PRODUCTION MARKETING STORAGE AND TRANSPORTATION LOSSES OF SELECTED VEGETABLES IN SHIMLA AND SOLAN DISTRICTS

Ranveer Singh
C.S. Vaidya

(Study Sponsored by Department of Agriculture, Government of Himachal Pradesh)

Agro-Economic Research Centre
H.P. University, Shimla-5
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EXECUTIVE SUMMARY

Abstract: *Due to large profit in vegetable cultivation, the farmers are shifting their land to this enterprise. With massive increase in production and very high marketable surplus has resulted in number of post harvest problems. During harvesting season, most of the vegetables growing areas of the state are confronted with road blockages due to natural calamities, which serve as critical bottleneck in the development of efficient marketing system. The present study on estimation of production, marketing, transportation and storage losses has been undertaken in Shimla and Solan districts of Himachal Pradesh for tomato, cabbage, cauliflower, peas and capsicum vegetables. The study reveals that quantity of marketed surplus was 3.10 quintals in case of cauliflower and 67.89 quintals in case of tomato. The farmers sent vegetables to local markets, Delhi and Chandigarh markets. Production and marketing losses in vegetables ranged between 7.47 percent in case of peas to 15.23 percent of total production in cabbage. The analysis reveals that the value of total losses was about Rs.9534 per farm, which was 13.41 per cent of the total production. The study suggested that the pre-harvest cultural practices are crucial for the reduction of post-harvest losses. Harvesting should be done in the early morning or late afternoon and avoid in wet conditions. The plastic crates should be preferred over wooden box as it is economical investment. If the produce is to be transported to far away markets, post-harvest treatments help to reduce the losses in fresh produce.*

Objectives of the Study

The specific objectives of the study are:

1. To study the production and marketed surplus of tomato, cabbage, cauliflower, peas and capsicum vegetables on sampled farms in districts Shimla and Solan;

2. To analyse the quantity of marketed surplus of vegetables under study sold in local and outside markets by sampled growers;

3. To asses the losses occurred in storage and transportation of vegetables under study.

Methodology

Two main vegetable growing districts of the state viz Shimla and Solan have been selected for the detailed study. The next sampling unit was blocks, one of which was selected in each of the district on the basis of area under vegetables. In this manner two blocks viz Mashobra in district Shimla and Kandaghat in district Solan have been selected for the study. In the selected blocks two village clusters having two villages each were selected. In the selected village clusters a sample of 50 vegetable growers has been randomly selected in such a manner that a sample of 10 farmers is ensured for each of the vegetables selected for the detailed study. In addition to this, two

markets viz Delhi and Chandigarh have been selected for working out the storage and transportation losses. The study pertains to agriculture year 2003-04.

Main Findings

Vegetable Production in Himachal Pradesh

The analysis reveals that highest area was under peas (27% of total area) followed by tomato (26%), cabbage (6%), french beans (5%), capsicum and chilli (5%) and cauliflower (4%). The production of various vegetables in the state indicate that largest production was of tomato (37%) followed by peas (15%), cabbage (10%), French beans (3%), cauliflower (5%) and capsicum & chilli (3%). The share of other vegetables in total production was 27 per cent. The change in area of vegetables from year 1984-85 to 2002-2003 reveals that in year 1984-85 only 15.75 thousand hectare of land was under vegetables. In year 1991-92 area increased to 23 thousand hectare and it was over 46 percent increase over the year 1984-85. In year 2002-03 the area under vegetables reached to 35.22 thousand hectare and the relative increase in area over year1984-85 was over 123 percent.

The area under tomato has been increased from 4500 hect to 9000 hect during the period. This increase is the highest among all the vegetables. The area under cauliflower has increased from 1250 hect. to 1450 hect. The total area under capsicum and chilies has decreased from 1500 hect to 1420 hect during the period. The area under french beans has decreased from 2100 to 1910 hect. The area under cabbage has increased from 2000 to 2195 hect over the period.

General Features of Sampled Vegetable Growers

The demographic features like family size, literacy, occupational pattern, land holding size and cropping pattern etc have been analysed. The family size at overall level was 5.44 persons per family in district Shimla and 5.68 in district Solan. The number of workers in the family was found to be 3.94 in district Shimla and this was 3.76 in district Solan. The dependency ratio was 0.38 in Shimla and 0.51 in Solan. The literacy levels were observed to be 76 percent in Shimla and about 83 percent in district Solan.

The main occupation of about 90% of the persons was agriculture. No person in the sample households had business, wage labor or rural artisan as primary source of income in district Shimla. However, in district Solan about 87 percent of the persons

had agriculture as their primary occupation. In addition to this, about eleven percent people had service as their main occupation.

Each farmer in the sample has 1.47 hectares of land of which 0.64 ha are under cultivation. About half of this land is irrigated. The farmers also had 0.83 ha of grassland. The average holdings size In Shimla was 1.56 ha and in Solan it was 1.38 ha. The cropping pattern of sampled households in district Shimla depicts that majority of the vegetables are grown during the kharif season. Pea is the most important followed by cabbage. In district Solan, tomato is most important.

Marketed Surplus and marketing System of Vegetables Produced on Sampled Farms

At overall level of both the districts, each farm produces about 71 qtls of tomatoes each year. Pea is the second largest produced crop in district Shimla whereas this position is secured by capsicum in district Solan. However, at overall level cabbage is the second largest vegetable crop with a production of about 16 qtls per farm. The production of peas was observed to be about 10.5 qtls per farm and is the third largest vegetable produced in the selected districts. The production of capsicum and cauliflower were 8.56 and 3.40 qtls per farm respectively.

The analysis shows that 27.02 quintals of tomato is the 'per farm' marketed surplus in district Shimla whereas in district Solan this quantity was about 109 quintals. The second most important vegetable in this respect was cabbage, of which about 15 quintals were available on each farm for marketing. The marketed surplus of peas was observed to be about 10 quintals. The highest quantity consumed at home, in both the districts is that of tomato, which at overall level was 0.43 qtls per family. The consumption of other vegetables was in the range of 0.21 to 0.29 qtls per family.

Marketing Arrangements for Vegetables by Sampled Farmers At overall level about 42 per cent of the tomato is sold with in the village and in local market. About nine per cent is sent to Delhi and about four per cent is disposed of through Mother Dairy. At overall level about 64 per cent of the peas produced is sent to local market and about 29 per cent to distant market of Delhi. The rest about seven percent is disposed of in the village itself. At overall level about 64 per cent of the capsicum is disposed of in local market followed by about 24 per cent sold within the village and about 13 per cent

sent to Delhi for sale. About 36 per cent of cauliflower being produced is sold within the village, about 46 per cent in the local market and the rest about 19 per cent is sold in the distant market of Delhi.

The markets being used for disposal of cabbage reveals that the Delhi market is most popular for disposal of cabbage in district Shimla, 41 per cent of the produce being sent to this market. This is followed by local market accounting for 39 per cent of the produce. The rest 20 per cent is disposed of through Mother Dairy. No produce in Solan was disposed of through Mother Dairy, instead local market of Shimla was most popular, accounting for about 41 per cent of the produce. Village sales accounted for about 33 per cent and the rest about 25 per cent was sent to Delhi.

Extent of Losses in Vegetables

Storage of Vegetables at Producers' Level One thing, which is common in marketing of all vegetables, is complete absence of storage at producers' level.

Losses due to Diseases, Insect and Pest during Production of Vegetables

On an average, the attack of diseases decreased the tomato yield by 1.5 per cent while hailing by 0.47 per cent. The tomatoes damaged by birds were 0.77 percent of total production. The under sized tomatoes accounted for 4.48 percent which couldn't be marketed. The losses were relatively higher on sampled farms of Solan district as compared to Shimla. On the whole, 7.25 percent of total production was damaged by diseases, birds, hailing etc. The production losses in peas were relatively lesser than other vegetables. On an average, diseases, birds, hailing on sampled farms, damaged 1.20 percent of total pea's production. The losses were more in Shimla district than that of Solan district under study. On an average, diseases damaged 1.45 percent of total production of capsicum and 2.91 percent produce was under sized which was not marketed. On the whole, 4.36 percent of total capsicum production was diseased and under sized. Due to poor farm practices and lack of proper management 10.21 percent of total production of cauliflower was under sized. The diseases in cauliflower reduced the yield by 1.55 percent. On an average, production losses in cauliflower accounted for 11.76 percent. The losses in production of cabbage due to diseases accounted for 1.86 percent and 6.51 percent was under sized produce. On the whole, 8.37 percent of total cabbage production was diseased and under sized.

Losses in Vegetables during Marketing Operations The losses at the time of harvesting, assembling, grading and packing ranged from 3.04 to 3.54 per cent in case of tomatoes. In case of peas 1.28 percent of production was damaged. The total losses during marketing operations of peas accounted for 3.27 percent of total production. Nearly 2 percent of total production of cauliflower was damaged during marketing operation at farmer's level. Damage during marketing operation of cabbage accounted for 1.51 percent.

Losses in Vegetables during Transportation The losses in tomatoes during transportation from road head to market were 1.35 percent at local markets, 9 percent at Chandigarh market and 19 percent of at Delhi market. The losses during transportation of peas were 0.30 percent at local markets, 2.75 percent at Chandigarh market and 9 percent at Delhi market. The losses in capsicum during transportation were 2.85 percent at local markets, 9 percent at Chandigarh market and 21 percent at Delhi market. Losses during transportation of Cauliflower were 0.60 percent at local markets, 5.50 percent at Chandigarh market and 19 percent at Delhi market. The losses in cabbage were 0.35 percent at local markets, 0.65 percent at Chandigarh market and 11 percent of quantity transported at Delhi market.

Per Farm Quantity of Total Losses: Quantity of total losses in tomatoes was 13.74 percent of total production. Out of total losses 7.25 percent were production losses and 3.17 percent each were marketing and transportation losses. In case of peas the total losses were 7.47 percent of total production. The production, marketing and transportation losses were 1.20, 1.28 and 4.99 percent. The losses in capsicum constituted 11.81 percent. In total losses 4.36 percent were production losses, 3.16 percent were marketing losses and 4.19 percent were transportation losses. In cauliflower total losses were 17.57 percent. The losses in cabbage estimated to be 15.23 percent. Production losses constituted the major part of total losses (8.37%), followed by transportation losses (5.35%) and marketing losses (1.51%).

Per farm Quantity of Losses in all Vegetables Overall losses in all vegetables are about 1454 Kgs per farm including the production, marketing and transportation losses. These losses are 13.32 per cent of the total production of the vegetables. The highest losses were the production losses which account for 6.74 per cent of the total production. The losses during transportation were 3.76 per cent and during marketing operation 2.82 per cent.

Reasons for Pre-harvest Losses Vegetable crops are very sensitive to climatic changes and to the degree of field management during the growing period. Hence the interference of abnormal weather condition such as untimely rain or frost and the reduced attention given to the essential cultural practices result in significant post-harvest losses; which is reflected in qualitative, quantitative and nutritional loss of the produce. Some of the insects and diseases that affect most of the fruits in storage and transit are the results of poor field management during the pre-harvest operations.

Reasons for Post-harvest Losses

(i) Faulty Methods of Picking, Grading and Packing
(ii) Lack of Appropriate Packaging and Safe Transportation
(iii) Lack of Cold Storage

Causes of Losses and Measures for Reduction of Wastage

Tomato The losses during picking have been attributed to poor staking material by 42 percent of respondents whereas the percentage of farmers reporting non-availability of proper picking equipments to be the cause was 45 per cent. Lack of sheds in the field was reported to be the major cause of losses during assembling (86). Excess quantity of vegetables in packing container was mainly responsible for losses during grading and packing (61% at overall level). Over-ripe vegetables and lack of packing skills were reported to be other reasons. Poor condition of local paths and roads was reported to be the main cause of losses in tomatoes during the stage of local carriage (87%).

Peas None of the farmers thought that losses during picking were the result of poor staking material. Only 26 Per cent of farmers reported that non-availability of proper picking equipments was responsible for losses during picking stage. The absence of shed in the fields was thought to be main reason for losses in the assembling stage (40%). Again, lack of skill emerged as main reason of losses during the grading and packing. The losses occurring during the local carriage are thought to be mainly due to poor condition of roads/paths, 48 per cent of the respondents. During transportation stage, excess quantity of vegetables in the vehicle was considered to be the main culprit by 42 per cent respondents. About third of respondents each attributed the losses to poor road conditions, delay during transportation and use of inferior packaging.

Capsicum Lack of skill/carelessness and poor quality of staking material were the main reasons for losses during the picking stage, being reported by 41 and 36 per cent of the respondents respectively. The losses during the assembling stage arose mainly due to poor condition of the village path (50%). About one third of the farmers thought that the assembling losses were the result of poorly designed containers and lack of assembling shed. About third of the farmers were of the view that the losses during grading and packing were the result of excess vegetables in the container, over-ripe vegetables.

Cauliflower There were no looses reported in cauliflower during the picking stage except those caused by own negligence and lack of skills (10%). Whatsoever losses reported during the assembling stage were mainly the result of poor conditions of local path and roads. No farmer thought that excess of vegetables in the container was causing any loss during the grading and packing stage. Poor condition of the roads was the overriding factor for the loss during the local carriage.

Cabbage There were no losses reported during the assembling, only 10 and 7 per cent respondents reported that the loss was the result of the fact that the containers were not properly designed and not having any shed in the field for assembling. About 27 per cent farmers reported that the poor condition of the roads was responsible for the cabbage losses during local carriage. The losses during transportation were attributed to poor conditions of the roads and frequent road blockages. Delay during the transportation was other prominent reason reported by 20 per cent of the farmers leading to losses.

Conclusion

To conclude, the pre-harvest cultural practices are crucial for the reduction of post-harvest losses. Harvesting should be done in the early morning or late afternoon and avoid in wet conditions. Proper grading improves the quality and the price in the market. The plastic crates should be preferred over the lose or packing in the box as it is economical investment. The package should provide adequate level of ventilation to the produce with the minimum wasted space. If the produce is to be transported to far away markets, post-harvest treatments help to reduce the losses in fresh produce. The surplus production may also be absorbed through establishment of processing plants in the region.

Chapter -1

INTRODUCTION

General Introduction

Agriculture has been and will continue to be the lifeline of the Indian economy. As the largest private enterprise in India, agriculture contributes nearly one fourth of the national GDP, sustains livelihood of about two-thirds of population, and is the backbone of agro-based industry. In food sector alone, agriculture contributes about Rs. 250 thousand crores annually.

For ages the Cereal crops were main emphasis just to feed the teaming millions. But cereals alone offered little hope for raising farmers out of poverty - new cropping systems were needed. Vegetables was an excellent choice for a cash crop which can be grown quickly, produce good yields, and generate higher income for the farmers. Vegetables crops are more suited for production on small and marginal land parcels as these are highly capital and labour intensive crops and these factors many times become limiting factors for its large scale adoption by a single farmer. Cultivating vegetables provides more jobs compared to cereal production. The vegetable production will diversify and generate farm income greater than other products. Vegetables farming develop management and leadership skills among farmers and create service industries that can help entire community.

India is the second largest producer of vegetables in the world (surpassed only by china), accounting for about 10 per cent of world's production. In 2002, India produced 78.2 million tons from 5.73 million hectares of land. Indian farmers grow an amazing number of different vegetables – 175 different types in all – but potato, tomato, onion, cabbage and cauliflower account 60 per cent of total production. It is projected that the domestic vegetables requirements will rise from current levels of 83-91 million tonnes to 151-193 million tonnes by 2030.

Specification of the Problem

The agricultural scenario of agriculture in Himachal Pradesh was subsistence with almost non-existent marketing infrastructure. With the development of roads, transport, communication and with rise of living standard of rural masses there was increase in

monetary needs of rural masses for the payment of modern amenities, education etc. To fulfill the monetary needs, the farmers have started producing for the market and hence the commercialization of agriculture is taking place. The gestation period of fruits is long varying between 5 to 15 years, whereas the gestation period of vegetables is very less 3 to 4 months. Further, vegetables grown in Himachal Pradesh are off-season in nature and these do not face any competition from the neighboring states having flat geography, thus producers have an absolute advantage in vegetable production as compared to other crops. This absolute advantage of production fetches high prices of vegetables from markets of neighboring states. This is the reason, the producers in the state are fast moving towards the vegetable production.

The transition from subsistence to commercial farming is inevitably linked with the development of marketing infrastructure facilities. In early phase of development the growth of transport and communication infrastructure helps in the development of market which accompanies the movement towards specialisation of agriculture production, division of labour, monetization of production process and increase in the use of purchased inputs; all of which are characteristics of an advanced economy.

Relevance of the Study

Due to large profit in vegetable cultivation, the farmers are shifting their land to this enterprise. With massive increase in production and very high marketable surplus as well as peculiar nature of vegetable crops like perishability, fragility, seasonality and bulkiness have resulted in number of post harvest problems. The perishable commodities like vegetables need special care in handling right from picking/harvesting to delivery to the consumer, so as to obtain better prices. There is a lack of understanding about the importance of the post harvest technology amongst most of the growers. In fact, post harvest technology received very little attention during early stage of development of vegetable industry in the country. Still the facilities so far created for post harvest handling of vegetables in producing areas like cold storages, processing, and transportation etc are far below the actual requirement of the vegetable production.

