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Economic Analysis of Tomato in Taluka Hyderabad, Sindh

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ABSTRACT
This study investigated the economic analysis of tomato production in Taluka Hyderabad, Sindh, focusing on the socio-economic characteristics of farmers, cost structures, labor dynamics, production expenses, market-related costs, and overall profitability. Primary data were collected through surveys and interviews with tomato growers, and a detailed cost-benefit analysis was conducted to assess the economic viability of tomato cultivation in the region. The findings revealed that tomato prices fluctuated seasonally, dropping during peak harvest months (May–June) and increasing during off-season shortages (e.g., November). Farmers in the study area were typically middle-aged with modest educational backgrounds and managed small-scale farms averaging 7.8 acres. Despite the relatively recent adoption of tomato farming, averaging just three years of experience, the activity proved to be economically promising. The total production cost per acre was calculated at PKR 117,380, while gross returns averaged PKR 378,000, resulting in a substantial net profit of PKR 260,620. The input-output ratio of 1:3.22 and a benefit-cost ratio of 1:2.22 underscored the strong profitability and efficient resource use in tomato cultivation. The study recommended enhanced market access, technical training, subsidies, and research investments to support and expand profitable tomato production in the region.

Keywords: *Economic Analysis, Tomato Production, Taluka Hyderabad, Sindh, Socio-Economic Characteristics of Farmers, Cost Structures, Labor Dynamics, Production Expenses, Market-Related Costs*.

INTRODUCTION

Economic analysis mainly deals with evaluating then the cost and benefits of a project. It starts by ranking projects in terms of economic viability to facilitate better resource allocation (Edomah, 2018). Economic analysis offers a framework with which to determine whether social impact of an intervention makes it worth its costs for the charities and their funders, shaping informed funding choices. This approach brings major benefits in various areas and contributes to proper decision making. Informed-decision making, resources allocation, policy allocation, forecasting, understanding market behavior, risk assessment, cost benefit analysis,

international trade and development, efficiency and productivity and social welfare analysis (Turner et al., 2021). The economic analysis of tomatoes encompasses an investigation into the production, distribution, and consumption of tomatoes. It delves into aspects such as production costs, market demand and supply, pricing dynamics, profitability for farmers, trade patterns, and the influence of government policies and external factors like weather conditions. Through this analysis, economists seek to understand the efficiency, competitiveness, and sustainability of tomato production systems within broader agricultural and economic frameworks (Doe, 2020).

Tomato (Lycopersicon esculentum Mill.) is one of the highest ranked vegetables in the world. Because of its short growing season and high yield possibilities, it is economically viable and therefore promoted expansion in its cultivated area. Tetraploid tomatoes belong to the family Solanaceae and are an integral part of a healthy diet being very rich in minerals, vitamins, essential amino acids, sugars and dietary fibre. They are especially one good source of vitamins B and C, iron and phosphorus. They are used in many cooking i.e. fresh in salads or cooked as soups, sauces, and meat and fish dishes. Also, they are extensively processed to products including purées, juices, household sauce, canned and dried tomatoes with therein substantial economic values. The yellow tomatoes contain greater amounts of concentrations of vitamin A, while the red tomatoes are rich sources of lycopene, a powerful antioxidant thought to help ward off carcinogens (GoP, 2018). In the world, the tomato was produced 42.758 million metric tons in 2023 – the most processed vegetable in the world. In Pakistan, Sindh average tomato production (2018 – 2022) was 174.25 thousand tons from an average tomato production for the whole country (2018 – 2022). This was 572.82 thousand tons (AMIS, 2023).

Pakistan's 2003–04 allocated about 0.34 million hectares of land to yield 4.8 million tons of vegetables and condiments (GoP, 2004). Besides, in 2004–05 alone the country earned $128.4 million from vegetable exports, a 17% increase from $109.6 million during 2003–04. Some of the major importers of Pakistani vegetables and fruits were Dubai, India, Afghanistan, Saudi Arabia and the United Kingdom (EPB, 2016).

In Sindh, tomato cultivation spans approximately 27,000 hectares, yielding an average annual production of around 200,000 tons. However, during the fiscal year 2019-20, cultivation occurred on 22,542 hectares, resulting in a production of 164,658 tons. As during the 2021 fiscal year, tomato crop cultivation is reported to have expanded to cover 30,000 hectares (GRASP, 2021). In 2022, tomato production in Sindh was estimated at 565 thousand tons from an area of 46,000 (Bashir et al., 2022).

