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An economic study on production and marketing of tomato (*Solanum lycopersicum*) in Janjgir district, Chhattisgarh, India

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Abstract
An attempt has been made to scrutinize the main objectives of the study in economic analysis of production and marketing of major vegetable crop (Tomato) in Janjgir district of Chhattisgarh. In which to work out the costs and returns of major vegetable crops in the study area. The findings of the study revealed that the cropping pattern of this area was found to be highest in kharif season around 43.38 percent, followed by rabi season at 38.08 percent and the lowest summer season was found to be 18.47 percent because water scarcity is found in this season. Simultaneously the cropping intensity was found to be 169.89 percent. The overall total costs of cultivation in tomato, in the selected farmers was found to be 133432.29 Rs. per hectare. In the overall total variable cost of tomato was found 88.12 percent, the overall total cost of production of tomato was found to be 333.42 Rs. per quintal. Whereas input-output ratio of tomato was found to be 3.30 and tomato B:C ratio as an overall was found to be 2.30 Simultaneously, the overall gross income, net income in tomato was found to be 440209.77 Rs., 306777.48 Rs. Per hectare.

Keywords: Costs of cultivation, gross income, benefit: cost ratio, net income, input-output ratio

Introduction
The horticulture sector consists of the production of fruits, vegetables and flowers. In today's world, people are very conscious about their diet and eating habits. A busy lifestyle and stressful work culture has pushed up the consumption of fruits and vegetables. Consequently, the sector is flourishing and opening up new prospects of employment and research, thereby introducing a new dimension into the agriculture sector across the world (Anonymous, 2014).
India is an agricultural country, which along with providing food to the residents of the country, contributes to the growth of the country's GDP. Vegetables play important role in the development of our country by improving the economic and social status of the people. India grows the largest number of vegetables from temperate to humid tropics and from sea level to Snowline, vegetable is excellent source of vitamins, particularly riboflavin, thiamine, niacin and vitamin A and C. India ranks second in fruits and vegetables production in the world, after China. As per National Horticulture Database published by National Horticulture Board, during 2020-21, India produced 10.04 million metric tons of fruits and 189.464 metric tons of vegetables. The area under cultivation of fruits stood at 6.702 million hectares while vegetables were cultivated at 10.31 million hectares (APEDA. Gov. in) Horticulture: Area 26.22 million hectares & production 319.57 million ton (Anonymous, 2020-21).
In India Tomato is cultivated in about 813.00 thousand million ha area with a production of about 21195 thousand MT. Chhattisgarh contributes nearly 61.333 thousand million ha area and 1151 thousand MT of production and Janjgir district contributes nearly 2.260 thousand million ha area and 46.45 thousand MT of total production of tomato in country during 2020-21. (Anonymous, 2020-21). The study is carried out with the specific objectives (i) To work out the costs and returns of major vegetable crops (Tomato) in Janjgir (C.G.).

Methodology
Janjgir district was selected purposively for the study as it is top sixteen largest producer of vegetable crops in the Chhattisgarh. 2 Blocks of Janjgir district namely Baloda and Akaltara was selected for the study purpose and 1-2 percent villages from Baloda and Akaltara blocks was selected randomly. The total sample size for the was 87.0 the primary data was collected through questionnaire, personal interview, field visits, mandi visits and telephone contacts and

secondary data was collected through National Horticulture Board, State Horticulture Department etc. Appropriate Statistical tools was used for analysis.

Cost concepts

Cost A_1 = It includes-

All actual expenses in cash and kind incurred in production by owner operator

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 manures (owned and purchased) and fertilizers
6. Depreciation
7. Irrigation charges
8. Land revenue
9. Interest on working capital
10. Miscellaneous expanses

- Cost A_2 = Cost A_1 + rent for leased-in land
- Cost B_1 = Cost A_1 + Interest on fixed capital (excluding land)
- Cost B_2 = Cost B_1 + Rental value of owned land + rent for leased- in land
- Cost C_1 = Cost B_1 + Imputed value of family labour
- Cost C_2 = Cost B_2 + Imputed value of family labour
- Cost C_3 = Cost C_2 + 10% of cost C_2 as management cost