Vegetables also being perishable in nature require careful handling during post-harvest operations till it reaches the ultimate consumers. The main consuming markets are situated at far-off places from the producing areas. During harvesting season, most of the vegetable growing areas of the state are confronted with road blockades due to

natural calamities (land slides, heavy rain, etc.). In addition, during transit there are long interruptions at various check posts within and outside the state. These factors induce an obvious time lag in the delivery of vegetables and the situation is further aggravated because of inadequate storage facilities at the producers' level. Such a delay enhances the chances of increased physical and physiological post-harvest losses to produce. Hence, lack of adequate all weather roads and non-availability of efficient transportation system within and between different regions serve as critical bottleneck in the development of efficient marketing system.

It is obvious that any reduction in post harvest and production losses will contribute to the net availability of food in the economy, which is of immeasurable worth and help producer in getting high returns and reduce cost of marketing and low consumer prices. The study of this nature will enable the proper identification of the problem and suggest means to minimize the problem and thereby reduce overall wastage. With this background the present study has been undertaken in Shimla and Solan districts of Himachal Pradesh for tomato, cabbage, cauliflower, peas and capsicum vegetables.

Objectives of the Study

The specific objectives of the study are:

4. To study the production and marketed surplus of tomato, cabbage, cauliflower, peas and capsicum vegetables on sampled farms in districts Shimla and Solan;

5. To analyse the quantity of marketed surplus of vegetables under study sold in local and outside markets by sampled growers;

6. To asses the losses occurred in storage and transportation of vegetables under study.

Sampling

Two main vegetable growing districts of the state viz Shimla and Solan as indicated by the Directorate of agriculture have been selected for the detailed study. The next sampling unit was blocks, one of which was selected in each of the district. This selection has been done on the basis of area under vegetables. In this manner two blocks viz Mashobra in district Shimla and Kandaghat in district Solan have been selected for the study. In the selected blocks two village clusters having two villages each were selected, one of the clusters was near to the road head and other away from it. In the selected village clusters a sample of 50 vegetable growers has been randomly selected in such a manner that a sample of 10 farmers is ensured for each of the

vegetables selected for the detailed study. The actual distribution of sample in both the districts has been presented in Table 1.1. In addition to this, two markets viz Delhi and Chandigarh have been selected for working out the storage and transportation losses.

Classification of the sample

The classification of the sampled farmers on the basis of their land holdings has been presented in table 1.1 wherein it may be seen that at overall level about 44% of the sample is of marginal category, 31% of small and the rest about 25% belong to medium categories. The district level situation has also been presented in this table.

Table 1.1: Sample distribution.

Districts	Category			Total
	Marginal	Small	Medium	
Shimla	40 (46)	35 (56)	25 (49)	100 (100)
Solan	47 (54)	27 (44)	26 (51)	100 (100)
Total	87 (43.5)	62 (31.0)	51 (25.5)	200 (100)

Note: Figures in parenthesis denote percentages from the total.

Data collection

The data has been collected from the sampled farmers by personal interview method. The detailed pre-structured schedules were used for the purpose. The pre-designed schedules were pre-tested in the field for the adequacy.

Data analysis

The simple tabular analysis has been used to analyse the data in order to arrive at the conclusions.

Reference period

The study pertains to agriculture year 2003-04.

Chapter -2

VEGETABLE PRODUCTION IN HIMACHAL PRADESH

Majority of vegetable production of Himachal Pradesh is off-season in nature. The term off-season means that these vegetables can be produced in the state due to varied climatic condition when the production of these vegetables is not economically viable and only can be produced under ideal conditions of green houses in controlled conditions in competing areas of neighboring states. The high initial and maintenance cost of such venture would push the cost of production so much making it difficult to compete with the Himachal vegetables.

Analysis of Area Under Vegetable (2002-03)

The area under various vegetables grown in the state has been presented in the table 2.1 depicting that highest area was under peas (27%) followed by Tomato (26%), cabbage (6%), French beans (5%), capsicum and chilli (5%) and cauliflower (4%). The area under different vegetables in all the districts of the state has also been presented in this table.

Analysis of Production of Vegetables (2002-03)

The production of various vegetables in the state during the year 2002-03 has been presented in table 2.1 indicating that largest production was of tomato (37%) followed by peas (15%), cabbage (10%), French beans (3%), cauliflower (5%) and capsicum & chilli (3%). The share of other vegetables in total production was 27 per cent. The district-wise details in this respect can be referred to from this table.

Table- 2.1: District wise area under different vegetables in Himachal Pradesh during 2002-03.

Districts	Peas	Tomato	French Beans	Cabbage	Cauliflower	Capsicum & Chillies	Other Vegetables	Total
Bilaspur	100 (5) {1}	800 (41) {9}	50 (3) {3}	20 (1) {1}	105 (6) {7}	100 (5) {7}	760 (39) {8}	1935 (100) {5}
Chamba	330 (27) {3}	25 (2) {0}	250 (20) {13}	115 (9) {5}	25 (2) {2}	65 (5) {5}	427 (35) {4}	1237 (100) {4}
Hamirpur	80 (7) {1}	100 (9) {1}	80 (7) {4}	25 (2) {1}	55 (5) {4}	60 (6) {4}	670 (64) {6}	1070 (100) {3}
Kangra	320 (12) {3}	275 (10) {4}	275 (10) {14}	100(4) {5}	130 (5) {9}	140 (5) {10}	1482 (54) {15}	2727 (100) {8}
Kinnaur	750 (65) {8}	25 (2) {0}	190 (17) {10}	70 (6) {3}	22 (2) {2}	0 (0) {0}	90 (8) {1}	1147 (100) {3}
Kullu	415 (12) {4}	600 (17) {7}	90 (3) {5}	385 (11) {17}	375 (11) {26}	125 (3) {9}	1510 (43) {16}	3500 (100) {10}
Lahul-Spiti	2200 (95) {23}	5 (0) {0}	30 (1) {2}	30 (1) {1}	23 (1) {2}	0 (0) {0}	45 (2) {0}	2333 (100) {7}
Mandi	1100 (21) {12}	1465 (29) {16}	270 (5) {14}	110 (2) {5}	115 (2) {8}	160 (3) {11}	1900 (37) {20}	5120 (100) {15}
Shimla	2400 (43) {25}	655 (12) {7}	340 (6) {18}	1090 (19) {50}	365 (6) {25}	290 (5) {20}	526 (9) {5}	5666 (100) {16}
Sirmour	1100 (24) {12}	1800 (39) {20}	210 (4) {11}	125 (3) {6}	100 (2) {7}	210 (4) {15}	1130 (24 {12}	4675 (100) {13}
Solan	660 (14) {7}	3200 (66) {36}	95 (2) {5}	80 (2) {4}	65 (1) {4}	220 (5) {15}	460 (10) {5}	4780 (100) {14}
Una	50 (5) {1}	45 (4) {0}	30 (3) {1}	45 (4) {2}	70 (7) {4}	50 (5) {4}	740 (72) {8}	1030 (100) {3}
H.P.	9505 (27) {100}	9000 (26) {100}	1910 (5) {100}	2165 (6) {100}	1450 (4) {100}	1420 (4) {100}	9740 (28) {100}	35220 (100) {100}

Source: Directorate of Agriculture, Himachal Pradesh, Shimla

Note : Figures in ( ) represent percentage share of particular vegetable in total area under vegetables in district

Figures in { } represent percentage share of particular vegetable in total area under vegetables in state.

Table-2.2: District wise production of different vegetables in Himachal Pradesh during year 2002-03.

Particulars	Peas	Tomato	French Beans	Cabbage	Cauliflower	Capsicum & Chillies	Other Vegetables	Total
Bilaspur	1000 (3) {1}	20000 (50) {9}	600 (1.5) {3}	600 (1.5) {1}	2900 (7) {9}	1250 (3) {7}	13630 (34) {8}	39980 (100) {6}
Chamba	2890 (15) {3}	650 (3) {0}	3000 (15) {14}	3400 (18) {5}	470 (2) {1}	820 (4) {5}	8273 (34) {5}	19503 (100) {3}
Hamirpur	720 (4) {1}	2650 (13) {1}	810 (4) {4}	800 (4) {1}	1125 (6) {4}	770 (4) {5}	12765 (65) {8}	19640 (100) {3}
Kangra	3000 (5) {3}	11440 (21) {5}	2980 (5) {14}	2900 (5) {4}	2690 (5) {9}	1800 (4) {11}	30768 (55) {19}	55578 (100) {10}
Kinnaur	7500 (52) {8}	690 (5) {0}	2220 (15) {11}	2100 (15) {3}	440 (3) {1}	0 (0) {0}	1485 (10) {1}	14435 (100) {2}
Kullu	4150 (8) {5}	15875 (32) {7}	720 (1) {3}	8470 (13) {10}	6750 (14) {22}	1000 (2) {6}	14870 (30) {9}	49835 (100) {8}
Lahul-Spiti	21780 (89) {24}	143 (1) {0}	300 (1) {1}	910 (4) {1}	470 (2) {2}	0(0) {0}	720 (3) {0}	24323 (100) {4}
Mandi	10000 15) {11}	14652 (22) {6}	3100 (5) {15}	3480 (5) {6}	2370 (4) [8}	2095 (3) {12}	30955 (46) {19}	66652 (100) {11}
Shimla	23130 (22) {26}	19650 (19) {9}	3625 (3) {18}	38590 (37) {58}	8325 (8) {27}	3995 (4) {24}	7914 (7) {5}	105229 (100) {17}
Sirmour	10050 10) {11}	55800 (57) {24}	2500 (3) {12}	3930 (4) {6}	2040 (2) {7}	2780 (3) {16}	20540 (21) {12}	97640 (100) {16}
Solan	5810 (5) {6}	89600 (82) {39}	608 (1) {3}	1851 (2) {3}	1430 (1) {5}	1760 (2) {10}	7709 (7) {5}	108768 (100) {17}
Una	450 (2) {1}	550 (3) {0}	335 (2) {2}	1300 (6) {2}	1425 (7) {5}	600 (3) {4}	15675 (77) {9}	20335 (100) {3}
H.P.	90480 (15) {100}	231700 (37) {100}	20798 (3) {100}	66311 (10) {100}	30435 (5) {100}	16870 (3) {100}	165304 (27) {100}	621918 (100) {100}

Source: Directorate of Agriculture, Himachal Pradesh, Shimla

Note: Figures in ( ) represent percentage share of particular vegetable in total production of vegetables in district
Figures in { } represent percentage share of particular vegetable in total production of vegetables in state.

Changes in Area Under Vegetables during 1984-85 to 2002-03

Table 2.3 shows the change in area of vegetables from year 1984-85 to 2002-2003. The table reveals that in year 1984-85 only 15.75 thousand hectare of land was under vegetables. In year 1991-92 area increased to 23 thousand hectare and it was over 46 percent increase over the year 1984-85. In year 2002-03 the area under vegetables reached to 35.22 thousand hectare and the relative increase in area over year1984-85 was over 123 percent.

The highest percentage growth was in year 1987-88 when area increased 17.65 per cent over previous year. In general, year-to-year growth during eighties was 2 to 5 per cent. In the period 1991-2000, year-to-year growth was 1.7 to 5.8 per cent and during 2001-03 it was 3.1 to 6.7 per cent. It reveals that the rate of growth in area is increasing.

Table - 2.3: Changes in area under vegetables during year 1984-85 to 2002-03.

Sr.	Year	Area 000' Hect.	Year to Year Percentage Change	Percentage Change from year 1984-85
1	1984-85	15.75	-	-
2	1985-86	16.55	5.08%	5.08%
3	1986-87	17.00	2.72%	7.94%
4	1987-88	20.00	17.65%	26.98%
5	1988-89	20.40	2.00%	29.52%
6	1989-90	21.00	2.94%	33.33%
7	1990-91	22.00	4.76%	39.68%
8	1991-92	23.00	4.55%	46.03%
9	1992-93	23.40	1.74%	48.57%
10	1993-94	24.00	2.56%	52.38%
11	1994-95	24.50	2.08%	55.56%
12	1995-96	25.00	2.04%	58.73%
13	1996-97	26.45	5.80%	67.94%
14	1997-98	27.50	3.97%	74.60%
15	1998-99	28.91	5.13%	83.56%
16	1999-00	30.00	3.77%	90.48%
17	2000-01	32.00	6.67%	103.17%
18	2001-02	34.15	6.72%	116.83%
19	2002-03	35.22	3.13%	123.62%

Source: Directorate of Agriculture, Himachal Pradesh, Shimla

Changes in Production of Vegetables during 1984-85 to 2002-03

The Table 2.4 shows the change in production of vegetables from year 1984-85 to 2002-03. It reveals that in year 1984-85 only 258 thousand MT. ton of vegetables were produced.. In year 1990-91 production 368 thousand MT. and it was over 42 percent increase over the year 1984-85. In year 1999-2000 the production was 502 thousand MT. and the increase over year 1984-85 was about 95 percent. In year 2002-03 the production of vegetables reached to 622 thousand MT. and the relative increase over year1984-85 was over 141 percent.

The percentage growth in production was high in period 1985-87 when area increased over 33 per cent over previous year. In general, year-to-year growth during year 1985-88 was high (5 to 16 %). The production was almost stagnated during 1988-92. The growth again picked up from year 1992. During the year 2000-01 highest growth was recorded in production was 24.9 per cent over previous year.

Table - 2.4: Changes in production of vegetables during year 1984-85 to 2002-03.

Sr.	Year	Production 000' MT.	Year to Year Percentage Change	Percentage Change from year 1984-85
1	1984-85	258.00	-	-
2	1985-86	301.00	16.67%	16.67%
3	1986-87	350.00	16.28%	35.66%
4	1987-88	370.00	5.71%	43.41%
5	1988-89	370.00	0.00%	43.41%
6	1989-90	365.00	-1.35%	41.47%
7	1990-91	368.00	0.82%	42.64%
8	1991-92	374.00	1.63%	44.96%
9	1992-93	385.00	2.94%	49.22%
10	1993-94	385.00	0.00%	49.22%
11	1994-95	400.00	3.90%	55.04%
12	1995-96	425.00	6.25%	64.73%
13	1996-97	455.00	7.06%	76.36%
14	1997-98	475.00	4.40%	84.11%
15	1998-99	500.00	5.26%	93.80%
16	1999-00	502.00	0.40%	94.57%
17	2000-01	627.00	24.90%	143.02%
18	2001-02	622.00	-0.80%	141.09%
19	2002-03	622.00	0.00%	141.09%

Source: Directorate of Agriculture, Himachal Pradesh, Shimla

District-wise Changes in Area under Vegetables during 1998-99 to 2002-03

Peas

The perusal of the table 2.5 shows that the total area under peas is increasing. In the tribal districts of Kinnaur and Lahul-Spiti their percentage share of area in state is increasing at very fast rate. The percentage share of area of Kinnaur and Lahul-Spiti has increased from 4.68 and 12.87 per cent to 7.89 and Kinnaur and Lahul-Spiti 23.15

percent respectively. The percent share of Kullu, Kangra, Chamba, Sirmour and Una has slightly improved. But in case of Bilaspur, Solan, Shimla and Mandi the percentage share in area has gone down. In case of Bilaspur area has gone down in absolute terms.

Tomato

The area under tomato has been increased from 4500 hect. to 9000 hect during the period (Table 2.6). This increase is the highest among all the vegetables. The cultivation of tomato is spreading to other districts from the main producing districts of Solan, Sirmour and Kullu where earlier production was concentrated. Mandi, Bilaspur and Shimla districts have increased substantially their percentage share of area from 3.30, 3.33, 5.57 per cent to 16.28, 8.89, 7.28 per cent respectively. Whereas in case of Solan, Sirmour Kullu the percentage share in area has gone down.

Cauliflower

The analysis of Table 2.7 shows that the area under Cauliflower has been increased from 1250 hect. to 1450 hect. over the period. The percentage share of area has increased in district Chamba, Hamirpur, Kangra, Lahul-Spiti, Mandi and Solan. Whereas the percentage share has gone down in district of Bilaspur, Kinnaur, Kullu, Shimla, Sirmour and Una. In the district Una area has gone down in absolute terms.

Capsicum

The perusal of the table 2.8 shows that the total area under Capsicum and Chilies has decreased from 1500 hect to 1420 hect during the period. The area has decreased in Bilaspur, Kullu, and Solan districts in absolute terms. The percentage share of Solan was reduced from 26 per cent to 15.49 per cent. The percentage share of area has increased in district Chamba, Hamirpur, Kangra, Mandi and Shimla.

Table-2.5: District-wise changes in area under Peas (1998-99 to 2002-03).