The consumption and demand for tomatoes in Pakistan are always rising, mostly attributed to the growing population. As a nutrient-dense vegetable, it is extensively eaten and economically accessible relative to several other vegetables. Tomatoes are a fundamental component in almost every home, used in several forms including cooked vegetables, salads, ketchup, chutneys, and as a crucial element in many traditional meals. Due to Pakistan's varied weather circumstances, tomatoes are accessible throughout the year. The nation generally produces two tomato harvests each year—one in spring and another in autumn—whereas southern areas allow for year-round growing. During the 2008–09 year, Pakistan produced 560,700 tonnes of tomatoes, with an average output of 10.50 tonnes per hectare over a planted area of 53,400 hectares. In Gilgit-Baltistan, 6,455 metric tonnes were produced from 805 hectares; of this, 3,194 MT were eaten locally, 2,293 MT were sold, and 968 MT were squandered (ASP, 2018).

Vegetables cultivated in several agro-climatic zones of Pakistan using varying production methods throughout the seasons are marketed regionally to satisfy national customer demand.

Approximately 80% of Pakistan's total vegetable production comprises marketable excess. Reports estimate that this excess amounts to 86% of total output; nevertheless, 25–35% is wasted owing to post-harvest complications. These losses are ascribed to reasons like delayed harvesting, insufficient packing, and the absence of suitable infrastructure for storage and transportation. Optimal tomato cultivation requires rigorous management measures that preserve soil fertility and water quality. Scientific research is crucial for determining the optimal mix of inputs to maximise tomato production. Many farmers are hesitant to embrace new technology or allocate more resources unless they are certain that the supplementary expenses will be offset by enhanced profits. Performing an input-output study of tomato production may encourage farmers to adopt enhanced agricultural methods. This situation prompted the researcher to conduct a study on tomato production within the context of production economics (Noonari et al., 2015).

Pakistan is one of the five nations most badly affected by climate change, while having one of the lowest per capita contributions to greenhouse gas (GHG) emissions. Temperature shocks had a detrimental impact on tomato output and pricing, according to a research by Bashir et al. (2022) that predicted tomato production in Pakistan in the context of climatic variability. Rainfall was shown to have varying effects, being advantageous in some areas and harmful in others. restricted cultivated areas, poor yields, pest and disease pressures, labour shortages, ineffective water management, and restricted access to contemporary agricultural knowledge are just a few of the significant issues that the research brought to light. In order to solve these problems, it is advised that a strong tomato value chain be established in the main production areas and that growers be given better access to timely and reliable meteorological information.

Tomato, a subtropical crop that originated in Western South America, ranks among the most widely consumed vegetables worldwide. Tomatoes are recognised for their nutritional value, containing antioxidants like lycopene, vitamins E and C, provitamin A (β-carotene), and essential minerals such as iron, phosphorus, and magnesium. Fresh and processed tomatoes are significant in the human diet because they are rich in health-promoting nutrients. Tomato, a subtropical plant, flourishes within a temperature range of 16–29°C, requiring a minimum night temperature of 11°C. Optimal fruit setting occurs within the temperature range of 19–24°C, while the most effective colour development of the fruit takes place at 20–29°C. Several factors can disrupt tomato economic production, including temperature extremes, irrigation challenges, nutrient management issues, pest infestations, and disease pressures. Temperature fluctuations and heavy metal toxicity are significant abiotic stresses that impact the growth, development, and yield of tomato plants. Identifying temperature thresholds is essential for assessing climate change risks, as it aids in predicting the probability and effects of temperature variations on tomato crops. Examining the impact of temperature stress on yield components can improve crop modelling and guide adaptive strategies. Identifying the key phenophases—growth stages particularly susceptible to heat—facilitates the adoption of specific precautionary measures. A significant reduction in fruit set has been recorded with an elevation in mean daily temperature from 28/22°C to 32/26°C (day/night). Photosynthesis in leaves functions most efficiently at 30°C, whereas the minimum temperature for tomato growth is approximately 6–8°C. Growth is markedly restricted at temperatures below 12°C, while elevated temperatures can considerably diminish yield due to reduced pollen availability (Chishti et al., 2019).

1.1 Problem statement

Tomato cultivation is a vital agricultural activity in Pakistan, contributing significantly to both domestic consumption and international trade. Despite its importance, the tomato industry faces multiple challenges, including production inefficiencies, post-harvest losses, and vulnerability to climate change impacts. Issues such as suboptimal temperature conditions, inadequate infrastructure, and pest and disease stresses undermine the potential for higher yields and profitability. This study aims to address these challenges by examining the economic viability of tomato production, analyzing the impact of climate variability on yield and quality, and identifying strategies to improve production efficiency and sustainability. The goal is to provide actionable insights that can enhance decision-making for farmers, policymakers, and stakeholders involved in the tomato value chain.

