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RESEARCH ARTICLE :

An economic analysis of post harvest losses in tomato of Akola district in Vidharbha region

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SUMMARY : Outputs of all agricultural commodities produced in the field have to undergo a series of operations such as threshing, transportation, processing and storage and exchange before they reach the consumer and there are appreciable losses of outputs during these stages of their handling. This is most uncertain to get expected returns. Moreover, vegetables are more perishable then food grains. Hence, post-harvest losses are quite often, at different marketing levels than food grains. The presence study was undertaken to find out the post-harvest losses of selected vegetable in Akola district for the year 2017-18. The data of 90 tomato growers were purposely collected from randomly located villages of the district. Simple tabular analysis was carried out to accomplished the objectives. This study revealed that per hectare cost of cultivation of tomato was Rs.101804.29 whereas per hectare the net return was Rs.73253.37 The input output ratio at Cost C_2 in production of tomato is 1.72. The per hectare post-harvest losses at the farm level was estimated to be 16.49 quintal in tomato. The corresponding economic loss was 16645.20 Rs./ha. It is suggested that to prevent from the losses the farmers should be aware through training on standardization and grading, handling, proper packing and providing storage facilities and quick transportation to prevent the economic losses.

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BACKGROUND AND OBJECTIVES

Vegetables are more perishable than other food grains hence, the post harvest losses are quite often at farm level and different marketing levels like farmer, wholesaler and retailer, these losses turn into an economic loss. An aggregate post-harvest losses of 12.98 per cent was found in tomato which comprised of 9.94 per cent at field and 3.04 per cent in storage (Nanda *et al.*, 2010). Hence, in order to study various aspects of post harvest loses of selected vegetable *i.e.* tomato at different marketing levels and its effect on farmer profitability, this study has been undertaken during 2017-18 with the following objectives.

Objectives:

– To workout the cost and returns of tomato in Akola district.

– To estimate the post harvest losses of tomato in Akola district.

– To identify the constraints in post harvest management of tomato.

RESOURCES AND METHODS

The present study was undertaken to study an economics analysis of post harvest losses in selected vegetable in Akola district. It comprises sampling techniques, methods of data collection, analysis of data by applying appropriate statistical tools. The data collected from the farmers included general information about the cultivation of vegetable crops methods harvesting storage system, mode of transportation and losses of farm level during post harvest operations through enquiry method.

OBSERVATIONS AND ANALYSIS

The findings of the present study as well as relevant discussion have been summerized under following heads:

Family size and its composition:

Family size and its composition are basically the functions of economic and social characteristics. The Family size and its composition of the tomato cultivator are presented in Table 1.

Table 1 revealed that average family size range was 5 to 6 members. In large size groups, male were 40 per cent, female 20 per cent and children 40 per cent. In medium size group 6 members were observed whereas in small size group the average family member was 5. At overall the average family size was 6 members which contributed 2 male, 2 female and 2 children.

Educational status of selected tomato cultivators:

Education is important variable in determining the educational status of the selected farmers which influencing the standard of living. The Educational status of selected tomato cultivators is presented in Table 2.

It is seen from the Table 2 that at overall level, the number of farmers having high school education was highest 48.89 per cent followed by Graduation (21.11

Table 1 : Average family size of selected tomato cultivator **(Number)**

Sr. No.	Particulars	Small	Medium	Large	Overall
1.	Male	2 (40.00)	2 (33.33)	2 (40.00)	2 (33.33)
2.	Female	1 (20.00)	2 (33.33)	1 (20.00)	2 (33.33)
3.	Children	2 (40.00)	2 (33.33)	2 (40.00)	2 (33.33)
4.	Total	5.00 (100.00)	6.00 (100.00)	5.00 (100.00)	6.00 (100.00)

(Figures in parenthesis indicate percentage to total)

