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# Crop diversity and tomato profitability in the Koramangala-Challaghatta valley project area: An economic analysis

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**Abstract**
The study was conducted in Koramangala-Challaghatta valley project (KCVP) and the Non-Koramangala-Challaghatta valley project (NKCVP) areas of the Kolar district. A total of 160 sample respondents were involved, evenly split with 80 from each area. The study aimed to know the cropping pattern and diversity of crops grown in the study region and also to assess cultivation and production costs, as well as the returns per rupee of expenditure (RRE), in both KCVP and NKCVP areas of tomato cultivation. Due to high price volatility of tomato crop, farmers in the region cultivated tomatoes year-round, aiming for higher profits in at-least one season. Findings indicated that labour costs accounted for nearly 15 per cent (KCVP) and 14 per cent (NKCVP) of the total cultivation cost, with KCVP experiencing higher labour costs. While the overall cultivation cost was higher in KCVP (Rs.1,79,871) compared to NKCVP (Rs.1,77,470), the production cost per quintal of tomatoes was lower in KCVP (Rs. 1,297) compared to NKCVP (Rs. 1,606). The Returns per Rupee of Expenditure (RRE) was higher in the KCVP area at 1.26, in contrast to 1.13 in the NKCVP area. This highlighted that tomato cultivation was more profitable in the KCVP area due to year-round irrigation availability from groundwater recharge following the implementation of the KCVP project in the district.

**Keywords:** Price, volatility, labour cost, tomato, cultivation and production cost

## Introduction
In the realm of dry land agriculture, diversification stands as the major strategy for mitigating risks posed by unpredictable climate and weather fluctuations. In India, crop diversification is commonly seen as a transition from traditionally cultivated, less profitable crops to those that offer higher farm returns (Basavaraja *et al.*, 2016) [5]. This practice of diversification not only guarantees food security, improved nutrition, and increased income but also generates employment opportunities for most of the rural population. Acharya *et al.* (2011) [1] findings indicate that crop diversification leads to increased cropping intensity, greater employment opportunities, a shift towards more commercialized farming, a decrease in the migration of male family members, and increased participation of women in income-generating activities. Nevertheless, their study primarily focused on crop diversification at the state level, leaving a gap in the availability of micro-level evidence on this subject. The current study seeks to address this gap by examining the patterns and extent of crop diversification at a finer, micro-level, particularly within two distinct regions of the same district.
Tomatoes (*Solanum Lycopersicum* L.) exhibit remarkable adaptability, finding extensive use in Indian culinary practices, where they are enjoyed in various forms: fresh, cooked, and processed. This versatile vegetable holds a prominent status due to its year-round production and consumption, making it one of the most cultivated crops. The economic importance of fresh tomatoes and their derivatives cannot be understated, as they not only contribute to household income but also create employment opportunities for local farmers, particularly those with limited resources, who engage with the market. The prevalence of pests and diseases significantly undermines tomato yields and the overall profitability of farmers in the

studied region. And Tomato crop was one of the major vegetable crops grown in both regions of the same district.

The tomato crop being a short duration of three to four months, rendering it compatible with various cultivation methods (Thonnissen *et al.*, 2000). [8] In the realm of agriculture, the evolving landscape has led to increased farmer receptivity to diverse inputs like fertilizers, pesticides, mechanization, insect-resistant varieties, and high-yielding crops, culminating in enhanced efficiency and productivity within the farming sector (Katanga *et al.*, 2018). [6] Nonetheless, the returns on agricultural investments remain low. This can be attributed to the elevated costs associated with agricultural inputs, limited labor availability during peak harvesting periods (Anonymous, 2020) [3], and the gamut of challenges encountered by farmers, encompassing droughts, floods, irrigation difficulties, all of which contribute to production costs. In this context, the present study was embarked to assess the profitability of tomato cultivation in the KCVP and NKCVP regions of Kolar district.

