over Cost C2) was Rs. 46366.49 for all farms. The analysis also brought to the fore that farm business income, family labour income and farm investment as well as net profit increased as the category of farm changed from marginal to large. (Table 5)

Table 5: Farm Business Income, Family Labour Income, Farm Investment Income and Net Profit over Cost-C2 (`/hectare)

Particulars	Category of farm				
	Marginal	Small	Medium	Large	Overall
Farm business income	38317.76	60629.31	72653.49	73602.04	66361.70
Family labour income	26626.17	50238.40	63243.18	64080.25	56477.47
Farm investment income	26631.27	49991.86	62632.42	63927.35	56250.72
Net profit	14939.69	39600.95	53222.11	54405.55	46366.49

3.4 Costs per Quintal

The estimated cost of production per quintal of cauliflower is given in Table 6. The overall paid out cost (cost A) per quintal was Rs. 157.99, which was 72.46 per cent of the total cost. The overall cost B came to Rs. 187.67 per quintal which was 86.07 per cent of total cost. The overall total cost of production (cost C2) per quintal of cauliflower was about Rs. 218.02. It was highest on marginal farms (Rs. 260.22). As the category of farm increased the total cost per quintal was declined. It was mainly due to the higher productivity seen in cauliflower on higher category of farms.

Table 6: Cost of Production per Quintal on the Basis of Different Cost Concepts

Category of farm	Different costs (Rs per quintal)			
	Cost A	Cost B	Cost C_1	Cost C_2
Marginal	178.54 (68.61)	219.39 (84.30)	236.56 (90.90)	260.22 (100.00)
Small	162.78 (71.01)	195.61 (85.33)	208.38 (90.90)	229.22 (100.00)
Medium	158.47 (73.94)	185.51 (86.56)	194.82 (90.90)	214.30 (100.00)
Large	154.84 (73.41)	182.65 (86.60)	191.73 (90.90)	210.91 (100.00)
Overall	157.99 (72.46)	187.67 (86.07)	198.20 (90.90)	218.02 (100.00)

Note : Figures in parentheses indicate the percentages to Cost-C2

3.5 Input-Output Ratio

The input-output ratio reflects the criteria for economic viability of the crop based on return per rupee invested. The input-output ratios were worked out on the basis of different cost concepts and the same are presented in Table 7.

Table 7: Input-Output Ratio

Category of farm	Cost A	Cost B	Cost C_1	Cost C_2
Marginal	1:1.75	1:1.42	1:1.32	1:1.20
Small	1:2.18	1:1.81	1:1.70	1:1.55
Medium	1:2.32	1:1.98	1:1.89	1:1.71
Large	1:2.39	1:2.02	1:1.93	1:1.75
Overall	1:2.26	1:1.90	1:1.80	1:1.64

The overall input output ratio which was found to be 1: 1.64 on the basis of cost C2 indicated that an investment worth Rs. 1 on all the inputs used in the cultivation of cauliflower yielded an output worth Rs. 1.64. The input output ratio was the lowest (1: 1.20) on marginal farms and the highest (1: 1.75) on large farms. This may be attributed to the low level of awareness and education background of the marginal farmers.

Further, it was observed that the input output ratio on the basis of cost A i.e. paid out cost, was highest (1:2.39) on large farms. The input-output ratio over cost A, cost B, cost C1 and cost C2 were 2.26, 1.90, 1.80 and 1.64, respectively. Results indicated that on an average the farmers obtained Rs 2.26 as total returns per rupee invested.

3.6 PRODUCTION FUNCTION ANALYSIS

To achieve the objective of resource use efficiency on the cauliflower farms, Cobb-Douglas production function was used. Gross production considered as dependent variable and other variables i.e. the human labour, bullock labour, manure, cost of seeds, chemical fertilizers, irrigation and plant protection chemicals taken as independent variables. The Elasticity's of production with its standard errors are presented in Table 8. It can be seen from the table that the co-efficient of multiple determinations was 0.96 which showed that 96 per cent of the variation in the yield was accounted for by the independent variables included in the function.