1.2 Justification of the study

The major focus of this study is to access the economic analysis of tomato crop in Hyderabad district. The main objectives to know the variation in tomato prices and the fluctuations in costs brought about by variables like supply and demand, production cycles, seasonal demand, and outside influences like the state of the economy or the weather across the year. This study also encompasses tomatoes various aspects related to their production, consumption, and economic impact. Growers can determine whether growing tomatoes is profitable, decide how best to allocate their resources, and put strategies into place to maximize their agricultural output by examining costs and returns.

Considering the above findings, the researchers became interested to undertake a study to determine the economic analysis of tomato crop in Hyderabad district.

1.3 Objectives

The present study focuses on four talukas in district Hyderabad of Sindh province with the following objectives.

i. To show price trends of tomatos across the seasons in taluka Hyderabad, Sindh
ii. To study the socioeconomic characteristics of tomato growers in the study area
iii. To estimate costs incurred and returns obtained by tomato growers in the study area

REVIEW OF LITERTURE

The literature review constitutes a critical element of any research endeavour. This provides crucial foundational knowledge, assisting individuals in the design and execution of their studies with greater efficiency. Through the analysis of existing studies, individuals gain insight into established techniques, results, and frameworks of theory, which improves the quality and relevance of their own work. Moreover, examining prior studies aids in avoiding redundant work and guarantees that the investigation offers fresh perspectives to the discipline. Considering these advantages, the subsequent section offers a comprehensive review of the literature relevant to the current study.

Bandgar et al. (2021) have investigated the expenses and benefits of producing tomatoes in Akola district of India during 2018-19. The primary data was collected from three tehsils provided which comprised of ninety tomato growers. They used simple tabular analysis to compile the data, and the result showed that the cost-A1, cost-A2, cost-B1, cost-B2, cost-C1, cost-C2, and benefit-cost ratio were calculated using the CACP's (Commission for Agricultural Costs & Prices) standardized cost concept. The largest group at Rs (Indian). 126412.96 per hectare, had the highest total cost of tomato cultivation, followed by the medium group (Rs. 122593.62) and the small group (Rs. 111806.84). In small groups, the benefit-cost ratio of tomatoes at cost 'C3' was 1.62, in medium groups, 1.65, and in big groups, 1.68. Their study suggests that large farm size owners should reduce their cultivation costs.

Afolayan et al. (2009) performed an economic loss analysis on four tomato varieties: UC82B, Roma, VT563/JM94/47, and Ibadan Local, grown in Ibadan, Oyo State, Nigeria. The research identified disparities in gender participation within tomato marketing, indicating that men primarily engage in wholesale activities while women are more involved in retail. The UC82B variety exhibited the highest percentage of loss due to pathological damage, which constituted 44%. In contrast, the Roma and VT563/JM94/47 varieties faced their most significant losses from physiological factors, representing 44% and 36%, respectively. Conversely, mechanical damage represented the primary loss factor for the Ibadan Local variety, accounting for 39% of the overall damage. Significant variations ($p<0.05$) were noted in the mean damage of UC82B relative to the other three varieties; however, no significant differences ($p>0.05$) were identified between VT563/JM94/47 and Ibadan Local. Additionally, decreases in marketing margins were observed at the retail level: UC82B (34%), Roma (85%), VT563/JM94/47 (94%), and Ibadan Local (79%). The study advocated for the implementation of enhanced transportation and storage methods to reduce losses after harvest in tomato marketing.

Ali et al. (2017a) analysed the costs, returns, and determinants of revenue in off-season cultivation of tomatoes in the districts of Faisalabad and Toba Tek Singh, Punjab, Pakistan, in 2014. The research employed primary data obtained via a stratified random sampling technique, encompassing 70 farmers engaged in off-season tomato cultivation. The findings revealed that the average total cost of production per acre for small, medium, and large farmers was Rs. 546,841.04, Rs. 542,636.04, and Rs. 598,125.66, respectively. Large farmers exhibited greater per acre production (295.63 kg) than small farmers (275.24 kg) and medium farmers (290.66 kg). Small farmers exhibited the highest net income per acre, amounting to Rs. 828,679.19, alongside the highest benefit-cost ratio (BCR) of 2.52. In contrast, medium and large farmers recorded BCR values of 2.47 and 2.22, respectively. Age, off-season tomato farming experience, education, irrigation, and contact with extension agents positively and significantly influenced revenue. The model demonstrated a satisfactory fit, indicated by a R^2 value of 0.69 and an F-value of 10.35. The research identified significant challenges, such as price volatility, disease outbreaks, insufficient extension services, and elevated initial investment costs. The authors advocate for government intervention to mitigate these issues and foster sector growth.

