

Adoption of Post-Harvest Management Practices by Vegetable Growers in Haryana State

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ABSTRACT

Vegetables are not only commercially important and nutritionally essential food commodities due to major dietary source of vitamins, sugars, organic acids, and minerals, and also other phytochemicals including dietary fiber and antioxidants with health-beneficial effect. It has created high demand for fresh vegetables but major challenge in meeting this high demand for fresh vegetables is postharvest losses which account about 30.00 per cent in India. A vast quantity of vegetables is destroying every year due to farmers' lack of knowledge about post harvest technologies. To meet the domestic as well as the export demands of vegetables it is essential to integrate the various technologies from production to post-harvest. The study revealed that majority of the respondents (51.7%) belonged to 'moderate' category of awareness pertaining to PHM practices. They were aware of the practices such as vegetable fruit should not be thrown but put carefully, it is better to harvest vegetables at coolest part of the day, cleaning and sorting is necessary for high shelf life, grading is necessary for getting high market price whereas less aware of PHM practices such as sorting of thick necked onion bulbs, vegetable fruit not to be pulled but clipped with sharp knife or secateurs, accurate extent of post harvest losses and curing of vegetables to enhance the shelf life since. The proper cleaning or washing before marketing, sorting & grading of vegetables, safe loading, transportation and safe unloading post harvest management practices were regularly adopted by the farmers while cooling & curing of vegetables were occasionally adopted by respondents clearly indicates no storage and processing of produce, essential for better earnings through value addition coupled with increasing food availability and nutritional security of the country. Lack of remunerative minimum support price policy, lower price of vegetables and high cost of inputs especially the hybrid seeds followed by price fluctuation, distress sale due to lower price at time of harvesting, perishable nature of vegetables and decrease in production due to natural calamities were found serious constraints by almost all respondents.

Key words: Post harvest management, awareness, adoption, post harvest losses and constraints

INTRODUCTION

The Government of India in the mid-1980s felt need for diversification to horticulture sector by focusing its attention on investment in this sector. Presently horticulture has well-established its credibility in improving income through increased productivity, generating employment and in enhancing exports. Resultantly, horticulture has moved to a commercial venture. India has over 10 per cent share of global fruits and vegetable in both production and export but hardly 2 per cent of the production is being processed. Indeed, India is next only to China in area and total production of vegetables with an average productivity of 17.3 tonnes / ha (NHB, 2014-15). The leading states contributing to the total vegetables production of the country are West Bengal (14 %) followed by Uttar Pradesh (12 %), Bihar (9 %), Madhya Pradesh (8 %), Gujarat (7 %), Maharashtra (6 %), Andhra Pradesh (5 %), etc. Vegetables are typically

grown in India in field conditions; the concept is opposed to the cultivation of vegetables in green houses as practiced in developed countries for high yields. Vegetables are considered as commercially important and nutritionally essential food commodities due to their provision of the major dietary source of vitamins, sugars, organic acids, and minerals, and also other phytochemicals including dietary fiber and antioxidants with health-beneficial effects (Chun-Ta, 2010). There is however an increasing demand for fresh produce at consumer level, because of the raising awareness among people about the superiority of fresh, natural foods than processed products resulting in the active encouragement by health agencies and public media as well as several medical researches demonstrating various health benefits of fresh produce consumption (Wills *et al.*, 2007). One of the major challenges in meeting this high demand for fresh vegetables is postharvest losses. Harvested fresh vegetables are living, characterized by high moisture

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content, active metabolism, and tender texture; as a consequence, significant losses resulting in senescence, desiccation, physiological disorders, mechanical injuries, and microbial spoilage occur at any point from harvest through the food value chain (Chun-Ta, 2010). Due to this nature, fresh vegetables are considered as highly perishable. Post harvest physiology of fruits and vegetables has in recent times become an important issue of discussion at national and international level. The increased attention afforded post harvest horticulture has mainly been due to the realization that faulty handling practices after harvest can cause large losses of produce (Wills *et al.*, 2007). Minimizing post harvest losses of produce that was produced through an investment of substantial labour, materials and capital to grow, is a very effective way to increase food availability without further boosting crop production (Wills *et al.*, 2007). Reduction of postharvest losses increases food availability to the growing human population, decreases the area needed for production, and conserves natural resources (Kader, 2005). Post harvest losses can occur at any stage in the production and marketing chain. It is estimated that these losses, due to inadequate post harvest handling, transportation and storage in fruits and vegetables is relatively higher, 20-50 per cent in developing countries when compared to 5-25 per cent in developed countries (Kader, 2005)”