Table 2 : Educational status of selected tomato cultivators **(Number)**

Sr. No.	Particulars	Small	Medium	Large	Overall
1.	Illiterate	6 (12.24)	3 (13.64)	1 (5.26)	3.33 (11.11)
2.	Primary	12 (24.49)	3 (13.64)	2 (10.53)	5.67 (18.89)
3.	High School	25 (51.02)	12 (54.55)	7 (36.84)	14.67 (48.89)
4.	Graduation	6 (12.24)	4 (18.18)	9 (47.37)	6.33 (21.11)
	Total	49 (100.00)	22 (100.00)	19 (100.00)	30.00 (100.00)

(Figures in parenthesis indicate percentage to total)

Table 3: Land use pattern of tomato cultivators **(ha)**

Sr. No.	Particulars	Small	Medium	Large	Overall
1.	Average land holding	1.58 (100.00)	2.85 (100.00)	6.05 (100.00)	3.49 (100.00)
2.	Fallow land	0.20 (12.66)	0.01 (0.35)	0.10 (1.65)	0.10 (2.96)
3.	Net cultivated area	1.56 (98.73)	2.80 (98.25)	5.95 (98.35)	3.39 (98.38)
4.	Area sown more than once	0.38 (24.05)	0.80 (28.07)	1.37 (22.64)	0.85 (24.33)
5.	Irrigated area	0.55 (34.81)	1.10 (38.60)	2.49 (41.16)	1.38 (39.50)
6.	Gross cropped area	1.94	3.60	7.32	4.29
7.	Cropping intensity (%)	124.36	128.57	123.03	125.32

(Figures in parenthesis indicate percentage to total)

%) and primary education (18.89%). The illiterate percentage was 11.11 per cent. In case of small and medium group the highest percentage of education was observed in high school *i.e.* 51.02 and 54.55 per cent, respectively. While in case of large farmers highest percentage of education was at graduate level 47.37 per cent. The illiteracy percentage was very less in large group 5.26 per cent then the small and medium.

Land use pattern of tomato cultivators:

Land is said to be one of the scarce resources and is one of the generating resources for the families depend upon Agriculture as the major source of livelihood. Land utilization indicates the area of holding actually put to use for various purpose as crop production, fallow land area sown more than once etc. The average land utilization of selected farmers is presented in Table 3.

It is seen from the Table 3 that, at overall level, the average land possessed by selected tomato growers was 3.49 ha, out of which 98.38 per cent was net cultivated area and 2.96 per cent was follow land. The area under irrigation was 39.50 per cent. The overall cropping intensity was 125.32 per cent.

It is observed from the Table 4 that at overall level, the gross cropped area was 4.29 ha out of which 80.17 per cent was under *Kharif* season and 18.66 per cent in *Rabi* season. The area under tomato crop was 10.73 per cent and 4.82 in other vegetables. The cotton and soybean is the dominant crop of *Kharif* season holding the 28.07 and 24.96 per cent area under cultivation. The wheat and gram was the major crop of *Rabi* season holding the area of 6.45 and 9.33 per cent of the gross cropped area.

The gross cropped area of the small, medium and large farmers were 1.94, 3.60 and 7.32 ha in which the area under tomato cultivation was 15.46 per cent, 11.94 per cent and 8.88 per cent, respectively.

From the Table 5 it is revealed that, number of the selected farmer was 90 out of which 42 farmers belongs to small holding, 2 7 farmers belongs to medium and 21 farmers to large size holding with average size of holding 1.58 , 2.85 and 6.05 hectare, respectively.

Table 4 : Cropping pattern of tomato cultivators **(ha)**

Sr. No.	Particulars	Small	Medium	Large	Overall
I.	***Kharif***				
1.	Cotton	0.43 (22.16)	0.98 (27.22)	2.20 (30.05)	1.20 (28.07)
2.	Tur	0.28 (14.43)	0.42 11.67	0.79 (10.79)	0.50 (11.59)
3.	Soybean	0.34 (17.53)	0.85 23.61	2.02 (27.60)	1.07 (24.96)
4.	Tomato	0.30 (15.46)	0.43 11.94	0.65 (8.88)	0.46 (10.73)
5.	Other vegetables	0.21 (10.82)	0.12 3.33	0.29 (3.96)	0.21 (4.82)
	Total	1.56 (80.41)	2.80 (77.78)	5.95 (81.28)	3.44 (80.17)
II	***Rabi***				
1.	Wheat	0.17 (8.76)	0.32 (8.89)	0.34 (4.64)	0.28 (6.45)
2.	Gram	0.14 (7.22)	0.31 (8.61)	0.75 (10.25)	0.40 (9.33)
3.	*Rabi* sorghum	0.05 (2.58)	0.11 (3.06)	0.21 (2.87)	0.12 (2.88)
	Total	0.36 (18.56)	0.74 (20.56)	1.30 (17.76)	0.80 (18.66)
IV	**Orange**	0.02 (1.03)	0.06 (1.67)	0.07 (0.96)	0.05 (1.17)
V	**Gross cropped area**	1.94 (100.00)	3.60 (100.00)	7.32 (100.00)	4.29 (100.00)

