



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(6): 2225-2229
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www.thepharmajournal.com

Received: 08-04-2023

Accepted: 06-05-2023

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Examine the cost of cultivation of tomato during COVID-19 in the surrounding area of Raipur City

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Abstract

The present study aims to examine the cost and returns of tomato in the surrounding area of Raipur city. This study is the comparison of costs and returns of tomato crop for two period as before COVID period and during the COVID period, March 2019 to February 2020 was selected as before the COVID period and March 2020 to February 2021 was selected as during the COVID period. Total 171 farmers were selected through random sampling for the study. The overall cost of cultivation was decreased by 0.43% from Rs. 147425.76/ ha and Rs. 146791.69/ha for before and during COVID period as well as the gross return and net return was decreased by 17.57% and 28.13% respectively.

The price of tomato sold increased by 11.65% and 10.47% for marginal and small farmers respectively but it decreased by 1.13% and 2.95% for medium and large farmers respectively. Likewise, gross return and net return increased for marginal and small farmers and decreased for medium and large farmers. Gross return increased by 9.93% and 7.25% for marginal and small farmers respectively and decreased for medium and large farmers by 1.95% and 10.74% respectively. Net return increased by 16.99% and 12.05% for marginal and small farmers respectively and it decreased by 2.92% and 16.34% for medium and large farmers respectively. The Overall B:C ratio was 1.49 before pandemic and 1.76 During pandemic and input-output ratio was 2.49 before pandemic and 2.76 During pandemic.

Keywords: COVID-19, Gross returns, Net returns, B:C ratio, Input-output ratio

Introduction

India's diverse climate ensures the availability of all variety of vegetables. Globally, India ranks second in fresh fruit and vegetable production. As per National Horticulture Database published by National Horticulture Board, during 2020-21, India produced 200.45 million metric tonnes of vegetables. The total area of vegetable crops in Chhattisgarh was recorded 4.93 lakh ha. In the year 2021-22 with the production of 68.69 lakh MT. In Raipur district, the total area under vegetable crops in 2021-22 is 23.38 lakh ha and production in 330.66 MT.

The Covid-19 pandemic has emerged as a significant health risk, and countries around the world have responded with partial shutdowns of their economies to slow the pace of infections. These measures have reportedly led to massive disruptions in the global and domestic supply chains (Mahajan and Tomar, 2020) [7]. After the arrival and attack of Covid-19 pandemic in India from first week of March 2020, it has lot of vegetative impact in the input supply chain and postharvest supply chain, transportation, retail marketing and trade of fruits and vegetables. Initially rumours and buzzes resulting in hoarding of semi-perishable items like potatoes, onions followed by sudden spike in demand affecting rise in retail rates. This scenario was persuaded by the disrupted movement of fruit and vegetables throughout the country due to closed borders. Mass migration triggered shortage of farm labourers trained in farm works inducing broken supply chain round the country (Joshi *et al.* 2019) [4]. There were major supply chain disruptions in the input and output markets of agriculture at global level (Ramakumar, 2020).

Material and Methods

The study has been confined to the Raipur district of Chhattisgarh because it has a larger area of tomato cultivation. A multistage random sampling technique was adopted to select villages and respondents. The farmers were categorised in four groups on the basis of the size of land holdings *viz.* marginal farmers (up to 1 Ha.), small farmers (>1-2 Ha.), medium farmers (>2-4 Ha.), and large (>4 Ha.). Twenty-one villages have been selected from the surrounding area of Raipur city and from those villages 171 vegetable growers have been selected. This comprised 58 marginal farmers, 48 Small Farmers, 35 small farmers and 30 Large farmers.

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To work out the cost of cultivation simple arithmetic and statistical techniques of analyses viz. average, percentage, and standard methods of cost of cultivation were adopted to fulfil the objective of the study.

Costs and returns of vegetable cultivation

A standard method of cost of cultivation of vegetables was also used. This method is accepted by the Commission of Agricultural Costs and Prices (CACP). Under this method, the cost of cultivation was computed by using the seven cost concepts, which are known as cost A_1 , cost A_2 , cost B_1 , cost B_2 , cost C_1 , cost C_2 , and cost C_3 .

Net income

It is the difference between input and output, which is an under

Input – Output Ratio = Gross return/Total cost

Cost of production per quintal

It is the total cost of cultivation derived from the production of vegetables. It is mentioned as cost of production (Rs/q) = Total cost of cultivation/production (output) cost of cultivation has also been computed by using the cost concepts.