Karnataka holds the position of being the third-largest contributor to the country's tomato production, boasting a substantial yield of 1,419 thousand metric tonnes, which accounts for 7.6 percent of the nation's total tomato output (Anonymous, 2020) [3]. Notably, within Karnataka, the Kolar district emerges as a significant player in tomato production, cultivating this crop across 9,695 hectares and yielding 5,47,000 metric tonnes, achieving a productivity of 12,283 kg's per hectare (DES,2021-22) in the region. The farmers in this area adopt a strategic approach by cultivating tomato crops across all three seasons, with the understanding that even if one season's crop falters, profits could still be gained from one of the other two seasons. Therefore, a study was undertaken to assess the profitability of tomato cultivation specifically within the KCVP and NKCVP regions of Kolar district in Karnataka.

## Methodology

This study was conducted in the Kolar district of Karnataka, focusing on both the KCVP (Koramangala-Challaghatta Valley Project) and NKCVP (Non-Koramangala Challaghatta valley Project) regions. We employed a purposive random sampling methodology to select our study participants. Our primary data collection efforts targeted 160 farming households, comprising 80 from the beneficiaries of KCVP i.e., whose borewells recharged after implementation of KCVP and an additional 80 from the Non-KCVP area, referring to areas outside the KCVP project's influence but they do posses an borewell to irrigate their crops. The differentiation between these two respondent groups was based on the level of KCVP implementation, specifically in terms of the number of irrigation tanks filled with treated sewage water within the district.

To accomplish our research objective, we gathered data directly from respondents via personal interviews, utilizing a meticulously designed and pre-tested schedule. The selection of villages was done at random, with preference given to areas where irrigation tanks had been filled as part of the project within the district. The data collected pertained to the agricultural activities of the year 2021-22.

Significantly, many farmers in the study area opted to cultivate tomatoes throughout all three seasons (kharif, rabi, and summer) with the aim of securing better market prices and anticipating profitable returns. However, this choice was contingent upon the availability of irrigation water for cultivation. Consequently, farmers in the KCVP region undertook tomato cultivation across all three seasons, while those in the NKCVP region limited their involvement to one or two seasons, often diversifying their crops to mitigate the risks associated with market price volatility and also due to the limited availability of irrigation water to cultivate the crops.

We collected primary data relating to the various crops grown on these farms, the inputs utilized, and the labor employed for cultivation. These data encompassed both quantitative and qualitative data. Subsequently, we analyzed the corresponding costs associated with crop production and marketing, categorizing them as variable costs, fixed costs, and marketing expenses.

Cropping intensity was calculated using the formula provided below, and returns were determined based on prevailing market prices. Furthermore, we calculated the return per rupee of expenditure (RRE) utilizing the following formula:

$$\text{Cropping Intensity} = \frac{Gross\ cropped\ area}{Net\ sown\ area} \times 100$$

$$\text{Returns per Rupee of Expenditure (RRE)} = \frac{Gross\ returns}{Total\ cost}$$

**The results of the study are presented in the following headings**

### Socio-economic characters of the sample respondents

Socioeconomic characteristics play a pivotal role in influencing the decision-making behaviour of farmers. The study area was delineated into two regions: KCVP (Koramangala-Challaghatta Valley Project) and Non-KCVP (Non-Koramangala-Challaghatta Valley Project) areas. In this context, we aimed to investigate the socioeconomic profile of the respondents, and the results are succinctly presented in Table 1.

The average age of the sampled respondents stood at 47 years for those in the KCVP area and 46 years for their counterparts in the NKCVP area. The age of the respondents varied from a minimum of 23 years to a maximum of 75 years within the KCVP area and from 28 to 70 years in the NKCVP area (as detailed in Table 1). A noteworthy observation is that the majority of respondents in both the KCVP (48.75%) and NKCVP (55.00%) regions fell within the middle age bracket of 36-50 years. However, it is important to note that the difference in mean age between the two farm categories was not statistically significant.