Year	BILASPUR	CHAMBA	HAMIRPUR	KANGRA	KINNAUR	KULLU	LAHUL-Spiti	MANDI	SHIMLA	SIRMAUR	SOLAN	UNA	H.P.
1998-99	120	270	60	240	400	360	1100	1085	2900	980	1010	25	8550
	1.40%	3.16%	0.70%	2.81%	4.68%	4.21%	12.87%	12.69%	33.92%	11.46%	11.81%	0.29%	100%
1999-00	110	280	65	270	500	370	1250	1085	2800	1040	1000	30	8800
	1.25%	3.18%	0.74%	3.07%	5.68%	4.20%	14.20%	12.33%	31.82%	11.82%	11.36%	0.34%	100%
2000-01	140	320	75	330	550	420	1600	1150	2625	1100	1050	40	9400
	1.49%	3.40%	0.80%	3.51%	5.85%	4.47%	17.02%	12.23%	27.93%	11.70%	11.17%	0.43%	100%
2001-02	100	330	90	270	650	400	2000	1045	2700	1125	1080	40	9830
	1.02%	3.36%	0.92%	2.75%	6.61%	4.07%	20.35%	10.63%	27.47%	11.44%	10.99%	0.41%	100%
2002-03	100	330	80	320	750	415	2200	1100	2400	1100	660	50	9505
	1.05%	3.47%	0.84%	3.37%	7.89%	4.37%	23.15%	11.57%	25.25%	11.57%	6.94%	0.53%	100%

Source: Directorate of Agriculture, Himachal Pradesh

Note: Percentage figure shows the percentage share in total area in state.

Table-2.6: District-wise changes in area under tomato (1998-99 to 2002-03).

Year	BILASPUR	CHAMBA	HAMIRPUR	KANGRA	KINNAUR	KULLU	LAHUL-Spiti	MANDI	SHIMLA	SIRMAUR	SOLAN	UNA	H.P.
1998-99	150	25	30	115	10	500	5	150	250	1355	1890	20	4500
	3.33%	0.56%	0.67%	2.56%	0.22%	11.11%	0.11%	3.33%	5.56%	30.11%	42.00%	0.44%	100%
1999-00	200	35	40	150	15	550	10	200	375	1400	2000	25	5000
	4.00%	0.70%	0.80%	3.00%	0.30%	11.00%	0.20%	4.00%	7.50%	28.00%	40.00%	0.50%	100%
2000-01	250	45	50	220	20	600	15	260	550	1450	2500	40	6000
	4.17%	0.75%	0.83%	3.67%	0.33%	10.00%	0.25%	4.33%	9.17%	24.17%	41.67%	0.67%	100%
2001-02	270	60	100	250	20	650	15	270	655	1600	3100	45	7035
	3.84%	0.85%	1.42%	3.55%	0.28%	9.24%	0.21%	3.84%	9.31%	22.74%	44.07%	0.64%	100%
2002-03	800	25	100	280	25	600	5	1465	655	1800	3200	45	9000
	8.89%	0.28%	1.11%	3.11%	0.28%	6.67%	0.06%	16.28%	7.28%	20.00%	35.56%	0.50%	100%

Source: Directorate of Agriculture, Himachal Pradesh

Note: Percentage figure shows the percentage share in total area in state.

Table-2.7: District-wise changes in area under Cauliflower (1998-99 to 2002-03).

Year	BILASPUR	CHAMBA	HAMIRPUR	KANGRA	KINNAUR	KULLU	LAHUL-Spiti	MANDI	SHIMLA	SIRMAUR	SOLAN	UNA	H.P.
1998-99	95	10	15	90	20	325	15	95	345	110	55	75	1250
	7.60%	0.80%	1.20%	7.20%	1.60%	26.00%	1.20%	7.60%	27.60%	8.80%	4.40%	6.00%	100%
1999-00	100	15	20	100	23	330	17	100	355	110	60	70	1300
	7.69%	1.15%	1.54%	7.69%	1.77%	25.38%	1.31%	7.69%	27.31%	8.46%	4.62%	5.38%	100%
2000-01	100	20	25	110	25	340	20	105	340	120	70	65	1340
	7.46%	1.49%	1.87%	8.21%	1.87%	25.37%	1.49%	7.84%	25.37%	8.96%	5.22%	4.85%	100%
2001-02	80	25	50	120	20	350	20	110	360	110	60	65	1370
	5.84%	1.82%	3.65%	8.76%	1.46%	25.55%	1.46%	8.03%	26.28%	8.03%	4.38%	4.74%	100%
2002-03	105	25	55	130	22	375	23	115	365	100	65	70	1450
	7.24%	1.72%	3.79%	8.97%	1.52%	25.86%	1.59%	7.93%	25.17%	6.90%	4.48%	4.83%	100%

Source: Directorate of Agriculture, Himachal Pradesh
Note: Percentage figure shows the percentage share in total area in state.

Table-2.8: District-wise changes in area under Capsicum (1998-99 to 2002-03).

Year	BILASPUR	CHAMBA	HAMIRPUR	KANGRA	KINNAUR	KULLU	LAHUL-Spiti	MANDI	SHIMLA	SIRMAUR	SOLAN	UNA	H.P.
1998-99	160	60	25	110	0	145	0	150	240	185	390	35	1500
	10.67%	4.00%	1.67%	7.33%	0.00%	9.67%	0.00%	10.00%	16.00%	12.33%	26.00%	2.33%	100%
1999-00	150	65	30	120	0	150	0	145	250	190	410	40	1550
	9.68%	4.19%	1.94%	7.74%	0.00%	9.68%	0.00%	9.35%	16.13%	12.26%	26.45%	2.58%	100%
2000-01	160	75	40	130	0	140	0	150	265	200	425	45	1630
	9.82%	4.60%	2.45%	7.98%	0.00%	8.59%	0.00%	9.20%	16.26%	12.27%	26.07%	2.76%	100%
2001-02	155	70	50	140	0	150	0	160	280	210	390	45	1650
	9.39%	4.24%	3.03%	8.48%	0.00%	9.09%	0.00%	9.70%	16.97%	12.73%	23.64%	2.73%	100%
2002-03	100	65	60	140	0	125	0	160	290	210	220	50	1420
	7.04%	4.58%	4.23%	9.86%	0.00%	8.80%	0.00%	11.27%	20.42%	14.79%	15.49%	3.52%	100%

Source: Directorate of Agriculture, Himachal Pradesh
Note: Percentage figure shows the percentage share in total area in state.

French Beans

The analysis of the table 2.9 shows that the total area under French beans has decreased from 2100 hect. to 1910 hect. during the period. In Bilaspur, Kullu, Lahul-Spiti, Mandi, Solan and Una districts area under French beans has decreased in absolute terms. The percentage share of Solan and Kullu was reduced from 14.05 and 7.14 per cent to 4.97, 4.71 per cent respectively. The percentage share of area has increased in district Chamba, Hamirpur, Kangra, Kinnaur, Mandi and Shimla.

Cabbage

The analysis of Table 2.10 shows that the area under Cabbage has been increased from 2000 hect. to 2195 hect. over the period. In contrast area in Bilaspur, Kullu, and Una districts has gone down in absolute terms. The percentage share of area has increased in district Chamba, Hamirpur, Kangra, Kinnaur, Lahul-Spiti, Mandi Sirmour. Whereas the percentage share has gone down in district of Bilaspur, Kullu, Shimla, Solan and Una.

Table-2.9: District-wise changes in area under French Beans (1998-99 to 002-03).

Year	BILASPUR	CHAMBA	HAMIRPUR	KANGRA	KINNAUR	KULLU	LAHUL-Spiti	MANDI	SHIMLA	SIRMAUR	SOLAN	UNA	H.P.
1998-99	70	200	70	275	140	150	50	320	280	200	295	50	2100
	3.33%	9.52%	3.33%	13.10%	6.67%	7.14%	2.38%	15.24%	13.33%	9.52%	14.05%	2.38%	100%
1999-00	75	210	70	290	150	155	40	310	290	205	310	45	2150
	3.49%	9.77%	3.26%	13.49%	6.98%	7.21%	1.86%	14.42%	13.49%	9.53%	14.42%	2.09%	100%
2000-01	70	220	70	300	160	150	35	305	300	200	320	40	2170
	3.23%	10.14%	3.23%	13.82%	7.37%	6.91%	1.61%	14.06%	13.82%	9.22%	14.75%	1.84%	100%
2001-02	75	250	90	270	180	150	30	270	340	210	340	35	2240
	3.35%	11.16%	4.02%	12.05%	8.04%	6.70%	1.34%	12.05%	15.18%	9.38%	15.18%	1.56%	100%
2002-03	50	250	80	275	190	90	30	270	340	210	95	30	1910
	2.62%	13.09%	4.19%	14.40%	9.95%	4.71%	1.57%	14.14%	17.80%	10.99%	4.97%	1.57%	100%

Source: Directorate of Agriculture, Himachal Pradesh
Note: Percentage figure shows the percentage share in total area in state.

Table-2.10: District-wise changes in area under Cabbage (1998-99 to 2002-03).

Year	BILASPUR	CHAMBA	HAMIRPUR	KANGRA	KINNAUR	KULLU	LAHUL-Spiti	MANDI	SHIMLA	SIRMAUR	SOLAN	UNA	H.P.
1998-99	35	100	10	65	45	410	10	90	1000	110	75	50	2000
	1.75%	5.00%	0.50%	3.25%	2.25%	20.50%	0.50%	4.50%	50.00%	5.50%	3.75%	2.50%	100%
1999-00	40	100	15	75	50	420	15	130	1030	105	70	50	2100
	1.90%	4.76%	0.71%	3.57%	2.38%	20.00%	0.71%	6.19%	49.05%	5.00%	3.33%	2.38%	100%
2000-01	45	105	20	85	60	410	20	125	1050	110	75	45	2150
	2.09%	4.88%	0.93%	3.95%	2.79%	19.07%	0.93%	5.81%	48.84%	5.12%	3.49%	2.09%	100%
2001-02	45	110	20	90	65	420	25	110	1070	120	85	40	2200
	2.05%	5.00%	0.91%	4.09%	2.95%	19.09%	1.14%	5.00%	48.64%	5.45%	3.86%	1.82%	100%
2002-03	20	115	25	100	70	385	30	110	1090	125	80	45	2195
	0.91%	5.24%	1.14%	4.56%	3.19%	17.54%	1.37%	5.01%	49.66%	5.69%	3.64%	2.05%	100%

Source: Directorate of Agriculture, Himachal Pradesh
Note: Percentage figure shows the percentage share in total area in state.

Chapter -3

GENERAL FEATURES OF SAMPLED VEGETABLE GROWERS

The present chapter deals with the various demographic features of the sampled vegetable growers located in the districts of Shimla and Solan. The demographic features like family size, literacy, occupational pattern, land holding size and cropping pattern etc have been discussed. The main purpose of this analysis has been to present briefly the socioeconomic conditions of the sampled households. The following text provides the details.

Family size

The family size of the sampled households in districts Shimla and Solan has been presented in tables 3.1 to 3.3. . It may be seen from the table that the family size at overall level was 5.44 persons per family in district Shimla. The family size was directly correlated with the holding size of the farmers. At overall level in this district they were 54 percent males. In district Solan the family size at overall level was 5.6 8 persons among which 54.22 percent were male. The highest family size was observed in case of medium farmers followed by marginal and small. At overall level of both the districts the average family size was 5.56 persons per family of which about 54 percent were male. The highest family size of 6.12 persons was observed in case of Medium farmers.

Table-3.1: Demographic profile of sampled households in Shimla.

(No. per household)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Family Size	4.97	5.65	5.88	5.44
Males (%)	53.32	55.04	55.10	54.21
Females (%)	46.68	44.96	44.90	45.79
Workers	3.50	4.15	4.48	3.94
Males (%)	57.71	55.66	56.25	57.11
Females (%)	42.29	44.33	43.75	42.89
Dependency Ratio (%)	0.42	0.39	0.31	0.38
Literacy rate (%)	73.00	78.00	78.00	76.00
Males (%)	83.00	79.00	86.00	82.00
Females (%)	62.00	76.00	68.00	68.00

Table-3.2: Demographic profile of sampled households in Solan.

(No. per household)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Family Size	5.74	4.93	6.35	5.68
Males (%)	55.55	52.63	53.33	54.22
Females (%)	44.45	47.37	46.67	45.78
Workers	3.76	3.33	4.19	3.76
Males (%)	50.84	53.33	55.05	52.66
Females (%)	49.16	46.67	44.95	47.34
Dependency Ratio (%)	0.52	0.48	0.49	0.51
Literacy rate (%)	85.83	41.42	83.45	83.14
Males (%)	92.09	84.85	85.90	88.69
Females (%)	77.78	68.97	80.60	76.39

Table-3.3: Demographic profile of all sampled households.

(No. per household)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Family Size	5.39	5.34	6.12	5.56
Males (%)	54.58	54.08	54.17	54.32
Females (%)	45.42	45.92	45.83	45.68
Workers	3.64	3.74	4.33	3.85
Males (%)	53.94	55.60	55.65	54.93
Females (%)	46.06	4.40	44.34	45.07
Dependency Ratio (%)	0.71	0.43	0.41	0.44
Literacy rate (%)	76.33	75.83	75.64	76.00
Males (%)	84.37	79.89	81.06	82.12
Females (%)	66.67	71.05	69.23	68.70

Proportion of Workers

The number of workers in the family was found to be 3.94 in district Shimla and this was 3.76 in district Solan. At overall level, there were 3.85 workers per family. In district Shimla, there were about 57 percent male workers whereas in district Solan about 53 per cent of the workers were male. At overall level, about 55 per cent of the workers were male. Invariably the percentage of male workers was higher than the females.

Dependency Ratio

The dependency ratio of the sample has also been presented in the same tables and it may be seen that this ratio was 0.38 in Shimla. It was highest incase of marginal farmers (0.42). The dependency ratio was observed to be 0.51 in Solan and was again highest for the marginal farmers. At overall level, the dependency ratio was observed to be 0.44 and had inverse relationship with the holding size.

Literacy Level

The analysis of the literacy levels of the sampled farmers along with their family members indicates that in Shimla 76 percent of the sampled population was literate, the respective percentages being 82 and 68 percent for males and females. In district Solan, about 83 percent of the sampled population was literate and the percentages for males and females were about 89 and 76 percent respectively. At overall level, about 76 percent of the sampled population was literate. The figures for males and females at this level were about 82 and 69 per cent respectively.

Educational Status

The educational Status of the sampled farmers and their family members has been presented in table 3.4 to 3.6 for district Shimla, Solan and for overall level respectively. For studying the education level various Standards have been considered like primary, middle, matriculation etc. It may be seen from the table that 59 percent of those who had received some formal education were males and 41 percent were females in district Shimla. The same percentages were repeated for district Solan and for overall level as well.

Table-3.4: Educational status of persons in sampled households in Shimla.

(Percent of total)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Primary	26.00	31.00	31.00	29.00
Male	25.00	27.00	27.00	27.00
Female	27.00	35.00	38.00	33.00
Middle	22.00	24.00	20.00	22.00
Male	23.00	21.00	20.00	21.00
Female	20.00	28.00	20.00	23.00
Matric/+2	45.00	39.00	37.00	41.00
Male	46.00	45.00	37.00	43.00
Female	44.00	33.00	35.00	37.00
Graduates	6.00	6.00	10.00	7.00
Male	5.00	7.00	14.00	8.00
Female	7.00	4.00	5.00	5.00
Post graduates	1.00	-	2.00	1.00
Male	1.00	-	2.00	1.00
Female	2.00	-	2.00	2.00
Total	100.00	100.00	100.00	100.00
Male	62.00	56.00	61.00	59.00
Female	38.00	44.00	39.00	41.00

Table-3.5: Educational status of persons in sampled households in Solan.

(Percent of total)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Primary	35.85	27.08	19.01	29.14
Male	32.81	25.00	11.94	25.50
Female	26.56	30.00	27.78	37.27
Middle	29.72	30.21	33.88	31.00
Male	30.47	30.36	34.33	31.47
Female	28.57	30.00	33.33	30.34
Matric/+2	30.19	29.17	35.54	31.47
Male	30.47	32.14	37.31	32.67
Female	29.76	25.00	33.33	29.77
Graduates	1.89	12.5	10.74	6.76
Male	3.12	10.71	14.92	7.97
Female	0.00	15.0	5.56	5.06
Post graduates	2.36	1.04	0.83	1.63
Male	3.12	1.79	1.49	2.39
Female	1.19	0.00	0.00	0.56
Total	100.0	100.0	100.0	100.0
Male	60.0	58.0	55.0	59.0
Female	40.0	42.0	45.0	41.0

Table-3.6: Educational status of persons on all sampled households.

(Percent of total)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Primary	31.83	25.43	22.52	27.09
Male	29.63	23.03	17.65	24.16
Female	35.25	28.57	29.36	31.28
Middle	26.48	22.68	24.43	24.67
Male	27.31	21.21	24.18	24.53
Female	25.18	24.60	24.77	24.87
Matric/+2	36.34	44.33	42.37	40.64
Male	37.04	47.88	43.79	42.32
Female	35.25	39.68	40.37	38.23
Graduates	3.38	7.22	9.54	6.39
Male	3.70	7.27	13.07	7.49
Female	2.88	7.14	4.59	4.81
Post graduates	1.97	0.34	1.14	1.21
Male	2.31	0.61	7.31	1.50
Female	1.44	0.0	0.92	0.80
Total	100.0	100.0	100.0	100.0
Male	61.0	57.0	58.0	59.0
Female	39.0	43.0	42.0	41.0

Occupational pattern

The occupational pattern comprising of the main occupation only has been presented in tables 3.7 to 3.9 for district Shimla, Solan and overall level respectively. It may be seen from the table 3.7 that main occupation of 90% of the persons was agriculture, 83 percent of the males and all the females had agriculture as the main occupation. No person in the sample households had business, wage labor or rural artisan as primary source of income. However, in district Solan about 87 percent of the persons had agriculture as their primary occupation. In addition to this, about eleven percent people had service as their main occupation. A minor fraction of the persons were also working as wage labours, and were in business also. At overall level, there were about 80% persons who had agriculture as their primary occupation. In addition to this about nine percent persons were in Service.