(Figures in parenthesis indicate percentage to total)

Table 5 : Average size of holding of tomato cultivator

Sr. No.	Size of holding	No. of farmer selected	Average size of holdings
1.	Small (0 to 2 ha)	42 (46.67)	1.58
2.	Medium (2.01 to 4.00 ha)	27 (30.00)	2.85
3.	Large (4.01 ha and above)	21 (23.33)	6.05
	Total/ Overall	90.00 (100.00)	3.49

(Figures in parenthesis indicate percentage to total)

Table 6 reveled that at overall level, the per hectare cost of cultivation of tomato was Rs.97724.00/-. Among the different items of expenditure, the rental value of land accounted highest share of the total cost *i.e.* 21.89 per cent followed by human labour, manure, family labour and fertilizer which contributes 15.76, 6.35, 5.79 and 5.46 per cent of the total cost, respectively. The per hectare yield was 169.11 quintal.

It is seen from the Table 7 that, per hectare expenditure of Rs. 101682.73/-was incurred in the cultivation of tomato as a cost C_2 by the cultivators. The major share of cost among different cost item where

Table 6 : Per hectare cost of cultivation of tomato for small farmers

Sr. No.	Item	Unit/ha		Input	Cost / Input (Rs.)	Total cost	Percentage to total cost
1	2	3		4	5	6	
1.	Hired human labour	Male	Days	24.92	200.02	4984.50	4.02
		Female	Days	97.67	149.12	14564.55	11.74
	Subtotal					23379.63	15.76
2.	Bullock labour		(Pair days)	9.23	499.82	4611.43	3.72
3.	Machine charges		Hours	6.54	297.68	1946.73	1.57
4.	Seed		g	135.00	35.92	4849.20	3.91
5.	Manures		carts	15.44	510.25	7878.26	6.35
6.	Fertilizer	N	kg	116.60	24.00	2798.10	2.26
		P	kg	62.68	44.00	2757.86	2.22
		K	kg	55.32	22.00	1216.98	0.98
	Subtotal					6433.98	5.46
7.	Irrigation charges	(Rs.)				1900.00	1.53
8.	Insecticide (Plant Protection)	(Rs.)				11586.31	9.34
9.	Incidental charges	(Rs.)				50.60	0.04
10.	Repairing charges	(Rs.)				210.71	0.17
11.	Working capital (1 to 10)	(Rs.)				59355.23	69.07
12.	Int.on wor.Cap. @ 6% /annum	(Rs.)				1780.65	1.44
13.	Depreciation	(Rs.)				1040.77	0.84
14.	Land Rev. cess and other taxes	(Rs.)				186.25	0.15
15.	Cost "A1" (Items 11 to 14)					62362.91	71.49
16.	Rental value leased in land	(Rs.)				-	-
17.	Cost "A2" (Items 15 to 16)					62362.91	71.49
18.	Int. on Fix.Cap. @ 10%/annum	(Rs.)				1027.96	0.83
19.	Cost "B1" (Items 17 + 18)					63390.87	72.32
20.	Rental value of land	(Rs.)				27150.61	21.89
21.	Cost "B2" (Items 19 to 20)	(Rs.)				90541.48	94.21
22.	Family human labour	Male	Days	12.95	200.02	2590.26	2.09
		Female	Days	30.80	149.12	4592.90	3.70
	Subtotal						5.79
23.	Cost " C1 " (Items 19+22)	(Rs.)				70574.02	78.11
24.	Cost " C2 " (Items 21+22)	(Rs.)				97724.63	100.00
25.	Yield per hectare	(Rs.)		169.11	963.30	162903.66	
26.	Per qtl. cost of main produce at cost C3	(Rs.)				577.88	

found in rental value of own land which is 28.82 per cent to the total cost of cultivation followed hired human labour of 22.99, plant protection 10.03, manure 8.74 per cent and fertilizer 6.33 per cent.

