

# An economic assessment on post harvest losses in fresh vegetables

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**SUMMARY :** A study was undertaken to know post-harvest losses in fresh vegetables in Banaskantha, Sabarkantha and Mehsana districts of Gujarat state. For this study, 120 farmers, 20 wholesalers and 40 retailers were selected. The total marketable surplus ranged from 97.44 per cent in tomato to 99.88 per cent in cauliflower. The total post-harvest losses occurred at farm level varied from 12.06 per cent in cabbage to 17.64 per cent in brinjal where as at the market level, it was observed highest in case of brinjal (17.58 %). The major causes of post-harvest losses mentioned by wholesalers were improper size of packing, lack of care during transportation and selection of improper vehicles where as the major causes mentioned by the retailers were lack of grading, use of improper packing materials and transportation vehicles. The damage due to birds was observed only in brinjal and tomato but the damage of crushed fruits was observed only in cabbage, cauliflower and tomato which varied from 1.56 to 4.12 per cent.

**KEY WORDS :** Vegetables, Post harvest losses, Wholesalers, Retailers

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**P**erishable nature and bulkiness of agriculture produces is many a times curse of farmers as it induces forced sale and spoilage loss during transition. The post-harvest loss (PHL) directly increases the cost of marketing and also reduces the per capita availability of vegetables. The estimated economic loss in value due to PHL in fruits and vegetables has been over Rs. 23,000 crores in recent years. The overall losses vary up to 25 per cent in vegetables *viz.*, tomato, cabbage, cauliflower and chilli (Verma and Singh, 2004). In some studies, PHL ranged between 22 and 33 per cent (Guraha, 1997 and Vishwanthan *et al.*, 1999). The losses are highly product specific and location specific. The rate of post-harvest

losses also depends on the length of marketing channel and state of marketing technology *i.e.*, mode of transportation, grading, packing, storing etc. The estimation of PHL at one or two levels in entire marketing channel results either under estimate or over estimate of PHL. Hence, quantification of losses occur at different stages is important in respect of taking actions to minimise losses as well as to develop a suitable marketing technology. The present study was, therefore, undertaken to estimate the post-harvest losses at the farm level as well as at the market level in Saurashtra region. The specific objectives of the study are to estimate the marketable surplus for major fresh vegetables, to workout the magnitude and amount of post-harvest losses and to identify the major causes of post-harvest losses at various stages.

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## EXPERIMENTAL METHODS

The study was confined to major fresh vegetables *viz.*, tomato, cabbage, cauliflower and brinjal. In total, 120 farmers, 20 wholesalers and 40 retailers were selected. The distribution of sample farmers, wholesalers and retailers among the villages are given below. Total three markets *viz.*, Deesa, Vijapur and Pratij were selected from Banaskantha, Mehsana and Sabarkantha districts, respectively. The distribution of sample

farmers among the villages is given in Table A. The information regarding production, post-harvest losses and marketable surplus were collected through personal interviews with the help of well structured interview schedules during the year 2011. The information about the post-harvest losses and causes associated with PHL was collected from 20 wholesalers and 40 retailers. The data about post-harvest losses were estimated by taking appropriate sample from the lot of each selected vegetables at farm, wholesaler and retailer levels. Then, the vegetables were sorted according to nature and damage. The proportion of PHL was worked out on the basis of weight and percentage of weight of sample drawn. The ancillary information regarding packing, mode of transportation, place of sale, mode of sale distance of market etc. was also collected. The tabular analysis was used for the processing of data. The estimation of post-harvest losses in monetary term for the state as a whole was made separately at farm, wholesale and retail stages by multiplying average wholesale and retail prices to quantity of PHL at respective stage.

**Table A (1): Selection of talukas**

Districts	Talukas/Markets	No.of villages	No.of farmers
Banaskantha	Deesa	5	40
Mehasana	Vijapur	4	40
Sabarkantha	Pratij	4	40

**Table A (2): Selection of villages and farmers in Deesa taluka**

Name of villages	Selection of farmers			
	Cabbage	Cauliflower	Tomato	Brinjal
Malgadh	4	4	2	4
Ranpur	3	2	1	2
Old Deesa	2	2	4	2
Rajpur	1	2	1	2
Davas	-	-	2	-

**Table A(3): Selection of villages and farmers in Vijapur taluka**

Name of villages	Selection of farmers			
	Cabbage	Cauliflower	Tomato	Brinjal
Manipura	2	2	5	4
Motipura	4	4	2	3
Govind pura	2	4	2	1
Sundarpura	2	-	1	2

