



Production and Marketing of Potato in Middle Gujarat

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ABSTRACT

Background: This paper presents the economic analysis of potato cultivation in middle Gujarat. The area under total vegetable and production of vegetables in the state has increased over the years. The study focuses on production and marketing of potato in middle Gujarat.

Methods: Primary data were collected using pre-tested schedule. The cost of production was calculated using cost concept and marketing efficiency was calculated using Acharya's formula.

Result: The study found that the cost C_2 was ₹ 208587.5 per hectare for potato cultivation. Yield of potato was found to be 242.5 quintal per hectare, while gross income was ₹ 247370.4 per hectare. The net return was observed to be at ₹ 38782.9 per ha for potato cultivation. Benefit cost ratio over cost C_2 was observed to be at 1.19. There were two marketing channels found in potato in study area. The market efficiency was found higher in channel I. Unavailability of labour, long distance of input market and increasing prices of inputs were the major production constraints, while low price received by farmer, delayed in payment and higher cost of transportation were the major marketing constraint found in study area.

Key words: Cost-concept, Marketing, Potato, Production.

INTRODUCTION

The wide variability in climate and soils available in state of Gujarat is favourable for growing a large number of horticultural crops such as vegetables like tomato, potato, brinjal, chilli *etc.* The cultivation of these crops provides sustainability to net income of farmers, especially small and marginal farmers of the region. The Government of India in co-operation with Government of Gujarat has taken several measures to diversify the cropping pattern of farmers towards horticultural crops mainly to generate additional and sustainable net income, increased employment opportunities, optimum utilization of natural resources *etc.* Due to these efforts, significant progress has been achieved in the expansion of area under horticultural crops in the state.

Vegetables over all scenario

To meet the ever-increasing demand for vegetables, efforts were being made to increase their production through adding area under these crops and improving their productivity in Gujarat state as well as national level. During 2001-02 to 2016-17, the average area under vegetable crops has increased in Gujarat state and at national level, by 172.01 per cent and 67.15 per cent, respectively (Commodities.cmie.in). During the period 2001-02 to 2016-17, the production of vegetables increased in Middle Gujarat, Gujarat and also at national level. The increase was highest at 298.82 per cent in Gujarat state and India (97.47%). The increase in production of vegetable crop was primarily due to area expansion and secondly, due to improvement in yield of vegetables crops. The mean production of vegetables crops during the study period was 80518.69 thousand tones and 132636.63 thousand tonnes in Gujarat state and at all-India level, respectively

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(Commodities.cmie.in). The improvement in productivity of vegetables crops was observed highest in Gujarat state (46.65%) and at the all-India level (18.14%). During the period 2001-02 to 2016-17, the average productivity level of vegetable crops was higher in Gujarat state (17.57 tonnes/ha) compared to all-India level (16.18 tonnes/ha) (Commodities.cmie.in).

Potato

Table 1 shows a comparative performance of area, production and productivity of potato at National level and state level (Gujarat) over a period of 11 years (2010-11 to 2020-21). Area under potato cultivation in Gujarat from 2010-11 to 2020-21 increased by 65.3 thousand hectares to 125.5 thousand hectares which is 92.19 per cent increase. It should be noted that the national growth of potato acreage was 18.24 per cent in the corresponding period. It indicates that the growth in acreage under potato is higher in the state as against the nation as a whole. In state of Gujarat, production of potato increased by massive 106 per cent from 1881 thousand tonnes in 2010-11 to 3890 thousand tonnes in 2020-21. On the other hand, All

India production of potato increased by 32.67 per cent from 42339 thousand tonnes to 56172 thousand tonnes in the corresponding period. Registering this huge growth in potato is production for the state of Gujarat and could be attribute to. The productivity of potato has increased from 28809.10 kg/ha in 2010-11 to 31002.40 kg/ha in 2020-21 in Gujarat state with 7.61 per cent. While at national level, the productivity has increased up to 12.21 per cent from 22724.00 kg/ha in 2010-11 to 25497.80 kg/ha in 2020-21.