The Table 8 revealed that per hectare cost of cultivation at Cost 'C_2' for tomato was Rs. 106103.66/-. In the cultivation of tomato the major item of cost were rental value of land, hired human labour, manure, plant protection and fertilizer which accounted 29.35, 24.17, 12.57, 7.58 and 5.82 per cent share to total cost,

Table 7: Per hectare cost of cultivation of tomato (Medium farmers)

Sr. No.	Item	Unit/ha		Input	Cost / Input (Rs.)	Total cost	Percentage to total cost
1	2	3		4	5	6	
1.	Hired human labour	Male	Days	27.87	200.08	5576.23	5.48
		Female	Days	118.67	150.02	17803.40	17.51
	Subtotal					23379.63	22.99
2.	Bullock labour		(Pair Days)	7.42	500.02	3710.15	3.65
3.	Machine charges		Hours	9.22	299.96	2765.63	2.72
4.	Seed		g	131.38	38.72	5087.03	5.00
5.	Manures		carts	17.44	509.76	8890.21	8.74
6.	Fertilizer	N	kg	115.43	24.00	2770.32	2.72
		P	kg	57.96	44.00	2550.24	2.51
		K	kg	50.61	22.00	1113.42	1.09
	Subtotal					6433.98	6.33
7.	Irrigation charges	(Rs.)				2025.00	1.99
8.	Insecticide (Plant protection)	(Rs.)				10200.61	10.03
9.	Incidental charges	(Rs.)				77.25	0.08
10.	Repairing charges	(Rs.)				232.71	0.23
11.	Working capital (1 to 10)	(Rs.)				62802.21	61.76
12.	Int.on wor.Cap. @ 6% /annum	(Rs.)				1909.70	1.88
13.	Depreciation	(Rs.)				1070.06	1.05
14.	Land Rev. cess and other taxes	(Rs.)				187.71	0.18
15.	Cost "A1" (Items 11 to 14)					65969.68	64.88
16.	Rental Value Leased in land	(Rs.)				0.00	0.00
17.	Cost "A2" (Items 15 to 16)					65969.68	64.88
18.	Int. on Fix.Cap. @ 10%/annum	(Rs.)				1520.68	1.50
19.	Cost "B1" (Items 17 + 18)					67490.36	66.37
20.	Rental value of land	(Rs.)				29304.06	28.82
21.	Cost "B2" (Items 19 to 20)	(Rs.)				96794.42	95.19
22.	Family human labour	Male	Days	10.80	200.08	2160.86	2.13
		Female	Days	18.18	150.02	2727.44	2.68
	Subtotal					4888.30	4.81
23.	Cost " C1 " (Items 19+22)	(Rs.)				72378.67	71.18
24.	Cost " C2 " (Items 21+22)	(Rs.)				101682.73	100
25.	Yield per hectare	(Rs.)		173.70	1012.23	175824.35	
26.	Per qtl. cost of main produce at cost C3	(Rs.)				585.39	

respectively.

It is revealed from the Table 9 that per hectare cost of cultivation of tomato at overall level was Rs. 101804. 29/- It is also observed from the table that cost A_1 and cost A_2 are same among all the farm categories because none of the respondents was found cultivating lease in land. On and average Cost A_1, A_2 and Cost B_1, Cost B_2, Cost C_1 and cost C_2 was found Rs. 66140.71/-,66140.71/-, 67713.70/-,96889 .98/-,72628.01/-and 101804.29/-, respectively. The average yield of tomato crop was 173.42 q/ha.