Jethi et al. (2012) examined the economics of tomato production in open protected fields in the Almora and Nainital districts of Uttarakhand, from May to July in 2010-11. The research employed primary data gathered from 76 farmers involved in vegetable cultivation. A straightforward tabular analysis and the standard cost concept were utilised to determine the cost of cultivation. The study indicated that the total cost of tomato cultivation in open and shaded field conditions was 1,36,250 and 4,01,743 per hectare, respectively, with gross returns of 1,81,500 and 8,66,250 per hectare. The output-input ratios for tomatoes were 1.3 in open field conditions and 2.2 in protected field conditions at cost 'C'. The results indicate a notable disparity in revenue between the two manufacturing settings. Therefore, they recommend that Tomato cultivation in poly houses is an effective solution to vegetable growers who would be able to recover investment on ploy house within a period of 4.2 years. This technology is very useful for the economic development of farmers.

Kondal (2017) has analyzed the cost and returns, and identify determinants of tomato crop/growers' profits in Telangana State, India. The primary data was collected from the 70 vegetable growers by using multi-stage random sampling method and structured scheduled. They used Simple percentage; descriptive statistics and multiple regression analysis to compile the data. The result showed that majority (91.3 percent) of the growers has received profits

whereas only 8.7 percent of growers have incurred losses up to Rs (Indian) 33547 per acre. The coefficient of determinate (R^2) reveals that the model is a best fit and the explanatory variables specified in it has collectively explained about 70.7 percent of the variation in tomato growers' profits per acre. They suggest that Govt. should implement the MGNREGP (Mahatma Gandhi National Rural Employment Guarantee Programme) in agriculture lean season to reduce the labor costs, and provide a vehicle at free of cost to transport the tomatoes from farm gate to markets to reduce the transport cost. In order to get more profits, provide marketing storage facilities, greatly expand extension services, run disease and crop insurance awareness campaigns, and increase earnings.

Cetin and Vardar (2008) conducted an analysis of direct and indirect input energy per hectare in industrial-type tomato production, juxtaposing it with production costs in the South Marmara region of Turkey. Data were collected from 95 tomato farmers through a questionnaire method. The research indicated that tomato production utilised a total of 45.53 GJ per hectare, with diesel energy consumption representing 34.82%, followed by energy used for fertilisers and machinery. The output-input energy ratio was 0.80, while the energy productivity was 0.99 kg of tomato per MJ. A cost analysis revealed that the primary cost components are labour, machinery, land rent, and pesticide expenses. The benefit-cost ratio indicated that larger farms surpassed smaller farms in both financial performance and energy efficiency. The study concluded that enhanced energy management at the farm level could result in more economical and efficient energy consumption.

Subedi et al. (2020) examined the production economics and resource utilisation efficiency of tomato cultivation in open field circumstances within the Kapilvastu area. Primary data were obtained from 90 tomato cultivators via pre-tested interviews and focus group talks with farmers and stakeholders. The data were examined with SPSS. The findings indicated that tomato cultivation was labour-intensive, with labour expenses comprising around 39% of the overall production cost. The gross margin per kattha was NRs. 7,255.10, whereas the net profit was NRs. 5,464.10 per kattha. The research indicates that, despite production costs above the national average in the assessed region, considerable potential exists for advancement in the technical and resource allocation dimensions of tomato production. This advancement may enhance profitability and productivity.

Parvin and Sarker (2021) have investigated the costs, revenues and production problems of tomato in two districts namely Cumilla and Rangpur in Bangladesh. The Primary data were collected from 240 tomato growers. All the data were analyzed statistically and economically. The result showed that the total cost of tomato was higher in Cumilla (Tk. 155,515/acre) than that of Rangpur (Tk. 151,224/acre). The gross returns from tomato cultivation in Cumilla and Rangpur were Tk. 234,942 per acre and Tk. 212,213 per acre, respectively. Net returns in Cumilla were superior at Tk. 77,010 per acre, in contrast to Rangpur's Tk. 60,989 per acre. The undiscounted benefit-cost ratio per acre was 1.51 for Cumilla and 1.40 for Rangpur, calculated from total expenses. The research discovered several substantial impediments to tomato production, including elevated input prices, insufficient storage facilities, price volatility, and damage inflicted by pests and illnesses. To tackle these difficulties, it is essential to guarantee the execution of existing policies and effective extension services that augment revenue and improve job prospects for tomato cultivators.

Gadhethariya et al. (2020) have examined the production economics of tomato in Kaparada, Mandvi, Vyara, Surat and Tapi districts of South Gujarat. They used multistage random sampling technique for the selection of 120 tomato farmers. The Result showed that the net income of 1.5 lakh/ha which indicated the economic viability of the crop in the study area with

a high output-input ratio of 3.25. It was suggested that the timely supply of credit and crop insurances scheme could further encourage cultivators for tomato production.