As potato is one of the major vegetable crops in middle Gujarat with significantly higher production, the economic analysis of potato cultivation needs to be investigated to check the profitability, economic viability and returns per rupee invested of the crop and also to analyse the marketing channel of the crop. For that purpose, study aims at economic analysis, marketing channel and constraint has been taken up.

MATERIALS AND METHODS

Area of survey

The study was conducted in Middle Gujarat which comprises of nine districts namely, Anand, Kheda, Vadodara, ChhotaUdepur, Ahmedabad, Botad, Dahod, Panchmahal and Mahisagar. For potato, the data was collected from Anand and Kheda district as the area and production of potato was higher in both the districts (doh.gujarat.gov.in) (Table 2). The research work has been carried out at International Agribusiness management Institute, Anand Agricultural University, Anand under the research project on Research on supply chain and market integration for key agro commodities for farmers awareness and income enhancement in middle Gujarat.

Source of data

Primary Data Primary data was collected through survey method with the help of well-structured pre-tested schedule. For potato, marketing channels were found during the primary data collections. The secondary data in respect of area and production of potato crop were collected from the records and reports of the Directorate of Horticulture and statistics, Government of Gujarat (Anonymous, 2016).

Period of study

Primary data was collected in agricultural year 2016-17. The sampling method was non-probability sampling under which convenience sampling technique was used. Farmers, commission agents, village level traders, pre-harvest contractors, wholesalers, traders and retailers from Middle Gujarat was selected as sampling unit. Table 3 shows the numbers of farmers, traders, wholesalers and retailers, which was selected as sample from selected districts. 50 farmers were selected from each district so a total 100 farmers were selected from both the districts for the study.

Analytical tools and techniques

Cost concepts

The cost concept (CACP approach) was used to calculate cost and return analysis. Here, Cost A is also referred as operating cost or paid-out cost and Cost C₂ is also referred as the total cost.

Cost A=	Value of hired human labour + Value of bullock labour(owned / hired) + Value of seeds (owned / purchased) + Value of manure (owned / purchased) + Value of fertilizer + Value of pesticides and insecticides + Irrigation charges + Charges for machineries(owned/hired) + Other paid-out expenses if any + Depreciation on farm building and implements + Interest on working capital
Cost B=	Cost A + Rental value of owned land + Interest on fixed capital assets (excluding land)
Cost C ₁ =	Cost B + Imputed value of family labour
Cost C ₂ =	Cost C ₁ + 10 per cent of the Cost C ₁ as a managerial charge

Marketing efficiency

Marketing efficiency was calculated using Acharya's Modified measure of Marketing Efficiency (MME) (Acharya and Agarwal, 2001), which states.

$$MME = [RP \div (MC + MM)] - 1$$

Where:

MME= Index of marketing efficiency.

RP= Price paid by the consumer.

MC= Total marketing cost.

MM= Net marketing margin.

Producer share in consumer rupee (PS) was calculated as below

$$PS = \frac{PF}{PR} \times 100$$

Where:

PF= Net price received by the producer.

PR= Retail price (price paid by the consumer).

Price spread

It is the difference between the two prices, i.e., the price paid by the consumer and the price received by the producer. e.g.

$$P_1 - P_2$$

Where:

P₁= Price at one level or stage in the market.

P₂= Price at another level.

Garrett's ranking technique

To find the most significant constraint influencing the stakeholders in the existing vegetable commodity system, Garrett's Ranking Technique was employed. It was calculated as percentage score and the scale value was obtained by employing Scale Conversion Table given by Henry Garrett.

The Percentage Score was calculated as,

$$\text{Percent score} = 100 (R_{ij} - 0.50) / N_{ij}$$

Where:

R_{ij} = Rank given for i th constraint by j th individual.

N_{ij} = Number of constraints ranked by j th individual.