**Table A(4): Selection of villages and farmers in Pratij taluka**

Name of villages	Selection of farmers			
	Cabbage	Cauliflower	Tomato	Brinjal
Pogalu	4	4	2	4
Kamalpur	3	2	1	2
Salal	2	2	4	2
Vadrad	1	2	1	2
Vagpur	-	-	2	-

## EXPERIMENTAL FINDINGS AND ANALYSIS

The results of the present study as well as relevant discussions have been presented under following sub heads:

### Marketable surplus and marketing behaviour :

The pattern of disposal and marketable surplus of different vegetables are shown in Table 1. It was observed from the Table 1 that the highest yield *i.e.*, 587 q/ha, was obtained in case of cabbage and the lowest productivity was observed in brinjal (241 q/ha). Total quantity retained by the vegetable producers varied from 0.05 per cent (cauliflower) to 1.78 per cent (tomato) of total production. Of the total retained quantity, quantity kept for home consumption was the major portion, followed by quantity given to relatives and labour in case of most of the vegetables. The total marketable surplus was found to be varied from 97.44 per cent in tomato to 99.88 per cent in cauliflower.

The marketing behaviour of vegetable growers is described in Table 2.

It can be seen from the results that packing of vegetables in Polythene bag (39.16%) was the most preferable type of packing material, followed by Gunny bag (24.16%), while least preferred types of packing material was bamboo-basket. Most of the selected vegetable growers used tempo-rickshaw as their mode of transportation and most of them sold their produce in nearby city markets. Open auction was the most preferred (76.66%) mode of sale, followed by selling through contract (16.68%) and private negotiation (6.66 %). Most of the vegetable growers were found in proximity of market *i.e.*, within 20 km. from market.

### Post harvest losses at the farm level :

The post-harvest losses in different vegetables at farm level are given in Table 3. It could be observed from the table that the Post-Harvest Loss (PHL) varied from 12.06 per cent in cabbage to 17.64 per cent in brinjal. The damage caused by birds was observed only in brinjal and tomato and that too was less than one per cent. The damage due to cracking of fruits was observed between 0.72 per cent in brinjal to 8.74 per cent in tomato. This indicates the need to develop harvesting technology especially for tomato crop to minimize PHL at field level. The losses due to attack by fruit borer was observed between 5.60 per cent in tomato and 16.74 per cent in brinjal. This shows the urgent need of effective control measures for fruit borer of brinjal which is the major vegetable of this area. Overall, it was observed that fruit borer attack and cracking of fruits were the prominent causes of loss at the field level. The same was also observed in case of tomato crops in Karnataka by Gajanana *et al.* (2006). Thus, the use of suitable packing

technology and plant protection measures are essential to minimize PHL at farm level.

#### Post harvest loss at the wholesale level :

The details of post-harvest losses in different vegetables at wholesale level are given in Table 4. The PHL at the wholesale level was observed highest in case of brinjal (17.58 %), followed by cabbage (17.08 %), cauliflower (16.10 %) and tomato (12.08 %). Among various components of PHL at this stage, the loss due to crushed fruits was observed in cabbage, cauliflower and tomato only ranging

from 1.56 to 4.12 per cent. The proportion of physically damaged fruits was found to be varied from 3.24 per cent in cauliflower to 8.02 per cent in case of brinjal. The proportion of loss due to overripe and rotten fruits was observed in the range of 3.74 per cent in tomato to 10.42 per cent in cabbage. Thus, of the total PHL losses at wholesale level, the loss due to physically damaged fruits was found relatively higher next to overripped and rotten fruits loss, indicated thereby the need of creating suitable mode of transportation *i.e.*, cold chain transportation which can prevent physical damage as well as over ripening of the vegetables too.

**Table 1: Pattern of disposal and marketable surplus of different vegetables**

Sr. No.	Crops	Production	Retained for home consumption	Relatives	Labour	Total	Marketable surplus (kg/ha)
1.	Cabbage	58654.36 (100)	35.19 (0.06)	17.60 (0.03)	29.32 (0.05)	82.11 (0.14)	58572.25 (99.86)
2.	Brinjal	24365.42 (100)	116.95 (0.48)	51.16 (0.21)	46.29 (0.19)	214.41 (0.88)	24151.02 (99.12)
3.	Tomato	32566.30 (100)	579.68 (1.78)	198.65(0.61)	55.36 (0.17)	833.69 (2.56)	31732.61 (97.44)
4.	Cauliflower	52457.26 (100)	26.22 (0.05)	15.73 (0.03)	20.98 (0.04)	62.93 (0.12)	52394.33 (99.88)