The conspicuous observation from the table is that the variables viz, bullock labour, plant protection chemical, and irrigation exert highly significant influence on the yield. It implies that 1 per cent increase in the use of these inputs will result in increase of 0.432, 0.192 and 0.187 per cent in the yield of crop respectively.

Table 8: Estimated Production Function for Cauliflower

Sr. No.	Variables	Production Elasticity (bi)
1.	X_1 = Human Labour (Man Days)	0.184 (0.158)
2.	X_2 = Bullock Labour (Pair Days)	0.432*** (0.159)

3.	X_3 = Manures (Trolley)	-0.331 (0.601)
4.	X_4 = Cost of Seeds (Rs.)	0.487 (0.431)
5.	X_5 = Cost of Fertilizers (Rs.)	-0.080 (0.310)
6.	X_6 = Cost of Plant Protection Chemicals (Rs.)	0.192*** (0.054)
7.	X_7 = Irrigation Charges (Rs.)	0.187*** (0.049)
8.	a = Constant	0.265
9.	R^2 = Co-efficient of Multiple Determination	0.96
10.	Σ bi's = Sum of Elasticities	1.071
11.	N = Number of Farms	120

Note: Figures in parentheses indicate standard error of corresponding elasticity

*** Significant at 1 per cent level of significance

The sum of regression co-efficient (Σbi's) was 1.071 indicating increasing returns to scale in other words sample farmers were observed operating in first zone of production. Looking to the elasticies, co-efficient of multiple determination on and returns to scale it can be concluded that gross income from cauliflower crop increasing proportionally with an increasing in the valuable factors except fertilizer and manure. The results reported by Singh & Vashist (1999), and Singh (2000) were closer to these findings.

Conclusions

Cauliflower cultivation activity is completed within 3 months in the study area. The average total cost of cultivation of cauliflower was Rs. 73232.95. It was the highest (Rs. 74577.4) on medium farms followed by Rs. 74483.08 on marginal farms, Rs. 72551.24 on small farms and Rs. 72622.81 on large farms. On an average Cost A (paid out cost) formed 72.46 per cent of total cost, while Cost B accounted for 86.07 per cent of total cost. Break-up of total cost on sample farms indicated that per hectare expenditure on cost of human labour ranked first. The average yield of cauliflower was observed 333.13 quintals per hectare. It was highest (348.00 quintals) on medium size farms and lowest (286.24 quintals) on marginal farms. The average farm harvest price received by the cauliflower growers was Rs. 357.20 per quintal. It varied from Rs. 369.80 on large farms to Rs. 312.41 on marginal farms. The gross income per hectare was highest (Rs. 127799.52) on medium farms and lowest (Rs. 89422.77) on marginal farms with an average of Rs. 118994.93 on sample farms.

On an average net return per hectare from cauliflower farms on Cost A, B, C1 and Cost C2 was Rs. 66361.70, Rs. 56477.47, Rs. 52969.08 and Rs. 46366.49, respectively. The study has brought to the fore that the average net profit increased as the size of farm increased. The average per hectare farm business income, family labour income and farm investment income were Rs. 66361.70, Rs. 56477.47 and Rs. 56250.72, respectively on the sample farms. The input-output ratio was 1:1.64 on the basis of cost C2 and it was found increasing with increase in the farm size.

The functional analysis indicated that cost of bullock labour, plant protection and irrigation exerted highly significant influence on the yield of cauliflower. One per cent increase in the use of these inputs resulted in an increase of 0.432, 0.192 and 0.187 per cent in the yield, respectively. The value of coefficient of multiple determinations showed that about 96 per cent of variation in gross income from cauliflower cultivation was explained by the independent variables included in the function. The sum of regression coefficient was observed 1.071 indicating increasing returns to scale suggesting more rational use of the inputs leading to higher returns. Looking to the cost, return, input-output ratio and resource use efficiency, it can be concluded that cauliflower cultivation was profitable vegetables crop in Middle Gujarat condition.

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