The percent position of each rank was converted into scores using Garrett's Table. For each constraint, scores of individual respondents were added together and were divided by total number of respondents who responded. Thus, mean score for each constraint was ranked by arranging them in descending order.

Table 1: Area, production and productivity of potato over the years 2010-11 to 2020-21.

Year	Gujarat			All India		
	Area (‘000 ha)	Production (‘000 t)	Productivity (Kg/ha)	Area (‘000 ha)	Production (‘000 t)	Productivity (Kg/ha)
2010-11	65.3	1,881.80	28,809.10	1,863.20	42,339.40	22,724.00
2011-12	80.7	2,395.50	29,684.50	1,907.00	41,482.80	21,753.30
2012-13	81.3	2,499.70	30,758.30	1,992.20	45,343.60	22,760.40
2013-14	73.6	2,267.40	30,790.10	1,973.20	41,555.40	21,060.00
2014-15	98.2	2,964.10	30,184.30	2,075.90	48,009.20	23,127.20
2015-16	112.4	3,549.40	31,578.10	2,116.90	43,417.10	20,509.40
2016-17	122.5	3,797.80	30,995.50	2,179.20	48,604.60	22,303.40
2017-18	133.3	3,806.90	28,560.90	2,141.70	51,310.00	23,957.40
2018-19	124.6	3,706.00	29,732.20	2,173.00	50,189.50	23,097.00
2019-20	118	3,616.50	30,648.30	2,051.30	48,561.90	23,673.20
2020-21	125.5	3,890.00	31,002.40	2,203.00	56,172.50	25,497.80
% Change	92.19	106.72	7.61	18.24	32.67	12.21
CAGR	0.061	0.068	0.007	0.015	0.026	0.011

Source: Commodities.cmie.in.

Table 2: Area and production of potato in Gujarat.

Crops	Districts	2016-17		2017-18	
		Area (ha)	Production (MT)	Area (ha)	Production (MT)
Potato	Ahmedabad	100	2563	50	1281
	Anand	2584	80698	2631	82166
	Botad	0	0	0	0
	ChhotaUdepur	0	0	0	0
	Dahod	0	0	0	0
	Kheda	6100	152515	6001	150025
	Mahisagar	200	4125	106	2187
	Panchmahal	100	2125	65	1378
	Vadodara	100	2100	334	8183

Source: [https://doh.gujarat.gov.in/Home/Horticulture Cultivation](https://doh.gujarat.gov.in/Home/Horticulture_Cultivation).

Table 3: Sampling unit.

Crops	Districts	No. of Farmers	No. of Commission Agents/Village level Traders	Wholesalers/Pre- Harvest Contractors	254 Retailers 254
Potato	Anand	50	20	20	10
	Kheda	50	20	20	10

RESULTS AND DISCUSSION

Cost of cultivation of potato

Cost of cultivation has importance in determining the net income from different vegetables crops. Hence, the details of per hectare cost and various factor costs for the production of potato was studied and presented in Table 4.

Among different items of expenditure, the overall cost of human labour and cost of machine labour ranked first with 21.97 per cent of the total cost of cultivation, followed by value of seeds (20.68%), value of chemical fertilizer (17.58%), value of pesticides (3.47%), depreciation charges (3.07%) and irrigation charges (1.69%). The share of human labour cost on all the categories of farms was higher because more labour was required for picking of potato.

Table 5 shows that the on an average total cost of cultivation (Cost C₂) per hectare of potato was ₹ 208587.5. It can also be observed that on an average Cost A formed 68.77 per cent (₹ 143443.6) of total cost, while Cost B accounted for 89.22 per cent (₹ 186099.4) of total cost.

A perusal of Table 6 shows the yield and gross income of potato cultivation. Yield of potato was observed 242.5 quintal per hectare, while gross income was ₹ 247370.4 per hectare.