Results and Discussion

The cost and returns of tomato in the study area

Cost on different heads of tomato in the Raipur district

Cost and returns of tomato cultivation is essential to understand how much cost is incurred for different inputs and whether farmers are receiving the profit or not. It is, therefore, the cost and return of tomato cultivation in the Raipur district was estimated in Rs/ha, which is given in table 1 and table 2 for before covid period and during covid respectively.

The total cost of cultivation of tomato of sample farms at overall was Rs 147425.76 Rs./ha before covid. Before covid

the total variable cost was 85.03 percent and the share of human labour (hired and family labour) cost was maximum and found to be 40.44 percent followed by materials imputed cost manure and fertilizer (6.92 percent), plant protection (11.99 percent), staking (12.60 percent), seed (4.88 percent), interest on working capital (3.27 percent), machine power cost (3.66 percent), irrigation (1.31 percent). The total fixed cost was 14.97.64 percent, the rental value of owned land was 13.25 percent and interest on fixed capital was 1.59 percent. Among all the input costs human labour was noticed to be the major cost. In which, the imputed value of hired labour cost was shared comparatively more than that of family labour cost i.e., 23.38 percent.

The total cost of cultivation of tomato was increasing with respect to farm size of holdings and was found to be maximum under large farms Rs 158558.49/ha and minimum for marginal farms Rs 139066.61/ha before covid.

The total cost of cultivation of tomato of sample farms at overall was Rs 146791.69/ha during covid. during covid the total variable cost was 84.98 percent and the share of human labour (hired and family labour) cost was maximum and found to be 39.34 percent followed by materials imputed cost manure and fertilizer (7.70 percent), plant protection (12.17 percent), staking (12.65 percent), seed (3.88 percent), interest on working capital (3.27 percent), machine power cost (3.68 percent), irrigation (1.28 percent). The total fixed cost was 15.02 percent, the rental value of owned land was 13.31 percent and interest on fixed capital was 1.60 percent. Among all the input costs human labour was noticed to be the major cost. In which, the imputed value of hired labour cost was shared comparatively more than that of family labour cost i.e., 20.43 percent.

The total cost of cultivation of tomato was found to be maximum under marginal farms Rs 138188.31/ha and minimum for large farms Rs 157967.23/ha during covid.

Table 1: Cost on different heads of tomato in the Raipur district before covid (Rs./ha)

Particular	Marginal		Small		Medium		Large		Overall	
	Rs./ha	%	Rs./ha	%	Rs./ha	%	Rs./ha	%	Rs./ha	%
A. Variable cost										
1. Human labour										
a. Family labour	34065.24	24.50%	34045.12	23.28%	18466	12.04%	1156.33	0.73%	25093.27	17.02%
b. Hired labour	24125.66	17.35%	25438.25	17.40%	41987.25	27.38%	60137.48	37.93%	34467.85	23.38%
Total human labour	58190.90	41.84%	59483.37	40.68%	60453.25	39.42%	61293.81	38.66%	59561.12	40.40%
2. Machine power	5400.00	3.88%	5400	3.69%	5400	3.52%	5400	3.41%	5400	3.66%
3. Seed	6935.82	4.99%	7155.66	4.89%	7375.5	4.81%	7507.41	4.73%	7187.80	4.88%
4. Manure and fertilizer	9968.40	7.17%	10193.6	6.97%	10318.83	6.73%	10536.2	6.64%	10202.95	6.92%
5. Plant protection	15280.00	10.99%	17260.56	11.80%	19589.22	12.77%	20769.45	13.10%	17681.01	11.99%
6. Irrigation	1765.50	1.27%	1834.43	1.25%	2045.34	1.33%	2253.07	1.42%	1927.66	1.31%
7. Staking	16650.50	11.97%	17580.25	12.02%	20022.65	13.06%	22201.33	14.00%	18575.51	12.60%
8. Interest on working capital	4567.64	3.28%	4756.31	3.25%	5008.19	3.27%	5198.45	3.28%	4821.44	3.27%
Total variable cost	118758.76	85.40%	123664.18	84.56%	130212.98	84.90%	135159.72	85.24%	125357.51	85.03%
B. Fixed cost										
1. Land revenue	12	0.01%	12	0.01%	12	0.01%	12	0.01%	12	0.01%
2. Rental value of land	18000	12.94%	20000	13.68%	20500	13.37%	20650	13.02%	19538.01	13.25%
3. Depreciation	135.85	0.10%	160.05	0.11%	182.1	0.12%	258.77	0.16%	173.67	0.12%
4. Interest on fixed capital	2160	1.55%	2400	1.64%	2460	1.60%	2478	1.56%	2344.56	1.59%
Total fixed cost	20307.85	14.60%	22572.05	15.44%	23154.1	15.10%	23398.77	14.76%	22068.24	14.97%
Total cost (A+B)	139066.61	100.00%	146236.23	100%	153367.08	100%	158558.49	100%	147425.76	100%

