

Input use, cost structure and return analysis of Sugarcane crop in South Gujarat

V. N. Parmar¹, K. S. Patel² and C. D. Pandya³

Abstract

This paper attempts to measure the economics of sugarcane production in South Gujarat. The study was conducted during the year 2013-14 with 240 farmers. The decision and choice of crops to be grown on a farm and the area to be allocated under a crop depends to a large extent on the price of output, productivity level, technology available and the level and prices of inputs used in their production. The knowledge of input use, cost structure and returns from the cultivation of crops helps in formulating policies at macro and micro levels. Such knowledge is more useful for crops cultivated mainly for the market viz. the cash crops, spice crops, fruits, vegetables and other high value crops. This paper focuses on pattern of input use in cultivation of sugarcane crop and cost structure and returns from sugarcane cultivation. Findings of the study revealed that due to statutory price for sugarcane, this crop is grown not by choice but due to its assured returns. Moreover, due to set package of practices, the cost and returns across the farm categories did not vary much.

Introduction

Sugarcane is an important commercial crop of the world. India ranks second among the sugarcane growing countries in the world in both area and production after Brazil. The production of sugarcane was 3345.41 lakh tonnes with an area of 50.85 lakh hectares and the productivity was about 65.7 t/ha. in the year 2012-13. Gujarat produced 127.50 lakh tonnes of sugarcane covering an area of 2.02 lakh hectares and 63.1 t/ha productivity in the year 2012-13. Of this more than 90 per cent area and production of sugarcane was recorded in the South Gujarat region of Gujarat state. Sugarcane is the main cash crop of South Gujarat region.

This study focuses on pattern of input use in cultivation of sugarcane crop and cost structure and returns from sugarcane cultivation.

Methodology

For calculating the cost of production of sugarcane, a cluster of four villages having major proportion of area under sugarcane was selected from each of the five

¹ Farm Manager, Krishi Vigyan Kendra, Vyara

² Retired Professor & Head, Dept. of Agricultural Economics, NMCA, Navsari Agricultural University, Navsari

³ Programme Co-ordinator, Krishi Vigyan Kendra, Vyara

districts viz., Surat, Bharuch, Navsari, Valsad, and Tapi. Two talukas were selected from each district having major area under sugarcane. Further, two villages were selected from each taluka. The selected villages were in the jurisdiction area of Bardoli, Madhi, Gandevi, Mahuva and Maroli sugar factories. From each taluka 12 farmers were selected, making a total sample size of 240 farmers.

Cost concept

The cost concepts used and the procedure followed in the analysis of data pertaining to the cost of cultivation of sugarcane are those which are generally adopted in farm management studies. The various cost concepts are derived by agricultural economists, which were used while analyzing the data:

Cost A₁: It includes

1. Value of hired human labour.
2. Value of hired and owned bullock labour.
3. Value of hired and owned machine labour.
4. Value of seed (both farm seed and purchased).
5. Value of manure (owned and purchased).
6. Cost of fertilizers.
7. Plant protection charges (insecticide/pesticide).
8. Irrigation charges.
9. Land revenue.
10. Interest on working capital.
11. Miscellaneous expenses.
12. Depreciation.

Family labour was charged at the rate of hired labour charges prevailing in the region. Owned bullock labour is taken on the basis of hire rate prevailing in the village. The purchased manures were valued at the actual price paid by the farmers.

Cost A₂: Cost A₁ + rent paid for leased in land.

Cost B₁: Cost A₁ + interest on fixed capital (excluding land)

Cost B₂: Cost B₁ + rental value of owned land + rent for leased land.

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

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

Cost of production:

$$\text{Cost of production /qt} = \frac{\text{Cost of cultivation}}{\text{Quantity of main product}}$$

Income measures: Following income measures were used:

Gross income: it is the total value of main product as well as of by product.

$$GI = (Q_m \times P_m) + (Q_b \times P_b)$$

Where,

GI = Gross income

Q_m = Quantity of main product

P_m = Price of main product

Q_b = Quantity of by product

P_b = Price of by product

Result and Discussion

The Results and Discussion focus on the pattern of input use in cultivation of sugarcane crop and the cost and returns from sugarcane cultivation.

