Azarian Journal of Agriculture

Azarian J. Agric. VOL (8) ISSUE 3, 2021: 84-91

http://dx.doi.org/10.52547/azarinj.056

www.azarianjournals.ir

Azarian Journals

Research article **ISSN:2383-4420**

Factors Affecting the Adoption of Proper Postharvest Activities of the Vegetables in Highway Corridor of Nepal

Sandhya Rijal[1], Milan Subedi[2*], Yam Bahadur Thapa[1], Rishi Ram Kattel[1], Raj Kumar Adhikari[3]

Article Info

Accepted:
6 Apr. 2022

Keywords:
Adoption, Economic loss, Postharvest

ABSTRACT

A study carried in 2019, assesses the sociodemographic characteristics of vegetable growers, their knowledge on proper postharvest practices, factors affecting the adoption of proper postharvest activities, and their economic calculation of significant vegetable growers of Nepal. The study sites included Hetauda, Khairahani, Bharatpur, and Kawasoti, municipality of Nepal which were purposively selected based on area coverage, production, number of growers, and commercialization scale. A total of 172 vegetable-producing households were sampled using a simple random sampling technique. Descriptive statistics, economic analysis, and Logit model were used for data analysis. Harvesting was mainly carried by hand whereas, very few people used a knife for cauliflower and cabbage. Damaged vegetables were discarded for grading in most of the vegetables. In the case of tomatoes, grading was done based on color and size. Few farmers used calcium zinc and potash to increase the shelf-life of vegetables. Logit econometric model revealed that education, ethnicity, demand information, household type, training on activities, and land area for vegetables significantly determined the adoption of proper postharvest activities. The total postharvest loss of $ 2382.67 occur on average in a season. Since this study is at the introductory level, the adoption level of farmers was based on their prior knowledge; thus, further educational aspects (knowledge, attitude, skill, and aspiration) on proper postharvest activities by the related project can help farmers and traders to minimize the postharvest losses.

INTRODUCTION

Agriculture is the most crucial sector in the Nepalese economy, which engages two-thirds of the total population. The horticulture sector contributes nearly 29.6% to the AGDP, and the vegetable sector contributes 9.71%. In the fiscal year 2017/2018, the total cultivated area under vegetable crops was 286864 ha, total production of 3.9 million MT, and average productivity of 13.79 MT/ha (AICC 2019). Despite the massive production, a significant share of produce does not reach the consumer because of the postharvest loss in vegetables (Mollah et al. 2018) ranging from 30%-40% (Barua et al. 2017; FAO, 2018) and sometimes above 50% in developing countries (Tadesse et al. 2018). Postharvest losses are defined as the qualitative and quantitative decrease in the value of products that occurs at any point in a postharvest chain, such as the different activities taking place from the initial harvest of the produce to the consumption by final consumers (Udas et al. 2005; Aulakh and Regmi 2013; Tadesse et al., 2018). A considerable amount of the vegetables is damaged at the farm gate because of the harvesting injuries (Devkota et al. 2014). Such losses increase to 30% when reaching retailers and more than 50% when it moves to consumers (Kiaya 2014). In developed countries, the postharvest loss is less because of the efficient and careful use of advanced postharvest management techniques that are affordable (Kader 2009). Postharvest management techniques incorporate different practices like harvesting, handling, cooling, cleaning, washing, packaging, selection, grading, disinfection, drying, controlling the temperature and relative humidity, and applying additional treatments like fungicides (Devkota et al.

1. Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan [2]= Rampur Campus, IAAS, Tribhuvan University, Chitwan,
2. Value Chain Development Project, UNDP-MOALD, Hariharbhawan
* E-mail: milan.subedi@rc.tu.edu.np

2014; Gautam et al. 2017). It is essential that controlling the postharvest loss not only provides the consumer with healthy and undamaged food produce (Weinberger et al. 2008**)** but also decrease the gap between the farm gate price and the retailer price, hence, adding to the revenue of the agriculture and trading sectors (Raghuvanshi et al. 2018). Postharvest management focuses on quality maintenance and not improvement (Bachmann & Earles, 2000). Contrary to the developed countries where the investment in high-tech postharvest management operation gives profitable results, the developing countries are characterized by small landholders. Those expensive vegetable supply chains will not give any additional benefits (Faqeerzada et al. 2018).