Table 2: Cost on different heads of tomato in the Raipur district during covid (Rs./ha)

Particular	Marginal		Small		Medium		Large		Overall	
	Rs./ha	%	Rs./ha	%	Rs./ha	%	Rs./ha	%	Rs./ha	%
A. Variable cost										
1. Human labour										
a. Family labour	38045.56	27.53%	35045.12	24.04%	23495.02	15.37%	1156.33	0.73%	27753.35	18.91%
b. Hired labour	18224.69	13.19%	22605.55	15.51%	35175.96	23.01%	58489.1	37.03%	29987.89	20.43%
Total human labour	56270.25	40.72%	57650.67	39.55%	58670.98	38.38%	59645.43	37.76%	57741.25	39.34%
2. Machine power	5400.00	3.91%	5400	3.70%	5400	3.53%	5400	3.42%	5400	3.68%
3. Seed	6875.96	4.98%	7130.62	4.89%	7385.29	4.83%	7538.08	4.77%	7167.85	4.88%
4. Manure and fertilizer	11072.20	8.01%	11297.4	7.75%	11422.4	7.47%	11640	7.37%	11306.70	7.70%
5. Plant protection	15294.29	11.07%	17593.63	12.07%	19868.54	13.00%	20953.28	13.26%	17868.77	12.17%
6. Irrigation	1795.28	1.30%	1825.89	1.25%	1966.97	1.29%	2037.25	1.29%	1881.46	1.28%
7. Staking	16650.50	12.05%	17580.25	12.06%	20022.65	13.10%	22201.33	14.05%	18575.51	12.65%
8. Interest on working capital	4534.34	3.28%	4739.14	3.25%	4989.47	3.26%	5176.61	3.28%	4797.66	3.27%
Total variable cost	117892.82	85.31%	123217.60	84.53%	129726.30	84.86%	134591.98	85.20%	124739.23	84.98%
B. Fixed cost										
1. Land revenue	12	0.01%	12	0.01%	12	0.01%	12	0.01%	12	0.01%
2. Rental value of land	18000	13.03%	20000	13.72%	20500	13.41%	20650	13.07%	19538.01	13.31%
3. Depreciation	123.5	0.09%	145.5	0.10%	165.55	0.11%	235.25	0.15%	157.88	0.11%
4. Interest on fixed capital	2160	1.56%	2400	1.65%	2460	1.61%	2478	1.57%	2344.56	1.60%
Total fixed cost	20295.5	14.69%	22557.5	15.47%	23137.55	15.14%	23375.25	14.80%	22052.46	15.02%
Total cost (A+B)	138188.31	100.00%	145775.09	100%	152863.85	100%	157967.23	100%	146791.69	100%

Measures of farm profit in tomato cultivation

The economics of tomato cultivation before covid presented in table 3. It has been observed from empirical findings that overall total cost of cultivation of tomato was Rs 147425.76/ha, it was vary from Rs 139066.61/ha to Rs 158558.49/ha for marginal to large farms size. The cost of production was found to be Rs. 305.07/qt, Rs. 298.67/qt, Rs. 289.09/qt, Rs. 273.53/qt and Rs 293.48/qt for marginal, small, medium, large and overall farms size, respectively. While overall B: C ratio were found to be 1.62. On an overall basis Gross returns (total income) was observed to the 386854.37 Rs /ha, while net returns was found to be Rs 239428.61/ha and overall price of the yield was found to be 770.12 Rs/qt.