Table-3.7: Occupational pattern of workers in sampled households of district Shimla (Main Occupation).

(Percent of total)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Agriculture	92.00	86.0	93.0	90.0
Male	86.00	78.0	87.0	83.0
Female	100.0	100.0	100.0	100.0
Service	8.0	14.0	7.0	10.0
Male	14.0	22.0	13.0	17.0
Female	-	-	-	-
Business	-	-	-	-
Male	-	-	-	-
Female	-	-	-	-
Wage labour	-	-	-	-
Male	-	-	-	-
Female	-	-	-	-
Rural Artisan	-	-	-	-
Male	-	-	-	-
Female	-	-	-	-
Total	-	-	-	-
Total Male	55.0	64.0	58.0	59.0
Total Female	45.0	36.0	42.0	40.0
Total	100.0	100.0	100.0	100.0

Table-3.8: Occupational pattern of workers in sampled households of district Solan (Main Occupation).

(Percent of total)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Agriculture	83.05	91.11	89.91	86.97
Male	67.78	85.42	81.67	76.26
Female	98.85	97.62	100.00	98.88
Service	12.99	6.67	10.09	10.64
Male	24.44	12.50	18.33	19.70
Female	1.15	0.0	0.0	0.56
Business	1.69	0.92	0.0	1.06
Male	3.33	0.0	0.0	1.51
Female	0.0	2.04	0.0	0.56
Wage labour	2.26	1.11	0.0	1.33
Male	4.44	2.08	0.0	2.52
Female	0.0	0.0	0.0	0.0
Rural Artisan	-	-	-	-
Male	-	-	-	-
Female	-	-	-	-
Total Male	50.84	53.33	55.04	52.66
Total Female	49.16	46.67	44.96	47.34
Total	100.00	100.00	100.00	100.00

Table-3.9: Occupational pattern of workers on all sampled households (Main Occupation).

(Percent of total)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Agriculture	80.13	76.72	84.16	80.26
Male	67.84	75.19	78.86	73.29
Female	94.52	78.64	90.82	88.76
Service	10.09	9.48	8.14	9.35
Male	18.13	17.05	14.63	16.78
Female	0.68	0.0	0.0	0.29
Business	0.95	0.86	0.0	0.65
Male	1.75	0.77	0.0	0.95
Female	0.0	0.97	0.0	0.29
Wage labour	1.26	0.43	0.0	0.65
Male	2.34	0.77	0.0	1.18
Female	0.0	0.0	0.0	0.0
Rural Artisan	-	-	-	-
Male	-	-	-	-
Female	-	-	-	-
Total Male	52.55	60.01	56.37	55.86
Total Female	47.45	39.99	43.63	44.14
Total	100.00	100.00	100.00	100.00

Land Resources

The land resources of the sample households in districts Shimla, Solan and at overall level have been presented in table 3.10. It may be seen from the table that at overall level each farmer had 1.47 hectares of land of which 0.64 ha is under cultivation. About half of this land is irrigated. The farmers also had 0.83 ha of grassland. The average holdings size In Shimla was 1.56 ha and in Solan it was 1.38 ha. The extent of irrigated land was higher in Solan. The sampled farmers did not have any barren Land. At overall level, the average holding size of marginal farmers was 0.56 hectares, of small farmers, it was 1.43 hectares and in case of medium farmers it was 3.04 hectares.

Table- 3.10: Land resources of sampled farm households in Shimla.

(In hectares)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Shimla				
Total land owned	0.49	1.53	3.33	1.56
Cultivated	0.42	0.67	1.11	0.68
Irrigated	0.13	0.21	0.42	0.23
Unirrigated	0.29	0.46	0.69	0.45
Grass land	0.10	0.86	2.22	0.88
Barren	-	-	-	-
Solan				
Total land owned	0.63	1.32	2.78	1.38
Cultivated	0.42	0.60	0.90	0.59
Irrigated	0.26	0.38	0.56	0.37
Unirrigated	0.16	0.22	0.33	0.22
Grass land	0.21	0.72	1.88	0.78
Barren	-	-	-	-
All sample				
Total land owned	0.56	1.43	3.04	1.47
Cultivated	0.42	0.64	1.00	0.64
Irrigated	0.20	0.28	0.49	0.30
Unirrigated	0.22	0.35	0.51	0.33
Grass land	0.15	0.75	2.05	0.83
Barren	-	-	-	-

Cropping Pattern

The cropping pattern of sampled households in district Shimla has been presented in table 3.11 depicting that majority of the vegetables are grown during the kharif season. Pea is the most important vegetable crop followed by cabbage. After these two vegetable crops, maize is next in the importance, followed by other vegetable crops. In district Shimla, Tomato is most important crop and the area under tomatoes surpasses the combined area under all other vegetable crops (Table 3.12). In This district, peas are grown in Rabi season. At overall level of both the districts combined together, tomato emerges as most important vegetable crop (Table 3.13) and next in importance are peas and cabbage.

Table-3.11: Cropping pattern on sampled farms in Shimla.

(In hectares)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Kharif				
Tomato	0.05	0.05	0.11	0.06
Peas	0.13	0.16	0.25	0.17
Capsicum	0.05	0.04	0.08	0.06
Cauliflower	0.01	-	0.04	0.02
Cabbage	0.07	0.16	0.17	0.13
Maize	0.06	0.14	0.19	0.12
F. Bean	0.03	0.06	0.06	0.05
Potato	0.03	0.06	0.08	0.05
Rabi				
Tomato	-	-	-	-
Peas	-	-	-	-
Capsicum	-	-	-	-
Cauliflower	-	-	-	-
Cabbage	-	-	-	-
Wheat	0.06	0.11	0.14	0.10
Mustard	0.04	0.01	0.10	0.04
G.C.A.	0.54	0.79	1.22	0.79
Net Area Sown	0.42	0.66	1.11	0.68

Table-3.12: Cropping pattern on sampled farms in Solan.

(In hectares)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Kharif				
Tomato	0.22	0.26	0.45	0.29
Peas	-	-	-	-
Capsicum	0.05	0.08	0.15	0.08
Cauliflower	0.02	0.01	0.03	0.02
Cabbage	0.03	0.05	0.07	0.04
Maize	0.05	0.12	0.16	0.09
Rabi				
Tomato	-	-	-	-
Peas	0.04	0.12	0.13	0.09
Capsicum	-	-	-	-
Cauliflower	-	-	-	-
Cabbage	-	-	-	-
Wheat	0.04	0.08	0.11	0.07
Mustard	-	-	-	-
G.C.A.	0.44	0.72	1.10	0.69
Net Area Sown	0.36	0.53	0.86	0.53

Table-3.13: Cropping pattern on all sampled farms.

(In hectares)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Kharif				
Tomato	0.14	0.14	0.29	0.18
Peas	0.05	0.09	0.12	0.09
Capsicum	0.05	0.06	0.12	0.07
Cauliflower	0.02	0.01	0.04	0.02
Cabbage	0.05	0.11	0.12	0.08
Maize	0.05	0.13	0.17	0.11
French Been	0.01	0.03	0.03	0.02
Potato	0.01	0.03	0.04	0.03
Rabi				
Tomato				
Peas	0.02	0.05	0.07	0.04
Capsicum	-	-	-	-
Cauliflower	-	-	-	-
Cabbage	-	-	-	-
Wheat	0.05	0.09	0.12	0.08
Barley	0.02	Neg	0.05	0.02
GCA	0.49	0.76	1.16	0.74
Net Area Sown	0.39	0.60	0.98	0.61

Chapter -4

MARKETED SURPLUS AND MARKETING SYSTEM OF VEGETABLES PRODUCED ON SAMPLED FARMS

Vegetables being commercial crops are produced essentially for the Market. Due to large profit in vegetable cultivation, the farmers are shifting their land to this enterprise. With massive increase in production and very high marketable surplus as well as peculiar nature of vegetable crops like perishability, seasonality and bulkiness have resulted in number of post harvest problems. The efficiency with which the post harvest tasks are performed varies with how effectively the various activities when put together, merge into a total marketing system. With this background it is envisaged to study the production of vegetables on sample farms, their marketed surplus and other related issues. The following text presents the details.

Vegetable Production on Sample Farms

The details of Vegetable production on the sampled farms have been presented in Table 4.1. It may be seen that the largest production in both the district's and at overall level is that of tomatoes. In district Solan, on an average about 113 quintals of tomatoes are produced on each farm. At overall level of both the districts, each farm produces about 71 qtls of tomatoes each year. Pea is the second largest produced crop in district Shimla whereas this position is secured by capsicum in district Solan. There is hardly any variation in the respect among the various size Groups. However, at overall level cabbage is the second largest vegetable crop produced with a production of about 16 qtls per farm. The production of peas was observed to be about 10.5 qtls per farm and this is the third largest vegetable produced in the selected districts. The overall production of capsicum and cauliflower were 8.56 and 3.40 qtls per farm respectively.

Table-4.1: Per farm production of vegetables on sampled farms.

(Qty in quintals/farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Shimla				
Tomato	20.10	19.34	53.68	28.23
Peas	13.30	11.97	23.80	15.26
Capsicum	5.12	3.40	7.16	5.03
Cauliflower	2.00	0.63	7.48	2.89
Cabbage	13.55	25.86	27.28	21.29
Solan				
Tomato	87.53	102.85	169.96	113.10
Peas	3.40	7.31	8.85	5.87
Capsicum	7.42	11.46	21.22	12.10
Cauliflower	3.72	2.40	5.86	3.92
Cabbage	6.45	12.44	16.26	10.62
All Sample				
Tomato	56.53	55.72	112.97	70.67
Peas	7.95	9.94	15.79	10.57
Capsicum	6.36	6.91	14.33	8.56
Cauliflower	2.93	1.40	6.66	3.40
Cabbage	9.72	20.02	21.66	15.96

Note: Figures in brackets are percentage of total.

Marketed Surplus

As the production of vegetables is mainly for the market, the home consumption of these is quite low. After accounting for the home consumption and production losses, whatever quantity is left is available for marketing. This quantity of vegetables is usually marketed and has been termed as the 'marketed surplus'. It may be seen from table 4.2 that 27.02 quintals of tomato is the 'per farm' marketed surplus in district Shimla whereas in district Solan this quantity was as high as about 109 quintals. On an average, about 68 quintals of tomatoes were available for marketing in each farm. The second most important vegetable in this respect was cabbage, of which about 15 quintals were available on each farm for marketing. The marketed surplus of peas was observed to be about 10 quintals. The details of market Surplus of other vegetables on the different farm sizes have also been presented in the table.

Table-4.2: Per farm marketed surplus of vegetables on sampled farms.

(Qtls./farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Shimla				
Tomato	19.28	18.36	51.37	27.02
Peas	12.85	11.56	23.13	14.79
Capsicum	4.65	2.88	6.63	4.52
Cauliflower	1.66	2.40	6.86	2.47
Cabbage	1.30	25.05	26.32	20.52
Solan				
Tomato	84.23	98.77	163.83	108.85
Peas	3.26	6.99	8.54	5.67
Capsicum	7.04	10.78	20.29	11.47
Cauliflower	3.59	2.29	5.57	3.76
Cabbage	6.28	12.12	15.88	10.37
All Sample				
Tomato	54.44	53.32	108.58	67.89
Peas	7.66	9.58	15.34	10.22
Capsicum	5.93	6.33	13.52	7.99
Cauliflower	2.70	1.14	6.18	3.10
Cabbage	9.36	19.47	21.04	15.46

Note: Figures in brackets are percentage of total.

Home Consumption of Vegetables on Sampled Farms

Although the vegetable production in the state is market oriented, some quantity of it is invariably consumed by the farming family. This not only saves them from buying from market, improves the nutritional status of the members of the family. The details of the quantities of vegetables consumed at home have been presented in table 4.3. The table reveals that the highest quantity consumed in both the districts is that of tomato, which at overall level was 0.43 qtls per family. The consumption of other vegetables was in the range of 0.21 to 0.29 qtls per family. The home consumption of vegetables appeared to be higher in district Shimla, may be because of the fact that most of the vegetable producing areas in this district are remotely located with not so developed market, reducing the dependence on market for home consumption of vegetables. This is not the case in district Solan.

Table-4.3: Per farm home consumption of vegetables on sampled households.

(Qty in Qtls/household)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Shimla				
Tomato	0.25	0.26	0.32	0.27
Peas	0.30	0.26	0.28	0.28
Capsicum	0.32	0.40	0.28	0.34
Cauliflower	0.30	0.37	0.40	0.35
Cabbage	0.35	0.29	0.44	0.35
Solan				
Tomato	0.48	0.64	0.74	0.59
Peas	0.09	0.20	0.18	0.14
Capsicum	0.16	0.27	0.18	0.23
Cauliflower	0.06	0.06	0.15	0.08
Cabbage	0.11	0.18	0.16	0.14
All Sample				
Tomato	0.37	0.43	0.54	0.43
Peas	0.19	0.23	0.23	0.21
Capsicum	0.24	0.34	0.30	0.29
Cauliflower	0.17	0.23	0.30	0.22
Cabbage	0.22	0.24	0.27	0.25

Note: Figures in brackets are percentage of total.

Marketing Arrangements for Vegetables by Sampled Farmers

The marketing arrangements for vegetables are largely conditioned by the factors like demand, supply, prevailing prices, and availability of expertise, labour and capital etc. As such farmers devise different marketing strategies for different vegetables. All the vegetables under consideration are marketed using various marketing channels. Some proportion of it may be sold in the village itself and some may be disposed of in the local market. But major share of the vegetables is dispatched to distant markets like Delhi and Chandigarh for taking advantage of higher and favourable price situation in such markets. The marketing arrangements for each of the vegetable are different and hence have been presented separately for each of these. The following text presents the details.

Tomato

The marketing arrangements for tomatoes have been presented in Table 4.4 highlighting the differences in the marketing arrangements in the selected districts. In district Shimla the produce is disposed of in the village, in local market, and distant market with very little stress on village sale, only about four per cent being sold with in the village. In the contrast, in district Solan almost all the produce is sold in the village or in local market with only about two per cent of the produce being sent to distant market. At overall level about 42 per cent of the produce each is sold with in the village and in local market. About nine per cent is sent to Delhi and about four per cent is disposed of through Mother Dairy. Chandigarh market is not the important market as far as the tomato crop of the state is concerned.

Table-4.4: Marketing arrangements for tomato by sampled households.

(In percent of marketed surplus)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Shimla				
In the village	2.74	5.17	4.69	4.25
Local market	24.88	25.11	24.96	24.97
Mother dairy	24.88	22.45	20.12	22.03
Distant market Delhi	41.29	38.70	47.09	43.43
Chandigarh	6.21	8.56	3.13	5.32
Total	100.00	100.00	100.00	100.00
Solan				
In the village	53.72	62.10	41.87	51.15
Local market	44.09	36.42	55.93	46.84
Mother dairy	-	-	-	-
Distant market	2.19	1.48	2.19	2.02
Total	100.00	100.00	100.00	100.00
All sample				
In the village	45.38	50.94	33.21	41.78
Local market	40.95	34.21	48.72	42.47
Mother dairy	4.07	4.40	4.69	4.40
Distant market Delhi	6.75	7.58	10.97	8.67
Chandigarh market	2.85	2.87	2.41	2.67
Total	100.0	100.0	100.0	100.0

Peas

A large variation is observed in the marketing arrangements for peas by the sampled farmers, table 4.5. About 20 per cent of the peas produced in Solan are sold within the village whereas this figure for district Shimla is only one per cent. In district Solan rest of the marketed surplus i.e. 79.93 per cent is disposed of in the local market. In Shimla, the peas are also sold in the distant market as well. But local market remains the

channel by which 58 per cent of peas produced in Shimla are disposed of. At overall level about 64 per cent of the produce is sent to local market and about 29 per cent to distant market of Delhi. The rest about seven percent is disposed of in the village itself.

Table-4.5: Marketing arrangements for peas by sampled farmers.

(In percent of marketed surplus)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Shimla				
In the village	2.0	-	2.0	1.0
Local market Shimla	60.0	63.0	53.0	58.0
Mother dairy	-	-	-	
Distant market Delhi	38.0	37.0	45.0	41.0
All	100.00	100.00	100.00	100.0
Solan				
In the village	15.85	20.53	22.60	20.07
Local market Shimla	84.15	79.47	77.40	79.93
Mother dairy	-	-	-	-
Distant market Delhi	-	-	-	-
All	100.0	100.0	100.0	100.0
All sample				
In the village	5.11	6.57	7.95	6.62
Local market	65.70	68.43	59.63	64.19
Mother dairy	-	-	-	-
Distant market Delhi	29.19	24.99	32.42	29.20
Total	100.0	100.0	100.0	100.0

Capsicum

The marketing arrangements adopted by farmers have been presented in table 4.6 depicting that capsicum are either sold in local market (56%) or sent to Delhi market (44%) Similarly, in Solan also there are only two channels but here these are the sale within the village and local market, about 33 and 67 per cent of the produce being routed through these respectively. At overall level about 64 per cent of the produce is disposed of in local market followed by about 24 per cent sold within the village and about 13 per cent sent to Delhi for sale.