It is seen from the Table 10 that per hectare production of tomato for small, medium and large farmer was 169.11, 173.70 and 177.45 q/ha, respectively. The gross returns from tomato was Rs. 1,62,904.00/-, Rs.1,75,824.04/- and Rs. 186819.04 /- for small medium

Table 8 : Per hectare cost of cultivation of tomato (Large farmers)

Sr. No.	Item	Unit/ha		Input	Cost / Input (Rs.)	Total cost	Percentage to total cost
1	2	3		4	5	6	
1.	Hired human labour	Male	Days	33.42	200.18	6690.02	6.31
		Female	Days	126.34	150.07	18959.84	17.87
	Subtotal					25649.86	24.17
2.	Bullock labour		(Pair days)	5.22	502.04	2620.65	2.47
3.	Machine charges		Hours	10.20	300.06	3060.61	2.88
4.	Seed		g	127.94	40.12	5132.95	4.84
5.	Manures		carts	25.89	514.96	13332.31	12.57
6.	Fertilizer	N	kg	92.46	24.00	2219.04	2.09
		P	kg	63.17	44.00	2779.48	2.62
		K	kg	53.42	22.00	1175.24	1.11
	Subtotal					6173.76	5.82
7.	Irrigation charges	(Rs.)				2533.33	2.39
8.	Insecticide (Plant Protection)	(Rs.)				8043.65	7.58
9.	Incidental charges	(Rs.)				85.20	0.08
10.	Repairing charges	(Rs.)				243.45	0.23
11.	Working capital (1 to 10)	(Rs.)				66875.78	63.03
12.	Int.on wor.Cap. @ 6% /annum	(Rs.)				2027.80	1.91
13.	Depreciation	(Rs.)				1058.13	1.00
14.	Land Rev. cess and other taxes	(Rs.)				175.18	0.17
15.	Cost "A1" (Items 11 to 14)					70136.89	66.10
16.	Rental value leased in land	(Rs.)				0.00	0.00
17.	Cost "A2" (Items 15 to 16)					70136.89	66.10
18.	Int. on Fix.Cap. @ 10%/annum	(Rs.)				2170.35	2.05
19.	Cost "B1" (Items 17 + 18)					72307.24	68.15
20.	Rental value of land	(Rs.)				31136.56	29.35
21.	Cost "B2" (Items 19 to 20)	(Rs.)				103443.80	97.49
22.	Family human labour	Male	Days	7.20	200.18	1441.30	1.36
		Female	Days	8.12	150.07	1218.57	1.15
	Subtotal					2659.86	2.51
23.	Cost " C1 " (Items 19+22)	(Rs.)				74967.10	70.65
24.	Cost " C2 " (Items 21+22)	(Rs.)				106103.66	100.00
25.	Yield per hectare	(Rs.)		177.45	1052.80	186819.36	
26.	Per qtl. cost of main produce at cost C3	(Rs.)				597.94	

and large group. The overall level gross returns was Rs. 175057.66/-. Whereas the cost of cultivation of these groups have been estimated to be Rs. 97,724.60/-, Rs.1,01,682.73/- and Rs. 1,06,103.66/-, respectively, The overall cost required for cultivation of tomato was Rs. 1,01,804.29/-. The per hectare net returns at cost C_2 obtained by the cultivator was Rs. 65,179.00/- , 74,141.62/- and 80,715.70/- for small, medium and large group of cultivator.

Efficiency of investment in the cultivation of tomato was judge by calculating input-output ratios. The input-output ratio at Cost C_2 for small, medium and large group of cultivator was 1.67 , 1.73 and 1.76, respectively. The overall ratio was 1.72. From this it can be conclude that