(1) Pattern of Input Use in Cultivation of Sugarcane Crop

Sugarcane is one of the major cash crops occupying a prominent place in the economy of cultivators. Therefore, the cost of sugarcane cultivation is of paramount importance in determining the net income from it. The details of per hectare component wise costs for sugarcane cultivation on different sizes of farms were studied and the results are furnished in Table 1.

It can be seen from the results presented in Table 1 that the per hectare total cost of cultivation was found to be the highest (Rs.187214.98) on large farms and the lowest (Rs.179486.99) on small farms with an overall total cost of Rs.181986.10. The cost of cultivation among large farmers may be higher due to utilization of hired human labour, bullock labour, tractor, manures and weedicide compared to other farm size groups. Among the different items of cash expenditure, the major cost of sugarcane cultivation was hired human labour and planting material constituting 13.89 and 13.02 per cent of the total cost, respectively. Rental value of land constituted a major proportion (14.79%) of the total cost.

Table 1. Pattern of Input Use in Cultivation of Sugarcane Crop**(Rs. /hectare)**

Sl. No.	Item	Category of Farm			
		Small	Medium	Large	Average
1	Total human labour				
	(a) Family	6654.66 (3.71)	4813.2 (2.63)	4200.7 (2.24)	5552.55 (3.05)
	(b) Hired	24680.4 (13.75)	25492.8 (13.95)	26480.4 (14.14)	25280.21 (13.89)
2	Bullock labour	2891.5 (1.61)	2995.5 (1.64)	3412.5 (1.82)	3014.29 (1.66)
3	Tractor charges (hrs)	9232.11 (5.14)	9804.33 (5.36)	10576.91 (5.65)	9666.77 (5.31)
4	Planting material (tonnes)	24050.5 (13.40)	23500.25 (12.86)	23200.34 (12.39)	23702.67 (13.02)
5	Manures	3970.65 (2.21)	4492.97 (2.46)	4639.11 (2.48)	4278.89 (2.35)
6	Chemical fertilizers	14806.98 (8.25)	15045.77 (8.23)	14962.37 (7.99)	14924.11 (8.20)
7	Irrigation	11691.33 (6.51)	11518.89 (6.30)	11086.26 (5.92)	11528.71 (6.33)
8	Weedicide	3500.89 (1.95)	4150.15 (2.27)	5150.55 (2.75)	4013.67 (2.21)
9	Insecticide / Pesticide	358.15 (0.20)	402.33 (0.22)	420.66 (0.22)	385.17 (0.21)
10	Miscellaneous	9592.97 (5.34)	9812.6 (5.37)	9941.87 (5.31)	9733.32 (5.35)
11	Depreciation	869.4 (0.48)	783.32 (0.43)	654.84 (0.35)	802.07 (0.44)
12	Interest on working capital	12677.55 (7.06)	12959.92 (7.09)	13263.01 (7.08)	12879.67 (7.08)
13	Interest on fixed capital	10989.43 (6.12)	12091.65 (6.62)	12834.35 (6.86)	11708.65 (6.43)
14	Rental value of owned land	26204.43 (14.60)	27199.65 (14.88)	28204.43 (15.07)	26906.74 (14.79)
15	Managerial cost	17316.04 (9.65)	17715.5 (9.69)	18186.68 (9.71)	17608.61 (9.68)
16	Total	179486.99 (100.00)	182778.83 (100.00)	187214.98 (100.00)	181986.1 (100.00)

Note : Figures in parentheses indicate percentage to total

Source: Field Survey

The other items of cost of cultivation were interest on managerial costs (9.68 per cent), interest on working capital (7.08 per cent), fixed capital (6.43 per cent), irrigation charges (6.33 per cent), manures and cakes (2.35 per cent), fertilizers (8.20 per cent), tractor charges (5.31 per cent), depreciation (0.44 per cent), miscellaneous (5.35 per cent), weedicide (2.21 per cent), bullock labour (1.68 per cent).