In India, post-harvest loss is estimated 30 per cent. The post-production losses are enormous in horticultural crops due to their highly perishable nature. The various factors, which are accountable for the post-harvest losses, are mainly: environmental (temperature, moisture, mechanical damage during harvesting and handling), improper post-harvest sanitation, poor cooling and environmental control. According to Reddy and Turkey 2004, poor farm management and manual harvesting practices also contribute losses to the vegetables production in India. Lack of technology and finance were found to be important constraints in adoption of technologies. This happens due to shortage of cold stores and processing facilities in production catchments which may be minimized by adoption of improved production and processing technologies. There is wide gap between agricultural technologies produced in research institutions and adoption of such technologies by small scale farmers and rural households. Meena *et al.* (2009) noticed that technical intervention through training programmes increase the knowledge level of small-scale farmers in food processing and preservation aspects. Nain *et al.*, 2013 suggested dissemination of information regarding income and employment opportunities in horticulture and related issues at a pre-college age through the use of the high school agriculture classroom

whereas Chahal *et al.* 2014 advocated participatory methods like learning by doing farm practices in conditions closely resembling their farming situations for transfer of horticultural technologies.

In Haryana the total area under horticultural crops was 4.90 lakhs hectare in the year 2015-16 which constitute 7.58 per cent of cropped area. The area under vegetables is 4.11 lakhs hectare which is around 8.3 per cent of the total area under horticulture. A vast quantity of vegetables is destroying every year because of lack of knowledge about post harvest technologies. Vegetable highly perishable in nature and it require management from sowing to harvesting as well as post harvesting. So farmers can enhance their income through value addition in vegetables which comprises the process of cleaning, washing, sorting, grading, packaging, marketing and processing of vegetable products. Value addition starts from the field and end the consumer.

Farmers are eager to earn more money from per unit in present era of global and liberal agriculture. So adoption of modern post harvest practices is necessary since these are complementary and supplementary in augmentation of production along with quality of produce to fetch higher prices. Haryana state being near to the national capital has better marketing opportunities of value added products from fruits and vegetables. In order to meet the domestic and export demands of vegetables it is essential to integrate the various technologies from production to post-harvest. The study aims to present the socio economic characteristics as well as awareness level and adoption of post-harvest management practices by vegetables growers and the constraint faced thereof.

METHODOLOGY

The study was carried out in the purposively selected Haryana state falling in Trans Gangetic Plain region of the country (known as the food bowl of the country). Primary data on vegetable growers' adoption status of post harvest management practices was collected by applying purposive and systematic random sampling procedures for selection of respondents. Karnal and Sonipat districts were selected purposively being in the national capital region along with highest area under vegetables cultivation in the state. The blocks Indri and Gharaunda from Karnal and Murthal and Rai from Sonipat district were randomly selected. The vegetables growing villages viz. Samoura and Kheri Man Singh from Indri block, Uchan Sammana and Daha from Gharunda block, Tikola and Jainpur from Murthal block and Manoli and Aterna from Rai block were selected. Finally, 15 vegetable

growers were randomly selected from each village thus total 120 respondents' data complete in all respect was considered for analysis and reporting. The data were collected with the help of well structured and pretested interview schedule comprising the items for assessment of awareness and adoption of post harvest management practices. The constraints have been studied under the major heads environmental, technical, labour related, economical and marketing aspects. The statistical measures like frequency, percentage, mean, standard deviation, correlation and regression analysis were used to analyze the data to draw tangible inferences.

RESULTS AND DISCUSSION

The results along with relevant discussion have been presented in prime heads as demographic socio-economic attributes, awareness level, adoption status and constraints faced by vegetable farmers in adoption of post harvest management technologies of vegetables.