Measures of farm profit in tomato cultivation in Janjgir district

Input-output ratio

It can be expressed as the ratio of output to input. The ratio was calculated as:

Input-Output ratio=O/I

Where,
O = Output
I = Input

Cost of production per quintal

The cost of production was worked by using following formula-

Cost of production /qt. = Cost of cultivation/ha

Quantity of main product/ha

Result and Discussion

General Characteristics of Sample Tomato Grower of the District

Table 1 indicate that out of the 87 respondents, 26.47 percent belongs to the scheduled tribes (ST), 19.54 percent respondents belong to the scheduled caste (SC), 45.97 percent respondents belong to the other backward caste (OBC), and 8.04 percent respondents belongs to the general caste. More than 80 percent of the respondents were belongs to the other backward caste.

Table 1. reveals that out of the 87 respondents, Nearly 28 percent respondents are educated up to the middle level, which is the highest followed by the people of the lowest illiterate class, which was found to be 12 percent. Along with this, the overall average literacy percentage of this study area was also very good which was found to be 88.12 percentage.

Table 1: General Characteristics of Sampled households in Janjgir District

S. No.	Particular	Marginal	Small	Medium	Large	Total
A. Distribution of Sampled Households in Social Position						
1.	Schedule Tribe (S.T.)	13 (28.88)	06 (28.57)	04 (26.66)	00 (0.00)	23 (26.47)
2.	Schedule Caste (S.C.)	08 (17.77)	05 (23.80)	03 (20.00)	01(16.66)	17 (19.54)
3.	Other Backward Classes (O.B.C.)	21 (46.66)	09 (42.85)	08 (53.33)	03 (50.00)	40 (45.97)
4.	Others	03 (6.66)	01 (4.76)	00 (00)	02 (33.33)	07 (8.04)
	Total	45 (100)	21 (100)	15 (100)	06 (100)	87 (100)
B. Distribution of Family member in sampled households (by Education Level)						
a.	Illiterate	38 (14.07)	18 (12.67)	14 (11.20)	00 (00)	70 (12.54)
b.	Primary School	60 (22.22)	24 (16.90)	22 (17.60)	01 (4.76)	107 (19.17)
c.	Middle School	77 (28.51)	47 (33.09)	29 (23.20)	03 (14.28)	156 (27.95)
d.	High School & higher secondary	51 (18.88)	29 (20.42)	23 (18.40)	05 (23.80)	108 (19.35)
e.	Above Higher Secondary	44 (16.29)	24 (16.90)	37 (29.90)	12 (57.14)	117 (20.96)
	Total	270 (100)	142 (100)	125 (100)	21 (100)	558 (100)
	Literacy %	85.92	87.32	88.80	90.47	88.12

Note: Figure in parentheses is indicating the percentage of total number of family member

Cost concepts

The cost and return of tomato in the Janjgir district

Costs and return of tomato development is crucial to comprehend that how much costs brought about for various source of info and anyway of whether farmers are getting the benefit or not.

It is subsequently, the costs and return of tomato development in Janjgir district area was assessed in Rs. /ha which is given in table 2. The overall cost of cultivation of tomato in farmstead at generally was Rs. 133432.29/ha. Total variable costs was 88.12 percent and the share of hired labour costs in this variable costs was found to be 24.56 percent which is higher than that of family labour costs where their share was found to be only 15.11 percent. Apart from this the share of other input factors is also shown in the table 2. below, in which the contribution of overall staking costs is 10.99 percent, and overall manure and fertilizer costs 5.43 percent sharing, the most important input is seed at overall 8.98 percent as well as 5.51 percent of overall machine labour costs. Insect-pest control plant protection chemical share overall 13.32 percent and water is an essential vector for providing nutrients to the plant contributed 1.65 percent

overall of irrigation water, overall working capital interest contributed 2.57 percent. Apart from these the largest cost in fixed costs was 11.24 percent of overall rental value of land followed by overall depreciation at 0.17, 0.01 percent at land revenue and 0.46 percent at interest on fixed capital.

