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## An economic assessment of post-harvest losses of tomato at the fresh produce marketing channel in Kolar district of Karnataka

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### Abstract

In recent days, the need for estimating post-harvest losses of perishables has gained higher prominence in India. Tomato is a highly perishable and inevitable vegetable for human life prompted to study its post-harvest losses at the fresh produce marketing channel in Kolar, one of the top tomato producing districts, in Karnataka. By employing purposive random sampling, the primary data was collected from various stakeholders for the period 2018-19 in Kolar Tomato market which was the second largest market for tomatoes in Asia. Tabular analysis and descriptive statistical analysis were used for the study. The traditional APMC channel (Farmers- Commission agent-Traders-Wholesalers-Retailer-Consumers) was purposively selected which had more intermediaries and higher business volume. The results showed that the post-harvest losses at the farmers, traders, wholesalers, retailers, and consumers' stages were 9.42 per cent, 2.2 per cent, 3.15 per cent, 4.49 per cent, and 3.95 per cent, respectively. The total post-harvest losses of Tomato were estimated at 22.23 per cent at the fresh tomato marketing channel. The major constraints faced by the stakeholders were inadequate financial facilities, price fluctuations, transportation, lack of market infrastructure, and more. Since there is scope for reducing post-harvest losses and overcoming these constraints, the policymakers shall work on the policies to improve the market infrastructures and market intelligence at the grass-root level.

**Keywords:** Marketing channels, market infrastructures, market intelligence, market intermediaries, post-harvest loss, traditional channel

### 1. Introduction

India's diverse climate ensures the accessibility of all kinds of fruits & vegetables. Fruits and vegetables are necessary complements for the human diet. It provides indispensable minerals, fibres, and vitamins required for preserving human health. Tomato is one of the foremost vital food insight of its exceptional nutrient value. It contains higher amounts of lycopene, a sort of antioxidant with inhibitor properties (Arab and Steck, 2000) <sup>[1]</sup>, that is favourable to scale back the incidence of some chronic diseases like cancer and lots of other cardiovascular disorders (Basu and Imrhan, 2007) <sup>[2]</sup>. Tomatoes are usually marketed by intermediaries such as commission agents and traders who are active in vegetable markets but are least interested in the well-being of producers or customers. Market commission agents work at the stage of the business and pay to the government a fixed per cent of charges. Traders, on the other side, buy a tomato from one market or straight from peasants and send it to retailers to realize their earnings. Wholesalers act as a bridge between farmers or traders and retailers, who supply produce to the ultimate consumer, with some considerable margin. These intermediaries are expected to play a crucial role in matching market demand with supply. Tomato is regarded as a significant commercial vegetable crop and a nutritional crop. It is one of the foremost widespread vegetables within the tropics and sub-tropics have grown all over the world. The USA and European countries contribute about 70 per cent of the world's production of tomato. The total cultivated area under tomato is 4582438 thousand ha. with a production of 15051381 thousand tonnes and productivity of 32.8 tonnes/ha. in the world (<https://www.fao.org/faostat/en/>) <sup>[8]</sup>.

According to reports of the National Horticulture Board, there was a slight increase in the area under horticulture crops. According to 2021-22 second advance estimates, the area was estimated to be 27.563 million hectares as compared to 27.476 million hectares in 2020-21. However, in the production of total horticultural crops, there is a slight reduction from 334.603 MT in 2020-21 to 333.251 MT in 2021-22.

The southern and central states make up a large part of India's production of tomato including Andhra Pradesh, Telangana, Karnataka, and Maharashtra. According to reports of the National Horticulture Board, in the year 2021-22, India accounts for 203.19 lakh tonnes of tomato production, out of which Karnataka stands at third position with a share of 10.23 per cent which accounts for 20.77 lakh tonnes (<https://agriexchange.apeda.gov.in/>)<sup>[9]</sup>. Kolar was the state's top Tomato-producing district of Karnataka based on its cultivated area (8150 ha) and production of 481.45 metric tonnes (<https://agricoop.nic.in/>)<sup>[7]</sup>. Hence, this district has thus been chosen for the analysis for gathering market-related knowledge from multiple market functionaries, the current Tomato sales market in the Kolar district was chosen.