The average family size in both the KCVP and NKCVP areas consisted of 5 adult members, along with two children, and this observation was found to be statistically insignificant. An examination of the educational backgrounds of the respondents revealed that there was one illiterate individual in the KCVP area and nine in the NKCVP area. The majority of respondents had attained a secondary education, followed by primary school education, pre-university education (PUC), and graduation. In the KCVP area, only one percent of respondents were illiterate, and the trend was similar in terms of the number of literate individuals, with the exception of fewer PUC holders (9.67%) compared to graduates (12.90%) in the NKCVP area (as detailed in Table 1). The Chi-square test indicated a significant difference in education levels between the KCVP and NKCVP areas.

Consequently, there was no substantial disparity between the two groups concerning their socioeconomic characteristics in the study area, except for education. This suggests that the sample populations were largely homogeneous and, therefore, suitable for meaningful comparisons.

**Table 1:** Socio-economic characteristics of respondents in KCVP and NKCVP

| Sl. No. | Particulars | KCVP(n=80) | NKCVP(n=80) |
|---|---|---|---|
| **1** | **Age** | | |
| a. | No. of respondents below<35 years | 13(16.25) | 14(17.5) |
| b. | No. of respondents between age 36-50 years | 39(48.75) | 44(55.00) |
| c. | No. of respondents aged 50 and above | 28(35.00) | 22(27.50) |
| d | Average Age (Years) | 47.16 | 46.54 |
| | Chi-square value | 0.593 | |
| | Range (Years) | 23-75 | 28-70 |
| **2.** | **Family Size** | | |
| a. | Adults (number) | 5 | 5 |
| i. | Male | 3 | 3 |
| ii. | Female | 2 | 2 |
| b. | Children (number) | 2 | 2 |
| | Chi-square value | 0.946 | |
| **3.** | **Education** | | |
| a. | No. of Illiterates | 1(1.25) | 9(14.51) |
| b. | Primary education (Number) | 30(37.5) | 11(17.74) |
| c. | Secondary Education (Number) | 34(42.5) | 28(45.16) |
| d. | PUC (Number) | 11(13.75) | 6(9.67) |
| e. | Degree (Number) | 4(5.00) | 8(12.90) |
| | Chi-square value | 0.0023* | |

**Note:** Figures in parentheses indicate per cent to the respective totals

### Land Holdings of the Sample Respondents

Among the sampled farmers, it was observed that they possessed an average of 0.49 acres (13.46%) and 1.12 acres (27.59%) of rain-fed land in the KCVP and NKCVP areas, respectively. Conversely, irrigated land holdings comprised an average of 3.15 acres (86.54%) and 2.94 acres (72.41%) for the KCVP and NKCVP areas, respectively. Notably, the average landholding was relatively higher in the NKCVP area, totaling 4.06 acres, compared to 3.63 acres in the KCVP area (as detailed in Table 2).

**Table 4.2:** Average Land holding details of sample respondents (acres)

| Landholdings | KCVP (n=80) | NKCVP (n=80) |
|---|---|---|
| Rain-fed | 0.49 (13.46) | 1.12 (27.59) |
| Irrigated | 3.15 (86.54) | 2.94 (72.41) |
| Average land holding | 3.64 | 4.06 |

**Note:** Figures in parentheses indicate per cent to the respective totals

### Cropping Pattern of the Respondent Farmers

Since, this study employed purposive sampling, targeting vegetable growers, all the respondents engaged in vegetable cultivation across all three agricultural seasons in both the KCVP and NKCVP areas. The land allocated for vegetable cultivation measured 353.87 acres in the KCVP area, whereas it amounted to 155.5 acres in the NKCVP area during the kharif, rabi, and summer seasons.