Figures in parentheses are percentages to total

**Table 2 : Distribution of vegetable growers according to marketing behaviour**

Sr. No.	Particular	Marketing behaviour items	Total (120)	Percentage (100.00)
1.	Types of packing	Bamboo-basket	4	3.33
		Wooden-box	5	4.16
		Carret	14	11.67
		Polythene bag	47	39.16
		Gunny cloth	21	17.52
		Gunny bag	29	24.16
2.	Mode of transport	Tempo rickshaw	110	91.67
3.	Place of sale	Nearby city	111	92.5
4.	Mode of sale	Private negotiation	8	6.66
		Open auction	92	76.66
		Contract	20	16.68
5.	Distance of the market	Less than 10 km.	19	15.83
		10-20 km.	101	84.17

**Table 3: Post harvest losses in different vegetables at farm level**

Sr. No.	Particulars	Cabbage (30)*	Brinjal (30)	Tomato (30)	Cauliflower (30)
1.	Quantity of sample drawn	168 (100)	172 (100)	216 (100)	162 (100)
2.	Quantity of good fruits	147.73 (87.94)	141.66 (82.36)	182.82 (84.64)	139.64 (86.02)
3a.	Bird damaged fruits	0	0.310 (0.18)	2.20 (1.02)	0
b.	Cracked fruits	6.65 (3.96)	1.24 (0.72)	18.88 (8.74)	6.22 (3.84)
c.	Fruit borers attack	13.61 (8.10)	28.79 (16.74)	12.1 (5.60)	16.14 (9.96)
Total		20.26 (12.06)	30.34 (17.64)	33.18 (15.36)	22.36 (13.8)

Figures in parentheses are percentages to total, \* Indicated number of sample drawn, PHL- Post- harvest level

Whereas, the causes of PHL mentioned by the wholesalers are given in Table 5. It can be seen that the reasons for PHL given by wholesalers varied across the type of vegetables. However, in general, it can be noticed that improper size of packing was recognized as one of the most common cause of PHL by 80.00 per cent wholesalers. Other important factors responsible for PHL revealed by wholesalers were lack of care during transportation (75.00 %), improper selection of mode of transportation (45.00 %), distance from farm to market (40.00 %), lack of grading (40.00 %) and improper packing materials (35.00%).

#### Post harvest loss at retail stage :

The information about post-harvest losses at retail market level is given in Table 6. The results indicated that PHL at retail level varied from 5.34 per cent in tomato to 11.22 per cent in

cabbage. The break up of total loss into various components showed that the loss due to crushed fruits was around 0.94 and 2.46 per cent mainly observed in case of brinjal and tomato. The proportion of physically damaged fruits varied between 0.86 per cent in tomato to 3.08 per cent in cauliflower. The proportion of overripped and rotten fruits observed was to the tune of 2.12 in cauliflower to 9.54 per cent in cabbage. Thus, in total loss at retail levels, the loss due to overripped and rotten fruits was found as the major factor in general particularly in cabbage.

Among the various causes of PHL mentioned by the retails, lack of grading was the major factor recognized by 65.00 per cent retails. Awareness and training of grading at farm level and grading facilities at market may help to minimize this loss. The other important reasons were improper packing material, improper mean of transportation and improper size of packing which is shown in Table 7.

**Table 4 : Post harvest losses in different vegetables at the wholesale market level**

(kg)

Sr. No.	Particulars	Cabbage (5)*	Cauliflower (5)	Brinjal (5)	Tomato (5)
1.	Quantity of sample drawn	62 (100.00)	34 (100.00)	54 (100.00)	46 (100.00)
2.	Quantity of good fruits	51.41 (82.92)	28.53 (83.90)	44.51 (82.42)	40.44 (87.92)
3.	Damaged fruits				
3a.	Crushed fruits	1.13 (1.82)	1.40 (4.12)	0	0.72 (1.56)
3b.	Physically damaged fruits	3.00 (4.84)	1.10 (3.24)	4.33 (8.02)	3.12 (6.78)
3c.	Overripped and rotten fruits	6.46 (10.42)	2.97 (8.74)	5.16 (9.56)	1.72 (3.74)
	Total PHL at the market level	10.59 (17.08)	5.47 (16.10)	9.49 (17.58)	5.56 (12.08)

Figures in parentheses are percentages to total, \* Indicated number of sample drawn