### 1.1 Post-harvest loss

Post-harvest loss can be defined as the loss entirely resulting from the harvest phase to the consumption phase resulting from qualitative loss, quantitative loss, and food waste. Post-harvest loss is one of the largest issues affecting global economic growth. The FAO (Food and Agriculture Organization) estimates the annual loss of 1/3<sup>rd</sup> of food products. Since fruits and vegetables are perishable, their chances of becoming spoiled or degraded are greater.

Post-harvest losses of horticultural crops in developing nations ranged from 15 to 50 per cent. With such high levels of losses, there are sporadic food shortages and severe price fluctuations of food commodities, leaving the poor and vulnerable in the society food insecure. In horticultural crops such as fruits and vegetables, post-harvest losses are even much higher because of their perishable nature. Relevant to this study, Gajanana *et al* (2006)<sup>[3]</sup> observed a total post-harvest loss of 19 per cent in tomato in Karnataka which consisted of 9.43 per cent at the field, four to five per cent at the market, and about five per cent at the retail level.

This study sheds some light on quantifying the post-harvest losses of tomato and its monetary value in the Kolar district of Karnataka. In addition, this study also identified the constraints of different market intermediaries of the tomato supply chain. The results will provide the right-hand information for policymakers to stabilize the supply chain and pave the way for better understanding and implementation of policies.

## 2. Materials and Methods

Kolar district was selected purposively based on the highest area under tomato cultivation in Karnataka and the scope for increasing tomato production. The agriculture produce market committee (APMC) of Kolar has been chosen for the collection of information about farmers and intermediaries. Considering the nature and scope of the study, the purposive random sampling technique was employed to collect the information of different intermediaries like growers/farmers, commission agents, traders, wholesalers, retailers, and consumers.

The primary data was collected in the period of June-July 2019 with the reference year for the study was 2018-19. The sample composition constitutes 120. Out of these, 20 respondents from each intermediary group were interviewed with a semi-structured and pre-tested questionnaire to gather relevant information from intermediaries based on their memories. Since, commission agent will not take title of the produce, he was not interviewed for estimation of post-harvest losses in the study.

Tabular analysis was used to study the post-harvest losses at different stages of marketing fresh tomatoes. The data collected were tabulated and analysed through simple statistical methods including averages and percentages.

Prioritization of the constraints was performed using Garrett's ranking technique, and the order of merit assigned by the respondents was converted into scores using the following formula given by Garrett and Woodworth (1969)<sup>[5]</sup>,

$$\text{Percent position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

$R_{ij}$  = Rank given for the  $i^{\text{th}}$  item by the  $j^{\text{th}}$ , respondent and  
 $N_j$  = Number of items ranked by the  $j^{\text{th}}$ , respondent

The per cent place values were translated into Garrett values with the aid of Garrett's conversion table. The total scores of each person were then multiplied by the Garrett value for each constraint, and each score of a particular constraint was added, and mean score values were determined afterward.

## 3. Results and Discussion

### 3.1 Post-harvest losses at different stages of marketing of Tomato

The post-harvest losses were estimated at the fresh produce marketing channel in the study area which is depicted in table 1. The average price of tomato was considered to estimate the post-harvest losses in monetary terms at intermediaries' levels.

At farmers' level, the average price of the tomato was ₹7.41 per Kg. The sampled tomato from the farmers was 159.40 quintals which accounted monetary value of ₹118115. Out of which, the worth of ₹1137.23 was accounted as a loss which sums to 9.42 per cent. Pests and diseases (53.22%) were the most prominent cause for the maximum loss owing to the lack of adequate knowledge regarding the control of pests and diseases. And other causes for loss were transportation (20.02%), improper packaging (9.38%), improper handling while loading and unloading (9.11%), and grading and sorting (8.25%).

The causes for post-harvest losses at the traders' level were quality deterioration, transportation losses, and poor handling during loading and unloading. The average price of Tomato was ₹9.2 /Kg. The total estimated tomato losses were around 177.85 Kg worth of ₹1636.22 out of 7980 kg of sample drawn tomatoes worth ₹73416. Poor transportation (41.97%) was the major cause due to the delicacy and perishability of Tomato. Besides, owing to the same above-mentioned nature, rotten tomatoes (23.89%), loading and unloading issues (19.28%), and poor quality (14.84%) were also considered as major causes and the total loss at the trader's stage was summed up to 2.22 per cent.

