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A study on analysis of cost of cultivation, usage of production technology and constraints faced by tomato growers

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Abstract

The current study was conducted at chintamani taluk of Karnataka by considering the productivity of tomato as a basis, for analysing the extent of adoption of production technology and the constraints faced by the tomato growers. Sixty tomato growers from Chintamani taluk of Chikkaballapur district were selected using a non-probability (snowball) sampling technique, and the data was collected with the help of a well structured schedule through telephonic interview method. The results revealed that more than three by fourth (83.3 percent) of the tomato growers belonged to the other backward caste and more than one third (40 percent) of the respondents had an annual income in the range ₹ 200000 - 300000. The benefit-cost ratio of the tomato growers was found to be 1:2.9. The majority of the farmers had acquired seedlings from private companies and were used to good agricultural practices like proper planting time, correct number of pre ploughing, better spacing between crops and usage of practices like mulching, fertigation, and superior supporting system. Most of the tomato growers sold their produce to the whole sellers through commission agents in the APMC (Agricultural Produce Market Committee). The farmers had shared several problems related to production and marketing of Tomato. The constraints during production included pest attack, disease incidence, high cost of pesticides, non-availability of labourers and high wages for labourers. And the major constraints in marketing were found to be fluctuation in the market price and having to pay high charges for commission agents.

To tap the economic power of vegetables, governments will need to increase their investment in farm productivity, good postharvest management, food safety and market access.

Keywords: production technology, constraints faced, tomato growers

Introduction

Vegetables are one of the important aspects of the horticulture sector of India and the agricultural sector of India in general. Vegetables are considered in dietary guidelines of the human diet, due to their nutritional value. The regular use of vegetables provides dietary fibre, micronutrients such as vitamins and minerals, electrolytes and phytochemicals especially antioxidants. According to the Dietary guidelines of the National Institute of Nutrition, the daily requirement of other vegetables is 200g. To uplift the quality of the diet of people and to ensure availability, it is essential to increase the production of vegetables in the country. This objective can overcome by increasing the yield per unit area by using new and advanced production technology. At present, tomato is one of the most popular vegetables which are grown in India because of its nutritive value, higher yield, and ecology.

Tomato (*Lycopersicon esculentum*) is one of the most important fruit vegetables; a wide range of varieties is grown in temperate climates across the world. It is a warm-season crop, which can grow highly on well-drained soils.

Tomatoes are called the king of vegetables due to their economic use. Tomatoes are also called poor man's orange because of its lower price and higher concentration of Vitamin C as well as citric and malic acid. Even though tomatoes are fruits, as evident by the seeds that it contains, they are considered vegetables by nutritionists.

Tomato fruits are consumed fresh in salads or cooked in sauces, soup and meat or fish dishes. Tomatoes are used for preparing ketchup which, is prepared by slurry of tomato grounded, spiced, and recommended food additives. Tomatoes are also used in the preparation of sauce, soups, and gravy of chicken and Gobi Manchurian.

The world production of tomatoes is 170.8 MT. China stands first (52.7 MT) just like many other vegetable productions and, India stands second with 18.39 MT (2014- 2015 Statistical data). India is one of the major vegetable producing country.

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Among vegetables, tomato is one of the important crops. In India, Tomato production is about 19,696.92 thousand MT from 808.54 thousand hectares (2016-2017 statistics). In India, Karnataka is the second leading state producing 2138 thousand MT of tomato from 63.73 thousand hectares after Madhya Pradesh (2016-2017 statistics). Major tomato growing districts in Karnataka are Kolar, Bengaluru, Chikkaballapur, Tumkur, Hassan, Davanagere, and Haveri. Tomato is the major commercial Vegetable crop in Chikkaballapur district, Cultivated in an area of 2,583 ha with a production of 67,546 tonnes and productivity of 26.15 tonnes/ha during the year 2016.

Even though progress has been made, the productivity of tomato is relatively low because of various factors such as finance, production technology, and constraints during cultivation and marketing. Today, neither the economic nor the nutritional power of vegetables is sufficiently realised.

