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# Post harvest losses in marketing of cole crops in Himachal Pradesh

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**Abstract**

**Post-harvest loss assessment in marketing and the methods of estimation are important areas of research in post-harvest management. The study was conducted in Chhota Bhangal area of district Kangra, Himachal Pradesh. A two-stage random sampling technique was employed for the selection of 10 vegetable growing villages out of 22 in the first stage and the 60 growers from selected villages through proportional allocation method in the second and final stage of sampling. A random sample of five local traders operating in the study area was taken to estimate the losses at trader's level. The total physical post-harvest loss of 18.97 kg per q equivalent to monetary loss of Rs 462 was found to be maximum in broccoli followed by cauliflower with a physical loss of 18.96 kg per q (Rs 331 per q) and cabbage with a physical loss of 18.38 kg per q (Rs 250 per q). The functional analysis revealed that inadequate transportation, long distance from farm to road head, pre-harvest disease occurrence and inadequate storage significantly affected the post-harvest losses. Thus basic infrastructural facilities such as all weather roads, controlled atmosphere storage (CAS) and modern market yards need to be developed in this difficult area. Scientific community from nearby public/private institutes should frequently visit the area to inform and interact with the farmers so that they become aware of cost effective methods to prevent post-harvest losses.**

**Key words:** Post-harvest, losses, cole crops, factors affecting, producer's share, consumer's rupee.

In Himachal Pradesh, the most important accompanying change in agriculture has been its transformation from cereal-based subsistence agriculture to vegetable dominated commercial agriculture, especially in temperate agro-climatic zones. The state has earned much reputation by producing different seasonal and off-season vegetables. The area under vegetable crops in the state has increased from 49.86 thousand ha in 2005-06 to 75.23 thousand ha in 2015-16. Consequently, the production of vegetables which was 9.30 lakh tonne in 2005-06 has gone up to 16.08 lakh tonne in 2015-16.It is well understood that agricultural commodities produced in the field have to undergo a series of operations after harvest such as assembling, grading/sorting, packaging, transportation, storage, processing and exchange before they reach the consumer, and there are appreciable losses of outputs during these stages of their handling due to happening of biological activities in the form of transpiration, respiration, ripening and other biological activities. The vegetable crops because of their moisture content are inherently more liable for deterioration in quality and quantity especially under tropical conditions. The post-harvest loss in vegetable output that occurs from the point of harvest in the field till it reaches the ultimate consumers has been assessed to the extent of about 60 per cent of the total post-harvest losses occurred at the farm level and about 25 per cent losses were observed at retailing level. A considerable gap between the gross production and net availability of vegetables has been felt due to heavy post-harvest losses which are caused by both external and internal factors. External factors are mechanical injury and parasitic diseases and internal factor is physiological deterioration. Various types of spoilage are physiological aging, spoilage due to insects or rodents, mechanical damage, chemical and enzyme spoilage, microbial spoilage, etc (Kumar *et al.*2006, 2015 & Singh *et al.* 2013). Since the post-harvest losses obviously have an impact both at micro and macro levels of the economy and hence a need was felt to study them. It is with this background a detailed study was conducted in one of the remotest areas namely Chhota Bhangal falling in district Kangra, Himachal Pradesh. This region has vast potential for the production and marketing of vegetables, especially cole crops like cabbage, cauliflower and broccoli. The specific objectives of

the study were to work out the extent of post-harvest losses in selected cole crops at different stages and to study the factors affecting post-harvest losses at farm level.

## Materials and Methods

A two-stage random sampling technique was employed for the selection of 10 vegetable growing villages out of 22 in the first stage and the 60 growers from selected villages through proportional allocation method in the second and final stage of sampling. A random sample of five local traders operating in the study area was also taken to estimate the losses at different stages. Based on allocation of area under crops at farmers' level, three major cole crops *viz.,* cabbage, cauliflower and broccoli were selected for detailed analysis. The data pertained to the agricultural year 2015-16.A multiple linear regression function was used to examine the factors affecting post-harvest losses in vegetables.