It is clearly visible in this table 2. that along with the increase in the land holding of the cultivator, the cost of cultivation in tomato is also increasing, like the production of tomato from is getting Rs. 127421.51 /ha at marginal farmers same, small farmer getting higher then marginal at 140709.02 Rs./ha, medium farmer 149745.00 Rs./ha cost was found and the highest costs large farmer getting at 156949.13 Rs./ha. It was because major farmers spent more money on modern agricultural inputs such quality seed, fertilizer, plant protection agrochemicals, hired labour, and so on as a result of credit institution borrowing and improved crop yields. As compared to marginal, small and medium farmers.

Break-up cost Obtained over different cost of tomato in the study area

The different costs included in the costs of cultivation of tomato vegetable crop is shown in this table 3. for example costs A_1 which is made up of all variable costs Rs. 79364.55/ha, Rs./ha 102661.22, Rs./ha 121373.30, Rs. 130089.49/ha marginal, small, medium, large of this vegetable were found respectively, and where the overall costs A_1 was found to be Rs. 97657.56 /ha. Similarly, the costs A_2 that comes out from the farmer's who pay the rent of the leased land along with the costs A_1 was overall found to be Rs. 97657.56/ha. Along with the overall costs of cost B_1 consisting of costs A1 and interest on fixed capital was found to be Rs. 98267.13/ha. The overall costs of costs B_2, Cost C_1, Cost C_2 and Cost C_3 were found to be Rs. 113267.13/ha, Rs. 118432.29/ha, Rs./ha 133432.29 and Rs./ha 146775.51/ha respectively.