Socio economic characteristics of vegetable growers

The characteristics of vegetable growers which were assumed to be associated with the knowledge and adoption of postharvest management practices of vegetables were included in this study and presented in Table 1.

**Table 1: Socio-personal profile of the respondent vegetable growers
n=120**

Variable	Category	Frequency	Percentage
Experience in vegetables cultivation	05-10 years	23	19.2
	11-20 year	45	37.5
	> 20 years	52	43.3
Age	Young (20-35 years)	27	22.5
	Middle (36-50 years)	59	49.2
	Old (51years and above)	34	28.3
Education	Illiterate	04	3.3
	Primary school	07	5.8
	Middle school	19	15.8
	High school	22	18.3
	Higher secondary	17	14.2
	Graduation	42	35.0
Family type	Post graduation	09	7.5
	Nuclear	73	60.8
	Joint	47	39.2
Family size	4-6 members	69	57.5
	7-9 members	33	27.5
	> 9 members	18	15.0
Land holding (including leased in)	Small farmers (up to 5 acres)	24	20.0
	Semi medium farmers (6-10 acres)	50	41.7
	Medium farmers (11-15 acres)	28	23.3
	Big farmers (16 acres and above)	18	15.0
Major Occupation	Agriculture	95	79.2
	Subsidiary	25	20.8
Source of irrigation	Tube well	107	89.2
	Canal	12	10.0
	Both tube well and canal	01	0.8

Farm mechanization	No draft animal	29	24.2	
	1-2 draft animal	04	3.3	
	Chaff cutter	11	9.2	
	Tractor/ mini tractor	20	16.7	
	Power sprayer/ seed drills	02	1.7	
	Laser leveler	07	5.8	
	Straw reaper	01	0.8	
	Combine	02	1.7	
	Planters/diggers	44	36.7	
	Trainings received on vegetables cultivation	Yes	31	25.8
Innovativeness	No	89	74.2	
	Low	12	10.0	
	Medium	45	37.5	
Economic motivation (Mean=29.42 SD=2.94)	High	63	52.5	
	Low (24-27)	29	24.2	
	Medium (28-30)	46	38.3	
Information sources use pattern	High (31& above)	45	37.5	
	Institutional information sources	Low (5-6)	21	17.5
		Medium(7-10)	52	43.3
		High (11-20)	47	39.2
	Non institutional sources	Mean=9.75		SD=4.11
		Low (11-17)	17	14.2
		Medium (18-23)	73	59.1
		High (24 &above)	32	26.7
	Media sources	Mean=22.12		SD=4.35
		Low (12-17)	25	20.8
Medium (18-25)		37	30.9	
High (26 &above)		58	48.3	
Total	Mean=24.31		SD=6.71	
	Low (32-44)	23	19.2	
	Medium (45-57)	44	36.6	
	High (58 & above)	53	44.2	
	Mean=56.18		SD=12.55	

Perusal of Table 1 shows that majority of respondents used to grow vegetables for more than 20 years followed by 11-20 years and up to 10 years of experience in vegetable cultivation. In nut shell vast majority (80.00 %) had wide experience of vegetable cultivation being their parental occupation. Similarly approximately 50.00 per cent of respondents belonged to middle age category. In case of educational qualification of respondents, about 58.00 per cent had qualification up to higher secondary followed by graduation (35.00%) and post graduation only 7.5 percent. The majority of respondents had nuclear family and 4-6 family members. The vast majority (85.00 %) of respondents belonged to small and medium farmers' category after including the leased in land and only 15.00 percent of farmers had more than 16 acres of land holding. Especially in Karnal district the vegetable growers were using rented (leased in) farms for cultivation @ ₹ 45000-50000/acre for 6-8 months which implies that the vegetable farming is a profitable enterprise in the region. Agriculture was main occupation of about 80.00 per cent respondents and rests of the farmers were doing subsidiary occupation like business & service.