**Table 5: Causes of post harvest losses perceived by wholesalers**

Sr. No.	Particulars	Cabbage (5)	Cauliflower (5)	Brinjal (5)	Tomato (5)	Total (20)
1.	Selection of improper vehicles	1	2	4	2	9 (45.0)
2.	Improper packing materials	1	2	3	1	7 (35.0)
3.	Improper size of packing	4	4	5	3	16 (80.0)
4.	More distance from farm to market	2	2	2	2	8 (40.0)
5.	Lack of care during transportation	5	3	3	4	15 (75.00)
6.	Due to lack of grading	3	2	2	1	8 (40.0)

Figures in parentheses are percentages to total, \* Indicated number of sample drawn

**Table 6: Post harvest losses in different vegetables at the retail level**

(kg)

Sr. No.	Particulars	Cabbage (10)*	Brinjal (10)	Tomato (10)	Cauliflower (10)
1.	Quantity of sample drawn	6.42 (100.00)	8.56 (100.00)	6.78 (100.00)	11.08 (100.00)
2.	Quantity of good fruits	5.70 (88.78)	7.85 (91.80)	6.418 (94.66)	10.231 (92.34)
3.	Damaged fruits				
3a.	Crushed fruits	0	0	0.064 (0.94)	0.273 (2.46)
3b.	Physically damaged fruits	0.108 (1.68)	0.159 (1.86)	0.058 (0.86)	0.341 (3.08)
3c.	Overripped and rotten fruits	0.612 (9.54)	0.543 (6.34)	0.240 (3.54)	0.235 (2.12)
	Total	0.720 (11.22)	0.702 (8.20)	0.362 (5.34)	0.849(7.66)

Figures in parentheses are percentages to total, \* Indicated number of sample drawn

Overall PHL in different vegetables is described in Table 8. The total PHL was found highest in brinjal *i.e.*, up to 40.56 per cent. In most of the crops, PHL was observed more than 30.00 per cent. Post harvest losses was found relatively higher at wholesale level and farm level than that on retail levels, indicating the need to create suitable market infrastructure *viz.*, grading facilities, storage facility, communication, *etc.*

**Economics of post-harvest losses :**

The magnitude of PHL of major vegetables in monetary terms for Gujarat State is given in Table 9. It is evident from the results that at farm level, the quantity of PHL was estimated to be around 0.48 lakhs tonnes which valued to the extent of Rs.32.5 crores. The value of PHL varied from 4.21 crores in cabbage to

12.87 crores in brinjal. Very high loss at farm level in case of brinjal was due to high infestation of fruit borers and white fly as indicated by vegetable growers. The total PHL at wholesale level amounted around 0.49 lakh tonnes which valued to Rs. 32.67 crores. The extent of PHL observed from Rs. 5.38 crores in cauliflower to as high as Rs. 12.82 crores in brinjal. At retail level, the total quantity of PHL was found quite lower than wholesale level *i.e.*, 0.23 lakh tonnes but its value was found the highest *i.e.*, Rs. 27.06 crores which is due to higher retail prices. On an average, the magnitude of total PHL was worked out to be around 1.21 lack tonnes which in monetary term reached to Rs. 92.23 crores. The monetary loss varied from Rs. 16.21 crores in cabbage to Rs. 33.74 crores in brinjal. This huge monetary loss emphasizes the need to take effect plant protection measures as well as development of

**Table 7: Causes of post harvest losses perceived by retailers**

Sr. No.	Particulars	Cabbage (10)	Cauliflower (10)	Brinjal (10)	Tomato (10)	Total (40)
1.	Selection of improper vehicles	0	0	6	9	15 (37.5)
2.	Improper packing materials	2	0	4	10	16 (30.0)
3.	Improper size of packing	2	1	3	4	10 (25.0)
4.	Lack of care during transportation	0	1	0	7	8 (20.0)
5.	Lack of grading	7	6	9	4	26 (65.0)

**Table 8: Overall post harvest losses in different vegetables**

Sr. No.	Particulars	Crops				(kg)
		Cabbage	Brinjal	Tomato	Cauliflower	
1.	Farm level loss (kg)	20.26 (12.06)	30.34 (17.64)	33.18 (15.36)	22.36 (13.8)	
2.	Market level loss (kg)	10.59 (17.08)	9.49 (17.58)	5.56 (12.08)	5.47 (16.10)	
3.	Retail level loss (kg)	0.720 (11.22)	0.362 (5.34)	0.849 (7.66)	0.702 (8.20)	
Total loss (kg)		31.57 (40.36)	40.192 (40.56)	39.589 (35.10)	28.532 (38.10)	