Thus, to identify the practical technology, it is essential to consider each actor's knowledge and attitude to adopt the given technology (Ghanghas et al. 2017) because knowledge and attitudes are the vital constituent of human behavior and are required for any action to be taken (Kitinoja and Gorny 1999). In addition, factors that affect technology adoption also need to be identified. The farmers' social and psychological factors also affect the adoption of postharvest loss control technologies beyond the knowledge delivery system (Jabil and Abdul 2012). Similarly, the economic benefit that could be achieved from the adoption of postharvest control measures, if visualized by the farmers and other related actors, their adoption could be increased. Given the above considerations, there is a need for intensive study of the postharvest losses in the vegetable supply chains at the present stage of development in Nepal (Ajzen 1991; Affogon et al. 2015). Therefore, there is an urgent need of the researchers, actors, and policymakers to come together to identify the existing knowledge and practices, calculate and compare the economic loss and benefit and develop the appropriate and affordable technology for vegetable losses in the supply chain through the coordinated efforts of all the stakeholders. Hence, this study aims to answer the following questions.

a) What are the postharvest practices followed by the farmers in the case of vegetables?

b) What are the factors affecting the adoption of postharvest practices among farmers?

c) How much loss is incurred due to the postharvest loss among the farmers?

MATERIALS AND METHODS

Selection of the study area: Hetauda Dumkibas road corridor, which lies in the central south of Nepal, was selected for the study. Popularly known as a vegetable production area characterized by the suitable agro-climatic zone, it includes different local governments as Hetauda, Manahari, Rapti, Khairahani, Ratnanagar, Bharatpur, Gaidakot, Kawasoti, and Madhyabindu. Hetauda, Narayangarh, and Kawasoti are the well-developed vegetable market center located within the corridor.

Sample and Sampling Techniques: For data collection, purposive and simple random sampling was done. A list of vegetable growers of the study area was prepared with the help of the agriculture office, municipality, cooperatives, and key informants of each location. The list comprised 1423 vegetable growers in the study site distributed to different local governments presented below. These farmers constituted the study population, from which 172 farmers were selected using the following formula (Sivakumar et al. 2017).

$$n=\frac{t_{\alpha}^{2}*p*q*N}{(N-1)*e^{2}+t_{\alpha}^{2}*p*q}$$

Where n= Sample size to be estimated, t_{α}= value of the normal curve associated to the confidence level (1.96), p= expected percentage of population having a particular attribute (0.15), q= 1-p (0.85), e= accepted margin of error (0.05), N= Population size (1423)

These sample farmers were selected purposively from 4 municipalities, namely one from Makwanpur district, two from Chitwan district, and one from Nawalpur district, Hetauda, Khairahani Bharatpur, and Kawasoti. The sample size from these municipalities was determined proportionately, and the individual respondents were selected randomly. The sampling frame was prepared by using the register of Agriculture Knowledge Center, primary cooperatives and vegetable zone office and farmers were listed non repeatedly where n sample was taken from N population in following municipalities as Hetauda (N= 220, n= 33), Khairahani (N=300, n=45), Bharatpur (N=425, n=67), Kawasoti (N=152, n=27) thus Total (N=1097, n=172).

Sources of information: Primary and secondary information were collected and analyzed for the study.

Primary data for the study was collected from direct household interviews. The data included household socioeconomic information like gender, age, marital status, family type, year of schooling, total owned land, income from different sources. In addition to household surveys and KII were conducted to poll information regarding the postharvest practices been followed.

Secondary data were collected from different bulletins, journals, books, published and unpublished reports, past research articles, reports from MOALMCC, ADS, Agriculture Knowledge Center (AKC).