The economics of tomato cultivation during covid presented in table 3. It has been observed from empirical findings that

overall total cost of cultivation of tomato was Rs 146791.69/ha. It was Rs 138188.32/ha for marginal farmers and Rs 157967.23/ha for large farmers for marginal to large farms size. The cost of production was found to be Rs. 307.87/qt, Rs. 306.66/qt, Rs. 290.57/qt, Rs. 296.29/qt and Rs. 331.94/qt for marginal, small, medium, large and overall farms size, respectively. While overall B: C ratio was found to be 1.17. On an overall basis, Gross returns (total income) were observed to the 318880.41 Rs/ha, while net returns were found to be Rs 172088.72/ha the and overall price of the yield was found to be 721.09 Rs/qt. The Gross returns were lower for marginal farmers i.e., 381684.09 Rs/ha and lower for large farmers i.e., 403690.52. The net returns were little lower for marginal farmers i.e., 243495.77 then large farmers i.e., 245723.29 Rs./ha.

Table 3: Per ha. yield value of output and cost of production per quintal of tomato

Particulars		Yield (qt/ha)	Price (Rs/qt)	Gross return (Rs./ha)	Cost of cultivation (Rs./ha)	Net return (Rs./ha)	Cost of production (Rs./qt)	Input-output ratio	B:C ratio
Marginal	Pre Covid	455.85	761.65	347198.15	139066.61	208131.54	305.0709	2.49	1.4
	During Covid	448.85	850.36	381684.09	138188.32	243495.77	307.87	2.76	1.76
Percentage change		-1.54%	11.65%	9.93%	-0.63%	16.99%	0.92%	10.55%	17.60%
Small	Pre Covid	489.62	769.76	376889.89	146236.23	230653.66	298.67	2.57	1.57
	During Covid	475.35	850.36	404218.62	145775.1	258443.52	306.66	2.77	1.77
Percentage change		-2.91%	10.47%	7.25%	-0.32%	12.05%	2.68%	7.59%	12.40%
Medium	Pre Covid	530.5	775.98	411657.39	153367.08	258290.31	289.09	2.68	1.68
	During Covid	526.08	767.21	403613.83	152863.85	250749.98	290.57	2.64	1.64
Percentage change		-0.83%	-1.13%	-1.95%	-0.33%	-2.92%	0.51%	-1.63%	-2.60%
Large	Pre Covid	579.67	780.23	452275.92	158558.49	293717.43	273.53	2.85	1.85
	During Covid	533.15	757.18	403690.52	157967.23	245723.29	296.29	2.56	1.56
Percentage change		-8.03%	-2.95%	-10.74%	-0.37%	-16.34%	8.32%	-10.41%	-16.03%
Overall	Pre Covid	502.33	770.12	386854.37	147425.76	239428.61	293.48	2.62	1.62
	During Covid	442.22	721.09	318880.41	146791.69	172088.72	331.94	2.17	1.17
Percentage change		-11.97%	-6.37%	-17.57%	-0.43%	-28.13%	13.10%	-17.21%	-27.81%

Cost obtain on the basis of different cost concepts of tomato

Cost of cultivation of tomato of sample farms in the Raipur district before covid has been worked out and presented in table 4. It is envisaged that Cost A₁ and A₂ as designated the variable cost and it was found to be Rs. 100276.24/ha an overall basis. the cost B₁ was found to be Rs. 102620.80/ha

and Cost B₂ was found to be Rs. 122158.82/ha. The Cost C₁ was found to be Rs 127714.08/ha, including the value of Cost B₁ and the imputed value of family labour was found to be Rs.25093.27/ha, The Cost C₂, found to be Rs. 147252.09/ha, includes the value of Cost B₂ and the imputed value of family labour and Cost C₃, found to be Rs 161977.30/ha, the imputed value of managerial allowances at 10 percent of Cost C₂.

Table 4: Break-up of total cost obtained over the different cost of tomato before covid (Rs/ha.)