Patil et al. (2017) assessed the demand potential for tomato seedlings and the economic feasibility of developing commercial nurseries in polyhouse environments in Karnataka, India. Ten nurseries were chosen from three regions: Southern Transitional Zone, Northern Transitional Zone, and Central Dry Zone. The research indicated an annual need of 62.10 crores for tomato seedlings in Karnataka. The entrepreneurs allocated Rs. 10,66,705 to create a nursery inside a 1000 m² polyhouse. The economic research indicated that the gross returns was Rs. 1,65,528, while the net returns were Rs. 50,438 each cycle. With eight cycles annually, the gross returns amounted to Rs. 13,24,224, while the net returns was Rs. 4,03,504. The capital investment in commercial nurseries is economically feasible, exhibiting a positive Net Present Worth of Rs. 2,121,346, a Discounted Benefit-Cost Ratio of 1.22, and an Internal Rate of Return of 103%.

MATERIALS AND METHODS

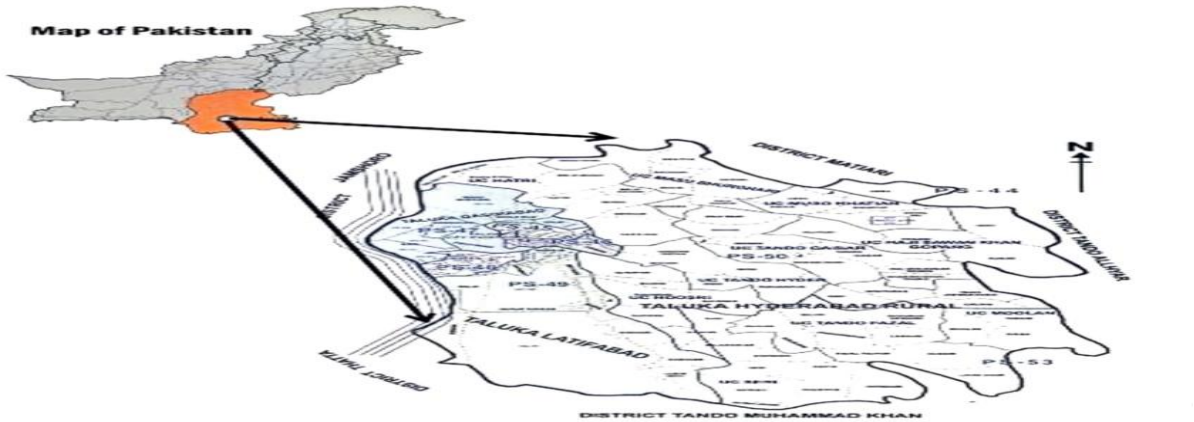
3.1 Research design

The research design of this study adopted a mixed-method approach, utilizing both secondary and primary data sources to achieve a comprehensive understanding of tomato production and price fluctuations in Hyderabad District. Secondary data were gathered from existing market research reports focusing on seasonal variations in tomato prices, which provided a valuable background for interpreting current market trends. Primary data were collected through a field survey using a multistage purposive sampling technique. A total of 120 tomato farmers were purposively selected from different villages within the district, ensuring the inclusion of respondents directly involved in tomato cultivation.

3.2 Study area

Four talukas of Hyderabad, Hyderabad rural, Qasimabad, and Latifabad—were purposively selected for the research because the region had one of the largest areas under agricultural production in Sindh.

Figure 3.1 Map of district Hyderabad, Sindh



3.3 Population

For the quantitative study, all respondents residing in the Hyderabad District were considered the target population. In contrast, for the qualitative study, the population was limited to those respondents specifically engaged in agricultural activities within the district.

3.4 The sample

A purposive sampling method was adopted to select the study area and villages based on their relevance to the research objectives. Within each selected village, a list of potential respondents was prepared with the assistance of local community members to ensure accuracy and representation. From this list, twenty respondents were randomly selected using a simple random sampling technique in each village. This process was repeated across six villages, resulting in a total sample size of 120 respondents.

3.5 Questionnaire development

A structured interview schedule was prepared to collect quantitative data. The interview schedule was pre-tested with 20 farmers before data collection, and necessary amendments were made based on the pre-test results.

3.6 Data analysis

The data were collected and subjected to statistical analysis using standard methods. The results were interpreted with the help of the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel.

3.6.1 Analytical measures

The data collected were analyzed based on the study objectives. Statistical analysis was conducted using the following regression equations to estimate the results.