The net return over different costs are presented in Table 7. That table revealed that the net return over cost A was ₹ 96395.5 per ha and over cost B ₹ 53739.7 per ha. The net return was observed to be at ₹ 34376.6 per ha for potato cultivation. The study on potato cultivation also revealed that the net income was ₹ 70013 per ha (Kushwaha *et al.*, 2019).

Table 8 presented the benefit cost ratio over different cost for potato cultivation. Benefit cost ratio over cost A was found to be at 1.64 and over cost B was 1.27. Benefit cost ratio over cost C₂ was observed to be at 1.20. The similar results were found in other vegetable studies like, Rajwadi and Pundir (2022) where B:C ratio of tissue and non-tissue pointed gourd was 1.95 and 1.37. Kushwaha *et al.*, (2019) also revealed the B:C of 1.87 for potato cultivation in Kannauj district of Uttar Pradesh.

Marketing channels of potato in middle Gujarat

In Middle Gujarat, cropping pattern change from potato to tomato, chilli and brinjal. These are the three vegetables that give high returns to the farmers as compared to potato crops. Due to this, potato cultivation has been decreasing in Middle Gujarat over the last five to six years.

Considering potato cultivation decreasing, it was necessary to know the backward linkages of this crop including in context to know marketing aspects of this crop existing marketing channels, marketing costs, marketing margins, price spread, marketing efficiency were studied and the results are presented below.

The existing marketing channels prevailing in Middle Gujarat was shown in Table 9. The table shows that around

Table 4: Average cost of cultivation.

Particulars	Potato
Value of human labour	37400.00
Value of machine labour	4896.00
Value of seeds	43142.00
Value of fertilizers and manures	36666.80
Value of pesticides	7246.80
Irrigation charges	3518.40
Depreciation	6395.60
Interest on working capital	4177.97
Rental value of land	40320.00
Interest on fixed capital	2335.80
Value of family labour	3525.60
Managerial charges @10%	18962.50

Source: Field survey.

Table 5: Estimation of different costs (₹/ha).

Different costs	Potato
Cost A	143443.6
Cost B	186099.4
Cost C ₁	189625.0
Cost C ₂	208587.5

Source: Field survey

Table 6: Yield, weighted average price and gross income of potato (/ha).

Particulars	Potato
Yield (q)	242.5
Weighted average price (₹/q)	1020
Gross Income (₹)	247370.4

Source: Field survey.

Table 7: Net returns over different costs.

	(₹ /ha)
Net returns over different costs	Potato
Cost A	96395.5
Cost B	53739.7
Cost C ₁	53739.7
Cost C ₂	34376.6

Source: Field survey.

Table 8: Benefit Cost ratio over different costs.

Input-output ratios	Potato
Cost A	1.72
Cost B	1.33
Cost C ₁	1.30
Cost C ₂	1.19

Source: Field survey.

77 per cent potato was supplied through channel II. This channel was most preferred by farmers because in this channel cold storage facility available so farmer can store potato to get better price in off season.

Channel wise marketing cost of potato in middle Gujarat (₹ /q)

Table 10 revealed that the producer-farmer incurred cost of ₹ 55.65/q (51.41%) in taking of the produce to the APMC. The wholesalers in marketing of potato incurred ₹ 36.75 (33.95%), which included transportation charge, grading and sorting charge, loading and unloading charge and spoilage loss. The retailers incurred ₹ 15.85/q (14.64%) in marketing of potato to the consumers. The producers, wholesalers and retailers together incurred a cost of ₹ 108.25 per quintal in sale of potato.