Cost/ Category	Marginal	Small	Medium	Large	Overall
Cost A ₁ & A ₂	84705.52	89631.06	111758.98	134015.39	100276.24
Cost B ₁	86865.52	92031.06	114218.98	136493.39	102620.80
Cost B ₂	104865.52	112031.06	134718.98	157143.39	122158.82
Cost C ₁	120930.76	126076.18	132684.98	137649.72	127714.08
Cost C ₂	138930.76	146076.18	153184.98	158299.72	147252.09
Cost C ₃	152823.84	160683.80	168503.47	174129.69	161977.30

Cost of cultivation of tomato of sample farms in the Raipur district during covid has been worked out and presented in table 5. It is envisaged that Cost A₁ and A₂ as designated the variable cost and it was found to be Rs. 96997.87/ha an overall basis. the cost B₁ was found to be Rs. 99342.44/ha and Cost B₂ was found to be 118880.45/ha. The Cost C₁ was

found to be Rs 127095.79/ha, including the value of Cost B₁ and the imputed value of family labour was found to be Rs. 27753.35/ha, The Cost C₂, found to be Rs. 146633.80/ha, includes the value of Cost B₂ and the imputed value of family labour and Cost C₃, found to be Rs 161297.18/ha, the imputed value of managerial allowances at 10 percent of Cost C₂.

Table 5: Break-up of total cost obtained over the different cost of tomato during covid (Rs/ha.)

Cost/ Category	Marginal	Small	Medium	Large	Overall
Cost A ₁ & A ₂	79859.26	88184.48	106243.28	133447.65	96997.87
Cost B ₁	82019.26	90584.48	108703.28	135925.65	99342.44
Cost B ₂	100019.26	110584.48	129203.28	156575.65	118880.45
Cost C ₁	120064.82	125629.60	132198.30	137081.98	127095.79
Cost C ₂	138064.82	145629.60	152698.30	157731.98	146633.80
Cost C ₃	151871.30	160192.56	167968.13	173505.18	161297.18

Return obtained over different cost of tomato

Table 6 shows the returns over Cost A₁ & A₂, Cost B₁, Cost B₂, Cost C₁, Cost C₂, and Cost C₃ was obtained to be Rs. 286884.54/ha, Rs. 265001.97/ha, Rs. 259446.70/ha, Rs. 239908.69/ha, and 225183.48/ha respectively before COVID

and Table 7 shows the returns over Cost A₁ & A₂, Cost B₁, Cost B₂, Cost C₁, Cost C₂, and Cost C₃ was obtained to be 299358.63/ha, Rs. 277476.06/ha, Rs. 269260.71/ha, Rs. 249722.70/ha, and Rs. 235059.32/ha respectively during COVID.

Table 6: Return obtained over different cost of tomato in Raipur district before covid (Rs/ha)

Particulars	Marginal	Small	Medium	Large	Overall
Return over Cost A ₁ & A ₂	262492.63	287258.82	299898.40	318260.53	286884.54
Return over Cost B ₂	242332.63	264858.82	276938.40	295132.53	265001.97
Return over Cost C ₁	226267.39	250813.70	278972.40	314626.20	259446.70
Return over Cost C ₂	208267.39	230813.70	258472.40	293976.20	239908.69
Return over Cost C ₃	194374.31	216206.08	243153.91	278146.23	225183.48

Table 7: Return obtained over different cost of tomato in Raipur district during covid (Rs/ha)

Particulars	Marginal	Small	Medium	Large	Overall
Return over Cost A ₁ & A ₂	301824.82	316025.64	297370.55	270242.86	299358.63
Return over Cost B ₂	281664.82	293625.64	274410.55	247114.86	277476.06
Return over Cost C ₁	261619.26	278580.52	271415.53	266608.53	269260.71
Return over Cost C ₂	243619.26	258580.52	250915.53	245958.53	249722.70
Return over Cost C ₃	229812.78	244017.56	235645.70	230185.33	235059.32

Conclusion

The overall cost of production of tomato was Rs. 147425.76/ha before COVID but during COVID it was Rs. 146791.69/ha which decreased by 0.43%. Overall yield decreased by 11.97% and the price also decreased by 6.37%. The gross return and net return decreased by 17.57% and 28.13% respectively. The price of tomato sold increased by 11.65% and 10.47% for marginal and small farmers respectively but it

decreased by 1.13% and 2.95% for medium and large farmers respectively. Likewise, gross return and net return increased for marginal and small farmers and decreased for medium and large farmers. Gross return increased by 9.93% and 7.25% for marginal and small farmers respectively and decreased for medium and large farmers by 1.95% and 10.74% respectively. Net return increased by 16.99% and 12.05% for marginal and small farmers respectively and it decreased by 2.92% and

16.34% for medium and large farmers respectively. The Overall B:C ratio was 1.49 before pandemic and 1.76 During pandemic and input-output ratio was 2.49 before pandemic and 2.76 During pandemic.

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