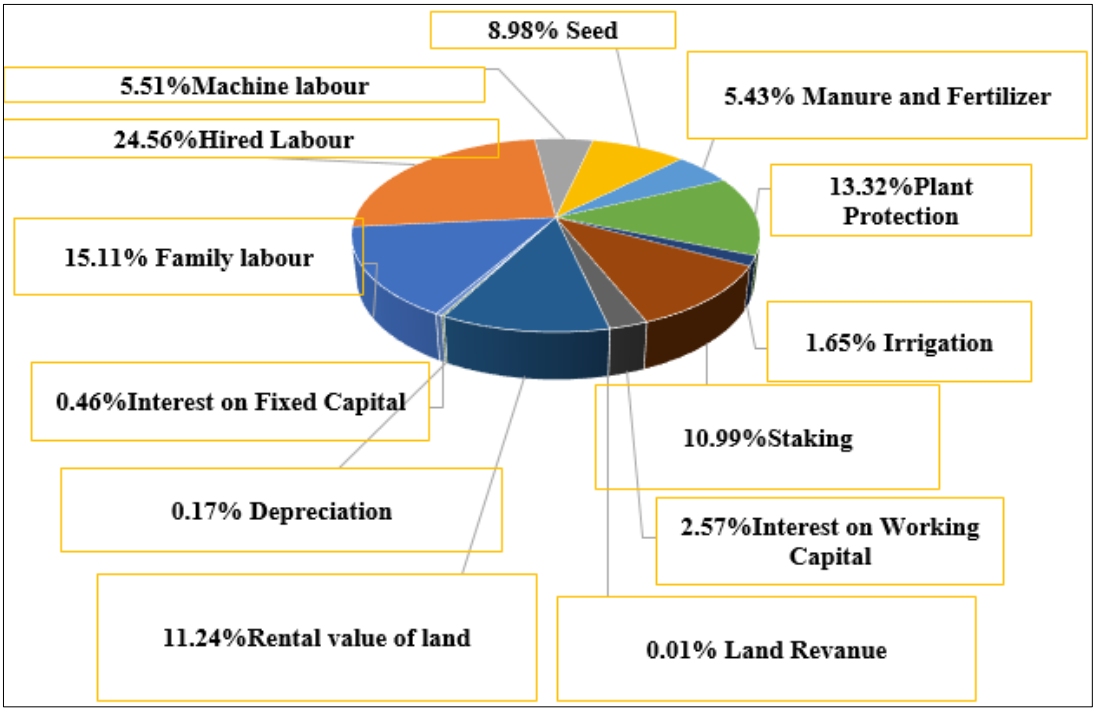

Fig 1: Costs of Cultivation of Tomato on Sampled Farm in the study area

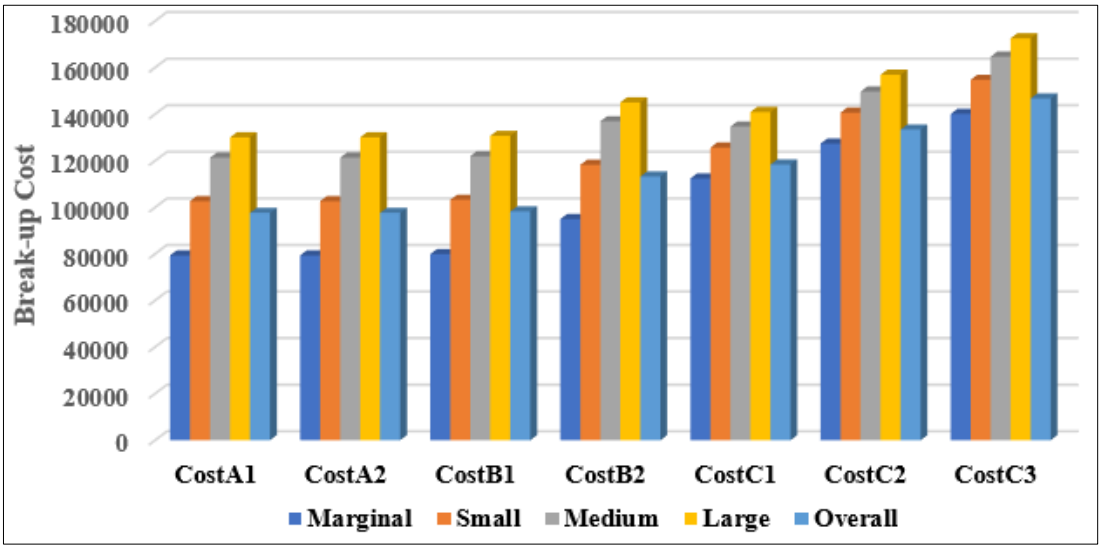

Fig 2: Break-up cost Obtained over different cost of tomato Janjgir district

Table 2: Costs of Cultivation of Tomato on Sampled Farm in the study area

Particular	Marginal (Rs./ha)	%	Small (Rs./ha)	%	Medium (Rs./ha)	%	Large (Rs./ha)	%	Overall (Rs./ha)	%
A. Variable Cost										
1. Human Labour										
a. Family labour	32446.23	25.46	22435.11	15.94	12757.38	8.52	10844.33	6.9	20165.16	15.11
b. Hired labour	21334.16	16.74	33253.21	23.63	43542.75	29.08	47637.17	30.35	32766.54	24.56
Total Human labour	53780.39	42.21	55688.32	39.58	56300.13	37.6	58481.5	37.26	52931.7	39.67
2. Machine labour	7156.69	5.62	7588.08	5.39	7983.63	5.33	8343.31	5.31	7347.32	5.51
3. Seed	11160	8.76	12568.12	8.93	13147.33	8.78	13875.16	8.84	11986.97	8.98
4. Manure and Fertilizer	5424.32	4.26	7435.15	5.28	9557.97	6.38	10647.12	6.78	7245.09	5.43
5.Plant Protection	14961.83	11.74	18735.46	13.32	21453.87	14.33	22987.89	14.64	17768.45	13.32
6. Irrigation	1243.32	0.98	2343.23	1.67	2436.06	1.63	2618.19	1.66	2205.34	1.65
7. Staking	14567	11.43	16786.31	11.93	18997.18	12.69	19864.14	12.65	14664.23	10.99
8. Interest on Working Capital	3248.8	2.55	3634.34	2.58	3896.28	2.6	4104.51	2.61	3434.2	2.57
Total on Variable Costs	111542.35	87.54	124779.01	88.68	133772.45	89.33	140921.82	89.78	117583.3	88.12
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	15000	11.77	15000	10.66	15000	10.02	15000	9.55	15000	11.24
3. Depreciation	256.43	0.2	305.32	0.22	346.23	0.23	398.88	0.25	227.42	0.17
4. Interest on Fixed Capital	610.73	0.48	612.69	0.44	614.32	0.41	616.43	0.39	609.57	0.46
Total fixed Cost	15879.16	12.46	15930.01	11.32	15972.55	10.67	16027.31	10.21	15848.99	11.88
Total Cost(A+B)	1,27,421.51	100	1,40,709.02	100	1,49,745.00	100	1,56,949.13	100	1,33,432.29	100