Several studies have been conducted on vegetable crops to study the effectiveness of production technology, and constraints facing by tomato growers but, fewer studies have been conducted on tomato crops in this regard. Hence, the present study was undertaken with the following objectives.

Methodology

This section explains the research design, locale of the study, sampling procedure, source and data gathering technique as well as the research instrument, data processing and analysis and interpretation.

Thirty respondents were selected from different villages of Chintamani taluk by following the non-probability (snowball) sampling technique. This is a descriptive evaluative research design aimed at analysis of cost of cultivation, level of adoption of production technology and constraints faced by tomato growers of chintamani taluk.

Socio-economic profile analyses of tomato growers

Age, educational level, income, caste and land holding of the tomato grower's data were collected.

Cost of cultivation

To study the economic profile of the tomato growers, data was collected regarding the variable cost in tomato farming which included procurement of seedlings, usage of FYM (farm yard manure), fertilizers, cost of insecticide & fungicide, tractor expanses, type of irrigation, staking sticks/stumps, mulching paper used, gunny twine, and human labour expenses and fixed cost which include depreciation and rental value of land spent in production.

Effectiveness of use of production technology in tomato farming

To know the effectiveness of the production technology of tomato farming, they were asked to indicate the usage of technologies like mulching, fertigation (fertilizer injection system connected to the drip irrigation), supporting system, crop rotation, greenhouse, soil tests conducted, integrated pest management, training for labors regarding harvesting and grading, and methods used to minimize post-harvest losses. Responses obtained from the farmers were tabulated in terms of frequencies and percentages.

Constraints in the production and marketing of tomato

To know the constraints faced by the tomato growers in both production and marketing of tomato, a list of all possible

problems were given to the respondents to indicate whether or not to what extent they face such problems as the greater extent and lesser extent they are, quantified in terms of frequencies and percentages. Those responses are ranked based on the majority of respondents who indicated that problem.

Instruments used for data collect

Keeping in view the objectives and variables of the study, a structured interview schedule was developed by consulting experts and referring to the relevant literature. Data collection was done by the telephonic interview method with the help of the schedule

Statistical tools used in the study

The statistical tools and tests such as frequency, percentage, and mean were used wherever found appropriate, and the data were analyzed systematically to draw valid inferences. The Benefit-Cost Ratio (BC Ratio) was also worked out to estimate returns from tomato crop cultivation.

i. Frequency: A simple frequency distribution was also used to identify the farmers distributed into different groups.

ii. Percentage: This measure was used to make a simple comparison of different groups. The process of gathering the percentage is dividing the frequency (sum of responses) by the total number of responses.

To compute for the Percentage (P), $P = (f/n) \times 100$

Where: P = percentage, f = frequency, n = total number of respondents

iii. Mean: Mean was used to compute the cost of cultivation of tomato.

iv. Benefit-Cost Ratio: The sum of fixed and variable costs make the total cost for production per acre. Cost of production (Rs/q) and Gross income were worked out for different size groups. A - Variable Cost, B - Fixed Cost, and C - Total Cost.

Benefit-Cost ratio is used to identify the returns of the tomato farmers. It is calculated by the formula $B.C.R = \text{Gross Income}/\text{Total Cost}$.

Results and Discussion

Findings of the present investigation in line with objectives set forth are presented under the following headings.

Socio-economic profile of the tomato growers

In the present study, the socio-economic characteristics of tomato growers were determined by including variables like age, caste, income, and educational level. The detailed information of socio-economic characteristics is presented in the following tables.

Table 1: Caste wise distributions of selected respondents

Sl. No.	Category	Percentage
1.	SC	13.3
2.	ST	3.4
3.	OBC	83.3
4.	General	0

Table 1 indicates that of the total sample, (n = 60) majority, of the respondent belonged to other backward community (83.3 percent) and scheduled caste (13.3 percent). Scheduled tribe and general category farmers were found to be 3.4 percent and zero percent respectively; which shows that within the

study population, most of the people belonging to the other backward classes and had taken up agriculture as their major

source of income.