(2) Cost and Returns from Sugarcane Cultivation

2.1 Estimates of different costs

Estimates of different costs such as Cost A₂, Cost B₂, Cost C₁ and Cost C₂ are presented in Table 2.

It can be inferred from the table that the highest per hectare Cost-A₂ was Rs.136623.20 on large farms and lowest was Rs.129311.90 on small farms. The overall Cost-A₂ incurred, amounted to Rs.131918.20 per hectare. The study also showed that (Cost-B₂) and (Cost-C₁) accounted for about 93.71 and 96.76 per cent of the total (Cost-C₂). On an average, Cost C₂ was the highest on large farms (Rs.187214.98 per hectare) and lowest on small farms (Rs.179486.99 per hectare). The overall cost C₂ incurred amounted to Rs.181986.10. Higher costs on large farms are associated with intensive use of hired human labour and bullock labour as compared to medium and small size farm group. No particular trend was observed in different cost concepts among various categories of sugarcane cultivators.

Table 2. Estimation of Different Costs

Category of Farm	Different Costs (Rs. per hectare)			
	Cost-A ₂	Cost-B ₂	Cost-C ₁	Cost-C ₂
Small	129311.90 (72.04)	166505.76 (92.76)	173160.42 (96.48)	179486.99 (100.00)
Medium	133050.50 (72.79)	172341.80 (94.29)	177155.00 (96.92)	182778.83 (100.00)
Large	136623.20 (72.98)	177661.98 (94.90)	181862.68 (97.14)	187214.98 (100.00)
Overall	131918.20 (72.49)	170533.59 (93.71)	176086.14 (96.76)	181986.10 (100.00)

Figure in parenthesis indicate percentages to Cost-C₂

Source: Field Survey

2.2 Yield, price, gross income and net gains

Yield, farm harvest price and value of gross output from sugarcane production on different farm size groups are presented in Table 3.

It is revealed from the table that the average yield of sugarcane across the categories of farmers was 84.91 tonnes per hectare. It ranged from 83.45 tonnes per ha on small farms to 87.99 tonnes per ha on large farms. Higher yield level on large farms may be due to optimum level of inputs utilized by them along with timely weeding operations, proper selection of varieties of sugarcane, which affect the output to a greater extent, as compared to other categories of farms. The variation in the yield might be due to the different time of sowing, types of land and use of hybrid variety.

The results pertaining to the price presented in Table 3 indicate that per tonne average price received by the respondent sugarcane growers was Rs.3196.17. The large size growers realized higher prices per tonne (Rs.3297.76) followed by medium (Rs.3228.55) and small (Rs.3133.13). Generally, medium and large farm growers managed the time of sowing and harvesting so they realized higher price as compared to small farmers. It is a known fact that, at early crushing stage, sugar factories pay marginally higher price to farmers.

Table 3. Yield Level, Farm Harvest Price and Gross Income per hectare

Category of Farm	Yield (tonnes)	Harvest price (Rs./ton)	Value of gross output (Rs.)
Small	83.45	3133.13	261459.70
Medium	85.77	3228.55	276912.73
Large	87.99	3297.76	288853.79
Overall	84.91	3196.17	271386.79

Source: Field Survey

The average gross returns per hectare on sugarcane farms amounted to Rs.271386.79 varying from Rs.288853.79 on large farms to Rs.261459.70 on small farms. The gross income was the highest on large farms followed by medium and small farms. This might be due to early harvesting of sugarcane by small farmers to manage the next season; some time for early harvesting they burn their produce or sell to other sources as khandsari or to other middlemen.