The costs incurred by different middleman in channel II is presented in Table 11. The table revealed that the

producer-farmers incurred a cost of ₹ 63.50/q (35.02%) in taking of the produce to the APMC. The cold storage is available in this marketing channel for storage of potato. Cost incurred by cold storage was ₹ 60/q (35.02%), in which only storage charge are there. The wholesalers in marketing of potato incurred ₹ 41.95 (23.14%), in which transportation charge, grading and sorting charge, loading and unloading charge and spoilage loss were the major cost-items accounting for 23.14 per cent of the total marketing cost. The retailers incurred ₹ 15.85/q (8.74%) in marketing of potato. The producers, cold storage, wholesalers and retailers together incurred a cost of ₹ 181.30 per quintal in sale of potato. The share of different middleman, viz. producer, cold storage, wholesaler and retailers in total costs of marketing was 35.20 per cent, 33.09 per cent, 23.14 per cent and 8.74 per cent, respectively. The similar result found in Sen and Maurya (1998).

Table 9: Marketing channels of potato in Middle Gujarat.

Channel No.	Channels
Channel I	Producer-Wholesaler-Retailer-Consumer (Short distant market)
Channel II	Producer- Cold Storage- Wholesaler-Retailer-Consumer (Long distant market)

Source: Field survey

Table 10: Channel-wise Marketing Cost of Potato in Middle Gujarat (₹/q).

Marketing Cost	Marketing Channel of Potato	
	Channel-1	Channel-2
Cost incurred by producer		
i) Labour cost	12.30(11.36)	12.30(6.78)
ii) Packing charge	15.50(14.32)	15.50(8.55)
iii) Transport charge	14.10(13.03)	18.25(10.07)
iv) Loading- Unloading charge	6.50(6.00)	12.25(6.76)
v) Post Harvest Loss	7.25(6.70)	5.20(2.87)
Total (i to iv)	55.65(51.41)	63.50(35.02)
Cost incurred by cold storage		
i) Storage charge	-	60.00(33.09)
ii) Post Harvest Loss	-	0.00
Total (I to ii)	-	60.00(33.09)
Cost incurred by the wholesaler		
i) Transportation charge	6.50(6.00)	9.25(5.10)
ii) Sorting and Cleaning	9.50(8.78)	9.50(5.24)
iii) Loading-Unloading	6.50(6.00)	6.50(3.59)
iv) Post Harvest Loss	14.25(13.16)	16.70(9.21)
Total (i to iv)	36.75(33.95)	41.95(23.14)
Cost incurred by the retailer		
i) Transportation	2.60(2.40)	2.60(1.43)
ii) Loading- Unloading	6.50(6.00)	6.50(3.59)
iii) Post Harvest Loss	6.75(6.24)	6.75(3.72)
Total (i to iii)	15.85(14.64)	15.85(8.74)
Total marketing cost	108.25(100.00)	181.30(100.00)

*Figures in parenthesis is percentage of total marketing cost.

Table 11: Price spread and marketing margin in supply chain of potato in middle Gujarat (₹/q).

Marketing Cost	Marketing Channel of Potato	
	Channel-I	Channel-II
Net price received by producer	800.00(70.28)	1050.00(69.30)
Marketing cost of producer	55.65(4.89)	63.50(4.19)
Marketing cost of cold storage	-	60.00(3.96)
Marketing cost of wholesaler	36.75(3.23)	41.95(2.77)
Marketing cost of retailer	15.85(1.39)	15.85(1.05)
Total marketing cost	108.25(9.51)	181.30(11.97)
Marketing margin by Wholesaler	94.50(8.30)	125.25(8.27)
Marketing margin by retailer	135.50(11.90)	158.50(10.46)
Total marketing margin	230.00(20.21)	283.75(18.73)
Consumer's purchase price	1138.25(100.00)	1515.05(100.00)
Price spread (Total marketing cost +margins)	338.25(29.72)	465.05(30.70)

*Figures in parenthesis is percentage of producers shares in consumers rupee.

Table 12: Marketing efficiency of potato in middle Gujarat (₹/q).

Particular	Channel-I	Channel-II
Consumer price/retailers selling price	1138.25	1515.05
Total marketing cost	108.25	181.3
Total marketing margin	230	283.75
Net price received by farmers	800	1050
Index of marketing efficiency		
Marketing efficiency (Acharya's)	2.37	2.26

Table 13: Constraints in production of potato.