During the kharif season in the KCVP area, the primary vegetable crops cultivated included Tomato (55.50 acres), potato (26.50 acres), cabbage (17.50 acres), beans (17.00 acres), carrot (28.20 acres), coriander (8.00 acres), chilli (6.50 acres), and other vegetable crops like brinjal, ridge-guard, cauliflower, radish, capsicum, and green-leafy vegetables, encompassing a total acreage of 26.5 acres. In the rabi season, vegetables such as Tomato (75 acres), potato (5 acres), cabbage (33 acres), carrot (15 acres), chilli (5 acres), and other vegetables were grown on 9.52 acres. In the summer season, major vegetables were cultivated on 25 acres, including tomato (32 acres) and potato (39 acres), along with other vegetables spanning 25 acres.

In the NKCVP area, during the kharif season, farmers primarily focused on cultivating vegetables such as Tomato (38 acres), Potato (41 acres), beans (8.50 acres), carrot (4.50 acres), chilli (4.50 acres), and other vegetables like brinjal, radish, cauliflower, capsicum, and green leafy vegetables on 5.5 acres. In the rabi season, tomato was cultivated on 8 acres, potato on 5 acres, carrot on 15 acres, and other vegetables on 2 acres. Ragi occupied 34.5 acres and 44.5 acres during the kharif season in the KCVP and NKCVP areas, respectively. Additionally, Marigold was cultivated on 25 acres in the KCVP area and 9 acres in the NKCVP area. Hence, this study provides insights into the land holdings and cropping patterns of the sampled farmers in both the KCVP and NKCVP areas, shedding light on the diversity of agricultural activities in these regions as detailed in Table 3.

In the district renowned for its mango cultivation, mangoes were grown on 77.4 acres in the NKCVP area, while in the KCVP area, it covered only 7.5 acres (as delineated in Table 3) as most of the area in KCVP is known for vegetable cultivation. Another significant crop in the study region was mulberry, which occupied 28.50 acres in the KCVP area compared to 13.8 acres in the NKCVP area.

### Cropped Area and Cropping Intensity

The gross cropped area was 582.15 acres in the KCVP area and 523 acres in the NKCVP area, with a net cropped area of 294.4 acres and 324.8 acres, respectively. Notably, cropping intensity was higher in the KCVP area (197.74%) than in the NKCVP area (161.02%), as detailed in Table 3. This disparity could be attributed to the increased water availability in the KCVP region following the project's implementation, encouraging farmers to cultivate a greater number of vegetable crops compared to the NKCVP region. Consequently, there was a 30% increase in cropping intensity in the KCVP area in comparison to the NKCVP area.