Table 4. Net Gains over Different Costs per hectare

Category of Farm	Net gains over different costs			
	Cost-A ₂	Cost-B ₂	Cost-C ₁	Cost-C ₂
Small	132147.80	94953.94	88299.28	81972.71
Medium	143862.23	104570.93	99757.73	94134.4
Large	152230.59	111191.81	106991.11	101638.81
Overall	140068.59	100833.20	95300.62	89400.69

Source: Field Survey

A perusal of Table 4 shows that the per hectare net return over operational cost (Cost-A₂) was the highest (Rs.152230.59) on large farms and the lowest (Rs.132147.80) on small farms with average net returns of Rs.140068.59. Overall net returns from sugarcane farms on the basis of Cost B₂, Cost C₁ and Cost C₂ was Rs.100833.20, Rs.95300.62 and Rs.89400.69 per hectare, respectively. It is apparent from table 4 that per hectare net returns on sugarcane farms over Cost C₂ ranged from

Rs.81972.71 on small farms to Rs.101638.81 on large farms with an average of Rs.89400.69. No particular trend was observed in different cost concepts on various categories of sugarcane cultivators.

The overall per hectare farm business income, family labour income and net profit (Table 5) were Rs.140068.59, Rs.100833.20, Rs.89400.69 respectively. The data further revealed that the overall net profit per hectare (over Cost - C₂) was Rs.89400.69. There was not much variation in farm business income across the farm categories.

Table 5. Farm Business Income, Family Labour Income, Farm Investment Income and Net Profit over Cost - C₂

(Rs./hectare)

Category of Farm	Small	Medium	Large	Overall
Farm business income	132147.80	143862.23	152230.59	140068.59
Family labour income	94953.94	104570.93	111191.81	100833.20
Net profit	81972.71	94134.40	101638.81	89400.69

Source: Field Survey

2.3 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 6.

The overall input output ratio was 1:1.49 on the basis of cost - C₂. It indicates that an investment worth Rs.1 on all the inputs used in the cultivation of sugarcane yielded an output worth Rs.1.49. The input output ratio was the lowest (1:1.46) on small farms and the highest (1:1.49) on large farms.

Further, it was observed that the input output ratio on the basis of cost-A₂ i.e. paid out cost, was the highest (1:2.11) on large farms followed by medium farms (1:2.02) and small farms (1:2.31). There was not much variation in input-output ratio across categories of farms, because sugarcane was mostly sold to co-operative sugar factories so, price variation was less.

Table 6. Input-Output Ratio

Category of Farm	Cost-A ₂	Cost-B ₂	Cost-C ₁	Cost-C ₂
Small	1:2.02	1:1.57	1:1.51	1:1.46
Medium	1:2.08	1:1.60	1:1.56	1:1.52
Large	1:2.11	1:1.62	1:1.59	1:1.54
Overall Farms	1:2.06	1:1.59	1:1.54	1:1.49

Source: Field Survey

2.4 Cost per tonne

It is the cost-price relationship (the cost-price ratio) that generally decides the economic prosperity and the degree of commercialization on these farms. Given the price, offered by the market mechanism to a unit of output, the farmer's prosperity depends upon his capacity to produce his output at a lesser cost than the market price.

Table 7. Cost of Production per tonne on the basis of Different Cost Concepts

Category of Farm	Different costs (Rs. per quintal)			
	Cost A ₂	Cost B ₂	Cost C ₁	Cost C ₂
Small	1549.57 (72.04)	1995.28 (92.76)	2075.01 (96.47)	2150.83 (100.00)
Medium	1551.25 (72.79)	2009.35 (94.29)	2065.47 (96.92)	2131.03 (100.00)
Large	1570.38 (72.98)	2042.09 (94.94)	2090.38 (97.14)	2151.90 (100.00)
Overall	1553.62 (72.49)	2008.64 (93.72)	2073.80 (96.75)	2143.28 (100.00)

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

Source: Field Survey

The estimated cost of production per tonne of sugarcane is given in Table 7. The overall paid out cost (cost- A₂) per tonne was Rs.1553.62, which was 72.49 per cent of the overall total cost. The overall cost B₂ came to Rs.2008.64 per tonne (93.72 per cent of overall total cost). The overall total cost of production (cost C₂) per tonne of sugarcane was Rs.2143.28. Cost of production per tonne is highest on large farms (Rs.2151.90), followed by small farms (Rs.2150.83) and medium farms (Rs.2131.03).