Table-4.6: Marketing arrangements for capsicum by sampled farmers.

(In percent of marketed surplus)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Shimla				
In the village	-	-	-	-
Local market Shimla	60.0	60.0	51.0	56.0
Mother dairy	-	-	-	-
Distant market Delhi	40.0	40.0	49.0	44.0
All	100.00	100.00	100.00	100.00
Solan				
In the village	36.94	30.90	32.79	33.47
Local market Shimla	63.06	69.20	67.21	66.53
Mother dairy	-	-	-	-
Distant market Delhi	-	-	-	-
Total	100.0	100.0	100.0	100.0
All sample				
In the village	23.26	22.23	24.76	23.64
Local market	61.75	66.57	63.20	63.57
Mother dairy	-	-	-	-
Distant market	14.99	11.20	12.04	12.78
Total	100.0	100.0	100.0	100.0

Cauliflower

The cauliflower produced in district Shimla is predominantly disposed of in local market, 55 per cent of the produce being sent through this channel (Table 4.7). The rest 45 per cent is sent to Delhi market. In district Solan as well there are only two channels being followed, about 61 per cent sold within the village and about 39 per cent sold in the local market. No produce from this district is sent to distant markets of Delhi or Chandigarh. At overall level about 36 per cent of cauliflower being produced is sold within the village, about 46 per cent in the local market and the rest about 19 per cent is sold in the distant market of Delhi.

Table-4.7: Marketing arrangements for cauliflower by sampled farmers.

(In percent of marketed surplus)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Shimla				
In the village	-	-	-	-
Local market Shimla	60.0	41.0	55.0	55.0
Mother dairy	-	-	-	-
Distant market Delhi	40.0	59.0	45.0	45.0
All	100.0	100.0	100.0	100.0
Solan				
In the village	60.10	77.22	56.39	61.48
Local market Shimla	39.90	22.78	43.21	38.52
Mother dairy	-	-	-	-
Distant market Delhi	-	-	-	-
All	100.0	100.0	100.0	100.0
All sample				
In the village	41.23	57.64	25.33	35.39
Local market	46.21	27.38	49.63	45.52
Mother dairy	-	-	-	-
Distant market	12.56	14.98	25.04	19.09
Total	100.0	100.0	100.0	100.0

Cabbage

The markets being used for disposal of cabbage have been presented in Table 4.8 along with the percentage of produce being sent to these markets. It may be seen from the table that the Delhi market is most popular for disposal of cabbage in district Shimla, 41 per cent of the produce being sent to this market. This is followed by local market accounting for 39 per cent of the produce. The rest 20 per cent is disposed of through Mother Dairy. No produce in Solan was disposed of through Mother Dairy, instead local market of Shimla was most popular, accounting for about 41 per cent of the produce. Village sales accounted for about 33 per cent and the rest about 25 per cent was sent to Delhi. At overall level all the four channels were being used with local market being most popular followed by distant market and Mother Dairy.

Table-4.8: Marketing arrangements for cabbage by sampled farmers.

(In percent of marketed surplus)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Shimla				
In the village	-	-	-	-
Local market Shimla	35.0	42.0	39.0	39.0
Mother dairy	18.0	22.0	20.0	20.0
Distant market Delhi	47.0	36.0	41.0	41.0
All	100.0	100.0	100.0	100.0
Solan				
In the village	46.32	38.69	20.06	33.45
Local market Shimla	24.07	31.84	61.49	41.43
Mother dairy	-	-	-	-
Distant market Delhi	29.61	29.46	18.45	25.12
All	100.0	100.0	100.0	100.0
All sample				
In the village	16.62	10.48	7.68	11.13
Local market	30.99	39.24	47.61	39.96
Mother dairy	11.47	15.95	12.22	13.47
Distant market	40.91	34.33	32.49	35.44
All	100.0	100.0	100.0	100.0

Chapter -5

EXTENT OF PRODUCTION MARKETING AND TRANSPORTATION LOSSES IN VEGETABLES

The present post-harvest system leads not only to the quantitative losses but also to the qualitative loss of the produce, which affects both internal and external trade of the commodity. Losses during harvesting, marketing and storage is much heavier than what are generally realized; because of the manifold increase in the unit value of the commodity. It is problem for not only the farmer and distributor but also to the society as a whole. For assessing the post-harvest losses, the technique of "overall assessment of the commodity movement system" has been used to identify the points for stages where the loss occurs and also to identify how farmers handle the commodity during harvesting and marketing.

Further, to make the present effort of assessing the post-harvest losses more meaningful and easier, a distinction between the terms "thrown out" and "sorted out" has been made. The term thrown out denotes the portion of the total quantity which is completely discarded and has no money value at all in the market, while the sorted out contains vegetables that are damaged by insect and pests, diseased, injured, bruised, of unmarketable shape and size and has some market value as compared to the good vegetables.

Post Harvest Losses in Vegetables

The vegetables crops differ from the other food crops with respect to certain characteristics like moisture content, texture, unit size etc. which makes them highly perishable resulting in huge post harvest losses. The losses start just from the field level due to the attack of various insect, pest and diseases, which damage the fruit and ultimately affects the yield. The producer has also to bear the losses at the time of grading and en route transportation. The extent of post harvest losses at various level, viz. field, assembling, grading, packing and transportation in tomato, peas, capsicum, cauliflower and cabbage are evaluated and the results are given below:

Storage of Vegetables at Producers' Level

One thing, which is common in marketing of all vegetables is complete absence of storage at producers' level. This scenario is the result of perishability and urgent cash needs of farmers. Also, the price situation in the markets is highly fluid inducing the farmers to take advantage of current price situation. Even the traders don't prefer to store the vegetables mainly due to high cost of cold storing making the storage uneconomical in majority of cases.

Losses due to Diseases, Insect and Pest during Production of Vegetables

During the production of vegetable crops, insect, pest and diseases reduces the yield and damages the fruit. Vegetable wise losses due to disease, hailing, birds and under sized produce are given below:

Tomato: Tables 5.1, 5.2 and 5.3 depicts the intensity of losses measured in terms of reduction in yield of tomato over different categories of farms in Shimla, Solan and overall respectively. On an average, the attack of diseases decreased the yield by 1.5 per cent while hailing by 0.47 per cent. The tomatoes damaged by birds were 0.77 percent of total production. The under sized tomatoes accounted for 4.48 percent of total production which couldn't marketed. The losses were the highest for the large farms and decreased with the farm size. The losses were relatively higher on sampled farms of Solan district as compared to Shimla district under study. On the whole, 7.25 percent of total production was damaged by diseases, birds, hailing etc.

Table- 5.1: Production Losses in tomatoes on sampled farms in Shimla.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.00	2.0	3.0	1.85
Hailed	-	2.0	1.0	0.95
Damaged by birds	1.0	1.0	2.0	1.25
Under size	2.0	3.0	3.0	2.60
Sub-Total	4.00 (80.4)	8.0 (154.72)	9.00 (483.12)	6.65 (187.73)

Note: Figures in brackets are per farm quantity in kg.

Table-5.2: Production Losses in tomatoes on sampled farms in Solan.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.19	1.22)	(1.21)	(1.21)
Hailed	-	-	-	-
Damaged by birds	0.30	0.28)	(0.28	(0.29)
Under size	6.39	6.00)	(6.76)	(6.44)
Sub-Total	7.88 (689.73)	7.50 (771.37)	8.25 (1402.17)	7.94 (898.01)

Note: Figures in brackets are per farm quantity in kg.

Table-5.3: Production Losses in tomatoes on sampled farms on all sampled Farms.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.10	(1.66)	(2.08)	(1.52)
Hailed	-	(1.12)	(0.49)	(0.47)
Damaged by birds	0.62	(0.68)	(1.12)	(0.77)
Under size	4.37	(4.30)	(4.91)	(4.48)
Sub-Total	6.09 (344.27)	7.78 (433.50)	8.62 (973.80)	7.25 (512.36)

Note: Figures in brackets are per farm quantity in kg.

Production Losses in Peas: the production losses in peas were relatively lesser than other vegetables under study. On an average, diseases, birds, hailing on sampled farms, damaged 1.20 percent of total peas production. The losses were more in Shimla district than that of Solan district under study (see tables 5.4,5.5 and 5.6).

Table- 5.4: Production Losses in peas on sampled farms in Shimla.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	0.50	0.50	0.50	0.50
Hailed	0.50	0.50	0.50	0.50
Damaged by birds	0.75	0.80	0.75	0.77
Under size	-	-	-	-
Sub-Total	1.75 (23.27)	1.80 (21.54)	1.75 (40.25)	1.77 (27.01)

Note: Figures in brackets are per farm quantity in kg..

Table- 5.5: Production losses in peas on sampled farms in Solan.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				-
Diseased	-	-	-	-
Hailed	-	-	-	-
Damaged by birds	0.65	0.55	0.70	0.64
Under size	-	-	-	-
Sub-Total	0.65 (2.21)	0.55 (4.02)	0.70 (6.19)	0.64 (2.48)

Note: Figures in brackets are per farm quantity in kg.

Table- 5.6: Losses in peas during various marketing operations on all sampled Farms.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	0.23	0.28	0.24	0.25
Hailed	0.23	0.28	0.24	0.25
Damaged by birds	0.69	0.69	0.72	0.70
Under size	-	-		-
Sub-Total	1.15 (9.14)	1.25 (12.42)	1.21 (19.10)	1.20 (12.68)

Note: Figures in brackets are per farm quantity in kg.

Production Losses in Capsicum: on an average, diseases damaged 1.45 percent of total production of Capsicum and 2.91 percent produce was under sized which was not marketed. On the whole, 4.36 percent of total capsicum production was diseased and under sized. The losses were the highest for the medium farms and decreased with the farm size (Tables 5.7, 5.8 and 5.9).

Table- 5.7: Production losses in capsicum on sampled farms in Shimla.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.50	2.0	2.0	1.80
Hailed	-	-	-	-
Damaged by birds	-	-	-	-
Under size	1.50	2.0	-	1.80
Sub-Total	3.00 (15.36)	4.00 (13.60)	4.00 (28.64)	3.60 (18.11)

Note: Figures in brackets are per farm quantity in kg.

Table-5.8: Production losses in capsicum on sampled farms in Solan.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.00	1.25	1.20	1.12
Hailed	-	-	-	-
Damaged by birds	-	-	-	-
Under size	4.29	3.80	3.86	3.97
Sub-Total	5.29 (39.25)	5.05 (57.87)	5.06 (107.37)	5.16 (62.43)

Note: Figures in brackets are per farm quantity in kg.

Table- 5.9: Production losses in capsicum on sampled farms on all sampled farms.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.22	1.67	1.59	1.45
Hailed	-	-	-	-
Damaged by birds	-	-	-	-
Under size	3.00	2.78	2.94	2.91
Sub-Total	4.22 (26.84)	4.45 (30.75)	4.53 (64.91)	4.36 (37.32)

Note: Figures in brackets are per farm quantity in kg.

Production Losses in Cauliflower: Due to poor farm practices and lack of proper management 10.21 percent of total production of cauliflower was under sized (see tables 5.10, 5.11 and 5.12). The diseases in cauliflower reduced the yield by 1.55 percent. On an average, production losses in cauliflower accounted for 11.76 percent, which were higher on marginal farms followed by medium and small farms.

Table- 5.10: Production losses in cauliflower on sampled farms in Shimla.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.5	2.0	2.0	1.80
Hailed	-	-	-	-
Damaged by birds	-	-	-	-
Under size	11.25	9.50	9.00	10.07
Sub-Total	12.75 (25.50)	11.50 (7.24)	11.00 (82.28)	11.87 (34.30)

Note: Figures in brackets are per farm quantity in kg.

Table- 5.11: Production losses in cauliflower on sampled farms in Solan.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.27	1.10	1.59	1.37
Hailed	-	-		-
Damaged by birds	-	-		-
Under Size	10.67	9.74	10.40	10.44
Sub-Total	11.94 (44.42)	10.84 (26.02)	11.99 (70.26)	11.81 (46.29)

Note: Figures in brackets are per farm quantity in kg.

Table- 5.12: Production losses in cauliflower on all sampled farms.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.37	1.60	1.79	1.55
Hailed	-	-	-	
Damaged by birds	-	-	-	
Under size	10.94	9.60	9.71	10.21
Sub-Total	12.31 (36.07)	11.20 (15.68)	11.50 (76.59)	11.76 (39.98)

Note: Figures in brackets are per farm quantity in kg.

Production Losses in Cabbage: The losses in production of cabbage due to diseases accounted for 1.86 percent and 6.51 percent were under sized produce. On the whole, 8.37 percent of total cabbage production was diseased and under sized. Further tables revealed that the losses were relatively higher on medium farms as compared to marginal and small farms (see tables 5.13, 5.14 and 5.15).

Table- 5.13: Production losses in cabbage on sampled farms in Shimla.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.75	1.75	2.20	1.86
Hailed	-	-	-	-
Damaged by birds	-	-	-	-
Under size	6.0	0.6	8.0	6.50
Sub-Total	7.75 (105.01)	7.75 (200.41)	10.20 (278.25)	8.36 (177.98)

Note: Figures in brackets are per farm quantity in kg.

Table- 5.14: Production losses in cabbage on sampled farms in Solan.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				
Diseased	1.75)	1.75	2.20	1.86
Hailed	-	-	-	
Damaged by birds	-	-	-	
Under size	6.0	6.0	8.0	6.52
Sub-Total	8.75 (56.43)	7.75 (96.41)	10.20 (165.85)	8.38 (88.99)

Note: Figures in brackets are per farm quantity in kg.

Table- 5.15: Production losses in cabbage on all sampled Farms.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Quantity of produce as				-
Diseased	1.75	1.75	2.20	1.86)
Hailed	-	-	-	-
Damaged by birds	-	-	-	-
Under size	6.0	6.0	8.00	6.51
Sub-Total	7.75 (75.33)	7.75 (155.15)	10.20 (220.93)	8.37 (133.58)

Note: Figures in brackets are per farm quantity in kg.

Losses in Vegetables during Marketing Operations

During marketing operations some vegetables damaged due to faulty method of operation and handling of produce. The damaged vegetables are not marketed. Losses in marketing operation are estimated and the results are presented below:

Losses in Tomato during Marketing Operations: Fruits bearing cut at the time of harvest are also discarded. So, some of the diseased/damaged/cut tomato has to be sorted out during these operations. Tables5.16, 5.17 and 5.18 shows that the losses at the time of harvesting, assembling, grading and packing ranged between 3.04 to 3.54 per cent across the various farm categories. Of the total losses during marketing operation, 1.00 per cent losses were incurred while harvesting, 1.03 per cent each during assembling and grading, 0.26 percent during packing.

Table- 5.16: Losses in tomatoes during various marketing operations on sampled farms in Shimla.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	20.10(1.00)	29.0(1.50)	80.52(1.50)	36.70(1.30)
Assembling	20.10(1.00)	19.30(1.00)	53.68(1.00)	28.23(1.00)
Grading/sorting	16.10(0.80)	18.40(0.95)	48.31(0.90)	24.84(0.88)
Packing of produce	-	5.00(0.25)	16.10(0.30)	4.52 (0.16)
Sub-Total	57.30(2.80)	71.70(3.70)	198.61(3.70)	94.29(3.34)

Note: Figures in brackets are percentage of total production.

Table-5.17: Losses in tomatoes during various marketing operations on sampled farms in Solan.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	56.00(0.64)	70.97(0.69)	113.87(0.67)	74.64(0.66)
Assembling	91.90(1.05)	115.19(1.12)	178.46(1.05)	121.02(1.07)
Grading/Sorting	100.02(1.17)	120.33(1.17)	193.76(1.14)	131.19(1.16)
Packing of produce	33.26(0.38)	37.02(0.36)	52.68(0.31)	39.58(0.35)
Sub-Total	281.18(3.24)	343.52(3.34)	538.77(3.17)	366.43(3.24)

Note: Figures in brackets are percentage of total production.

Table- 5.18: Losses in tomatoes during various marketing operations on all sampled Farms.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	45.22(0.80)	64.07(1.15)	119.75(1.06)	70.67(1.00)
Assembling	58.22(1.03)	58.50(1.05)	115.23(1.02)	72.79(1.03)
Grading/sorting	56.53(1.00)	57.95(1.04)	115.23(1.02)	72.79(1.03)
Packing of produce	11.87(0.21)	16.71(0.30)	33.89(0.30)	18.37(0.26)
Sub-Total	171.84(3.04)	197.23(3.54)	384.10(3.40)	234.62(3.32)

Note: Figures in brackets are percentage of total production.