**Table 3:** Cropping pattern of sample respondents in KCVP and NKCVP area

| SL. No. | Crops | KCVP | | NKCVP | |
|---|---|---|---|---|---|
| | | Area(ac.) | % to GCA | Area(ac.) | % to GCA |
| **I.** | **Kharif** | | | | |
| **A.** | **Cereals** | | | | |
| 1 | Ragi | 34.5 | 5.93 | 45.5 | 8.70 |
| 2 | Fodder maize | 1.78 | 0.31 | 6.1 | 1.17 |
| | Sub-total | 36.28 | 6.23 | 51.6 | 9.87 |
| **B.** | **Vegetables** | | | | |
| 1 | Tomato | 55.5 | 9.53 | 38 | 7.27 |
| 2 | Potato | 26.5 | 4.55 | 41 | 7.84 |
| 3 | Cabbage | 17.15 | 2.95 | - | - |
| 4 | Beans | 17 | 2.92 | 8.5 | 1.63 |
| 5 | Carrot | 29.2 | 5.02 | 4.5 | 0.86 |
| 6 | Coriander | 8 | 1.37 | 0.5 | 0.10 |
| 7 | Chilli | 6.5 | 1.12 | 4.5 | 0.86 |
| 8 | Others# | 26.5 | 4.55 | 5.5 | 1.05 |
| | Sub-total | 186.35 | 32.01 | 102.5 | 19.60 |
| **C.** | **Flower crop** | | | | |
| 1 | Marigold | 25 | 4.29 | 9 | 1.72 |
| | Subtotal- Kharif | **247.63** | 42.54 | **163.1** | 31.19 |
| **II.** | **Rabi** | | | | |
| **A.** | **Cereals** | | | | |
| 1 | Fodder maize | 11 | 1.89 | 15.5 | 2.96 |
| **B.** | **Vegetables** | | | | |
| 1 | Tomato | 75 | 12.88 | 8 | 1.53 |
| 2 | Potato | 5 | 0.86 | 5 | 0.96 |
| 3 | Cabbage | 33 | 5.67 | - | |
| 4 | Carrot | 15 | 2.58 | 15 | 2.87 |
| 5 | Chilli | 5 | 0.86 | 8 | 1.53 |
| 6 | Other vegetables | 9.52 | 1.64 | 2 | 0.38 |
| | Sub total | 142.52 | 24.48 | 38 | 7.27 |
| | Rabi subtotal | 153.52 | 26.37 | 53.5 | 10.23 |
| III | **Summer** | | | | |
| | Vegetables | | | | |
| 1 | Tomato | 32 | 5.50 | 25 | 4.78 |
| 2 | Potato | 39 | 6.70 | 35 | 6.69 |
| 3 | Other vegetables | 25 | 4.29 | 15 | 2.87 |
| | Summer-sub total | 96 | 16.49 | 75 | 14.34 |
| D. | **Perennials** | | | | |
| 1 | Mango | 7.5 | 1.29 | 77.4 | 14.80 |
| 2 | Mulberry | 28.5 | 4.90 | 13.8 | 2.64 |
| 3 | Nilgiri | 6.5 | 1.12 | 15.5 | 2.96 |
| 4 | Papaya | - | | 9 | 1.72 |
| | Sub-total | 42.5 | 7.30 | 115.7 | 22.12 |
| III. | Gross cropped Area (ac.) | 582.15 | | 523 | |
| IV. | Net cropped area (ac.) | 294.4 | | 324.8 | |
| V. | Cropping Intensity (%) | 197.74 | | 161.02 | |
| VI. | Herfindahl Index (HI) | 0.42 | | 0.69 | |
| VII. | Simpson index | 0.58 | | 0.31 | |

**Note:** #- includes Brinjal, ridgeguard, raddish, cauliflower, capsicum, Green leafy vegetables. GCA-Gross cropped area

**Diversification Analysis**

The diversification of crops was also assessed using the Herfindahl index, which yielded a value of 0.42 for the KCVP area and 0.68 for the NKCVP area (as per Table 3). Additionally, the Simpson index, used to gauge crop diversification, produced an index of 0.576 for the KCVP area, signifying a more diversified crop pattern. In contrast, the NKCVP area exhibited a relatively lower index value of 0.314, indicating a prevalent tendency towards specialized farming, with farmers concentrating on a few crops. This observation underscores the less diversified crop pattern in the NKCVP area compared to the KCVP area. These findings align with the results reported by Ramesh (2020) [7], which also indicated a higher degree of diversification in the KCVP area compared to the NKCVP region.

**Costs and Returns in Tomato Cultivation**

Shifting our focus to the realm of tomato farming, the cumulative variable expenses for cultivating one acre of tomatoes amounted to Rs. 1,48,011 in the KCVP area and Rs. 1,47,531 in the NKCVP area. Labor expenditures constituted a substantial segment of the overall variable costs in both regions, making up 14.55% and 13.92% of the total cultivation expenses in the KCVP and NKCVP areas, respectively.

Tomato cultivation is labor-intensive, involving specific operations such as staking, multiple harvests, regular maintenance, and pest and disease management. Consequently, the cost of plant protection chemicals, another major component of the total variable cost, accounted for 11.24% (Rs. 20,210) in the KCVP area and 13.48% (Rs. 23,937) in the NKCVP area. In order to safeguard their crops

and ensure a healthy crop stand and yield, farmers opt for frequent pesticide and insecticide spraying, often two to three times per week, regardless of the presence of pests or diseases. This practice results in increased expenditure on plant protection chemicals, thus contributing to the overall cultivation costs. Another vital technique employed by farmers for tomato cultivation is mulching, which helps maintain optimal soil moisture levels by preventing water evaporation.