Data analysis: Descriptive tools like frequency, mean, median, mode, standard deviation was used as per requirements in the study. For the inferential study, the Chi-square test, correlation, and regression models were used. The Chi-square test was used to measure the degree of association between socioeconomic characteristics and adoption level categories. Similarly, the Logit model was used to assess the factors affecting the adoption of postharvest technologies.

A. Logit model:

$$L_i = \ln\left[\frac{P_i}{1-P_i}\right] = Z_i = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \epsilon_i$$

L_i is logit and $\frac{P_i}{1-P_i}$ are odd ratios, Z_i is unobserved utility index on which response variable (Y_i) is dependent, X_i includes the vector of explanatory variables used in the model, $\beta_0$is parameter to be estimated, and ϵ_i is the error term of the model.

Thus, the binary logit regression model can be expressed as:

$P_i = Pr\ (Y_i = 1) = f\ (X_1, X_2, X_3 \ldots\ldots X_n)$

Y_i is the observed response for ith respondent (Y = 1 for adopters, otherwise 0), and X_1, X_2, $X_3 \ldots\ldots X_n$ are factors affecting the adoption of postharvest loss reduction techniques.

Where,

X_1 is Sex #(1= Female, 0= Male) (Dummy)

X_2 is Age in years (Continuous)

X_3 is Ethnicity# (1= Higher caste 0=Otherwise) (Dummy)

X_4 is Education# (1= Literate, 0= Otherwise) (Dummy)

X_5 is Demand Information# (1= Yes,0= Otherwise) (Dummy)

X_6 is Price fixation# (1= Yes, 0= Otherwise) (Dummy)

X_7 is Market Price information# (1= Yes, 0-= Otherwise) (Dummy)

X_8 is Household Type# (1= Joint, 0= Otherwise) (Dummy)

RESULTS AND DISCUSSION

This section includes the detailed study of the sociodemographic features and the postharvest activities followed in vegetable production and marketing by all the value chain actors that included the sex, social background, family type, and education in the study area described below**.**

Table 1 shows that most of the sampled respondents were male (64 percent), while females accounted for 36 percent. In terms of schooling, most of the respondents did not complete their school level study after joining school, only 11.5 percent completed school level and attended higher education, while 31.40 percent of respondents had never attended school.

Among three categories of social background, the most dominating group was elite (73 percent), while the least respondents were non-elite and untouchable (17.44 percent).

The nuclear type of family was found dominating in all study sites. In totality, 75.5 percent of the households were nuclear, whereas the remaining 24.42 percent were joint.

The average age of the respondents was 45.68 years. Similarly, the average member size of the family was 5.21. On average, the landholding occupied by the respondents was 0.77 ha, out of which the land used for vegetables was as much as 0.61 (Table 2).

Only 43.6% of overall respondents were found to receive training related to vegetable farming, while a tiny fraction of respondents (5.23%) were found to receive training related to postharvest

Table 1. Sociodemographic characteristics of respondents by study sites (Categorical)

Attributes	**Total (n=172)**
Sex	
Female	62 (36.00)
Male	110 (64.0)
Education	
School not attended	54 (31.40)
School attended	98 (57.56)
Higher education	19 (11.05)
Social Background	
Elite	73 (42.44)
Non-elite and touchable	69 (40.12)
Non-elite and untouchable	30 (17.44)
Family Type	
Nuclear	130 (75.5)
Joint	42 (24.42)

Source: Field survey, 2019 Notes: Figures in parenthesis indicate percentage.

knowledge (Table 3).

Majority respondents had not access to finance and extension. Among others, majority respondents have access to finance and extension for vegetable production (29.07 percent and 37.21 percent). Access of finance and extension was in little portion of respondents for post-harvest and marketing (Table 4 and 5). Results describe that post-harvest and marketing is least considerable topic in extension and finance.

Table 2. Average sociodemographic characteristics of the respondents of the study area

Attributes	Mean ± SE (n=172)	SD.
Age (Years)	45.68 ± 0.93	12.18
Family Size	5.21 ± 0.15	1.91
Total land cultivated (Ha)	0.77 ± 0.06	0.80
Land for vegetable (Ha)	0.61 ± 0.06	0.84

Source: Field survey, 2019

Table 3. Decision of respondents on different training attended by location.