The identified causes for losses to quantify post-harvest losses at the wholesalers' level. The average price of Tomato was ₹12.15 /Kg. The total losses were estimated at approximately 3.15 per cent representing a monetary value of ₹3004.69 out of ₹95256. The maximum losses incurred in transportation was 33.48 per cent. Further, poor quality, loading and unloading, and rotten tomatoes had caused 23.81 23.53, and 19.16 per cent of loss respectively.

The various types of retailers' level losses were also identified. The average price of Tomato was 14.8 ₹/Kg. Out of 2020 Kg of sampled Tomato 90.74 Kg were lost due to various reasons, which accounted for ₹1342. The maximum

losses were estimated in transportation (33.88%.) Further, owing to over-ripening and perishability, rotten tomatoes accounted for 25.39%, followed by poor quality (23.03%) and improper handling and storage (17.68%) of tomatoes summed up the total loss of tomatoes at the retailers' stage to 4.49 per cent.

Finally, the losses at the consumer's level were estimated and the results have shown that the average price of Tomato was ₹18.1 /Kg. The total sampled tomato was 43.5 Kg worth ₹787.35 out of which, 1.72 kg worth ₹31.13 were lost before consumption. The maximum losses were incurred while transporting and handling (51.16%) tomato from the shop to home or any function ceremonies. Besides, poor quality and rotten tomatoes had caused a loss of 26.16 and 22.67 per cent respectively. All above-mentioned causes accounted for 3.95 per cent of post-harvest loss at the consumer level.

For the farmer, pest and disease attack was the significant factor that caused a loss of 9.42 per cent, and the other causes like lack of better infrastructure for transporting accounted for the loss which affected the farmers' income badly. And traders had incurred a relatively lower percentage of post-harvest loss (2.22%) owing to the handling duration, the traders handle the tomatoes for a short period. On the contrary, wholesalers handle tomatoes for a bit longer period, they incurred a relatively higher percentage of losses (3.15%) compared to traders. Further, the ripened tomatoes were dispersed at the retailers' stage and a slight injury or infection can harm the tomato. Hence, the percentage of tomato loss was higher (4.4%) compare to traders and wholesalers. Also, due to the

perishability nature of Tomato, with the consideration of the duration of reaching tomato to the consumer, the post-harvest losses were quite higher compared to the trader and wholesaler at the consumers' stage.

### 3.2 Total post-harvest losses

From Table 2, it could be concluded that the total post-harvest losses were added to 23.23 per cent at all stages. It has been observed that the highest percentage of losses was at the farmers' level (9.42%), nearly 2.2 per cent of losses were at the traders' level, 3.15 per cent at the wholesalers' level, 4.49 per cent at the retailers' level, and finally 3.95 per cent at the consumer level. In monetary terms, the total post-harvest losses were accounted to ₹17152.22 out of ₹317470.75 of total sample drawn. It is learnt from here that that farmers lost tomatoes mainly from pest and disease attacks, and on average, every stage has maximum transportation losses since tomato is a very sensitive crop and it is vulnerable to slight damages during transportation, loading, and unloading.

This study lines with the results obtained by Rehman *et al.* (2017) [6]. They have estimated the post-harvest losses of tomato in the Peshwar valley and found a loss of 20 per cent of total production.

The results were also supported by the findings of Gajanana TM and Sudha (2011) [4]. They reported on post-harvest losses in vegetable crops reported a loss of 5.86 per cent at the farm, 10.59 per cent at the market, and 0.81 per cent at the consumer levels. A maximum loss of 32.14 per cent was observed in the case of Tomato.