$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + \mu$

where,

$Y$ = Post-harvest loss at farm level in quintals per hectare

$X_1$ = Age of the respondent in years

$X_2$ = Education of the respondent in years

$X_3$ = Crop yield of vegetable in quintals per hectare

$X_4$ = Number of working family members

$X_5$ = Distance from farm to road head (Kms)

$X_6$ = Dummy for availability of transport facility [value '1' for inadequate and '0' otherwise]

$X_7$ = Pre-harvest disease occurrence during crop growth period in terms of per cent area infested

$b_0$ = Intercept

$b_1 - b_7$ = Regression coefficients

$\mu$ = Random error

To isolate the most important socio-economic factors conditioning the post-harvest losses, step wise regression was carried out. This facilitated to retain only those factors, which significantly influenced the post-harvest losses in the regression model.

## Results and Discussion

### Post-harvest losses in vegetables

Post-harvest physical losses in cole crops at farm level and trader's level have been presented in Table 1. It can be seen from the table that total post harvest loss of 18.97 kg/ q was found to be highest in broccoli followed by cauliflower (18.96 kg/ q) and cabbage (18.38 kg/ q). At farm level, losses of 10.00 kg/ q (52.71 %) were found to be highest in broccoli as compared to 9.61 kg/ q (52.29 %) of the losses in cabbage and 9.56 kg/ q (50.42 %) of the losses in cauliflower. This might be due to more exposed nature of broccoli and cauliflower in comparison to cabbage as far as eatable part is concerned. Losses of 2.04 kg/ q during harvest & assembling at farm level were found to be highest in cabbage followed by 1.88 kg/ q of losses in cauliflower and 1.86 kg/ q in broccoli. Losses of 2.46 kg/ q during sorting, grading and cleaning at farm level were found to be highest in cabbage. Verma *et al.* (2003) also reported maximum post-harvest losses in cabbage during sorting process. Losses of 1.05 kg/ q and 0.89 kg/ q during packing were found to be highest in cabbage and broccoli, respectively. At farm level, losses of 0.99 kg/ q during loading/unloading were found to be highest in cabbage. Losses of 2.46 kg/ q and 2.40 kg/ q during transit were found to be highest in broccoli and cauliflower, respectively. Losses of 3.43 kg/ q and 2.89 kg/ q due to pest infection were found to be highest in broccoli and cauliflower, respectively. The main reasons for post-harvest losses at farm level attributed to inadequate knowledge of farmers towards post-harvest losses, following improper handling practices during different stages and ineffective pest management.

At trader's level, losses of 9.40 kg/ q (49.58 %) were found to be highest in cauliflower as compared to 8.97 kg/ q (47.29 %) of the losses in broccoli and 8.77 kg/ q (47.71 %) of the losses in cabbage. At trader's level, the use of suitable packaging material (corrugated boxes) was the reason behind low post-harvest losses of broccoli. At trader's level, grading/sorting losses of 1.36 kg/ q were found to be highest in cabbage. Loading/unloading losses of 1.23 kg/ q were found to be highest in cabbage at trader's level. Losses of 4.87 kg/ q and 4.33 kg/ q due to pest infestation were found to be highest in broccoli and cauliflower, respectively. Damage during transit of 4.33 kg/ q was found to be highest in cabbage. Pal *et al.* (2002) have also reported maximum losses in cabbage during transit. The main reasons for losses at trader's level were on account of long distance during transportation, improper handling of produce at different stages of marketing and poor transportation facilities.

Post-harvest losses in monetary form were also estimated by valuing the physical post-harvest losses at the average price realized by the growers during sale proceeds and have been presented in Table 2. It can be seen from the table that because of high value, a total loss of Rs 462/ q was found to be highest in broccoli. It varied from Rs 220/ q (48 %) at farm level to Rs 242/ q (52 %) at trader's level. It was