Table 2: Age wise distribution of tomato growers

Sl. No	Category (yrs)	Percentage
1.	Young (<32)	16.7
2.	Middle Aged (31-51)	46.6
3.	Older Adults (>51)	36.7

From Table 2 it was noticed that majority of the tomato growers were middle-aged (46.6 percent) followed by older adults (36.7 percent) and, young farmers were found to be 16.7 percent

as shown from Table 3. None of them were found to have studied up to post-graduation.

Table 3: Education level of tomato growers

Sl. No.	Category	Percentage
1.	Illiterate	10
2.	Up to primary school	10
3.	Up to middle school	13.3
4.	Up to high school	40
5.	PUC/Diploma/ITI	10
6.	Graduation	16.7
7.	Post-graduation	0

Forty percent of the tomato growers had studied up to high school. Followed by this, 16.7 percent had their educational level up to graduation, 13.3 percent studied up to middle school. While three percent of the respondents studied up to PUC (Pre-University Course), Primary school and illiterates

Table 4: Annual Income of tomato farmers

Sl. No.	Income	Percentage
1.	₹ <50000/annum	6.7
2.	₹ 50000 - 100000/annum	6.7
3.	₹ 100000 - 200000/annum	33.3
4.	₹ 200000 - 300000/annum	40
5.	₹ > 300000/annum	13.3

About forty percent of tomato growers had an annual income in the range ₹ 2,00,000 to 3,00,000 and 33.3 percent of the tomato growers had an annual income in the range ₹ 1,00,000 to 2,00,000, whereas 13.3, 6.7 and 6.7 percent of them had income more than ₹ 3,00,000, less than ₹. 50,000 and ₹ 50,000 to 1,00,000 respectively.

The profitability of tomato growers

Table 5: Cost of cultivation of tomato farming

A - Variable Cost	Total Cost (₹)	Average
Purchase of Seedlings	199000 (3.10%)	6633.3 (3.10%)
Farmyard Manure	582000 (9.08%)	19400 (9.08%)
Fertilizers	598000 (9.33%)	19933 (9.33%)
Cost of Insecticide & Fungicide	760000 (11.86%)	25333 (11.86%)
Human Labour Expenses	715000 (11.16%)	23833 (11.16%)
Tractor expenses	480000 (7.49%)	16000 (7.49%)
Irrigation	1305000 (20.37%)	43500 (20.37%)
Staking Sticks/ Stumps	444000 (6.93%)	14800 (6.93%)
Gunny Twine / Rope	337000 (5.26%)	11233 (5.26%)
Miscellaneous Cost	61000 (0.95%)	2033.3 (0.95%)
Interest on variable cost (12%) for 6 months	328860 (5.13%)	10962 (5.13%)
Sub Total	5809860 (90.70%)	193660.6 (90.70%)
B – Fixed Cost		
Depreciation	51083.335 (0.79%)	1702.8 (0.79%)
Rental Value of Land	510000 (7.96%)	17000 (7.96%)
Land Revenue	750 (0.01%)	25 (0.0117%)
Interest on Fixed Cost (12%) for 6 months	33710.0006 (0.52%)	1123.7 (0.52%)
Sub Total	595543.3 (9.3%)	19851.5 (9.3%)
C - Total Cost	6405403 (100%)	213512.1 (100%)
Yield in Quintal	9250	308.33
Rate Rs. / Quintals	62000	2066.67
Gross Returns (Rs. in round Figure)	573500000	637216

Source: survey

Average yield per acre: 308.33 quintal

*Figures in parenthesis indicate the percentage of the total cost of cultivation.