Tube well was the main source of irrigation of about 90.00 per cent farmers whereas only 36.00 per cent were having high farm mechanization. The vast majority (90.00 %) belonged to moderate to high innovativeness category. Huge majority of respondents (75.8 %) had

moderate to high economic motivation. Vast majority of the respondents (82.5%) made medium to high use of institutional sources for getting information which are credible as well as responsible for generating and disseminating farm information. About 86.00 per cent of farmers made moderate to high use of non institutional sources like progressive farmers, friends, other farmers as well as input dealers etc. and majority (80.8 %) had used moderately to higher extent the media sources. In nut shell it can be concluded that non-institutional sources *i.e.* personal localite communication sources were highly utilized by the vegetable growers for information. Similar results were reported by earlier studies of Bhagat *et al* (2004), Nain *et al* (2015) and Ravi kumar *et al* (2015). As such there is dire need of concerted efforts by institutional sources like SAUs, research institutes working on post harvest management and value addition & processing of fruits and vegetables and extension organizations to vividly highlight economics at farmers' field for large scale adoption of PHM practices by farmers.

Vegetable growers' awareness pertaining to post harvest management practices: It was measured with help of rating scale specially constructed consisting of various technological recommendations by CCSHAU, Hisar and PAU, Ludhiana.

Table 2: Vegetable growers' awareness pertaining to post harvest management practices

Aspects	Frequency	Percentage
Extent of post harvest losses in vegetables (25-40 %)	63	52.5
Vegetable fruit should not be pulled but clipped with sharp knife or secateurs	50	41.7
Vegetable fruit should not be picked/ harvested when dew is settled on fruits	98	81.7
Vegetable fruit should not be picked/harvested during rain	113	94.2
Quality deteriorate if harvested vegetables kept in sun or rain	109	90.8
Vegetable fruit should not be thrown but put carefully	120	100
Harvested vegetable fruit should not be heaped but spread evenly	94	78.3
Harvested vegetables should be kept in shade for cooling	119	99.2
It is better to harvest vegetables at coolest part of the day <i>i.e.</i> early morning or evening	120	100
Proper harvesting indices of vegetables grown	115	95.8
Over mature vegetables are not fit for eating & health	117	97.5
Sorting of thick necked onion bulbs	35	29.2
Better to apply insecticide/pesticide 7-10 days before harvesting	53	44.2
Excessive use of nitrogenous fertilizers reduce the shelf life	86	71.7
Optimum dose of potash, calcium, zinc improve shelf life	110	91.7
The irrigation should be stopped 15-20 days before the harvesting to enhance the shelf life	108	90.0
Cleaning and sorting is necessary for high shelf life	120	100
Grading is necessary for getting high market price	120	100
Loss can be minimized by using lining material	99	82.5
Proper and modern packing material use in transportation	94	78.3

Better to transport two or more vegetables together to minimize transportation cost	116	96.7
Proper storage method and facilities enhance the shelf life	114	95.0
Curing of vegetables (onion and potato) enhance the shelf life	67	55.8
Garlic bulb should be stored in bunching of 4-5 kg.	76	63.3

Data pertaining to awareness of post harvest management practices presented in Table 3 depicts that cent per cent respondent farmers were aware of the aspects such as vegetable fruit should not be thrown but put carefully, it is better to harvest vegetables at coolest part of the day *i.e.* early morning or evening, cleaning and sorting is necessary for high shelf life, grading is necessary for getting high market price followed by harvested vegetable should be kept in shade for cooling (99.2%), over mature vegetables are not fit for eating & health (97.5%), better to transport two or more vegetables together to minimize transportation cost (96.7%), proper harvesting indices of vegetables grown (95.8%), proper storage method and facilities enhance the shelf life (95.0%) and vegetable fruit should not be picked/harvested during rain (94.2%) whereas they were less aware or not aware of aspects such as sorting of thick necked onion bulbs (29.2%), vegetable fruit should not be pulled but clipped with sharp knife or secateurs (41.7%), extent of post harvest losses in vegetables (52.5%) and curing of vegetables (onion and potato) enhance the shelf life (55.8%). As such it can be inferred that the majority was well aware regarding the post-harvest management practices of vegetables.