**Table 1. Post-harvestlosses in cole crops at different stages**

(kg/ q)

| Sr. No. | Particulars | Cabbage | Cauliflower | Broccoli |
|---|---|---|---|---|
| **1.** | **At farm level** | 9.61 | 9.56 | 10.00 |
| | | (52.29) | (50.42) | (52.71) |
| i. | During harvest& assembling | 2.04 | 1.88 | 1.86 |
| | (mechanical injury + rotting) | (11.10) | (9.92) | (9.80) |
| ii. | Sorting/grading/cleaning | 2.46 | 1.10 | 0.86 |
| | | (13.39) | (5.80) | (4.53) |
| iii. | Packing | 1.05 | 0.68 | 0.89 |
| | | (5.71) | (3.58) | (4.69) |
| iv. | Loading/unloading | 0.99 | 0.61 | 0.50 |
| | | (5.39) | (3.21) | (2.64) |
| v. | Damage during transit | 2.00 | 2.40 | 2.46 |
| | | (10.88) | (12.66) | (12.96) |
| vi. | Quantity rotten due to pest infection | 1.07 | 2.89 | 3.43 |
| | | (5.82) | (15.25) | (18.09) |
| **2.** | **At trader's level** | 8.77 | 9.40 | 8.97 |
| | | (47.71) | (49.58) | (47.29) |
| i. | Grading/sorting | 1.36 | 0.69 | 0.31 |
| | | (7.40) | (3.64) | (1.63) |
| ii. | Loading/ unloading | 1.23 | 0.66 | 0.37 |
| | | (6.68) | (3.48) | (1.95) |
| iii. | Damage during transit | 4.33 | 3.72 | 3.42 |
| | | (23.56) | (19.62) | (18.03) |
| iv. | Quantity rotten due to pest infection | 1.85 | 4.33 | 4.87 |
| | | (10.07) | (22.84) | (25.68) |
| **3.** | **Total loss** | **18.38** | **18.96** | **18.97** |
| | | **(100)** | **(100)** | **(100)** |

Figures in the parentheses show percentages to total

**Table 2. Post-harvestmonetary losses in cole crops**

(Rs/ q)

| Sr. No. | Vegetables | At farm level | At trader's level | Total loss |
|---|---|---|---|---|
| 1. | Cabbage | 96 | 154 | 250 |
| | | (38.00) | (62.00) | (100) |
| 2. | Cauliflower | 143 | 188 | 331 |
| | | (43.00) | (57.00) | (100) |
| 3. | Broccoli | 220 | 242 | 462 |
| | | (48.00) | (52.00) | (100) |

Figures in the parentheses show percentages to total

followed by cauliflower and cabbage with total monetary loss of Rs 331/ q and Rs 250/ q, respectively. The overall picture of these losses indicated that post-harvest losses in vegetables not only reduced the availability of vegetables at consumer's level but also reduced the farmers and producer's share in consumer's rupee. It can be concluded from the table that the monetary post-harvest losses increased from farm level to trader's level for all cole crops.

**Factors affecting post-harvest losses in vegetables at farm level**

To examine the influence of socio-economic characteristics of vegetable growers on post-harvest losses, a multiple linear regression analysis was carried out. To isolate the most important socio-economic factors conditioning the post-harvest losses, a step wise regression analysis was carried out. This facilitated to retain only those factors, which significantly influenced the post-harvest losses in the regression model the result of which have been presented in Table 3. It can be seen that the F-ratio was significant in all the cole crops thereby indicating the good fit of the regression models Age of the respondent ($X_1$) was found to be significant only in cabbage as compared to other crops. Cabbage was the first vegetable crop grown by farmers of the study area in the process of following diversification. The negative relation of the age of the respondent with post-harvest losses of cabbage indicated that as the age of the respondent increased, the post-harvest losses decreased due to obvious reasons. The education of the head of household ($X_2$) was found to be non significant in all the crops. Crop yield per hectare ($X_3$) was found to be significant in all the vegetables. It was significant at one (1) per cent level of significance for cabbage and broccoli while for cauliflower it was significant at five (5) per cent level of significance. Family workers at farm level ($X_4$) were found to be non significant in all the crops. Distance from farm to road head ($X_5$) was found to be significant in all the crops. It was significant at one (1) per cent level of significance for cabbage while in cauliflower and broccoli it was significant at five (5) per cent level of significance. Dummy for inadequate transport facility ($X_6$) significantly accounted for the post-harvest losses for all cole crops. Pre-harvest disease occurrence ($X_7$) during crop growth period was found to be significant only in cabbage and broccoli. The adjusted coefficient of multiple determination (R-2) was found to vary from 74.65 per cent in cauliflower to 92.20 per cent in broccoli. On the whole it can be concluded that crop productivity, the distance of farmers' fields from road head and non-availability of required transport facility were the significant factors responsible post-harvest losses.