Constraints	WAM	Rank
Unavailability of labor	4.58	1
Long distance of input market	4.37	2
Increasing prices of inputs	3.67	3
Availability on time	3.11	4
Insufficient delivery	2.91	5
Quality of input	2.73	6
Less extension service	2.08	7

Price spread and marketing margin in supply chain of potato in middle Gujarat (₹/q)

Margin added by intermediaries in all channels was shown in Table 12, which showed in channel I and II, total margin added was 230 ₹/q and 283.75 ₹/q, highest margin added in channel II followed by channel I in which only wholesaler and retailer were present. Whereas producers share in consumer rupee was highest in channel I (70.28%) whereas farmers sold produce directly to the wholesaler, while in channel II had 69.30 per cent producers share in consumer rupee. Similar result was found in Pandey *et al* (2003) and Chahal *et al* (1997).

Marketing efficiency of potato in middle Gujarat (₹/q)

The marketing efficiency of potato in different marketing channels is presented in Table 12. It was revealed that the

marketing efficiency of potato was highest in channel I (2.37) and in channel II (2.26). the similar result was found in Naveen *et al.* (2015) and Gopalan and Gopalan (1991). The major constraints in potato input system reported by farmers was unavailability of labour which forces the farmers to make a call for pre-harvest contracts with wholesalers and other suppliers, followed by long distance of input market, increasing prices of inputs, lack of timely availability of input on time, less extension activity and quality of inputs (Table 13).

Constraints in marketing of potato

The major constraints in marketing sub system for farmers was shown in below Table 14. The results show that major problems faced by farmers in potato marketing was that they were not getting fair price of their produce as regulated markets were not present, followed by delayed payments by pre-harvest contractors and other mandi wholesalers, higher cost of transportation, then distant markets, labour availability for harvesting, loading, unloading, spoilage of fruits and less space available for post-harvest handling.

CONCLUSION

Among different components of costs of cultivation, the cost of human labour was highest (₹ 40925.6) The average total cost of cultivation (Cost C₂) per hectare of potato was ₹ 208587.5. Yield of potato was observed 242.5 quintal per hectare, while gross income was ₹ 247370.4 per hectare.

Table 14: Constraints in Marketing of potato.

Constraints	Garrett score	Mean value	Garrett rank
Spoilage of fruits	5827	48.56	6
Large space required for post-harvest handling	4833	40.28	7
Less price received by farmer	9319	77.66	1
Delayed payment	8136	67.80	2
Higher cost of transportation	7506	62.55	3
Distance market	7008	58.40	4
Lack of market information	3448	28.73	9
Labor problem	6526	54.38	5
Commission problem	4180	34.83	8
Infrastructure problem	2977	24.81	10

The net return was observed to be at ₹ 38782.9 per ha for potato cultivation. Benefit cost ratio over cost C_2 was observed to be at 1.19. Two marketing channels were found in potato in the study area. Marketing cost incurred by producer was ₹ 55.65 per quintal in channel I and ₹ 63.50 per quintal in channel II. It was also found that marketing cost incurred by wholesaler was ₹ 36.75 per quintal and ₹ 41.95 per quintal in channel I and channel II, respectively. While the market efficiency was higher in channel I. Unavailability of labour, long distance of input market and increasing prices of inputs were the major production constraint observed in study area. While low price received by the farmers, delayed in payment and higher cost of transportation were the major marketing constraints found in study area.

SUGGESTION

It can be seen from the study that net return and benefit cost ratio was substantially higher in the study area, so the cultivation of potato is beneficial to farmers. But, some constraints were found in production and marketing of potato. So, it is suggested that proper marketing facility should be made available to the farmers so that they can get better price for their produce. Potato is mostly stored in cold storage so there is need to strengthen the cold storage facility and transport facility so that post-harvest losses is minimum. Strengthen marketing, storage and handling procedure of potato can go a long way in making potato cultivation a more paying and alternative proposition in the study area.

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