Table 3: Distribution of vegetable growers based on their level of awareness of post harvest management practices

n=120					
Category	Score range	Frequency	Percentage	Mean	Standard deviation
Low	Up to 16	15	12.5		
Medium	17-20	62	51.7	19.30	2.49
High	21-24	43	35.8		

Distribution of respondents based on their level of awareness of post harvest management practices in Table 3 shows that majority of the respondents (51.7%) belonged to 'moderate' category followed by 35.8 per cent and 12.5 per cent in high and low categories of adoption of post harvest management practices, respectively. Thus it implies that majority of vegetable growers might have not been fully exposed to the post harvest management practices since 51.7 per cent of vegetable growers belonged to moderate category. The findings are in agreement with the results reported by Nain and Bhagat (2005), Ravikumar *et al.*, (2010), Nain and Chandel (2013) and Azad (2013) whereas majority of respondents had medium level of knowledge regarding horticultural aspects. The knowledge is prerequisite to make full use of any technology hence more sincere

concerted efforts by research, extension and training organizations are required to enhance the farmers' technical knowledge to make efficient and best use of these practices to reduce the post harvest losses and income enhancement of vegetable growers.

Vegetable growers' adoption level of post harvest management practices

The adoption level was measured using a scale developed consisting of PHM technologies with four response categories *i.e.* regularly, occasionally, rarely and not at all.

Table 4: Vegetable growers' adoption level of post harvest management practices

Post harvest management practices	Extent of Adoption				TWS WMS		Rank Order
	Regularly (4)	Occasionally (3)	Rarely (2)	Not at all (1)			
Harvesting of vegetables according to proper maturity indices	80 (66.7)	40 (33.3)	-	-	440	3.67	IV
Collection of vegetables from the field on time	109 (90.8)	11 (9.2)	-	-	469	3.91	III
Keeping the harvested produce in shady place	113 (94.2)	07 (5.8)	-	-	473	3.94	II
Proper cleaning or washing before marketing	120 (100)	-	-	-	480	4.00	I
Sorting of vegetables	120 (100)	-	-	-	480	4.00	I
Grading of vegetables	120 (100)	-	-	-	480	4.00	I
Cooling of vegetables	82 (68.3)	06 (5.0)	04 (3.3)	28 (23.3)	382	3.18	V
Curing of vegetables	35 (29.2)	45 (37.5)	12 (10)	28 (23.3)	332	2.77	VII
Use of modern packing material	79 (65.8)	10 (8.3)	05 (4.2)	26 (21.7)	382	3.18	V
Use of lining material	74 (61.7)	09 (7.5)	02 (1.7)	35 (29.2)	362	3.01	VI
Safe loading	120 (100)	-	-	-	480	4.00	I
Safe transportation	120 (100)	-	-	-	480	4.00	I
Safe unloading	120 (100)	-	-	-	480	4.00	I

Figures in parenthesis shows respective percentages

Perusal of Table 4 depicts that proper cleaning or washing before marketing, sorting & grading of vegetables, safe loading, transportation and safe unloading post harvest management practices were regularly adopted by the farmers (Rank 1st). The possible reason could be realization of importance of these practices to fetch better price besides being routine practices due to vegetable cultivation as parental occupation of majority of respondents. Keeping the harvested produce in shady place, collection of vegetable from the field on time, harvesting of vegetables according to proper maturity indices, use of modern packing material, cooling, lining material and curing of vegetables, were occasionally adopted by the vegetable

growers and ranked in respective order. The reason might be most of the respondents used to sell their produce at the farm gate itself through the contact of their FIGs with marketers. The low rank given to cooling & curing of vegetables clearly indicates no storage of produce. It implies that large numbers of respondents were not storing & processing the produce which is most urgent for better earnings through value addition coupled with increasing food availability and nutritional security of the country. Similar findings were reported by Kader (2005) and Azad (2013).

Table 5: Extent of adoption of post harvest management practices by vegetable growers

n= 120					
Category	Score range	Frequency	Percentage	Mean	Standard deviation
Low	Up to 43	26	21.7		
Moderate	44-48	27	22.5	47.51	4.35
High	49-52	67	55.8		

Distribution of respondents based on their level of adoption of post harvest management practices shown in Table 5 depicts that majority of the respondents (55.8%) belonged to 'high' category followed by 22.5 per cent and 21.7 per cent in medium and low categories of adoption of post harvest management practices, respectively. Thus it implies that majority of vegetable growers adopted the post-harvest management practices to high extent since 55.8 per cent of vegetable growers belonged to this categories. This might be due to reason that most of the farmers had organized into FIGs based on crops grown and also in contact with marketing agencies. Although this is an encouraging trend, since then the sincere efforts are still required to promote large scale adoption of these practices to enhance the income and sustainability of vegetable farming essential for nutritional security. The findings are in conformity with the results reported by Azad (2013).