Conclusion

Overall per hectare Cost-A₂, Cost-B₂, Cost-C₁ and Cost C₂ of sugarcane cultivation came to Rs.131918.20, Rs.170533.59, Rs.176086.14 and Rs.181986.10. Higher costs on big farms are associated with intensive use of hired human labour, bullock labour, tractor charges and manure charges.

The average overall yield of sugarcane was 84.91 tonnes per hectare. It was highest (87.99 tonnes) on large size farms and lowest (83.45 tonnes) on small size farms.

The average overall farm harvest price received by the sugarcane growers was Rs.3196.17 per tonne. It varied from Rs.3133.13 on small farms to Rs.3297.17 on large farms. The gross income per hectare was highest i.e. Rs.288853.79 on large farms and lowest i.e. Rs.261459.70 on small farms with an average of Rs.271386.79.

On an average net return per hectare from sugarcane farms on the basis of Cost A, B, C₁ and C₂ was Rs.140068.59, Rs.100833.20, Rs.95300.62 and Rs.89400.69, respectively.

The average per hectare farm business income and family labour income were Rs.140068.59, and Rs.100833.20, respectively on the sample farms. The average net profit per hectare over (Cost-C₂) was Rs.89400.69 and it increased with the increase in size of farms, except in case of small size farms.

The overall input-output ratio was 1:1.49 on the basis of cost- C₂. It was the highest (1: 1.54) on large farms, followed by medium farms (1:1.52), and small farms (1:1.46). Thus, it shows increasing trend with an increase in the farm size.

The average cost of production per tonne of sugarcane was about Rs.2143.28 which was lower than the market price of sugarcane ranging from Rs.3000 to Rs.3400 per quintal. Therefore, it can be concluded that sugarcane cultivation was quite remunerative even if the lowest market price is considered. Cost of production per tonne varied from Rs.2131.03 on medium farms to Rs.2151.90 on large farms.

Therefore, it can be concluded that sugarcane cultivation was quite remunerative, but if the price of cane is dropped by co-operative sugar factories then it would not be remunerative, as there is no other marketing option for sugarcane in South Gujarat.

References

- Alibaba (2005). Economics of jaggery industry in Andhra Pradesh. Ph. D thesis, unpublished, submitted to Acharya N.G.Ranga Agricultural University.
- Deokate tai Balasaheb. Quantification of yield gaps in different types of sugarcane in Maharashtra, <http://www.igidr.ac.in/pdf/publication/WP-2013-011.pdf>
- Namadeva Shinde, Patil B.L., Murthy C. and Maledesai N.R. (2009) Profitability analysis of sugarcane based inter cropping systems in Belgaum districts of Karnataka. *Karnataka J. of Agri. Sci.*, 22(4) : (820-823):2003.
- Padilla M. Dina and Peter Leslie Nuthall (1998). Technical efficiency in the production of sugarcane in central negros area, Philippines: an application of data envelopment analysis. *J. ISSAAS*. Vol. 15 No. 1:77-90.

- Raman Rao I.V.Y. (2012). Economic analysis of value addition in sugarcane in north coastal zone of Andhra Pradesh. *Ind. Jour. Agril. Mktg.*, 24(2):40-49.
- Raman Rao I.V.Y. (2012). Efficiency, yield gap and constraints analysis in irrigated vis-à-vis rainfed sugarcane in north coastal zone of Andhra Pradesh. *Agricultural Economic Research Review*, 25(1):161-171.
- Sandeep Bogale, (2002). An economic analysis of cropping system in Bidar district of Karnataka. M.Sc.(Agri.) thesis, Univ. Agric. Sci., Dharwad.