Attributes	Total n=172
Vegetable farming	
No	97 (56.40)
Yes	75 (43.60)
Postharvest	
No	163 (94.77)
Yes	9 (5.23)

Source: Field survey, 2019
Notes: Figures in parentheses indicate percentage.

In table 6, we can observe that most of the respondents (46.51 percent) out of overall (n= 172) respondents were found to seek market price information always before selling their products, while the least respondents (14.53 percent) tend to seek market price information sometimes only. Likewise, 38.95 percent were never found to seek market price before selling products.

Table 7 depicts that in majority household, decision for production and post-harvest activities were done by both men and women together. In marketing decision of men was higher than production and post-harvest. Women's decision for post-harvest activities was considerably higher among the topics.

Postharvest activities followed by farmers:

Different postharvest activities followed by farmers of the study area are as explained.

a) Harvesting: Cauliflower and cabbage were harvested in the perfect maturity stage with the help of a knife, while cucumber, tomato, and radish were harvested according to the market need manually. Cauliflower, cabbage, and tomato were harvested generally in the afternoon, while other vegetables were harvested regardless of any fixed time.

b) Storage: Any corner of the home was used to store the harvested vegetables. The insignificant number of respondents entertained the cold storage facility for storage. A small minority were found to use potash and calcium zinc for increasing the shelf life of harvested vegetables.

c) Grading: Expect for tomato, other vegetables were separated from the severely damaged one in the name of grading. Tomato was graded in terms of its size and color and washed off before packaging. We found washing practice before packaging in radish as well, and cleaning was absent in other vegetables.

d) Packaging: Plastic crates were used for tomato and capsicum, while a sack was used for other vegetables like radish, cabbage, carrot. Cauliflowers were plastic wrapped for transportation.

e) Transportation: The essential means of transportation found were open vans followed by trucks, auto, public vehicles, and even bicycles.

Table 4. Distribution of respondents' decision on access to finance/credit

Attributes	Total n=172
Vegetable production	
No	122 (70.93)
Yes	50 (29.07)
Postharvest activities	
No	162 (94.19)
Yes	10 (5.81)
Marketing activities	
No	16 (95.35)
Yes	8 (4.65)

Source: Field survey, 2019
Notes: Figures in parentheses indicate percentage.

Total postharvest loss worth value $2382.67 from total production of $25649.92. Farmers bear loss mostly in cucumber ($537.45) followed by tomato ($515.92) (Table 8).

Table 5. Distribution of respondents' decision on access to extension services

Attributes	Total n=172
Vegetable production	
No	108 (62.79)
Yes	64 (37.21)
Postharvest activities	
No	138 (80.23)
Yes	34 (19.77)
Marketing	
No	134 (77.91)
Yes	38 (22.09)

Source: Field survey, 2019
Note: Parenthesis indicates the percentage.5% and 1% level

Table 6. Distribution of respondents' decision about access to market price and demand information

Attributes	Total n=172
Market price	
Always	80 (46.51)
Sometime	25 (14.53)
Never	67 (38.95)
Demand information	
Always	86 (50.00)
Sometime	34 (19.77)
Never	52 (30.23)

Source: Field survey, 2019
Note: Figure in parenthesis indicates percentage,

Logit model for factors determines adoption decisions of postharvest measures.

The logit model is explained by table 9 that five variables were statistically significant for the adoption of postharvest measures. Among them, ethnicity, education, and household type were positively significant at a 5% level of significance. Sex was negatively significant at a 10% level of significance. Similarly, demand information was positively significant at a 1% level of significance. Though statistically non-significant, three other variables like age, migrated household members, market price information, price fixation, and vegetable cultivation area was associated positively with adoption.