Losses in Peas during Marketing Operations: During marketing operations 1.28 percent of peas production was damaged. These losses were relatively higher on medium farms than that of small and marginal farms (see tables 5.19, 5.20 and 5.21)

Table- 5.19: Losses in peas during various marketing operations on sampled farms in Shimla.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	3.32(0.25)	3.59(0.30)	6.90(0.30)	4.27(0.28)
Assembling	6.62(0.50)	4.79(0.40)	11.50(0.50)	7.02(0.46)
Grading/sorting	5.32(0.40)	5.98(0.50)	13.80(0.60)	7.47(0.49)
Packing of produce	-	-	-	-
Sub-Total	15.26(1.15)	14.36(1.20)	32.20(1.40)	18.76(1.23)

Note: Figures in brackets are percentage of total.

Table- 5.20: Losses in peas during various marketing operations on sampled farms in Solan.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	1.39(0.41)	2.99(0.41)	3.54(0.40)	1.55(0.40)
Assembling	1.15(0.34)	3.65(0.50)	3.98(0.45)	1.58(0.41)
Grading/sorting	1.73(0.51)	4.60(0.63)	4.51(0.51)	2.08(0.54)
Packing of produce	-	-	-	-
Sub-Total	4.27(1.26)	11.24(1.54)	12.03(1.36)	5.21(1.35)

Note: Figures in brackets are percentage of total.

Table-5.21: Losses in peas during various marketing operations on all sampled farms.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	2.62(0.33)	3.38(0.34)	5.52(0.35)	3.59(0.34)
Assembling	3.26(0.41)	4.37(0.44)	7.42(0.47)	4.54(0.43)
Grading/sorting	3.65(0.46)	5.56(0.56)	8.68(0.55)	5.39(0.51)
Packing of produce	-	-	-	-
Sub-Total	9.53(1.20)	13.31(1.34)	21.62(1.37)	13.52(1.28)

Note: Figures in brackets are percentage of total.

Losses in Capsicum during Marketing Operations: On an average, 1.13 percent of total production of capsicum was damaged during assembling, 1.16 percent during grading, 0.48 percent during picking and 0.50 percent during packing of produce. The total losses during marketing operations accounted for 3.27 percent of total production (see tables 5.22, 5.23 and 5.24).

Table- 5.22: Losses in capsicum during various marketing operations on sampled farms in Shimla.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	2.30(0.45)	1.70(0.50)	3.58(0.50)	2.41(0.48)
Assembling	5.12(1.00)	3.40(1.00)	10.74(1.50)	5.68(1.13)
Grading/sorting	5.12(1.00)	5.10(1.50)	7.16(1.00)	6.03(1.20)
Packing of produce	2.56(0.50)	1.70(0.50)	3.58(0.50)	2.51(0.50)
Sub-Total	15.10(2.95)	11.90(3.50)	25.06(3.50)	16.63(3.31)

Note: Figures in brackets are percentage of total.

Table- 5.23: Losses in capsicum during various marketing operations on sampled farms in Solan.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	3.34(0.45)	5.73(0.50)	10.61(0.50)	5.81(0.48)
Assembling	7.42(1.00)	11.46(1.00)	31.83(1.50)	13.67(1.13)
Grading/sorting	7.42(1.00)	17.19(1.50)	21.22(1.00)	13.67(1.13)
Packing of produce	3.71(0.50)	5.73(0.50)	10.61(0.50)	6.05(0.50)
Sub-Total	21.89(2.95)	40.11(3.50)	74.27(3.50)	39.20(3.24)

Note: Figures in brackets are percentage of total.

Table- 5.24: Losses in capsicum during various marketing operations on all sampled farms.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	2.86(0.45)	3.45(0.50)	7.16(0.50)	4.11(0.48)
Assembling	6.36(1.00)	6.91(1.00)	21.49(1.50)	9.67(1.13)
Grading/sorting	6.36(1.00)	10.36(1.50)	14.33(1.00)	9.93(1.16)
Packing of produce	3.18(0.50)	3.45(0.50)	7.16(0.50)	4.28(0.50)
Sub-Total	18.76(2.95)	24.17(3.50)	50.14(3.50)	27.99(3.27)

Note: Figures in brackets are percentage of total.

Losses in Cauliflower during Marketing Operations: Nearly 2 percent of total production of cauliflower was damaged during marketing operation at farmer's level out of which 1.36 percent damaged during grading, 0.62 percent during harvesting and 0.29 percent during assembling of produce from farm to farm house. The losses during marketing operation increases as farm size increases (see tables 5.25, 5.26 and 5.27)

Table- 5.25: Losses in cauliflower during various marketing operations on sampled farms in Shimla.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	2.00(1.00)	0.63(1.00)	7.48(1.00)	2.89(1.00)
Assembling	-	0.32(0.50)	3.74(0.50)	0.60(0.21)
Grading/sorting	2.00(1.00)	0.94(1.50)	11.22(1.50)	3.75(1.30)
Packing of produce	-	-	-	-
Sub-Total	4.00(2.00)	1.89(3.00)	22.44(3.00)	7.24(2.51)

Note: Figures in brackets are percentage of total.

Table- 5.26: Losses in cauliflower during various marketing operations on sampled farms in Solan.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	0.89(0.24)	0.60(0.25)	1.70(0.29)	1.02(0.26)
Assembling	0.96(0.26)	0.74(0.31)	1.87(0.32)	1.14(0.29)
Grading/sorting	4.87(1.31)	3.04(1.27)	10.78(1.84)	5.92(1.51)
Packing of produce	-	-	-	-
Sub-Total	6.72(1.81)	4.38(1.83)	14.35(2.45)	8.08(2.06)

Note: Figures in brackets are percentage of total.

Table-5.27: Losses in cauliflower during various marketing operations on all sampled farms.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	1.71(0.58)	0.94(0.67)	4.26(0.64)	2.11(0.62)
Assembling	0.41(0.14)	0.57(0.41)	2.66(0.40)	0.98(0.29)
Grading/sorting	3.41(1.16)	1.94(1.39)	11.12(1.67)	4.62(1.36)
Packing of produce	-	-	-	-
Sub-Total	5.53(1.89)	3.45(2.49)	18.04(2.71)	7.71(2.28)

Note: Figures in brackets are percentage of total.

Losses in Cabbage during Marketing Operations: Damage during marketing operation of cabbage accounted for 1.51 percent of total production. These losses included 0.91 percent during harvesting and 0.60 percent during grading of produce (see tables 5.28, 5.29 and 5.30).

Table- 5.28: Losses in cabbage during various marketing operations on sampled farms in Shimla.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	13.55(1.00)	25.86(1.00)	27.28(1.00)	21.29(1.00)
Assembling	-	-	-	-
Grading/sorting	13.55(1.00)	25.86(1.00)	24.55(0.90)	20.65(0.97)
Packing of produce	-	-	-	-
Sub-Total	27.10(2.00)	51.72(2.00)	51.53(1.90)	41.94(1.97)

Note: Figures in brackets are percentage of total.

Table-5.29: Losses in cabbage during various marketing operations on sampled farms in Solan.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	4.51(0.70)	11.19(0.90)	16.26(1.00)	8.81(0.83)
Assembling	-	-	-	-
Grading/sorting	1.61(0.25)	2.61(0.21)	5.36(0.33)	2.76(0.26)
Packing of produce	-	-	-	-
Sub-Total	6.12(0.95)	13.80(1.11)	21.62(1.33)	11.57(1.09)

Note: Figures in brackets are percentage of total.

Table-5.30: Losses in cabbage during various marketing operations on all sampled farms.

(Qty in kgs per farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Losses during				
Picking/harvesting	8.07(0.83)	19.02(0.95)	21.66(1.00)	14.52(0.91)
Assembling	-	-	-	-
Grading/sorting	5.73(0.59)	12.41(0.62)	13.21(0.61)	9.57(0.60)
Packing of produce	-	-	-	-
Sub-Total	13.80(1.43)	31.43(1.61)	34.87(1.61)	24.09(1.51)

Note: Figures in brackets are percentage of total.

Losses in Vegetables during Transportation

During the commercial handling of vegetables, a period of about 3-4 days elapses between harvesting and the arrival of the vegetables in the terminal market. In addition to this, it may take a week or so for retailing of the vegetables. In the absence of modern techniques like pre-cooling and refrigerated transportation, the vegetables are handled at high ambient temperatures. Being climatic crops, vegetables produces

large amount of ethylene as a result of which the fruits exhibit rapid softening and other changes associated with ripening and senescence. Consequently, the vegetables show considerable physical and physiological deterioration by the time they reach the market. The transportation losses in vegetables were assessed at local markets, Chandigarh market and at Delhi market as vegetables from Himachal Pradesh are marketed in these markets. The losses during transportation include weight loss of produce, vegetables rotten, broken during transportation, pockmarked due to faulty method of packing and pressed, bruises due to temperature during transportation. The details of transportation losses in various vegetables at different markets are given below:

Tomato: The losses in tomatoes during transportation from road head to market were 1.35 percent at local markets, 9 percent at Chandigarh market and 19 percent of quantity transported at Delhi market (Table 5.31). At local markets the losses in tomato included rotten, pockmarked/pressed and broken. At Chandigarh market 4 percent losses were due to weight loss, 2 percent were rotten, 1.5 percent were broken, 1 percent pressed and 0.5 percent damaged due to temperature. At Delhi market 7 percent was weight loss, 4 percent were rotten, 2 percent broken, 3 percent pressed and 3 percent damaged due to temperature.

Table- 5.31: Losses of tomato during transportation at different markets.

(Per quintal)

Particulars	Markets					
	Local Market		Chandigarh		Delhi	
	Qty in Kg	Losses in Rupees	Qty in Kg	Losses in Rupees	Qty in Kg	Losses in Rupees
Quantity handled in qtls	1200		1,500		3,000	
Average price (Rs/kg)		7.24		8.42		9.15
Weight loss	0.00	0.00	4	33.68	7	64.05
Rotten	0.30	2.17	2	16.84	4	36.60
Broken/damaged	0.80	5.79	1.5	12.63	2	18.30
Pockmarked/ pressed	0.25	0.87	1	3.37	3	13.73
Ambient temperature	0.00	0.00	0.5	2.53	3	13.73
Total	1.35	8.83	9.00	69.05	19	146.41
Physical Losses	1.10	7.96	7.50	63.15	13	118.95
Economic Losses	0.25	0.87	1.50	5.90	6	27.46
Total Losses	1.35	8.83	9.00	69.05	19	146.41

Peas: It may be seen from the Table 5.32 that the losses during transportation of peas were 0.30 percent at local markets, 2.75 percent at Chandigarh market and 9 percent at Delhi market. At local markets 0.10 percent peas were rotten and 0.20 percent were

broken. The quantity of peas rotten, broken, pressed and bruises during transportation at Chandigarh market was 0.75, 0.25, and 2.00 percent respectively. The weight loss during transportation was 1.75 percent. At Delhi market the losses during transportation were 4 percent weight loss, 3 percent rotten, 2 percent each broken and pressed and 6 percent damaged due to temperature.

Table-5.32: Losses of peas during transportation at different markets.

(Per quintal)

Particulars	Markets					
	Local Market		Chandigarh		Delhi	
	Qty in Kg	Losses in Rupees	Qty in Kg	Losses in Rupees	Qty in Kg	Losses in Rupees
Quantity handled in qtls	1,500		2,000		3,500	
Average price (Rs/kg)		9.75		9.32		9.77
Weight loss	0.00	0.00	1.75	16.31	4	39.08
Rotten	0.10	0.98	0.75	6.99	3	29.31
Broken/damaged	0.20	1.96	0.25	2.33	2	19.54
Pockmarked/ pressed	0.00	0.00	0.25	1.40	2	9.77
Ambient temperature	0.00	0.00	2.00	0.75	6	23.45
Total	0.30	2.93	5.00	27.78	17	121.15
Physical Losses	0.30	2.93	2.75	25.63	9	87.93
Economic Losses	0.00	0.00	2.25	2.15	8	33.22
Total Losses	0.30	2.93	5.00	27.78	17	121.15

Capsicum: The losses in capsicum during transportation from road head to market were 2.85 percent at local markets, 9 percent at Chandigarh market and 21 percent of quantity transported at Delhi market (Table 5.33). At local markets the losses in capsicum included rotten and pockmarked/pressed. At Chandigarh market 1.5 percent losses each were due to weight loss and rotten, 3.00 percent were broken, 2.00 percent pressed and 1.00 percent damaged due to temperature. At Delhi market 4 percent each was weight loss and rotten, 5 percent each broken and pressed and 3 percent damaged due to temperature.

Table-5.33: Losses of capsicum during transportation at different markets.

(Per quintal)

Particulars	Markets					
	Local Market		Chandigarh		Delhi	
	Qty in Kg	Losses in Rupees	Qty in Kg	Losses in Rupees	Qty in Kg	Losses in Rupees
Quantity handled in qtls	1,000		1200		1,500	
Average price (Rs/kg)		9.08		9.58		9.92
Weight loss	0.00	0.00	1.50	14.37	4	39.68
Rotten	0.35	3.18	1.50	14.37	4	39.68
Broken/damaged	1.00	9.08	3.00	28.74	5	49.60
Pockmarked/ pressed	1.50	6.81	2.00	5.75	5	19.84
Ambient temperature	0.00	0.00	1.00	4.79	3	14.88
Total	2.85	19.07	9.00	68.02	21	163.68
Physical Losses	1.35	12.26	6.00	57.48	13	128.96
Economic Losses	1.50	6.81	3.00	10.54	8	34.72
Total Losses	2.85	19.07	9.00	68.02	21	163.68

Cauliflower: It may be seen from the Table 5.34 that the losses during transportation of Cauliflower were 0.60 percent at local markets, 5.50 percent at Chandigarh market and 19 percent at Delhi market. At local markets 0.15 percent cauliflower was rotten, 0.25 percent was broken and 0.20 percent was pressed. The quantity of cauliflower rotten, broken, pressed and bruises during transportation at Chandigarh market was 0.50, 1.50, and 0.05 percent respectively. The weight loss during transportation was 2.00 percent. At Delhi market the losses during transportation were 5 percent weight loss, 3 percent rotten, 4 percent broken, 3 percent pressed and 4 percent damaged due to temperature.

Table- 5.34: Losses of cauliflower during transportation at different markets.

Particulars	Markets					
	Local Market		Chandigarh		Delhi	
	Qty in Kg	Losses in Rupees	Qty in Kg	Losses in Rupees	Qty in Kg	Losses in Rupees
Quantity handled in qtls	1,800		3,000		5,000	
Average price (Rs/kg)		6.06		7.30		8.13
Weight loss	0.00	0.00	2.00	14.60	5	40.65
Rotten	0.15	0.91	0.50	3.65	3	24.39
Broken/damaged	0.25	1.52	1.50	10.95	4	32.52
Pockmarked/ pressed	0.20	0.61	0.05	1.83	3	10.16
Ambient temperature	0.00	0.00	1.00	4.38	4	16.00
Total	0.60	3.04	5.50	35.41	19	123.72
Physical Losses	0.40	2.43	4.00	29.20	12	97.56
Economic Losses	0.20	0.61	1.50	6.21	7	26.16
Total Losses	0.60	3.04	5.50	35.41	19	123.72

Cabbage: The losses in cabbage during transportation from road head to market were 0.35 percent at local markets, 0.65 percent at Chandigarh market and 11 percent of quantity transported at Delhi market (Table 5.35). At local markets the losses in cabbage included broken and pressed. At Chandigarh market 0.25 percent cabbage were broken, 0.20 percent each were broken and pressed. At Delhi market 5 percent was weight loss, 2 percent rotten, 1 percent each broken and pressed and 2 percent damaged due to temperature.

Table- 5.35: Losses of cabbage during transportation at different markets.

(Per quintal)

Particulars	Markets					
	Local Market		Chandigarh		Delhi	
	Qty in Kg	Losses in Rupees	Qty in Kg	Losses in Rupees	Qty in Kg	Losses in Rupees
Quantity handled in qtls	1,200		1,500		2,000	
Average price (Rs/kg)		6.00		6.72		7.54
Weight loss	0.00	0.00	0.25	1.68	5	37.70
Rotten	0.00	0.00	0.0	0.00	2	15.08
Broken/damaged	0.20	1.20	0.20	1.34	1	7.54
Pockmarked/ pressed	0.15	0.60	0.20	0.67	1	4.52
Ambient temperature	0.00	0.00	0.00	0.00	2	9.05
Total	0.35	1.80	0.65	3.69	11	63.89
Physical Losses	0.20	1.20	0.45	3.02	8	50.32
Economic Losses	0.15	0.60	0.20	0.67	3	13.57
Total Losses	0.35	1.80	0.65	3.69	11	63.89

Per Farm Transportation Losses: The losses in transportation of vegetables to different markets are analysed and presented in Tables 5.36 and 5.37. It may be seen from the table that per farm quantity of transportation losses in tomatoes was 223.75 kg, which ranges between 156.36 kg on marginal farms to 418.19 kg on medium farms. Out of total losses 160.60 kg was the physical loss and 63.15 kg was economic loss. In case of peas per farm transportation losses were 52.80 kg. The physical and economic losses were 28.88 and 23.92 kg respectively. Per farm transportation losses in capsicum were estimated to be 35 kg that ranges between 26.90 kg on small farms to 58.60 kg on medium farms. The physical losses were 20.12 kg and 15.78 per farm were the economic losses. Transportation losses in cauliflower were 12.05 kg per farm and these ranges between 3.41 kg per farm on medium farms to 31.10 kg per farm on medium farms. Out of total these 7.64 kg per farm were physical losses and 4.41 kg economic losses. Per farm transportation losses in cabbage were 85.33 kg out of these 61.72 kg were physical losses and 23.61 kg economic losses.