Constraints faced in adoption of post harvest management practices of vegetables

All the constraints were rated on seriousness in 'Yes' and 'No' response categories and the results are presented in Table 6 which explicit that among environmental constraints almost all the respondent farmers opined decrease in production due to natural calamities and highly fluctuating weather conditions as serious constraint in adoption of post-harvest management practices. In case of technical constraints they faced hindrances such as lack of storage and processing facility at village, lack of suitable hybrid varieties by public sector and lack of guidance by extension staff about modern technology. High cost of labour was also perceived as

serious constraint by 60.00 percent of respondents. Lack of remunerative MSP policy, lower price of vegetables, high cost of inputs especially the hybrid seeds and poor crop insurance coverage were the major economic constraints faced by them whereas, price fluctuation, distress sale due to lower price at time of harvesting and perishable nature of vegetables were the major serious constraints in marketing of vegetables by farmers. Among the constraints, economic constraints were found more serious followed by marketing constraints and environmental aspects related constraints by the respondent farmers.

Table 6: Constraints faced by vegetable growers in adoption of post-harvest practices

n= 120

Aspects	Frequency	Percentage
Environmental		76.95
Highly fluctuating weather conditions	117	97.50
Decrease in production due to natural calamities	119	99.17
Poor drainage	41	34.17
Technical		57.92
Lack of guidance by extension staff about modern technology	83	69.17
Lack of storage and processing facility at village	112	93.33
Lack of quality agro-chemicals required at village level	68	56.67
Lack of suitable hybrid varieties by public sector	103	85.83
Difficulties in following the recommended practices	14	11.67
Lack of diagnostic skill of insect- pests	37	30.83
Labour		31.94
Non-availability of labour during harvesting period	20	16.67
High cost of labour	73	60.83
Lack of skilled labour	22	18.33
Economic		95.83
High cost of inputs especially the hybrid seeds	113	94.17
Lower price of vegetables	120	100.00
Poor crop insurance coverage	107	89.17
Lack of remunerative MSP policy	120	100.00
Marketing		81.53
High cost of transportation	73	60.83
Price fluctuation	120	100.00
Distress sale due to lower price at time of harvesting	120	100.00
Lack of marketing facilities at local place	89	74.17
Middle man malpractices	65	54.17
Perishable nature of vegetables	120	100.00

CONCLUSION

The study revealed that majority of respondent farmers adopted the post harvest management practices of vegetable cultivation moderate to high extent. The practices such as proper cleaning or washing before marketing, sorting and grading of vegetables, safe loading, transportation and unloading were regularly adopted by the farmers whereas, keeping the harvested produce in shady place, collection of vegetable from the field on time, harvesting of vegetables according to proper maturity indices, curing and cooling of vegetables and use of modern packing material were occasionally

adopted by the respondent farmers. Lack of remunerative MSP policy, lower price of vegetables, price fluctuation, distress sale due to lower price at time of harvesting, perishable nature of vegetables and high cost of inputs especially the hybrid seeds were the major serious constraints faced by respondent vegetable farmers. The extension strategy for scale up the adoption of PHM practices needs to be framed on the basis of the findings. Concerted efforts are required to make farmers aware of PHM practices through knowledge building activities like meetings, discussions, mass media etc. by Department of Horticulture as well as State Agricultural Universities. Economic benefits of PHM practices need to be vividly highlighted to convince farmers to adopt PHM technologies. There is dire need to frame pro-farmer policies by the government especially minimum support prices for fruits and vegetables along with proper implementation of procurement of produce. Supply of hybrid seeds of vegetables by public sector organizations to the farmers at reasonable price and establishment of cold storage and fruit and vegetables processing units at village level may boost the post-harvest management practices. In addition promotion of eco-friendly low cost technologies of PHM is requirement to enhance income and sustainability of vegetable farming to ensure nutritional security to burgeoning population of the country.

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