Marketing costs were also substantial contributors to the variable cost, amounting to Rs. 20,275 in the KCVP area and Rs. 21,335 in the NKCVP area. These findings were consistent with a study by Vanitha *et al*. (2016) [9] on tomato-based farming systems in the eastern dry zone of Karnataka, where eight percent of the cost of cultivation was attributed to commission charges.

In terms of fixed costs, farmers incurred Rs. 31,860 in the KCVP area and Rs. 29,939 in the NKCVP area, constituting approximately 17% of the total cultivation cost. Notably, farmers in the KCVP area realized higher returns (Rs. 2,26,636) compared to those in the NKCVP area (Rs. 1,99,766). This was primarily due to higher yields in the KCVP area (138.70 quintals per acre) compared to the NKCVP area (121.07 quintals per acre), resulting in lower production costs in the KCVP area (Rs. 1,297) versus the NKCVP area (Rs. 1,606).

Yields attained by farmers in the KCVP region and the NKCVP area were 138.7 quintals and 121 quintals, respectively, with average prices of Rs. 16 in the KCVP area and Rs. 16.50 in the NKCVP area. Consequently, returns over variable costs were higher in the KCVP area (Rs. 78,625) compared to the NKCVP area (Rs. 52,235), resulting in higher net returns and returns per rupee of expenditure in the KCVP area (Rs. 46,765 and 1.26, respectively) as compared to the NKCVP area (Rs. 22,295 and 1.13, respectively).