Education, ethnicity, and household type were positively associated and significant at a 5% significance level. It means that if the household head was literate, the probability of adopting postharvest measures increased by about 26.4% compared to illiterate ones. Thus, literate farmers tend to seek more and more information for improvement. Similar results were found by Ali (2012), Mukarumbwa et al. (2014) on their research related to postharvest adoption measures. In addition, (Kassie et al. 2011) and Yusuf and Fakayode (2012) also found that a higher literacy level induces people's adoption behavior.

Similarly, If the household belonged to the higher caste as defined by the society, the probability of adopting postharvest measures increased by 22.9%. Further, farmers from joint families tend to increase the probability of adopting a postharvest measure by 25.1%. Jabil & Abdu (2012) supported the positive relationship between household size and adoption. According to them, the joint family provides chap labor force and reduces the adoption cost. A similar result was found by Mukurumbwa et al. (2017), but authors found the opposite result like Ajibesin et al. (2019), Mustapha et al. (2012), and Kikulwe et al. (2018) on their results where the household type was negatively significant. They had further mentioned that if the family is joint, their income is utilized on their livelihood, and no savings are left to adopt different postharvest measures. However, in our research, the joint family is related to the other experience in farming and hence increased adoption of postharvest measures. The study also found that those farmers, who regularly seek market demand information, increased the probability of adoption by 42.3%. This is because the farmer gets informed about the market demand; he focuses on controlling the probable loss and following postharvest measures than those farmers who neglect the market demand information. However, in the female-headed household, the probability of adopting the PH measures decreased by 18.5% than male counterparts. As women are more engaged in household chores, they were more likely to refrain from participating in PH activities outside the house.

Contrary to our finding, Elemasho et al., 2017, Mukarumbwa et al. (2017), Abdul-Hanan et al. (2014), and Tadesse et al. (2018) found gender to have a significant but positive association with the adoption of postharvest measures. The female

Table 7. Decision on different activities by gender

	Gender			Total
Decision on	Men	Women	Both	
Vegetable Production	51 (29.65)	18 (10.47)	103 (59.88)	172 (100.00)
Postharvest Activities	61 (35.47)	35 (20.35)	76 (44.19)	172 (100.00)
Marketing	78 (45.35)	24 (13.95)	70 (40.70)	172 (100.00)

Source: Field survey 2019,
Note: Figure in parenthesis indicates the percentage

Table 8. Economic analysis of postharvest loss of farmers

Vegetable	Indicators				
	Actual Harvest (Kg)	Loss (Kg)	Sold (Kg)	Consumed (Kg)	Price ($Kg-1)
Cauliflower	21262.96	1365.96	20097.1	374.97	0.29
Cabbage	18986.95	1656.01	17433.42	681.92	0.20
Tomato	16114.36	1357.68	14644.76	390	0.38
Cucumber	16578.28	2442.94	14064.58	260.24	0.22
Capsicum	7792.92	372.5	7113.33	470	0.47
Carrot	1940	230	1650	0	0.23
Radish	9509.08	1968.42	7883.33	170	0.19

Source: Field survey 2019

Table 9. Factors influencing the adoption of postharvest measures in the study area.

Variables	Coefficient	P-value	SE.	dy/dx	S.E (dy/dx)
Sex #	-0.779*	0.100	0.479	-0.185*	0.114
Age	0.014	0.456	0.018	0.003	0.004
Ethnicity #	0.978**	0.018	0.412	0.229**	0.095
Education #	1.231**	0.015	0.508	0.264**	0.096
Demand Information #	2.194***	0.001	0.669	0.423***	0.091
Price Fixation #	0.513	0.266	0.461	0.123	0.113
Market price information #	0.063	0.907	0.539	0.015	0.126
Household Type #	1.039**	0.032	0.486	0.251**	0.116
Migrated member #	0.443	0.427	0.558	0.107	0.137
Vegetable area	0.378	0.153	0.264	0.088	0.062
Constant	-4.843***	0.000	1.321		
Summary statistics					
Number of observation (N)	172				
Log Likelihood	-81.057				
LR chi^2 (11)	73.51*** (Prob > chi^2= 0.000)				
Pseudo R^2	0.3120				

***, **, * indicate significant at 1%, 5% and 10% level of significance, respectively.
# indicates a dummy variable

household head was engaged in value addition activities like cleaning, sorting, grading. The result indicated that market price information, price fixation, and age had no significant influence at 1%, 5%, or 10% significance level. However, positive signs could be that farmers who seek market price information and fix their product price had increased adoption level than those who ignore it. Moreover, the old farmer had more ideas on postharvest measures and followed them than the younger ones.