3.6.2 Averages

To examine the socio-economic development, averages were calculated using the following formula:

Average = ∑Xi / n

Were, s

∑Xi = sum of independent variables

n = number of observations in data

N = Total number of respondents

3.6.3 Total cost of production

The total cost of production was calculated using the following formula:

TC=TFC+TVC

3.6.4 Net returns

Net returns were determined using the following formula:

NR= TI- TC

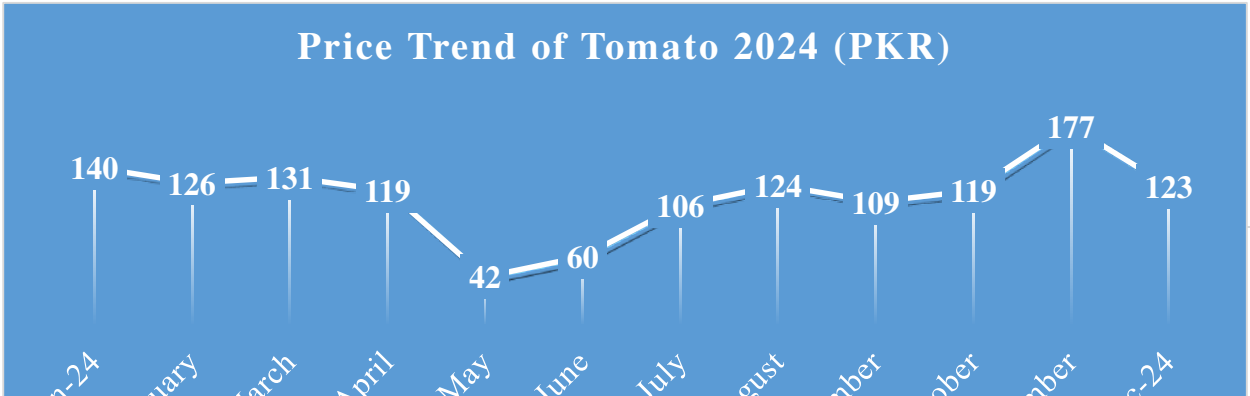
RESULTS

This chapter presents the findings of the study on the economic analysis of tomato production in Taluka Hyderabad, Sindh. It highlights key results derived from data analysis, focusing on various aspects such as the price trends across different seasons, the socio-economic characteristics of tomato growers, and the costs incurred along with the returns obtained by the farmers. The chapter is structured around the research objectives, providing a comprehensive understanding of the economic dynamics of tomato production in the study area

4.1 Annual Price trends of tomato Jan-Dec 2024

Source: Pakistan Bureau of Statistics (PBS), 2024

Figure 4.1 Price trends of tomato Jan-Dec 2024



The above graph shows a price trend of tomatoes price fluctuations in 2024 are driven by seasonal variations, supply-demand dynamics, weather conditions, and market factors. Prices drop during peak harvest months (May-June) and rise during shortages (November). The price trend shows fluctuations in the average retail prices during the year. The data points Likely represent the prices in Pakistani Rupees (PKR) for different months or intervals during the year. The trend shows a gradual decline in prices, starting at 140 PKR and decreasing to 123 PKR, with some minor fluctuations in between. This suggests a relatively stable but slightly decreasing price trend for tomatoes throughout the year, which could be influenced by factors such as seasonal availability, market demand, and agricultural production cycles. The graph aims to provide a visual representation of these changes, helping stakeholders understand the price dynamics of tomatoes in 2024.

4.2 General characteristics of respondents

Table 4.1 Socio-economic characteristics of tomato growers in the study area

Characteristics	Unit	Average
Age	Year	42
Education level	Year of Schooling	6.5
Family size	Number	3
Farm size	Acre	7.8
Land rent	Rs. /Acre/Annum	7,000
Full-time family labor	Number	3
Part-time family labor	Number	2
Farming experience	Year	8
Tomato farming experience	Year	3

Table 4.1 summarizes the general characteristics of respondents, likely from an agricultural survey, showing that the average respondent is 42 years old with 6.5 years of schooling, indicating a middle-aged demographic with primary-level education. Average family size is 3, on average, they manage small-scale farms of 7.8 acres, paying Rs. 7,000 per acre annually for land rent. Households typically rely on 3 full-time and 2 part-time family laborers, reflecting a strong dependence on family labor for farming activities. The respondents' moderate familiarity with agriculture is indicated by their average of 8 years of farming experience. However, many of them have only been growing tomatoes for three years, making it a relatively new endeavor.

Overall, the data paints a picture of small-scale farmers with moderate education levels and a significant reliance on family support for their agricultural work.