**Table 1:** Post-harvest losses at different stages of marketing of Tomato

Sl. No.	Particulars	Quantity(kg)	Value (₹)	Percentage
<b>Farmers</b>				
1	Quantity of sample drawn	15940	118115.40	100
2	Quantity of good tomatoes	14437	106978.17	90.57
3	<b>Post-harvest losses</b>			
	a) Pests and diseases	800	5928	53.22
	b) Transportation losses	301	2230.41	20.02
	c) Loading and unloading losses	137	1015.17	9.11
	d) Losses due to grading/sorting	124	918.84	8.25
	e) Improper packing	141	1044.81	9.38
	Total	1503	11137.23	9.42
<b>Traders</b>				
1	Quantity of sample drawn	7980	73416	100
2	Quantity of good tomatoes	7802.15	71779.78	97.77
3	<b>Post-harvest losses</b>			
	a) Poor quality	26.40	242.88	14.84
	b) Got rotten	42.50	391	23.89
	c) Transportation losses	74.65	686.78	41.97
	d) Loading and unloading losses	34.30	315.56	19.28
	Total	177.85	1636.22	2.22
<b>Wholesalers</b>				
1	Quantity of sample drawn	7840	95256	100
2	Quantity of good tomatoes	7592.70	92251.30	96.84
3	<b>Post-harvest losses</b>			
	a) Poor quality	58.90	715.63	23.81
	b) Got rotten	47.40	575.91	19.16
	c) Losses during transportation	82.80	1006.02	33.48
	d) Loading and unloading losses	58.20	707.13	23.53
	Total	247.3	3004.69	3.15
<b>Retailers</b>				
1	Quantity of sample drawn	2020	29896	100
2	Quantity of good tomatoes	1929.26	28553.04	95.50
3	<b>Post-harvest losses</b>			
	a) Poor quality	20.90	309.32	23.03
	b) Got rotten	23.04	340.99	25.39

	c) Improper handling and storing	16.05	237.54	17.68
	d) Transportation losses	30.75	455.1	33.88
	Total	90.74	1342.95	4.49
<b>Consumers</b>				
1	Quantity of sample drawn	43.5	787.35	100
2	Quantity of good fruits	41.78	756.21	96.04
3	Post-harvest losses			
	a) Poor quality	0.45	8.14	26.16
	b) Got rotten	0.39	7.05	22.67
	c) Transportation and handling loss	0.88	15.92	51.16
	Total	1.72	31.13	3.95

**Table 2:** Total post-harvest losses of Tomato at all the stages

Sl. No.	Stages	Average Price (₹/Kg)	Quantity (kg)	Monetary Value (₹)	PHL (kg)	PHL in percentage	In monetary terms (₹)
1	Farmers	7.41	15940	118115.4	1503	9.42	11137.23
2	Traders	9.20	7890	73416	177.85	2.22	1636.22
3	Wholesalers	12.15	7840	95256	247.3	3.15	3004.69
4	Retailers	14.80	2020	29896	90.74	4.49	1342.95
5	Consumers	18.10	43.5	787.35	1.72	3.95	31.13
	Total		33733.5	317470.75	2020.61	23.23	17152.22

Note: PHL- Post-harvest loss

**Table 3:** Garrett scores of value chain constraints faced by market intermediaries

Sl. No.	Constraints	Mean score	Rank
<b>Farmers</b>			
1	Financial constraint	69.65	I
2	Realization of low price	66.70	II
2	Very high input cost	62.95	III
3	Transportation	60.10	IV
5	Distant market	51.35	V
6	Limited market information	45.55	VI
<b>Commission Agents</b>			
1	Lack of market infrastructure (roads, toilets, etc.)	70.50	I
2	Congested and unhygienic marketplace	65.70	II
3	Lack of grading by farmers	62.10	III
4	Delay in receiving payments from buyers	57.60	IV
5	Labour shortage	49.50	V
<b>Traders</b>			
1	Price fluctuation in the procurement market.	73.90	I
2	Lack of storage facility	64.50	II
3	Long-distance from the market	62.10	III
4	Lack of transportation facilities.	53.70	IV
5	Lack of price information system	45.95	V
6	Poor quality	42.50	VI
<b>Wholesalers</b>			
1	Price fluctuation in the procurement market.	71.65	I
2	Lack of storage facility	68.35	II
3	Lack of transportation facilities	65.95	III
4	Long-distance from the market	63.15	IV
5	Lack of price information system	45.95	V
6	Poor quality	44.44	VI
<b>Retailers</b>			
1	Competition from fellow retailers.	65.20	I
2	Price fluctuation	61.70	II
3	Lack of transportation facilities.	55.55	III
4	Long-distance from the market.	47.55	IV
5	Poor quality	41.35	V
6	Lack of price information system	38.55	VI
<b>Consumers</b>			
1	Price factor	67.25	I
2	Poor quality	63.75	II
3	Low income	53.50	III
4	Less market information	32.75	IV