CONCLUSIONS

The vegetable sector has a vital role in improving the individual's physical health and uplifting the entire economy of the country. However, the improper postharvest practices in the value chain of vegetables create the question mark when reached to the final consumer, causing increased cost and decreased quality. This study mainly focused on the farmers' knowledge and the factors affecting the adoption of proper postharvest activities, which can be used by the policymakers, Program planners, and researchers involved in the vegetable value chain. Study shows that most farmers harvest at the right time properly; however, activities after harvesting like grading, packaging, treatment, and transportation are not adequately managed, suggesting strict quality standards and technology support. Financial and extension services for postharvest activities are still unreached to farmers, so coordinated efforts from GO, I/NGOs, and VCDP are required for proper access. Age, sex, ethnicity, family type, education, access to demand information, and price fixation are factors affecting the adoption of postharvest activities. Women, youth, and disadvantaged ethnicity need to be addressed in promotional policy with the generation of less effort-based low-cost technology. Further research based on technological efficiency, physiology, behavior, and economics in a different location with additional explanatory variables, research methods, and data collecting tools is highly recommended.

ACKNOWLEDGMENTS

The authors are thankful to VALUE CHAIN DEVELOPMENT PROJECT, UNDP-MOALD, Hariharbhawan, Lalitpur, Nepal for financial support.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

ORCID

Sandhya Rijal: https://orcid.org/0000-0002-2280-1162

Milan Subedi: https://orcid.org/0000-0002-3707-2433

REFERENCES

Abdul-Hanan A. Ayamga M. & Donkoh S.A. (2014) Smallholder adoption of soil and water conservation techniques in Ghana. African Journal of Agricultural Research, 9(5): 539-546

Affognon H. Mutungi C. Sanginga, P. & Borgemeister C. (2015) Unpacking postharvest losses in sub-Saharan Africa: a meta-analysis. World Development, *66*: 49-68.

AICC (2019) Krishi Diary 2076. Agriculture Information and Communication Center, Hariharbhawan, Lalitpur

Ajibesin D.T. Oluwasola O. & Ajayi D. (2019) Socioeconomic factors determining the adoption of postharvest technologies among maize farmers in Kwara State, Nigeria. International Journal of Agriculture and Environmental Science, 6(5): 8-17.

Ajzen I. (1991) The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2): 179-211.

Ali J. (2012) Factors influencing adoption of postharvest practices in vegetables. International Journal of Vegetable Science, 18(1): 29-40.

Aulakh J. & Regmi A. (2013) Post-harvest food losses estimation-development of consistent methodology. Food and Agriculture Organization. Rome, Italy.

Bachmann J. & Earles R. (2000) Postharvest handling of fruits and vegetables. Fayetteville, Arizona: ATTRA

Barua S. Singh P. Mridiula D. Gupta R.K. & Tomar BS (2017) Attitude assessment of farmers towards postharvest technologies and value addition of horticultural crops in Punjab. Journal of Human Ecology, 59(2-3): 164-168.

Devkota A. R. Dhakal, D. D. Gautam, D. M. & Dutta J. P. (2014) Assessment of fruit and vegetable losses at major wholesale markets in Nepal. International Journal of Applied Sciences and Biotechnology, 2(4), 559-562.

Elemasho M.K. Alfred SD.Y. Aneke C.C. Chugali AJ.C. & Ajiboye O. (2017) Factors affecting adoption of postharvest technologies of selected food crops in Rivers State, Nigeria. International journal of agricultural economics and extension.

FAO. (2018) Postharvest Management of Cauliflower for quality and safety assurance. Rome: FAO.