Table 9 : Per hectare cost of cultivation of tomato for overall farmers

Sr. No.	Item	Unit/ha		Input	Cost / Input (Rs.)	Total cost	Percentage
1	2	3		4	5	6	
1.	Hired human labour	Male	Days	28.74	200.09	5750.02	5.65
		Female	Days	114.23	149.74	17104.09	16.80
	Subtotal					22854.11	22.45
2.	Bullock labour		(Pair Days)	7.29	500.63	3648.93	3.58
3.	Machine charges		Hours	8.65	299.23	2589.33	2.54
4.	Seed		g	131.44	38.25	5023.06	4.93
5.	Manures		carts	19.59	511.66	10023.35	9.85
6.	Fertilizer	N	kg	108.16	24.00	2595.82	2.55
		P	kg	61.27	44.00	2695.86	2.65
		K	kg	53.12	22.00	1168.55	1.15
	Subtotal					6460.23	6.35
7.	Irrigation charges	(Rs.)				2152.78	2.11
8.	Insecticide (Plant Protection)	(Rs.)				9943.52	9.77
9.	Incidental charges	(Rs.)				71.02	0.07
10.	Repairing charges	(Rs.)				228.96	0.22
11.	Working capital (1 to 10)	(Rs.)				62995.29	61.88
12.	Int.on wor.Cap. @ 6% /annum	(Rs.)				1906.05	1.87
13.	Depreciation	(Rs.)				1056.32	1.04
14.	Land Rev. cess and other taxes	(Rs.)				183.05	0.18
15.	Cost "A1" (Items 11 to 14)					66140.71	64.97
16.	Rental value leased in land	(Rs.)				0.00	0.00
17.	Cost "A2" (Items 15 to 16)					66140.71	64.97
18.	Int. on Fix.Cap. @ 10%/annum	(Rs.)				1573.00	1.55
19.	Cost "B1" (Items 17 + 18)					67713.70	66.51
20.	Rental value of land	(Rs.)				29176.28	28.66
21.	Cost "B2" (Items 19 to 20)	(Rs.)				96889.98	95.17
22.	Family human labour	Male	Days	10.32	200.09	2064.30	2.03
		Female	Days	19.03	149.74	2850.02	2.80
	Subtotal					4914.31	4.83
23.	Cost " C1 " (Items 19+22)	(Rs.)				72628.01	71.34
24.	Cost " C2 " (Items 21+22)	(Rs.)				101804.29	100
25.	Yield per hectare	(Rs.)		173.42	1009.44	175057.66	
26.	Per qtl. cost of main produce at cost C3	(Rs.)				587.04	

Table 10 : Per hectare cost and returns of tomato **(Rs.)**

Sr. No.	Particulars	Small	Medium	Large	Overall
1.	Main produce (q/ha)	169.11	173.70	177.75	173.42
2.	Value of main produce	162904.00	175824.40	186819.40	175057.66
3.	Gross return	162904.00	175824.40	186819.40	175057.66
4.	**Cost of cultivation at**				
	Cost "A1"	62362.90	65969.68	70136.89	66140.71
	Cost "A2"	62362.90	65969.68	70136.89	66140.71
	Cost "B1"	63390.90	67490.36	72307.24	67713.70
	Cost "B2"	90541.50	96794.42	103443.80	96889.98
	Cost "C1"	70574.00	72378.67	74967.10	72628.01
	Cost "C2"	97724.60	101682.70	106103.70	101804.29
5.	**Return at**				
	Cost "A1"	100541.00	109854.70	116682.50	108916.95
	Cost "A2"	100541.00	109854.70	116682.50	108916.95
	Cost "B1"	99512.80	108334.00	114512.10	107343.96
	Cost "B2"	72362.20	79029.93	83375.56	78167.68
	Cost "C1"	92329.60	103445.70	111852.30	102429.65
	Cost "C2"	65179.00	74141.62	80715.70	73253.37
6.	**Output input ratio at**				
	Cost "A1"	2.61	2.67	2.66	2.65
	Cost "A2"	2.61	2.67	2.66	2.65
	Cost "B1"	2.57	2.61	2.58	2.59
	Cost "B2"	1.80	1.82	1.81	1.81
	Cost "C1"	2.31	2.43	2.49	2.41
	Cost "C2"	1.67	1.73	1.76	1.72

Table 11 : Post harvest losses in tomato at farm level (Small farmer)