**Table 4:** Cost of cultivation of tomato in KCVP and NKCVP area (per acre)

| Sl. No. | Particulars | | KCVP | | | % to TC | NKCVP | | | % to TC | % diff. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Qty. | Rate (Rs.) | Value (Rs.) | | Qty. | Rate (Rs.) | Value (Rs.) | | |
| **Variable cost** | | | | | | | | | | | |
| 1 | Seedlings (No.) | | 7245 | 1.63 | 11809 | 6.57 | 8742 | 1.50 | 13113 | 7.39 | -0.11 |
| 2 | FYM (TL) | | 5.51 | 2927.00 | 16128 | 8.97 | 4.14 | 2965.00 | 12275 | 6.91 | 0.24 |
| 3 | Chemical fertilizer | | | | 9739 | 5.41 | | | 11089 | 6.24 | -0.14 |
| A | Nitrogen (Kg) | | 111.6 | | | | 109.52 | | | | |
| B | Phosphorus | | 63.76 | | | | 69.78 | | | | |
| C | Potassium | | 59.09 | | | | 66.32 | | | | |
| 4 | Other micro-nutrients (Kg) | | 28 | | 9709 | 5.40 | 23.9 | | 8176 | 4.60 | 0.16 |
| 5 | Cost of sticks for staking | | 1589 | 3.89 | 6181 | 3.44 | 1930 | 3.72 | 7180 | 4.04 | -0.16 |
| 6 | Wire (Kg) | | 30 | 70.00 | 2100 | 1.17 | 32.15 | 70.00 | 2251 | 1.26 | -0.07 |
| 7 | Thread (Kg) | | 69 | 62.65 | 4322 | 2.40 | 73 | 59.20 | 4322 | 2.43 | 0.00 |
| 8 | Plastic mulch (Kg) | | 89 | 198.99 | 17710 | 9.85 | 88 | 200.00 | 17600 | 9.91 | 0.01 |
| 9 | Weedicide | | | | 3979 | 2.21 | | | 4099 | 2.31 | -0.03 |
| 10 | Plant protection chemical | | | | 20210 | 11.24 | | | 23937 | 13.48 | -0.18 |
| 11 | Labour | Man-days | 52.34 | 500.00 | 26172 | 14.55 | 67.23 | 500.00 | 24717 | 13.92 | 0.06 |
| | | Machine hours | 3.12 | 890.00 | 2776 | 1.54 | 1.5 | 850.00 | 1275 | 0.71 | 0.54 |
| 12 | Transportation of resources | | | | 8590 | 4.78 | | | 8957 | 5.04 | -0.04 |
| 13 | Irrigation cost | | 14.32 | 250.00 | 3580 | 1.99 | 14.21 | 250.00 | 3553 | 2.00 | 0.01 |
| 14 | Interest on working capital (7% p.a.) | | | | 5005 | 2.78 | | | 4989 | 2.81 | 0.00 |
| I | Total variable cost | | | | 148011 | 82.29 | | | 147531 | 83.13 | 0.00 |
| **Fixed cost** | | | | | | | | | | | |
| 1 | Depreciation | | | | 1384 | 0.77 | | | 1445 | 0.81 | -0.04 |
| 2 | Rental value of land (Prevailing rate) | | | | 12342 | 6.86 | | | 10450 | 5.88 | 0.15 |
| 3 | Managerial cost (10% of working capital) | | | | 14801 | 8.23 | | | 14753 | 8.31 | 0.00 |
| 4 | Amortized cost of drip irrigation | | | | 437 | 0.24 | | | 569 | 0.32 | -0.30 |
| 5 | Interest on fixed capital (10% p.a.) | | | | 2896 | 1.61 | | | 2722 | 1.53 | 0.06 |
| II | Total Fixed cost | | | | 31860 | 17.71 | | | 29939 | 16.86 | 0.06 |
| III | **Total cost** | | | | 179871 | 100.00 | | | 177470 | 100 | 0.01 |
| IV | Marketing cost | | | | 20275 | | | | 21335 | | -0.05 |
| V | Main yield (Qtl.) | | 148.7 | 16.34 | 226636 | | 121.07 | 16.50 | 199766 | | 0.12 |
| VI | Total returns | | | | 226636 | | | | 199766 | | 0.12 |
| V | Cost of production | | | | 1297 | | | | 1606 | | -0.24 |
| VI | Net returns | | | | 46765 | | | | 22295 | | 0.52 |
| VII | Returns per rupee of expenditure | | | | 1.26 | | | | 1.13 | | 0.11 |

**Table 5:** Cost and return analysis of Tomato production in KCVP and NKCVP area

| SL. No. | Particulars | KCVP | NKCVP |
|---|---|---|---|
| 1 | Total cost of cultivation (Rs.) | 179871.00 | 177470.00 |
| 2 | Average Yield (quintals) | 138.70 | 121.07 |
| 3 | Average price (Rs.) | 16.34 | 16.50 |
| 4 | Returns over total cost (Rs.) | 226636.00 | 199766.00 |
| 5 | Returns over variable cost (Rs.) | 78625.00 | 52235.00 |

## Conclusion

Farmers in the study area chose to cultivate tomatoes with the expectation of achieving favourable profits, driven by the crop's higher yields in a relatively short growing period and its price volatility. Consequently, many farmers opted to cultivate tomatoes throughout all three seasons of the year, aiming to secure advantageous prices at any point during the year to maximize their earnings. Consequently, the study comprehensively examined the costs, returns, and profits of tomato cultivation in both the KCVP and NKCVP areas.

To address the challenge of narrow profit margins for these farmers, there is a clear opportunity to enhance profitability by reducing cultivation costs. Consequently, further research should be conducted to explore cost-effective production and protection technologies specific to tomato farming. Establishing an effective monitoring mechanism is essential to mitigate commission charges imposed by agents at Kolar, Malur, and Srinivaspura markets, aligning with the rules and regulations governing regulated markets, which should be rigorously enforced.

It's worth noting that tomato cultivation in the KCVP area appeared to be more lucrative compared to the NKCVP area, primarily due to the continuous availability of irrigation water through groundwater recharge, a result of the successful implementation of the KCVP project in the Kolar district.

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