The identification of constraints in the Tomato value chain plays a vital role in finding lacunae and suggesting policy measures. During interviews with respondents through semi-

structured schedules, a wide range of constraints was identified at different stages in the value chain analysis of Tomato (Table 3). The Garrett score shows the strength of

constraints, the higher the score, severe the constraint the market intermediaries are facing.

The financial aspect was the major constraint for farmers, with the Garrett score of 69.65, to make the tomato supply available, as tomato cultivation requires more investment from land preparation to transport to the market. Realizing lower prices (Garrett mean score of 66.70) for the product was also the major constraint due to the actions of market forces, which hinders the confidence of the farmers. Also, the other major challenge was the high input cost because of high labour wages and high cost of other factors which cause an increase in investment. Followed by, constraints like transportation problems, distant markets, and limited market information also had a major impact on farmers' production and marketing of produce. For commission agents, inadequate market infrastructure (Garrett mean score of 70.50) and a congested and unhygienic market (Garrett mean score of 65.70) were the major constraints, and poor primary grading by the farmers led to less attraction of buyers, which was also a considerable constraint. For traders, price fluctuation (Garrett mean score of 73.90) was a major constraint due to market forces' action, which fluctuate the prices and effect traders' income. Along with it, tomato is the perishable commodity one should be aware of and store in controlled scientific storages (Garrett mean score of 64.50), which was one of the major constraints in the marketing of fresh tomatoes for traders. Poor transportation facilities lead to a huge loss of tomatoes, which was also considered one of the constraints too. The other constraints of traders were the long distance to the market which was affecting relatively low traders' activities. Moreover, lack of market information and poor quality constraints were considered to be relatively least affected on the marketing of Tomato, since the traders were quite cautious in purchasing tomato in the auction, they would always purchase the best quality tomato with their experience. For wholesalers, price fluctuation (Garrett mean score of 71.65) was a major constraint due to the action of market forces which incur enormous losses in income, along with poor storage facilities (Garrett mean score 68.35) leads to enormous deterioration of tomatoes was also a considerable constraint. Lack of transport facilities, a long distance from the market, a lack of price information, and poor quality were the other constraints of the wholesalers. Competition is a key constraint for retailers because more competitors in a market make it difficult for retailers to make an adequate profit, the fluctuation in price due to market forces is also a major constraint that hinders retailers' confidence. Poor quality (Garrett mean score 63.75) and price factors (Garrett mean score 67.25) were the main constraints for consumers that affect tomato consumption. And other major constraints were low income and less market information.

#### 4. Conclusion

It can be inferred from the study that the total post-harvest losses were accumulated at all stages to 23.23 per cent. out of which, the highest losses of 9.42 per cent were at the farmers', 2.2 per cent of losses at the trader, 3.15 per cent at the wholesaler, 4.49 per cent at the retailer, and 3.95 per cent at the consumer levels. It is also inferred from the study that farmers had lost major produce from pest and disease attacks, and evidently, every stage had maximum losses in transporting the produce due to its delicacy and perishable nature that subsequently caused early deterioration and unsuitable for use. Further. results of the analysis also showed

that finance/investment, lower price, very high cost of input, inadequate transportation facilities, long distant market, and limited market information were the major production and marketing constraints of farmers; Price fluctuations, transportation facilities, competition from fellow traders, lack of storage facilities, lack of price information and poor quality were the major constraints of rest of the intermediaries. Since there is a huge scope for reducing post-harvest losses and overcoming production and marketing constraints of all stakeholders, the outcomes of this study might be readymade inputs for policymakers to frame suitable policies for better market intelligence and infrastructure at grass-root level.

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