Faqeerzada M. A. Rahman A. Joshi R. Park E., & Cho B. K. (2018) Postharvest technologies for fruits and vegetables in South Asian countries: A review. Korean Journal of Agricultural Science, 45(3): 325-353.

Gautam S. Acedo Jr A.L. Schreinemachers P. & Subedi B.P. (2017) Volume and value of postharvest losses: the case of tomatoes in Nepal. British Food Journal, 119(12): 2547-2558.

Ghanghas B.S. Nain MS & Malik J.S. (2017) Adoption of postharvest management practices by Vegetable growers in Haryana State. Indian Journal of Extension Education, 53 (1): 104-110.

Jabil I.Y. & Abdu U.D. (2012) Socioeconomic characteristics of farmers and the factors that hamper their Adoption of Agricultural Technologies in Northern Central Zones of Plateau State, Nigeria. International Journal of Agricultural Economics and Extension, 4(1): 5

Kader A.A. (2009) Handling of horticultural perishables in developing vs. developed countries. In VI International Postharvest Symposium 877 (121-126).

Kassie M. Shiferaw B. & Muricho G. (2011) Agricultural technology, crop income, and poverty alleviation in Uganda. World Development, 39(10): 1784-1795.

Kiaya V. (2014) Postharvest losses and strategies to reduce them. Technical Paper on Postharvest Losses, Action Contre la Faim (ACF).

Kikulwe E.M. Okurut S. Ajambo S. Nowakunda K. Stoian D Naziri D. (2018) Postharvest losses and their determinants: A challenge to creating a sustainable cooking banana value chain in Uganda. Sustainability, 10(7): 19

Kitinoja L. & Gorny J.R. (1999) Postharvest technology for small-scale produce marketers: economic opportunities, quality, and food safety. Postharvest Horticultural Series-Department of Pomology, University of California, 21

Mollah MA.H. Hawlader A.J. Ali M.R. Khatun R. Ahmed S. Mahmud M.S. & Hasan, M.A. (2018) Assessment of technological knowledge on pre-and postharvest agricultural management system and its economic impacts in Bangladesh. Universal Journal of Agriculture Research, 6(2): 79-90.

Mukarumbwa P. Mushunje A. Taruvinga A. Akinyemi B. and Ngarava S. (2018) Analysis of factors that influence market channel choice of smallholder vegetable farmers in Mashonaland East province of Zimbabwe. International Journal of Development and Sustainability, 7(2): 734-754.

Mustapha S.B. Makinta A.A. Zongoma B.A. & Iwan A.S. (2012) Socioeconomic factors affecting adoption of soya bean production

technologies in Takum local government area of Taraba State, Nigeria. Asian Journal of Agriculture and Rural Development, 2(2): 271-276.

Raghuvanshi A. & Chandrakar AGDM (2018) Postharvest losses in potatoes and factors affecting postharvest losses at farm level in Chhattisgarh. Journal of Pharmacognosy and Phytochemistry, 7(3): 3122-3124.

Sivakumar P.S. Sontakki B.S. Sulaiman R.V. Saravanan R. & Mittal N. (2017) Manual on Good Practices in Extension Research and Evaluation. Agriculture Extension in South Asia (AESA). Hyderabad, India.

Tadesse B. Bakala F. & Mariam L. W. (2018) Assessment of postharvest loss along the potato value chain: the case of Sheka Zone, Southwest Ethiopia. Agriculture & Food Security, 7(1): 18.

Udas S. Rai B.K. Gurung, M. Thapa R. & Khatiwada, P.P. (2005) Assessment of postharvest handling systems of vegetables in the Eastern Hills of Nepal. Acta orticulturae.

Weinberger K. Genova Ii C. & Acedo A. (2008) Quantifying postharvest loss in vegetables along the supply chain in Vietnam, Cambodia, and Laos. International Journal of Postharvest Technology and Innovation, 1(3): 288-297.

Yusuf T.M. Fakayode S. (2012) Technical efficiency of women farmers in Nigeria: A study of women food crops in Kwara State. International Journal Agricultural Economics and Extension, 4(1): 4.