Table 5 shows the overall total cost of cultivation of tomatoes, of tomato producers per acre during the year 2019-2020. The overall average total cost of tomato cultivation amounted to ₹ 213512.10 per acre of which ₹ 193660.6 (90.70%) was incurred on variable cost. Out of the total cost of cultivation, the expenditure on irrigation (20.37%) formed the major component, followed by the cost of insecticide & fungicide and human labor (11.86%) and (11.16%) respectively. The

expenditure incurred on Chemical fertilizers was found to be 9.33 percent, farmyard manure (9.08%), Tractor expenses (7.49%), Staking Sticks/Stumps (6.93%), gunny twins/rope (5.26%), Interest on variable cost (5.13%), Seedlings (3.10%) and miscellaneous cost (0.95%). In the fixed cost of tomato cultivation overall average was ₹ 19851.5 (9.3%) of the total cost. The rental value of land (7.96%) formed the major cost of cultivation among fixed costs. Followed by that,

depreciation (0.79%), interest on fixed cost (0.52%), land revenue (0.01%) stood next. Finally, the production cost of tomato was found to that of ₹ 6.9 per kg and, an average Benefit-Cost Ratio of tomato production was found to be

1:2.9

Effectiveness of use of production technology

Table 6: Adoption of good cultivation practices

Sl. No	Cultivation Practices	Full adoption	Partial adoption	No adoption
		Percentage	Percentage	Percentage
1.	Verities of private companies	100	0.00	0.00
2.	Planting Time of Tomato (June-July, Oct-Nov, Jan-Feb)	86.7	13.3	0.00
3.	Number of pre plowing (3 – 4 times)	93.3	6.7	0.00
4.	Spacing (3*1.5 feet)	100	0.00	0.00
5.	Frequency of irrigation (daily 1-2 hours)	100	0.00	0.00
6.	Mulching(plastic)	96.7	3.3	0.00
7.	Fertigation	96.7	3.3	0.00
8.	Supporting system	100	0.00	0.00
9.	Crop rotation	20	6.7	73.3
10.	Soil test	26.7	10	63.3
11.	Integrated pest management	30	16.7	53.3
12.	Training for labors about picking, grading, and packing	86.7	13.3	0.00

More than half of the tomato growers under the study had not adopted crop rotation (73.3%). Sixty three percent of the tomato growers had not adopted soil testing. Fifty three percent (53.3%) of respondents had not adopted integrated pest management.

From Table 6 it could be observed that 13.3 percent had partially adopted the cultivation practices like providing training for labors regarding picking, grading, and packing, crop rotation. The reason could be the lack of technical guidance and lack of capital.

The majority of the tomato growers fully adopted practices like procuring verities of seedlings from private companies, planting time of tomato, number of pre ploughing, spacing, frequency of irrigation, mulching, fertigation, supporting system, and training for labors regarding picking, grading, and packing. The possible reason for adoption might be to get higher yields.

Constraints experienced by the tomato growers in the production and marketing of tomatoes

Table 7: Constraints in the production of tomatoes

Sl. No.	Problems	Percentage	Ranking
1.	More pest and diseases incidence	90.0	I
2.	High Cost of pesticides	86.7	II
3.	Non-Availability of labor	63.3	III
4.	High wages for labor	53.3	IV
5.	Lack of capital	46.7	V
6.	The high cost of fertilizers	43.3	VI
7.	The high cost of seedling	33.3	VII

Table 8: Constraints in the marketing of tomatoes

Sl. No.	Problems	Percentage	Ranking
1.	Fluctuation in the market	80.0	I
2.	Commission agent charge is more	73.3	II
3.	The market place is far away	30.0	III
4.	The high cost of transportation	30.0	III

It could be observed from Table 7 that the majority of the tomato growers expressed constraints related to increased pest attacks and disease incidence (90 percent), higher cost of pesticides (86.7 percent), non-availability of labors (63.3 percent), high wages for labor (53.3 percent), lack of capital (46.7 percent), high cost of fertilizers (43.3 percent) and high cost of seedling (33.3 percent).

From the above results, it could be noticed that the majority of the tomato growers expressed that production constraints were mostly due to pest attacks, disease incidence and high cost of pesticide. The reason might be changes in climatic conditions, crop cultivation in off-seasonal period of the year, lack of knowledge regarding the control measures for different pests and disease. High cost of pesticide was another constraint faced by these tomato farmers.

The majority of the tomato growers experienced constraints

like non-availability of the labourers and high wages for labourers. Another major constraint raised by the respondents was labourer's non-availability which becomes scares during the offseason which might be due to the fact that most of the farmers required labor around the same time and, most of the rural people were found changing their occupation towards industries leading to a lack of labourers and higher wages.