Stages	losses q/ha	percent loss	losses kg/quintal	Economic loss
Harvesting				
Injury	2.16	14.19	1.36	2080.72
Immature	0.53	3.48	0.33	510.54
Over ripe	3.63	23.85	2.28	3496.77
Climate	0.47	3.09	0.30	452.75
Pest and disease	0.93	6.11	0.58	895.86
Rotting	2.05	13.47	1.29	1974.76
Sub total	9.77	64.19	6.14	9411.44
Grading and packing				
Sorting	1.87	12.29	1.18	1801.37
Packing	0.45	2.96	0.28	433.48
Sub total	2.32	15.24	1.46	2234.85
Transportation				
Handling	0.63	4.14	0.40	606.87
Poor packing	0.56	3.68	0.35	539.44
Loading and unloading	1.26	8.28	0.79	1213.75
Sub total	2.45	16.10	1.54	2360.08
Self marketing				
Over ripening	0.43	2.83	0.27	414.21
Other	0.25	1.64	0.16	240.82
Sub total	0.68	4.47	0.43	655.04
Total losses	15.22	100.00	9.57	14661.42

(Figures in parenthesis indicated per cent losses in total production)

cultivation of tomato was economically benefited.

From Table 11 it is observed that in small farmer total post harvest losses was estimated 15.22 q/ha *i.e.* 9.57 kq/ha. The maximum losses were observed in harvesting 9.77 q/ha fallowed by transportation 2.45 q/ha, grading and packing 2.32 q/ha and marketing 0.68 q/ha. The per hectare economic loss was Rs. 14661.42/-.

It is seen from the Table 12 that in case of medium size farmer the total post harvest losses was 16.74 q/ha, in which losses incurred by harvesting was maximum 10.45 q/ha. fallowed by transportation, grading and packing and markeitng *i.e.* 3.00, 2.38 and 0.91 q/ha, respectively. The per hectare respective corresponding economic losses were estimated to be Rs. 3036.69/-, Rs. 2409.10/- and Rs.921.12/-.The per hectare total economic losses was Rs.16,944.73/-.

It is revealed from the Table 13 that the total post harvest losses tomato for large farmers was observed to be 17.44 q/ha which causes the per hectare economic loss of Rs.18360.83./-.The maximum losses occurred during harvesting, transportation and grading and packing and marketing *i.e.*10.97, 3.17, 2.36 and 0.94 q/ha, respectively and the corresponding economic losses were. Rs.11549.21/-, Rs.3337.38/-.Rs. 2484.61/- and Rs. 989.63/-, respectively.

Table 14 presents that the overall scenario of post-harvest losses at different stages was workout to be 16.49 q/ha and the per hectare corresponding monetary losses was Rs.16471.20/-.The maximum losses registered at the harvesting (10.42 q/ha) fallowed by transportation (2.88 q/ha) grading and packing (2.35q/ha) and marketing (0.84 q/ha).

Post-harvest losses in tomato at wholesaler and retailer level:

The Table 15 revealed that the total post-harvest losses at wholesaler level was 7.54 kg/q where as 11.41

Table 12 : Post harvest losses in tomato at farm level for medium farmer

Stages	Losses q/ha	Per cent loss	Losses kg/quintal	Economic loss
Harvesting				
Injury	1.93	8.11	1.12	1953.60
Immature	0.53	1.99	0.31	536.48
Over ripe	4.74	13.63	2.74	4797.97
Climate	0.46	1.76	0.27	465.62
Pest and disease	0.94	3.49	0.54	951.49
Rotting	1.85	7.70	1.07	1872.62
Sub total	10.45	36.68	6.05	10577.80
Grading and packing				
Sorting	1.9	7.02	1.10	1923.2
Packing	0.48	1.69	0.28	485.87
Sub total	2.38	8.71	1.38	2409.10
Transportation				
Handling	0.72	2.37	0.42	728.80
Poor packing	0.59	2.10	0.34	597.21
Loading and unloading	1.69	4.73	0.98	1710.66
Sub total	3.00	9.20	1.74	3036.69
Self marketing				
Over ripening	0.65	1.61	0.38	657.94
Other	0.26	0.94	0.15	263.17
Sub total	0.91	2.55	0.53	921.12
Total losses	16.74	100.00	9.69	16944.73

(Figures in parenthesis indicated per cent losses in total production)