4.3 Costs of tomato crops in the study area

Table 4.2 All costs of tomato per acre in the study area

Particulars		Average Qty	Rate Per Unit	Amount (PKR)
Land Tax		1	350	350
Water Charges	Canal	7	800	800
	Tube well	6	3300	3300

Jungle Clearnce (day)		1	1500	1500
Ploughing (hours)		3	3200	9600
Bund & Chennel Making		1	1000	1000
Seedling Cost		1000	3	3000
Planting/Rumbo		2	800	1600
Fertilizer	DAP	1	11000	11000
	Urea	2	4800	9600
	Potash	1	4000	4000
Fertilizer application		2	800	1600
Pesticides		4	1000	3000
Pesticide Application		4	3000	12000
Weeding		3	1600	4800
Harvesting		5	4500	22500
Packing Material		400	20	8000
Transportation Charges		400	40	16000
Market Commission (usually 1% on total revenue at the market)				3730
Total Amount		**117,380**		

The data in Table 4.2 outlines the comprehensive costs associated with tomato cultivation per acre in the study area, amounting to a total of PKR 117,380. The breakdown includes various fixed and variable expenses, starting with land tax (PKR 350) and water charges, which consist of canal water (PKR 800) and tube well irrigation (PKR 3,300). Land preparation costs cover jungle clearance (PKR 1,500), ploughing (PKR 9,600 for three hours), and bund & channel making (PKR 1,000). The seedling cost totals PKR 3,000 for 1,000 units, while planting labor adds another PKR 1,600.

Fertilization expenses include DAP (PKR 11,000), urea (PKR 9,600), and potash (PKR 4,000), along with fertilizer application labor (PKR 1,600). Pest control involves pesticides (PKR 3,000) and their application (PKR 12,000). Weeding requires three labor units, costing PKR 4,800. Harvesting is the most labor-intensive activity, amounting to PKR 22,500 for five units. Post-harvest costs include packing materials (PKR 8,000), transportation (PKR 16,000), and a 1% market commission (PKR 3,730) on total revenue.

Overall, the data highlights the significant financial inputs required for tomato farming, with major expenditures on ploughing, fertilizers, pesticide application, harvesting, and transportation. This detailed cost structure helps farmers and policymakers understand the economic dynamics of tomato production in the region.

Table 4.3 Cost and profit analysis for tomato production in the study area

Particular	**Value (Rs.)**
Average Yield (Per Acre in munds)	210
Market Price Per munds	1800
Gross Income (Per Acre): a	378,000
Total cost of Production: b	117,380
Net Profit (Per Acre): c=a-b	260,620
Input output ratio: d=a/b	1: 3.22
Benefit-Cost ratio e=c/b	1: 2.22

Table 4.3 highlighted the tomato cultivation in the study area demonstrates strong economic viability, with an average yield of 210 munds per acre fetching a market price of PKR 1,800 per mund, resulting in a gross income of PKR 378,000 per acre. After deducting the total production costs of PKR 117,380, farmers achieve a substantial net profit of PKR 260,620 per

acre. The input-output ratio of 1:3.22 indicates that for every rupee invested, farmers earn PKR 3.22 in return, highlighting efficient resource utilization. Additionally, the benefit-cost ratio of 1:2.22 reveals a net gain of PKR 2.22 for every rupee spent, further underscoring the profitability of tomato farming. These figures suggest that tomato production is a financially rewarding enterprise in the region, offering farmers a high return on investment.

DISCUSSION

This chapter discusses the economic analysis of tomato production in Taluka Hyderabad, Sindh, by examining price trends across seasons, the socio-economic characteristics of tomato growers, and the costs and returns associated with tomato cultivation. The findings are compared with existing literature to provide a comprehensive understanding of the economic dynamics in the study area.

The findings from the present study demonstrate a strong economic potential for tomato cultivation in the study area. On a per-acre basis, farmers achieved a gross income of PKR 378,000 against a total production cost of PKR 117,380, resulting in a net profit of PKR 260,620. The input-output ratio of 1:3.22 and benefit-cost ratio of 1:2.22 underscore the high profitability and efficient resource use in tomato farming.

These results are consistent with those of Ali et al. (2017b), who conducted an economic analysis of off-season tomato production in Punjab. Their study highlighted the substantial profitability of tomato farming driven by favorable market prices and efficient input application, achieving input-output ratios above 1:3 closely matching the present study's outcomes. This confirms that both regular and off-season tomato production offer promising returns when market conditions and farm practices are well-managed.

Similarly, the findings align with Noonari et al. (2015a), who performed a comparative economic analysis of hybrid and conventional tomato farming in District Tando Allahyar, Sindh. Their results showed hybrid tomato varieties generated higher yields and gross margins. Although the current study does not differentiate between hybrid and conventional varieties, the high average yield of 210 mounds per acre suggests widespread adoption of improved or hybrid seeds, contributing significantly to the observed profitability. The market price of PKR 1,800 per mound also supports the economic viability of tomato farming outside peak pricing periods.

In addition, Solangi (2015), in his study of tomato production in Naushahro Feroze District, reported attractive profit margins and strong input-output ratios, further validating the findings of this study. Solangi emphasized that timely input use, pest management, and efficient harvesting are critical determinants of profitability factors that also significantly influenced costs in the present study, such as ploughing (PKR 9,600), pesticide application (PKR 12,000), and harvesting (PKR 22,500). Despite these relatively high operational costs, the overall returns indicate the strategic value of such investments in tomato farming.