Less than half of the tomato growers expressed constraints like lack of capital, high cost of fertilizers, and seedlings. The reason might be constant increase in the price of the inputs. These constraints could be overcome by the proper functioning of government institutions like banks, RSK (Raitha Samparka Kendra), and societies in the study area. Eighty percent of the tomato growers expressed constraints related to fluctuation in market prices. The reason might be that the main objective of farmers is to produce high yields

and to acquire better prices for their produce. However, as the supply of the product increases, the demand for the product decreases, and vice versa and, this led to fluctuations in the market prices. Hence, according to this study, the fluctuation in the market price was found to be a major problem in the marketing of tomatoes.

Seventy-three percent of the tomato growers expressed that commission agent's charges were more. The reason might be that majority of the tomato growers sell their produce through commission agents in the APMC, where 8-10 percent of commission charge is charged to them directly.

Thirty percent of each tomato growers expressed that marketplaces are far away and, transportation costs were high. The markets were far away and felt that the government should consider this constraint. The increasing price of fuel was found to be a major factor for the transporter demanding high price, which was in turn responsible for the higher cost of transportation.

Conclusion

Tomato is a major commercial crop in the Chikkaballapur district. Hence, this district was selected purposively for the study. Although much progress was made in tomato cultivation, the productivity of the tomato is still low due to various problems in the production and marketing of tomato. It was found that the socio-economic profile and the adoption of improved agricultural technologies played an important role in procuring better returns, and productivity of tomato. Farmers also faced a lot of marketing constraints due to the fluctuation in market prices and having to pay high charges to the middlemen.

Important findings

1. The majority of the respondent belonged to the other backward class (83.3%), followed by scheduled caste (13.3%). Scheduled tribe and general category farmers were found to be 3.4 percent and zero percent, respectively.
2. The majority of tomato growers were middle-aged individuals (46.6%), followed by older adults (36.7%) and young farmers (16.7%).
3. More than one-third (40%) of the tomato growers studied up to high school, followed by 16.7 percent who studied up to graduation and 13.3 percent of them had studied up to middle school. While three percent of the tomato growers had studied up to PUC, Primary and illiterates each. None of the respondents studied up to post-graduation.
4. More than one third (40%) of tomato growers possessed an annual income in the range ₹ 2,00,000 to 3,00,000 and 33.3 percent of the tomato growers had an annual income between ₹ 1,00,000 to 2,00,000, whereas 13.3, 6.7 percent and 6.7 percent of them had an income more than ₹ 3,00,000, less than ₹ 50,000 and ₹ 50,000 to 1,00,000 respectively.
5. The overall average total cost of tomato cultivation amounted to ₹ 213512.10 per acre.
6. The production cost of tomato revealed that it amounted to ₹ 6.9 per kg and, the average Benefit-Cost Ratio of tomato production was found to be 1: 2.9
7. More than half of the tomato growers had not adopted production technology practices like crop rotation, soil test, and integrated pest management (73.3, 63.3, and 53.3 percent, respectively).

8. The majority of the tomato growers fully adopted production technologies practices like procuring different varieties of seedlings from private companies (100 percent), spacing (100%), frequency of irrigation (100%), supporting system (100%), mulching (96.7%), and fertigation (96.7%). Number of times of pre plough was adopted by 93.3 percent of the farmers under study. Training for labourers regarding picking, grading and packing (86.7%) and planting time of tomato was found to be 86.7 percent.
9. The major constraints faced by the tomato growers in the production of tomato were increased pest attacks and diseases incidence (90%), high Cost of pesticides (86.7%), non-availability of labourers (63.3%), high wages for labourers (53.3%), lack of capital (46.7%), high cost of fertilizers (43.3%) and high cost of seedling (33.3%).
10. Fluctuation in the market price (80%) and high commission charges (73.3%) were the major constraints faced by tomato growers in the marketing of tomato.
11. Elimination of the middlemen in the market (86.7%), support price for their produce during price fluctuation (76.7%), labor-saving techniques (66.7%), training for integrated pest management (60%) were major suggestions given by tomato growers.

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