Per farm value of transportation losses are given in Table 5.37 wherein it may be seen that on an average, transportation losses in tomatoes were Rs 1678.36 per farm. In case of peas per farm transportation losses were Rs 286.09 on marginal farms and Rs 605.09 on medium farms. On the whole, per farm losses in peas were Rs 381.45. Transportation losses in capsicum were estimated to be Rs 264.80 per farm. The highest losses were observed on medium farms and lowest on small farms. Nearly Rs 77 per farms was the transportation losses in cauliflower. In marketing of cabbage to different markets farmers incurred transportation losses of Rs 570 per farm.

Table- 5.36: Per farm quantity of transportation losses in vegetables marketed by sampled farmers.

(Kg per farm)

Particulars	Marginal Farms	Small Farms	Medium Farms	All Farms
Tomato				
Physical loss	113.20	114.55	298.97	160.60
Economic loss	43.16	45.14	119.22	63.15
Total Losses	156.36	159.69	418.19	223.75
Peas				
Physical loss	21.67	23.48	45.05	28.88
Economic loss	17.92	19.12	39.76	23.92
Total Losses	39.59	42.60	84.81	52.80
Capsicum				
Physical loss	16.51	14.91	32.73	20.12
Economic loss	12.61	11.99	25.87	15.78
Total Losses	29.12	26.90	58.60	35.90
Cauliflower				
Physical loss	4.58	2.16	19.71	7.64
Economic loss	2.63	1.25	11.39	4.41
Total Losses	7.21	3.41	31.10	12.05
Cabbage				
Physical loss	39.97	79.66	77.28	61.72
Economic loss	15.27	30.37	29.73	23.61
Total Losses	55.24	110.03	107.01	85.33

Table- 5.37: Per farm value transportation losses in vegetables marketed by sampled farmers.

(Rs per farm)

Particulars	Marginal Farms	Small Farms	Medium Farms	All Farms
Tomato				
Physical loss	979.54	1001.55	2610.09	1399.01
Economic loss	190.00	200.17	528.57	279.35
Total Losses	1169.54	1201.72	3138.66	1678.36
Peas				
Physical loss	211.68	229.36	440.08	282.12
Economic loss	74.41	79.39	165.01	99.33
Total Losses	286.09	308.75	605.09	381.45
Capsicum				
Physical loss	159.63	143.13	314.98	193.80
Economic loss	55.82	53.30	114.84	71.00
Total Losses	215.45	196.43	429.82	264.80
Cauliflower				
Physical loss	36.20	17.32	157.69	60.95
Economic loss	9.65	4.63	42.15	16.28
Total Losses	45.85	21.95	199.84	77.23
Cabbage				
Physical loss	300.19	598.57	579.31	463.46
Economic loss	69.72	136.75	133.60	106.23
Total Losses	369.91	735.32	712.91	569.69

Per Farm Quantity of Total Losses: Quantity of production, marketing and transportation losses in different vegetables are given in Table 5.38 and next table 5.39 presents the proportion of different losses in total production. It may be seen from table that the quantity of total losses in tomatoes was 970.73 kg per farm, which accounted for 13.74 percent of total production. Out of total losses 7.25 percent were production losses and 3.17 percent each were marketing and transportation losses. In case of peas the total losses accounted for 7.47 percent of total production of 79 kg per farm. The production, marketing and transportation losses were 1.20, 1.28 and 4.99 percent total production of peas respectively. The losses in capsicum constituted 11.81 percent of total production of 101.21 kg per farm. In total losses 4.36 percent were production losses, 3.16 percent were marketing losses and 4.19 percent were transportation losses. In cauliflower total losses accounted for 17.57 percent of total production of 59.74 kg per farm. The losses in cabbage estimated to be 15.23 percent of total production of 243 kg per farm. Production losses constituted the major part of total losses (8.37%), followed by Transportation losses (5.35%) and marketing losses (1.51%).

Table- 5.38: Per farm quantity of losses in vegetables during production, marketing and transportation on sampled farms.

(Quantity in kg/Farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Tomato				
Production losses	344.27	433.50	973.80	512.36
Qty picked/harvested	5,653.00	5,572.00	11,297.00	7,067.00
Losses during marketing operations	171.84	197.23	384.10	234.62
Quantity Sold in the Village	2,471.16	2715.77	3,275.90	2,838.38
Qty Sent to markets	2,973.00	2,616.00	7,253.00	3,951.00
Losses during Transportation	156.36	159.69	418.19	223.75
Total losses	672.47	790.42	1776.09	970.73
Peas				
Production losses	9.14	12.42	19.10	12.68
Qty picked/harvested	795.00	994.00	1,579.00	1,057.00
Losses during marketing operations	9.53	13.31	21.62	13.52
Quantity Sold in the Village	38.47	63.69	122.38	67.48
Qty Sent to markets	728.00	894.00	1,412.00	955.00
Losses during Transportation	39.59	42.60	84.81	52.80
Total losses	58.26	68.33	125.53	79.00
Capsicum				
Production losses	26.84	30.75	64.91	37.32
Qty picked/harvested	636.00	691.00	1,433.00	856.00
Losses during marketing operations	18.76	24.17	50.14	27.99
Quantity Sold in the Village	138.24	140.83	334.86	189.01
Qty Sent to markets	455.00	492.00	1,018.00	610.00
Losses during Transportation	29.12	26.90	58.60	35.90
Total losses	74.72	81.82	173.65	101.21
Cauliflower				
Production losses	36.07	15.68	76.59	39.98
Qty picked/harvested	293.00	140.00	666.00	340.00
Losses during marketing operations	5.53	3.45	18.04	7.71
Quantity Sold in the Village	111.47	85.55	156.96	110.29
Qty Sent to markets	159.00	48.00	461.00	200.00
Losses during Transportation	7.21	3.41	31.10	12.05
Total losses	48.81	22.54	125.73	59.74
Cabbage				
Production losses	75.33	155.15	220.93	133.58
Qty picked/harvested	972.00	2,002.00	2,166.00	1,596.00
Losses during marketing operations	13.80	31.43	34.87	24.09
Quantity Sold in the Village	63.20	299.60	161.13	172.91
Qty Sent to markets	873.00	1,647.00	1,943.00	1,374.00
Losses during Transportation	55.24	110.03	107.01	85.33
Total losses	144.37	296.61	362.81	243.00

Table-5.39: Losses in vegetables during production, marketing and transportation on sampled farms.

(Percent of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Tomato				
Total Production	100.00	100.00	100.00	100.00
Production losses	6.09	7.78	8.62	7.25
Losses during marketing operations	3.04	3.54	3.40	3.17
Losses during Transportation	2.76	2.86	3.70	3.17
Total losses	11.89	14.18	15.72	13.74
Peas				
Total Production	100.00	100.00	100.00	100.00
Production losses	1.15	1.25	1.21	1.20
Losses during marketing operations	1.20	1.34	1.37	1.28
Losses during Transportation	4.98	4.28	5.37	4.99
Total losses	7.33	687	7.95	7.47
Capsicum				
Total Production	100.00	100.00	100.00	100.00
Production losses	4.22	4.45	4.53	4.36
Losses during marketing operations	2.95	3.50	3.50	3.16
Losses during Transportation	4.58	3.89	4.08	4.19
Total losses	11.75	11.84	12.11	11.81
Cauliflower				
Total Production	100.00	100.00	100.00	100.00
Production losses	12.31	11.20	11.56	11.76
Losses during marketing operations	1.89	2.46	2.71	2.27
Losses during Transportation	2.46	2.44	4.67	3.54
Total losses	16.66	16.10	18.88	17.57
Cabbage				
Total Production	100.00	100.00	100.00	100.00
Production losses	7.75	7.75	10.20	8.37
Losses during marketing operations	1.42	1.57	1.61	1.51
Losses during Transportation	5.68	5.50	4.94	5.35
Total losses	14.85	14.82	16.75	15.23

Per Farm Value of Total Losses: The total losses in different vegetables are valued and presented in Tables 5.40 and 5.41. On an average, value of total losses in tomatoes was Rs 6286.36 per farm. In peas farmers incurred total losses worth Rs 613.45 per farm. In case of capsicum total losses were Rs 758.80 per farm. The value of total losses in cauliflower and cabbages estimated to be Rs 349.23 and Rs 1526.69 per farm respectively.

Table- 5.40: Per farm value of losses in vegetables during production, marketing and transportation on sampled farms.

(Rs per Farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Tomato				
Production losses	2110	2532	6018	3161
Qty picked/harvested	34,653	32,540	69,815	43,603
Losses during marketing operations	1053	1152	2374	1447
Losses during Transportation	1169.54	1201.72	3138.66	1678.36
Total losses	4332.54	4885.72	11530.66	6286.36
Peas				
Production losses	81	110	169	112
Qty picked/harvested	7036	8797	13990	9365
Losses during marketing operations	84	118	192	120
Losses during Transportation	286.09	308.75	605.09	381.45
Total losses	451.09	536.75	966.09	613.45
Capsicum				
Production losses	203	232	491	282
Qty picked/harvested	4808	5217	10833	6480
Losses during marketing operations	142	182	379	212
Losses during Transportation	215.45	196.43	429.82	264.80
Total losses	560.45	610.43	1299.82	758.80
Cauliflower				
Production losses	200	91	443	228
Qty picked/harvested	1623	816	3856	1941
Losses during marketing operations	31	20	104	44
Qty packed for market				
Losses during Transportation	45.85	21.95	199.84	77.23
Total losses	276.85	132.95	746.84	349.23
Cabbage				
Production losses	458	953	1319	811
Qty picked/harvested	5910	12292	12931	9688
Losses during marketing operations	84	193	208	146
Losses during Transportation	369.91	735.32	712.91	569.69
Total losses	911.91	1881.32	2239.91	1526.69

Table-5.41: Losses in vegetables during production, marketing and transportation on sampled farms.

(Percent of value of total production)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Tomato				
Total Production	100.00	100.00	100.00	100.00
Production losses	6.09	7.38	8.62	7.25
Losses during marketing operations	3.03	3.54	3.40	3.32
Losses during Transportation	3.38	3.69	4.49	3.85
Total losses	12.50	15.01	16.51	14.42
Peas				
Total Production	100.00	100.00	100.00	100.00
Production losses	1.15	1.26	1.20	1.20
Losses during marketing operations	1.19	1.34	1.37	1.28
Losses during Transportation	4.07	3.50	4.32	4.07
Total losses	6.41	6.10	6.90	6.55
Capsicum				
Total Production	100.00	100.00	100.00	100.00
Production losses	4.22	4.44	4.53	4.35
Losses during marketing operations	2.95	3.49	3.50	3.27
Losses during Transportation	4.48	3.77	3.96	4.08
Total losses	11.65	11.70	11.99	11.70
Cauliflower				
Total Production	100.00	100.00	100.00	100.00
Production losses	12.32	11.55	11.49	11.75
Losses during marketing operations	1.91	2.45	2.70	2.26
Losses during Transportation	2.82	2.69	5.18	3.98
Total losses	17.05	16.29	19.37	17.99
Cabbage				
Total Production	100.00	100.00	100.00	100.00
Production losses	7.75	7.75	10.20	8.37
Losses during marketing operations	1.42	1.57	1.61	1.50
Losses during Transportation	6.26	5.98	5.51	5.88
Total losses	15.43	15.30	17.32	15.75

Per farm Quantity of Losses in all Vegetables

The per farm total losses in all vegetables under consideration has been presented in Table 5.42. Simultaneously, the losses in percentage terms have been presented in Table 5.43. It may be seen from the table the overall losses in all vegetables are about 1454 Kgs per farm including the production, marketing and transportation losses.

These losses are 13.32 per cent of the total production of the vegetables. The highest losses are the production losses which account for 6.74 per cent of the total production. The losses during transportation were observed to be 3.76 per cent and the losses during marketing operation were 2.82 per cent of the total production f the vegetables.

Table- 5.42: Per farm quantity of losses in all vegetables during production, marketing and transportation on sampled farms.

(Quantity in kg/Farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Production losses	491.65	647.50	1355.33	735.92
Qty picked/harvested	8349.00	9399.00	17,141.00	10,916.00
Losses during marketing operations	219.46	269.59	508.77	307.93
Quantity Sold in the Village	2821.54	3305.44	4051.23	3378.07
Qty Sent to markets	5188.00	5697.00	12,087.00	7090.00
Losses during Transportation	287.52	342.63	699.71	409.83
Total losses	998.63	1259.72	2563.81	1453.68

Table- 5.43: Per farm quantity of losses in all vegetables during production, marketing and transportation on sampled farms.

(Percent of total Quantity)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Total production	100.00	100.00	100.00	100.00
Production losses	5.90	6.90	7.91	6.74
Losses during marketing operations	2.63	2.86	2.97	2.82
Losses during Transportation	3.44	3.64	4.08	3.76
Total losses	11.97	13.40	14.96	13.32

Per farm Value of Losses in all Vegetables

The losses have been evaluated at the current market prices and the losses in the monetary terms have been presented in Table 5.44 and its percentages in Table 5.45. The table reveals that the value of total losses was about Rs.9534 per farm which was 13.41 per cent of the total production on each sampled farm. In value terms the production losses accounted for 6.46 per cent of the value of the vegetables which was Rs. 71077 per farm. This was followed by the transportation losses (4.18%) and losses during marketing operations (2.77%).

It may therefore be concluded that the total loss of vegetable on average sampled farm whether in physical terms or in value terms stands around 13 per cent of the total production of vegetables on such farms.

Table- 5.44: Per farm value of losses in all vegetables during production, marketing and transportation on sampled farms.

(Rupees/Farm)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Production losses	3052.00	3918.00	8440.00	4594.00
Losses during marketing operations	1394.00	1665.00	3257.00	1969.00
Losses during Transportation	2086.84	2464.17	5086.32	2971.53
Total losses	6532.84	8047.17	16,783.32	9534.53
Total Production	54,030.00	59,662.00	1,08,425.00	71,077.00

Table- 5.45: Per farm value of losses in all vegetables during production, marketing and transportation on sampled farms.

(Percent of Value)

Particulars	Farm Sizes			
	Marginal	Small	Medium	Overall
Total Production	100.00	100.00	100.00	100.00
Production losses	5.65	6.57	7.79	6.46
Losses during marketing operations	2.58	2.79	3.00	2.77
Losses during Transportation	3.86	4.13	4.69	4.18
Total losses	12.09	13.49	15.48	13.41

Causes of Post-harvest Losses

In vegetable crops losses may be caused at different stages of crop growth and post-harvest handling and the types of losses observed can be classified as qualitative, quantitative and nutritional loss. The major operational problems or causes that lead to any of the above mentioned losses are as follows.

Reasons for Pre-harvest Losses Vegetable crops are very sensitive to climatic changes and to the degree of field management during the growing period. Hence the interference of abnormal weather condition such as untimely rain or frost and the reduced attention given to the essential cultural practices result in significant post-harvest losses; which is reflected in qualitative, quantitative and nutritional loss of the produce. Some of the insects and diseases that affect most of the fruits in storage and transit are the results of poor field management during the pre-harvest operations.

Reasons for Post-harvest Losses

(i) Faulty Methods of Picking, Grading and Packing Lack of properly designed harvesting equipment and inadvertent mishandling of the produce at most times leads to mechanical damage to the produce. During grading, some infected and inferior quality produce is also packed together in boxes, which contaminate the healthy and quality produce in transit and in storage; thus increasing the proportion of rejects in the market.

(ii) Lack of Appropriate Packaging and Safe Transportation Vegetables are living and respiring objects when harvested and continue to live during post-harvest stages as well. Location of production sites, mode of packaging, modes and the means of transportation have a significant effect on the rate of metabolic activities that in turn affect the physical appearance of a commodity and its final acceptability by consumers. The use of ordinary open trucks and unscientifically designed (conventional wooden) boxes on very rough and poorly maintained feeder roads add to the post-harvest losses of vegetables.

(iii) Lack of Cold Storage The vegetable storage operations in general, are not carried out as per the desired standard due to lack of proper storage facilities at farm levels and at the wholesale distribution centres. Sometimes, prolonged storage necessitated due to surplus production, lack of unfavourable market conditions and change in market destination also increase the level of biochemical activities and result both qualitative and quantitative losses.

During the investigation in vegetable markets under study, traders reported that mix grades in boxes, improper arrangements of trays of cfb cartons, excess quantity in bags, crates and high loads in the trucks were the main reasons of pockmarks in vegetables during the transportation.