The results of the current study also correspond with the findings of Bashir et al. (2022), who forecasted tomato production under climate variability in Pakistan. Their study underscored the importance of understanding climate patterns and their influence on production levels and market dynamics. Although this study primarily focused on economic analysis, the seasonal price variations observed from PKR 140 to PKR 123 per kg during 2024 reflect the influence of climatic and supply-demand factors, similar to the trends discussed by Bashir et al.

Moreover, a comparative perspective from Parvin and Sarker (2021), who analyzed tomato production in Bangladesh, revealed similar profitability patterns. Their findings showed that tomato farming can be a lucrative enterprise when input costs are managed effectively and

farmers have access to stable markets insights that are in line with the current study, where profitability was achieved despite moderate landholdings and input costs.

Socio-economic data from Table 4.1 further reveals that tomato farming in the study area is primarily conducted by middle-aged farmers (average age 42) with moderate levels of education (6.5 years of schooling) and small landholdings (average 7.8 acres). These characteristics are consistent with farmer profiles noted by Noonari et al. (2015) and Solangi (2015), emphasizing that smallholder farmers remain key stakeholders in tomato production. These farmers often rely on family labor and low-cost land leases (PKR 7,000 per acre annually), which contribute to their ability to sustain profitable operations despite economic and climatic challenges.

CONCLUSION AND RECOMMANDATIONS

6.1 Conclusion

The present study highlights the economic dynamics and profitability of tomato production in the study area during 2024. The price trend analysis reveals seasonal fluctuations largely driven by supply-demand forces, weather patterns, and market conditions. Prices typically decline during peak harvest periods (May–June) due to increased supply and rise again during off-season months like November due to scarcity. Despite some price volatility, a generally stable and slightly decreasing trend in retail tomato prices was observed throughout the year.

The socio-economic profile of the respondents indicates that tomato farming is primarily undertaken by middle-aged farmers with modest educational backgrounds and significant reliance on family labor. With an average farm size of 7.8 acres and approximately three years of experience specifically in tomato cultivation, the data points to an emerging engagement in tomato farming as a viable economic activity.

Cost analysis showed that tomato production entails substantial financial input, especially in ploughing, fertilization, pest control, harvesting, and transportation. However, the return on investment is highly favorable. With a gross income of PKR 378,000 and production costs totaling PKR 117,380, farmers earned a net profit of PKR 260,620 per acre. The impressive input-output ratio of 1:3.22 and benefit-cost ratio of 1:2.22 confirm that tomato farming offers substantial financial rewards and efficient resource use, making it a highly profitable venture for small-scale growers.

6.2 Recommendations

Based on the findings of the study, the following recommendations are proposed to improve the economic viability of tomato production in Taluka Hyderabad and similar regions:

Enhance market access and storage facilities: To mitigate the effects of seasonal price fluctuations, it is recommended to establish cold storage and improved supply chain infrastructure. This will allow farmers to store their produce during peak seasons and sell it when market prices are favorable.

Provide technical training and extension services: Since many farmers have only recently adopted tomato cultivation, training programs focusing on modern cultivation practices, pest and disease management, and efficient irrigation techniques should be introduced to enhance productivity and sustainability.

Subsidize key inputs: Given the high costs of fertilizers, pesticides, and labor, targeted subsidies or input support programs can reduce production expenses and enhance profitability for small-scale farmers.

Facilitate access to credit: Financial institutions should offer low-interest credit schemes to farmers, particularly those adopting tomato cultivation for the first time, to help them manage upfront costs without economic strain.

Promote off-season tomato production: Farmers can benefit significantly from higher market prices during the off-season. Therefore, promoting off-season production through protected cultivation methods (like tunnel farming) can enhance profitability, as supported by studies such as Ali et al. (2017).

Encourage farmer cooperatives: Forming farmer groups or cooperatives can help in bulk purchasing of inputs, accessing markets more efficiently, and negotiating better prices, thereby reducing overall costs and increasing bargaining power.

Invest in research and development: Further research into high-yielding, disease-resistant tomato varieties suitable for local conditions can help improve productivity and reduce dependency on chemical inputs.

Tomato production in Taluka Hyderabad has the potential to significantly contribute to the livelihoods of small-scale farmers and the local economy. By addressing the challenges identified in this study and implementing the recommended strategies, farmers can enhance their productivity, reduce costs, and maximize profits. Collaborative efforts between farmers, government agencies, and private sector stakeholders are essential to create an enabling environment for sustainable and profitable tomato farming in the region.

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