Table 13 : Post harvest losses in tomato at farm level for large farmer

Stages	losses q/ha	Per cent loss	losses kg/quintal	Economic loss
Harvesting				
Injury	2.17	6.40	1.28	2284.58
Immature	0.54	1.76	0.32	568.51
Over ripe	4.95	15.73	2.93	5211.36
Climate	0.41	1.53	0.24	431.65
Pest and disease	0.99	3.12	0.59	1042.27
Rotting	1.91	6.14	1.13	2010.85
Sub total	10.97	34.67	6.49	11549.22
Grading and packing				
Sorting	1.9	6.30	1.12	2000.32
Packing	0.46	1.59	0.27	484.29
Sub total	2.36	7.90	1.40	2484.61
Transportation				
Handling	0.78	2.39	0.46	821.18
Poor packing	0.64	1.96	0.38	673.79
Loading and unloading	1.75	5.61	1.04	1842.40
Sub total	3.17	9.95	1.88	3337.38
Self marketing				
Over ripening	0.69	2.16	0.41	726.43
Other	0.25	0.86	0.15	263.20
Sub total	0.94	3.02	0.56	989.63
Total	17.44	100.00	10.32	18360.83

(Figures in parenthesis indicated per cent losses in total production)

Table 14 : Post harvest losses in tomato at farm level for overall farmer

Stages	Losses q/ha	Per cent loss	Losses kg/quintal	Economic loss
Harvesting				
Injury	2.09	7.79	1.27	2109.73
Immature	0.53	1.94	0.32	535.00
Over ripe	4.46	17.76	2.70	4502.10
Climate	0.45	1.47	0.27	454.25
Pest and disease	0.95	3.55	0.58	958.97
Rotting	1.94	6.85	1.18	1958.31
Sub total	10.42	39.36	6.32	10518.36
Grading and packing				
Sorting	1.89	6.82	1.15	1907.84
Packing	0.46	1.65	0.28	464.34
Sub total	2.35	8.47	1.42	2372.18
Transportation				
Handling	0.71	2.80	0.43	716.70
Poor packing	0.6	2.30	0.36	605.66
Loading and unloading	1.57	6.28	0.95	1584.82
Sub total	2.88	11.38	1.75	2907.19
Self marketing				
Over ripening	0.59	2.48	0.36	595.57
Other	0.25	0.90	0.15	252.36
Sub total	0.84	3.37	0.51	847.93
Total losses	16.49	62.58	9.99	16645.67

(Figures in parenthesis indicated per cent losses in total production)

Table 15 : Post-harvest losses in tomato at market level **(kg/q)**

Sr. No.	Losses at wholesaler level	Physical losses	Economic losses
	Loading - unloading	1.83	30.66
1.	Sorting and grading	0.53	8.82
2.	Packaging	0.75	12.58
3.	Storage	1.24	20.82
4.	Transportation	3.20	53.71
5.	Sub total	7.54	126.59
	Losses at retailer level		
	Loading - unloading	1.08	16.89
1.	Transportation	1.38	23.24
2.	Sorting and grading	1.41	8.78
3.	Sub total	3.87	82.43
	Total losses	11.41	209.02

* The per season total quantity of produce handle by wholesaler and retailer was 460 and 125 quintals.

kg/q at retailer level. The economic loss to the wholesaler and retailer was Rs. 126.59/- and 82.43 per quintal. Similar work related to the present investigation was also carried out by Ali (1983); Basavaraja *et al*. (2007); Maini *et al.* (2017) and Narain and Khosla (1983).

Conclusion:

The per hectare cost of cultivation of tomato was Rs.1,01,804.29/- and where of the net return was Rs.73,253.37. The input output ratio at cost C_2 in production of tomato is 1.7. The per hectare post-harvest losses at the farm level was estimated to be 16.49 quintal in tomato. The corresponding economic loss was 16471.20 Rs./ha. At wholesaler and retailer level the post harvest losses in tomato was 11.41 kg/q. Major constraints in post harvest management of tomato was inadequate storage facilities recorded by 93.12 per cent respondent. Shortage of labour and lack of knowledge about post harvest technology, which was experienced by 82 and 93 per cent.

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