Chapter -6

THE REASONS OF LOSSES AND MEASURES FOR REDUCTION OF WASTAGE IN VEGETABLES

The losses in vegetable production and marketing occur at various Levels. There are losses in the field itself and additional losses take place at the stages of picking, assembling, Grading and packing etc. The losses are also reported during the carriage of the produce to the road head for onward transportation. During the transportation itself certain losses, physical as well as economic, take place. Delay of produce at farm, road head and market give rise to further losses. In the present chapter the reasons for such losses have been analysed. The extent of losses varies from vegetable to vegetable. It was, therefore, considered important to present the analysis separately for each vegetable. The analysis has been carried out by recording the responses of vegetable growers indicating a particular cause responsible for the loss. Thus, the analysis presents the results in the form of multiple responses. The following text presents the details of losses in case of each selected vegetable, separately for district Shimla, Solan and at overall level.

Tomato

The losses during Picking have been attributed to poor staking material by 42 percent of respondents at overall level whereas the percentage of farmers reporting non-availability of proper picking equipments to be the cause was 45 per cent. These percentages were reported to be higher in district Shimla (Table 6.1). Lack of sheds in the field was reported to be the major cause of losses during assembling (86%), respective figures in Shimla and Solan being as high as 82 and 91 per cent. Excess quantity of vegetables in packing container was mainly responsible for losses during grading and packing (61% at overall level). Over-ripe vegetables and lack of packing skills were reported to be other reasons. Poor condition of local paths and roads was reported to be the main cause of losses in tomatoes during the stage of local carriage (87%). The transportation losses were mainly attributed to excess quantity of vegetables in the vehicle (28%) whereas 27 per cent farmers thought that the poor condition of roads was responsible for the losses. Fifteen per cent each thought that the delays in transportation and use of inferior packing material was responsible for the present transportation losses. The delays occurring at various stages were attributed to

lack of labour by 47 percent and large number of check-posts en-route, by 48 per cent vegetable farmers. Non-availability of transport and interference by police personnel were also cited as reasons of delay by about one-third of the farmers.

Table-6.1: Reasons for various types of losses in tomato.

(Multiple response in %)

Particulars	Shimla	Solan	Overall
During picking			
Poor quality of staking material	58.0	26.0	42.0
Non-availability of proper picking equipments	49.0	42.0	45.0
Lack of skill/carelessness	52.0	67.0	60.0
Assembling			
Lack of properly designed container	42.0	32.0	37.0
Poor conditions of local path	79.0	73.0	76.0
Lack of shed in the field	82.0	91.0	86.0
Grading and packing			
Excess vegetables in packing container	48.0	74.0	61.0
Over ripe vegetables	32.0	27.0	20.0
Lack of skill	42.0	65.0	53.0
Local carriage to road head			
Long distance of road head	35.0	59.0	47.0
Poor condition of local roads/paths	82.0	93.0	87.0
Excess vegetables in packing container	20.0	33.0	26.0
Lack of suitable	-	-	-
Transportation from road head to market			
Poor road conditions/blockages	42.0	12.0	27.0
Excess quantity of vegetables in the vehicle	25.0	30.0	28.0
Delay during the transportation	20.0	11.0	15.0
Use of inferior packing material to save the packing and freight charges	29.0	-	15.0
Delay of produce at farm, road head and market			
Lack of labour and packing materials	42.0	53.0	47.0
Non-availability of transport	25.0	42.0	34.0
Police interference	52.0	12.0	32.0
Large number of check posts/tax and other barriers	82.0	12.0	48.0

Peas

The result of analysis in respect of causes of losses for pea crop has been presented in Table 6.2 wherein it may be seen that none of the farmers thought that losses during picking were the result of poor staking material. Only 26 Per cent of farmers that overall reported that non-availability of proper picking equipments was responsible for losses during picking stage. None of the farmers in district Solan was of this view. The only Predominant reason reported by the farmers but was either lack of picking skills or the carelessness by the persons involved in picking. The absence of shed in the fields was thought to be main reason for losses did in the assembling stage, 40% of farmers at overall level reported this reason. Again, lack of skill emerged as main reason of losses during the grading and packing, 33 per cent of farmers consenting to this reason. The losses occurring during the local carriage are thought to be mainly due to poor condition of roads/paths, 48 per cent of the respondents. Another 32 per cent of the respondents held the long distance of road head to be responsible for the losses. During transportation stage, excess quantity of vegetables in the vehicle was considered to be the main culprit by 42 per cent respondents. About third of respondents each attributed the losses to poor road conditions, delay during transportation and use of inferior packaging. Delays during the transportation were reported to be mainly due to police interference en route, 34 per cent of the respondents affirming to this reason. Non-availability of transport was another reason reported by 26 per cent of the respondents. Lack of labour and packing materials and large number of check posts were other reasons reported by 16 and 17 per cent of the respondents respectively.

Table-6.2: Reasons for various types of losses in peas.

(Multiple response in %)

Particulars	Shimla	Solan	Overall
During picking			
Poor quality of staking material	-	-	-
Non-availability of proper picking equipments	53.0	-	26.0
Lack of skill/carelessness	22.0	35.0	28.0
Assembling			
Lack of properly designed container	38.0	-	19.0
Poor conditions of local path	33.0	32.0	32.0
Lack of shed in the field	58.0	22.0	40.0
Grading and packing			
Excess vegetables in packing container	15.0	10.0	12.0
Over ripe vegetables	25.0	-	13.0
Lack of skill	30.0	37.0	33.0
Local carriage to road head			
Long distance of road head	35.0	28.0	32.0
Poor condition of local roads/paths	60.0	36.0	48.0
Excess vegetables in packing container	35.0	17.0	26.0
Lack of suitable	-	-	-
Transportation from road head to market			
Poor road conditions/blockages	62.0	8.0	35.0
Excess quantity of vegetables in the vehicle	48.0	36.0	42.0
Delay during the transportation	53.0	15.0	34.0
Use of inferior packing material to save the packing and freight charges	25.0	40.0	32.0
Delay of produce at farm, road head and market			
Lack of labour and packing materials	20.0	13.0	16.0
Non-availability of transport	30.0	22.0	26.0
Police interference	62.0	5.0	34.0
Large number of check posts/tax and other barriers	35.0	-	17.0

Capsicum

In the capsicum crop lack of skill/carelessness and poor quality of staking material were the main reasons for losses during the picking stage, being reported by 41 and 36 per cent of the respondents respectively. The losses during the assembling stage arose mainly due to poor condition of the village path, 50 per cent of the farmers were of this opinion. About one third of the farmers thought that the losses during the assembling were the result of poorly designed containers and lack of assembling shed

Table-6.3: Reasons for various types of losses in capsicum.

(Multiple response in %)

Particulars	Shimla	Solan	Overall
During picking			
Poor quality of staking material	40.0	33.0	36.0
Non-availability of proper picking equipments	10.0	5.0	8.0
Lack of skill/carelessness	30.0	52.0	41.0
Assembling			
Lack of properly designed container	42.0	27.0	34.0
Poor conditions of local path	45.0	55.0	50.0
Lack of shed in the field	30.0	35.0	32.0
Grading and packing			
Excess vegetables in packing container	-	52.0	26.0
Over ripe vegetables	35.0	23.0	29.0
Lack of skill	20.0	35.0	27.0
Local carriage to road head			
Long distance of road head	20.0	53.0	36.0
Poor condition of local roads/paths	15.0	47.0	31.0
Excess vegetables in packing container	30.0	27.0	29.0
Lack of suitable	-	-	-
Transportation from road head to market			
Poor road conditions/blockages	30.0	43.0	36.0
Excess quantity of vegetables in the vehicle	20.0	58.0	39.0
Delay during the transportation	10.0	36.0	23.0
Use of inferior packing material to save the packing and freight charges	25.0	11.0	18.0
Delay of produce at farm, road head and market			
Lack of labour and packing materials	30.0	32.0	31.0
Non-availability of transport	20.0	37.0	28.0
Police interference	10.0	8.0	9.0
Large number of check posts/tax and other barriers	5.0	8.0	6.0

in the field itself. Little less than third of the farmers were of the view that the losses during grading and packing were the result of excess vegetables in the container, over-ripe vegetables and lack of skill. Long distance to road-head emerged as the main reason for losses in capsicum during the local carriage. Poor conditions of the local paths and excess of vegetables in the container were other reasons reported by about one third of the respondents each. The main cause of losses during the transportation stage emerged out to be excess of vegetables in vehicle (39%) followed by poor conditions of roads (36%). Lack of labour and packing material was the main cause of delay of produce at farm level followed by lack of transport vehicle.

Cauliflower

As the extent of losses in this vegetable is low the percentage of farmers reporting reasons for losses was also quite low in comparison with other vegetables. There were no looses reported in cauliflower during the picking stage except those caused by own negligence and lack of skills (10%). Whatsoever losses reported during the assembling stage were mainly the result of poor conditions of local path and roads, 14 per cent of the respondents affirming to this reason. Very few farmers held responsible the factors like shed in the field and lack of properly designed containers for the losses. No farmer thought that excess of vegetables in the container was causing any loss during the grading and packing stage. Only one and five per cent farmers reported reasons like over-ripe vegetables and lack of skill responsible for the loss. A poor condition of the roads was the overriding factor for the loss during the local carriage. The percentage of farmers reporting the listed reason responsible for the loss during the transportation varied between three and nine percent.

Table-6.4: Reasons for various types of losses in cauliflower.

(Multiple response in %)

Particulars	Shimla	Solan	Overall
During picking			
Poor quality of staking material	-	-	-
Non-availability of proper picking equipments	-	-	-
Lack of skill/carelessness	5.0	15.0	10.0
Assembling			
Lack of properly designed container	6.0	-	3.0
Poor conditions of local path	10.0	18.0	14.0
Lack of shed in the field	5.0	8.0	6.0
Grading and packing			
Excess vegetables in packing container	-	-	-
Over ripe vegetables	2.0	-	1.0
Lack of skill	8.0	11.0	5.0
Local carriage to road head			
Long distance of road head	3.0	10.0	7.0
Poor condition of local roads/paths	12.0	9.0	10.0
Excess vegetables in packing container	5.0	12.0	8.0
Lack of suitable	-	-	-
Transportation from road head to market			
Poor road conditions/blockages	8.0	7.0	8.0
Excess quantity of vegetables in the vehicle	2.0	15.0	8.0
Delay during the transportation	-	6.0	3.0
Use of inferior packing material to save the packing and freight charges	5.0	13.0	9.0
Delay of produce at farm, road head and market			
Lack of labour and packing materials	5.0	6.0	5.0
Non-availability of transport	-	-	-
Police interference	6.0	2.0	4.0
Large number of check posts/tax and other barriers	3.0	-	2.0

Cabbage

Like cauliflower, the losses in cabbage during the picking stage were minimal and only cause reported by 32 per cent of respondents was the lack of skills or carelessness. There were no losses reported during the assembling due to poor condition of the path only 10 and 7 per cent respondents reporting that the loss was the result of the fact that the containers were not properly designed and not having any shed in the field for assembling. A few farmers reported that the loss during grading and packing was due lack of packing skill and by packing excess vegetables in the container. About 27 per cent farmers reported that the poor condition of the roads was responsible for the cabbage losses local carriage. The losses during transportation were attributed to poor

conditions of the roads and frequent road blockages. Delay during the transportation was other prominent reason reported by 20 per cent of the farmers leading to losses. Non-availability of labour and harassment by the police officials en route were reasons cited for delay of vegetables leading to losses.

Table-6.5: Reasons for various types of losses in cabbage.

(Multiple response in %)

Particulars	Shimla	Solan	Overall
During picking			
Poor quality of staking material	-	-	-
Non-availability of proper picking equipments	-	-	-
Lack of skill/carelessness	45.0	19.0	32.0
Assembling			
Lack of properly designed container	20.0	-	10.0
Poor conditions of local path	-	-	-
Lack of shed in the field	15.0	-	7.0
Grading and packing			
Excess vegetables in packing container	-	11.0	6.0
Over ripe vegetables	-	-	-
Lack of skill	52.0	20.0	3.0
Local carriage to road head			
Long distance of road head	20.0	-	10.0
Poor condition of local roads/paths	53.0	-	27.0
Excess vegetables in packing container	5.0	-	2.0
Lack of suitable	-	-	-
Transportation from road head to market			
Poor road conditions/blockages	55.0	-	28.0
Excess quantity of vegetables in the vehicle	35.0	-	17.0
Delay during the transportation	40.0	-	20.0
Use of inferior packing material to save the packing and freight charges	30.0	-	15.0
Delay of produce at farm, road head and market			
Lack of labour and packing materials	30.0	-	15.0
Non-availability of transport	-	-	
Police interference	20.0	-	10.0
Large number of check posts/tax and other barriers	15.0	-	7.0

Suggestions and Policy Implications

Pre-Harvest Factors

The following points should be kept in mind:

- Dry conditions followed by rain or irrigation, which can give rise to growth cracks in vegetables.
- Lack of potash can bring about poor fruit development and abnormal ripening in vegetables.

Harvesting and Field Handling

The harvest maturity, which is based on following judgments:

- Sight-colour, size and shape
- Touch-texture, hardness or softness
- Smell-odour or aroma
- Taste-sweetness, sourness, bitterness
- Resonance-sound when tapped.

Growers will have to train their own field labour on the following points:

- Do not place the produce directly on the soil, especially wet soil;
- Do not use dirty harvesting or field containers contaminated with soil, crop residues or decaying produce: containers must be kept clean.

While taking a decision to start harvesting, the basic rules to observe are:

- Harvest during the coolest part of the day i.e. early morning or late afternoon;
- Do not harvest produce when it is wet from dew or rain. Wet produce will overheat if not well ventilated, and it will be more likely to decay.
- Protect harvested produce in the field by putting it under open-sided shade when transport is not immediately available.
- Produce for local markets can be harvested early in the morning. For more distant markets it may be an advantage if suitable transport can be arranged to harvest in the late afternoon and transport to market at night or early the next morning;
- Plastic buckets or other containers are suitable for harvesting vegetables that are more easily crushed, such as tomatoes, capsicum. The containers should be smooth, with no sharp edges or projections to damage the produce.
- Bruised, damaged and misshapen vegetables should be sorted out and healthy vegetables should be graded according to their size, weight, shape, colour, maturity etc. Vegetables when graded fetch better price.

Packing

The wooden boxes must be properly assembled; nails, staples and splinters are always a danger in wooden boxes. Bruising results from overfilling containers or from the collapse of boxes; collapse may be caused by weak walls of boxes. It must provide

adequate ventilation for contents during transport and storage. It must be cost effective in relation to the market value of the commodity for which used.

The plastic crates are strong, rigid, smooth, easily cleaned and can be stacked when packed and nest when empty to conserve space. Despite their cost, however, their capacity for reuse can make them an economical investment.

- Provision and/or up-gradation of necessary infrastructure such as packing houses, pre-cooling units, cold storage facilities in production areas and marketing centres.
- Promotion of low cost modern technology for standardized grading & packing.
- Strengthening of the vegetable distribution network and the marketing services.
- Seasonal surveys of production of vegetables and well designed market studies for designing efficient marketing strategies.
- Strengthening marketing extension system to transfer post harvest technology to the vegetable growers.

Transportation

Routes for the movement of produce within farm fields should be planned before crops are planted. Farm roads should be kept in good condition because great damage can be inflicted on produce carried over rough roads in unsuitable vehicles. Containers must be loaded on vehicles carefully and stacked in such a way that they cannot slip or collapse. Jolting of laden containers can aggravate damage to produce on rough roads, even at low vehicle speeds.

For the produce to be taken to market carried by trucks may be in bulk bins or in hand-loaded sacks or wooden or plastic boxes; where vehicles wait in the sun or rain for long periods before unloading, only the top part of the load should be protected by a covering. Complete enclosing of the load with a tarpaulin is disastrous because it restricts ventilation and the temperature of the produce rises rapidly. Grass or leaves are not recommended for this purpose because they restrict ventilation and may be a source of disease.

Post-harvest Treatments

The produce which is subject to long-term storage, highly perishable and transported over long distances to market, require special treatments in order to slow deterioration and minimize losses. These treatments may be applied before, during or after packing

and are supplementary to the routine measures, such as temperature and moisture control, which aim to reduce losses in all fresh produce.

Processing

The production of tomato is seasonal, making them available only during short period of the year. During this short time, they are produced in greater quantity than the market can absorb, so the surplus of many of these crops must be processed and preserved to avoid wastage of the food and loss of income to the grower.

To avoid wastage of vegetables due to high temperature, a shed/room should be constructed in the field, to maintain the temperature. All the post-harvest practices like grading, packing, transportation, etc., can be undertaken in the above structure.

The traditional method of harvesting vegetables normally early hours in the morning, by the rudimentary method of sprinkling water before transportation. These methods are cheap, easy to follow and effective in reducing post-harvest losses.

- Well-established infrastructure facilities like pukka roads and timely transportation from village to marketplace are essential requirements.
- Cold storage/s may be constructed near the market place to avoid excess supply of vegetables and price crash.

Conclusion

To conclude, the pre-harvest cultural practices are crucial for the reduction of post-harvest losses. Harvesting should be done in the early morning or late afternoon and avoid in wet conditions. Proper grading improves the quality and the price in the market. The plastic crates should be preferred over wooden box as it is economical investment. The package should provide adequate level of ventilation to the produce with the minimum wasted space. If the produce is to be transported to far away markets, post-harvest treatments help to reduce the losses in fresh produce. The surplus production may also be absorbed through establishment of processing plants in the region.