**Conclusions and Policy Implications**

The study found that total post-harvest loss of 18.97 kg/q equivalent to Rs 462 was found to be the highest in broccoli the new crop due to its tenderness and being inadequate experience of farmers followed by cauliflower with a physical loss of 18.96

**Table 3. Regression estimates of factors significantly affecting post-harvest losses**

| Sr. No. | Explanatory variables | Cabbage | Cauliflower | Broccoli |
|---|---|---|---|---|
| 1. | Intercept | -4.0421 | -1.9075 | -12.9823 |
| | | (3.4342) | (2.7902) | (2.3879) |
| 2. | Age of the respondent ($X_1$) | -0.1367** | - | - |
| | | (0.0513) | | |
| 3. | Crop yield per hectare ($X_3$) | 0.1024*** | 0.0504** | 0.1432*** |
| | | (0.0140) | (0.0212) | (0.0133) |
| 4. | Distance from farm to road head ($X_5$) | 1.5006*** | 1.8072** | 2.2381** |
| | | (0.4857) | (0.7285) | (0.9710) |
| 5. | Dummy for availability of transport facility($X_6$) | 2.7477** | 2.2273** | 2.1763** |
| | | (1.0218) | (0.9319) | (0.9230) |
| 6. | Pre-harvest disease occurrence ($X_7$) | 0.2252** | - | 0.1297* |
| | | (0.1078) | | (0.0732) |
| 7. | Coefficient of multiple determination ($R^2$) | 0.8362 | 0.7782 | 0.9324 |
| 8. | Adjusted $R^{-2}$ | 0.8158*** | 0.7465*** | 0.9220*** |
| 9. | F-value | 35.43 | 20.62 | 76.83 |
| 10. | Degrees of freedom | 40 | 28 | 26 |

Figures in parentheses indicate standard errors of coefficients

***, ** and * denote significance at 1, 5 and 10 per cent level, respectively

kg/ q (Rs 331/q) and cabbage with physical loss of 18.38 kg/ q (Rs 250/q). The functional analysis revealed that inadequate transportation, long distance from farm to road head, pre-harvest disease occurrence and inadequate storage facility significantly accounted for the post-harvest losses. The findings thuscalls for strengthening of basic infrastructural facilities such as all weather roads, controlled atmosphere storage (CAS), better pest management and development of modern market yardin the study area. Extending market middleman based financial assistance to procure refrigerated vehicles for marketing vegetables to long distance may be a welcome step. This will ensure reduction to a great extent in post-harvest losses during transportation at trader's level.Scientific community from nearby public/private institutes should frequently visit the area to inform and interact with the farmers, so that they become aware of cost effective methods to prevent post-harvest losses at farmers' level.

## References


Kumar DK, Basavaraja H and Mahajanshetti SB. 2006. An economic analysis of post-harvest losses in vegetables in Karnataka. Indian Journal of Agricultural Economics **61** (1): 134-146.

Kumar SK, Jain S, Shakya MK and Kushwaha S. 2015. Extent of physical post-harvest losses of important vegetables of Varanasi in Uttar Pradesh. International Journal of Agricultural Science and Research **5** (5): 139-146.

Pal US, Sahoo GR, Khan MK and Sahoo NR. 2002. Post-harvest losses on tomato, cabbage and cauliflower. Agricultural Mechanization in Asia, Africa and Latin America **33** (3): 35-40.

Singh AK, Singh N and Singh BB. 2013. Marketing and post-harvest loss assessment of vegetables in Varanasi district (U.P.). International Research Journal of Agricultural Economics and Statistics **4** (1): 47-50.

Verma A, Singh KP and Kumar A. 2003. Post-harvest losses of vegetables- an assessment. Annals of Agricultural Research **24** (4): 815-818.