Table 3: Break-up cost Obtained over different cost of tomato in the study area (Rs./ha)

S.No.	Category	Marginal	Small	Medium	Large	Overall
1.	Cost A1	79364.55	102661.22	121373.3	130089.49	97657.56
2.	Cost A2	79364.55	102661.22	121373.3	130089.49	97657.56
3.	Cost B1	79975.28	103273.91	121987.62	130705.92	98267.13
4.	Cost B2	94975.28	118273.91	136987.62	145089.49	113267.13
5.	Cost C1	112421.51	125709.02	134745.00	140933.82	118432.29
6.	Cost C2	127421.51	1,40,709.02	1,49,745.00	1,56,949.13	1,33,432.29
7.	Cost C3	140163.66	154779.92	164719.50	172644.04	146775.51

Measures of farm profit in tomato cultivation in Janjgir district

Table 4: Total costs of tomato cultivation of sampled household in the study area (Rs./ha)

S. No.		Marginal	Small	Medium	Large	Overall
1.	Gross costs (Rs./ha)	1,27,421.51	1,40,709.02	1,49,745.00	1,56,949.13	1,33,432.29
2.	Cost of production (Rs./qt.)	363.59	341.39	336.15	306.1	333.42
3.	Yield of main product (qt.)	350.45	412.16	445.47	512.74	400.19
4.	Price (Rs./qt.)	1100	1100	1100	1100	1100
5.	Gross income (Rs./ha)	3,85,495.00	453376	490017	564014	440209.77
6.	Net income (Rs./ha)	258073.49	312666.98	340272	407064.87	306777.48
7.	Family labour income (Rs.)	290519.72	335102.09	353029.38	418924.51	326942.64
8.	Farm business income (Rs.)	306130.45	350714.78	368643.7	433924.51	342552.21
9.	Input-output ratio	3.03	3.22	3.27	3.59	3.30
10.	B:C ratio	2.03	2.22	2.27	2.59	2.30

Measures of farm profit in tomato cultivation in Janjgir district

The measures of farm profit in tomato vegetable crop is being shown in this table 4. in which overall cost of cultivation 133432.29 Rs./ha of this crop was found different from marginal farmer's costs 127421.51 Rs./ha to large farmer's costs 156949.13 Rs./ha until. Apart from this, the overall cost of production of this crop was found at 333.42 Rs./qt. where the marginal costs of Rs. 363.56 /qt. was found to be where as the small, medium, and large farmers expenditure was found to be Rs. 341.39 /qt., Rs. 336.15/qt. and Rs. 306.10 /qt. respectively. It reduced as farm size expanded due to improved returns in return for the costs of production on the large farm. Along with this, the overall gross income, net income, family labour income and farm business income were found to be Rs. 440209.77/ha, Rs. 306777.48/ha, 326942.64 and 342552.21 respectively. Their input-output ratio was found to be 3.03, 3.22, 2.27, 3.59 marginal, small medium, large farmer respectively, the same overall was found to be 3.30. The overall B:C ratio was found to be 2.30

Conclusion

Argo-ecological characteristics in Janjgir district provide ample scope for vegetable production, well-established road networks ensure easy transportation and market access for the vegetables produced in the area. The overall total cost of cultivation in tomato were found to be 133432.29 Rs. per hectare. In the overall total variable cost of tomato was found 88.12 percent. The overall total cost of production of tomato was found to be 333.42 Rs. per quintal. Whereas overall input-output ratio of tomato was found to be 3.30 and B:C ratio of tomato was found to be 2.30. The overall gross income, net income in tomato was found to be 440209.77 Rs. 306777.48 Rs. per hectare respectively. Insect-pest and

disease resistance varieties farmers should be grown & there should be strong technical information available for improved packaging and practices, vegetable crop techniques and also information about regular agrochemical doses. Market information should be widely spread between all of farmers. For effective marketing facilities or structure should be developed. Farmers should be more engaged in outreach activities such as demonstrations, training programmes and exhibitions. All business issues should be taken into account by market authorities.

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