Figures in parentheses are percentages to total

**Table 9: Economics of PHL of major vegetables in Gujarat state**

Particulars		Crops				
		Cabbage	Cauliflower	Brinjal	Tomato	Total
Av. production (Q)		55355	38741	123626	97843	315565
Post harvest losses						
Farm level	Q	6676	5346	21808	15028	48858
	V	4.21	4.60	12.87	10.82	32.5
Wholesale level	Q	9455	6238	21733	11819	49245
	V	5.96	5.38	12.82	8.51	32.67
Retail level	Q	6210	3176	6601	7495	23482
	V	6.04	4.69	8.05	8.28	27.06
Total	Q	22341	14760	50142	34342	121585
	V	16.21	14.67	33.74	27.61	92.23
Prices (Rs./kg.)						
Wholesale		6.30	8.62	5.90	7.20	
Retail		9.73	14.78	12.20	11.05	

Q = Quantity in tonnes; V = Value in crore rupees

suitable market technology and infrastructure in the state.

### Conclusion:

Perishable nature and bulkiness of agriculture produces seems to have a curse to farmers as it induces forced sale and spoilage loss during transition. The rate of post-harvest losses was found very high in horticultural produces like fruits and vegetables *i.e.*, from 25 to 30 per cent. This loss directly increases the cost of production and marketing, and also reduces the per capita availability of vegetables indirectly. Thus, the post-harvest losses affect both the producers as well as consumers. The post-harvest losses are highly product and location specific. The rate of post-harvest losses also depends on the length on marketing channel and the state of marketing technology *i.e.*, mode of transportation, grading, packing, storing, etc. Quantification of losses occurred at different stages is important in respect of taking actions to minimise losses as well as to develop suitable marketing technology.

The important findings are given below:

- The total marketable surplus varied from 97.44 per cent in tomato to 99.88 per cent in cauliflower.
- The total post-harvest losses occurred at farm level varied from 12.06 per cent in cabbage to 17.64 per cent in brinjal.
- The damage due to birds was observed only in brinjal and tomato.
- The proportion of cracked fruit was found maximum in tomato (8.74 %).
- The losses due to fruit borer attack were observed between 5.60 (tomato) to 16.74 per cent (brinjal).
- The total post-harvest losses at the market level was observed highest in case of brinjal (17.58 %), followed by cabbage (17.08 %), cauliflower (16.10 %) and tomato (12.08 %).
- The damage of crushed fruits was observed only in cabbage, cauliflower and tomato which varied from 1.56 to 4.12 per cent.
- The proportion of physically damaged fruits varied from 3.24 (cauliflower) to 8.02 per cent (brinjal).
- The proportion of over ripped and rotten fruits varied from 3.74 (tomato) to 10.42 per cent (cabbage).
- The major causes of post-harvest losses mentioned by wholesalers were improper size of packing, lack of care during transportation and selection of improper vehicles.

- Total PHL at retail level was found highest in cabbage (11.22 %) and the lowest in brinjal (5.34%).
- The loss due to crushed fruits was observed in brinjal and tomato.
- Damage due to over ripped and rotten fruits was observed relatively higher varying from 2.12 per cent in tomato to 9.54 per cent in cabbage.
- The major causes of post-harvest loss mentioned by the retailers were lack of grading, use of improper packing materials and transportation vehicles.
- In majority of the crops, overall post-harvest loss was observed more than 30 per cent.
- On the basis of estimated post-harvest losses for major vegetables, the total loss at the state level amounted to 1.22 lakh tonnes which valued at Rs. 92.23 crores.

The analysis showed that post-harvest losses in major vegetable crops were very high ranging from 28.53 per cent in cauliflower to 40.56 per cent in brinjal. The quantity of loss was observed relatively higher in farm and wholesale level than that of retail levels. The share of post-harvest loss due to over ripped and rotten fruits seemed to be higher than other factors. Improper mode of transportation, improper size of packing, lack of grading was also found responsible for losses during transition of the vegetables. Thus, there is urgent need to take appropriate steps to save huge monetary loss in the interest of farmers, traders and consumers.

### Suggestions :

- Campaign for awareness of grading and packing at farm level should be done at large scale by marketing extension agency.
- Training should be given to the farmers, retailers and wholesalers for preventing PHL.
- Farmers should be trained for harvesting of vegetables at physiological maturity stage to prevent over ripening losses.
- The effective plant protection measures against fruit borers should be carried out through mass campaign in vegetables growing area.
- The creation of market infrastructure particularly for effective transportation system, grading and storage facilities at market level, communication net work *etc.* can help to minimise the huge monetary loss of the state.

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