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Smallholder Farmers' Willingness to Reduce Post-Harvest Losses: A Case Study in the Ashanti Region of Ghana.

Kofi Kyei (Corresponding author)
University College of Agriculture and Environmental Studies
Post Office Box 27. Bunso-Eastern Region, Ghana.
E-mail: kofi.kyei@ucaes.edu.gh

Grace Darko Addy
University of Koblenz
Universitatsstrasse 1 56070
Koblenz, Germany
E-mail: graceaddy@uni-koblenz.de

Abstract

Losses of fruit and vegetable products after harvesting place a major constraint on food security in Ghana. Understanding farmers' willingness is very significant to developing long term policies in reducing post-harvest losses. This paper investigated the factors that contributes to smallholder famers' willingness to reduce post-harvest loss of fruit and vegetables in Ghana. Employing the binary logistic regression model, the findings revealed factors such as storage facilities, processing facilities and socio-demographic characteristics of farmers such as age, education and years of farming experience were found to be significant in determining farmers' willingness to reduce post-harvest losses. The paper further emphasized the need for the Ghana government to build more storage facilities within farming communities to enable smallholder farmers store their harvested crop products.

Keywords: Post-Harvest Loss, Storage Facilities, Processing Facilities, Ghana.

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1. Introduction

Interventions in post-harvest loss reduction are seen as an important element of the works of many developing countries to reduce food insecurity. Most of these interventions come from development partners such as Japan International Cooperation Agency (JICA), Alliance for a Green Revolution in Africa (AGRA), Food and Agriculture Organization (FAO), Canadian International Development Agency (CIDA), United States Agency for International Development (USAID), the World Food Program and others.

Over the years, these development partners have supported countries from Sub-Saharan Africa in the fight to reduce post-harvest losses. An example is the Zero Loss Initiative by the World Food Program (WFP), which was aimed to reduce food losses throughout the value chain. With this initiative, the World Food Program identified some steps to support smallholder farmers and agricultural markets in Sub-Saharan Africa. These steps include connecting farmers to markets, improving food quality and advocating for quality standards (Costa, 2015). Although these interventions by development partners are good, I believe that they will be fruitless if

smallholder farmers are still perceived as beneficiaries but not contributors. Smallholder farmers' role is very critical in the fight to reduce post-harvest losses.

In Ghana, fruits and vegetables are the third national food commodity after cereals and starchy staples in terms of production (Drechsel and Keraita, 2014). The production of fruits and vegetables is being restricted by post-harvest loss factors which reduces the volume of good quality products reaching consumers. Several factors such as road infrastructure, availability of storage and processing facilities, post-harvest handling practices, market readiness for farm products and other socio-demographic characteristics of farmers contributes to more post-harvest loss of fruit and vegetables in Ghana.

Although, the Ghanaian government has taken steps in the reduction of post-harvest loss, not much has been done to understand the factors that determines farmers' willingness to reduce post-harvest losses in Ghana. In this paper, we investigated the factors that contributes to smallholder famers' willingness to reduce post-harvest loss of fruit and vegetables in Ghana.

The remainder of this paper is structured as follows. Section 2 summarizes literatures on post-harvest loss factors and willingness of farmers to reduce post-harvest losses. Section 3 describes the methodology. Then section 4 present the results and discussion. Lastly, section 5 includes the research conclusion and policy recommendations.

2. Literature Review

Studies carried out by some scholars regarding factors that determines post-harvest losses focused on storage facilities and post-harvest handling practices. For example, Arah et al's study on post-harvest handling practices and treatment methods for tomato handlers in developing countries revealed that quality and shelf life of tomato fruit largely depends on post-harvest handling practices carried out after harvest (Arah et al, 2016). Chegere (2018) found the adoption of post-harvest handling practices very significant in the reduction of post-harvest loss. Tibagonzeka et al (2018) also found inappropriate post-harvest handling practices being the main factor for high post-harvest loss of maize, millet, beans, sorghum, cassava, groundnuts and sweet potatoes farmers in Uganda. In southern Ethiopia, Parmar et al (2017) identified post-harvest handling of harvested potatoes at the farm level as the main contributor of sweet potato food loss.

For storage facilities, Tefera et al (2011) found household metal silos to be a very effective grain storage technology for reducing post-harvest insect and pathogen losses for harvested maize in many developing countries. Another study to examine the performance of a range of storage facilities in the protection of stored maize grain against insect pests also found the hermetic bags to be the most effective in reducing post-harvest of stored maize in southern Malawi (Singano et al, 2019).

Other past research also focused on road infrastructure. An example is a study by Kuyu et al (2019) in Ethiopia. Kuyu et al (2019) found more mechanical damages and losses were observed for fruit and vegetable crops due to the poor quality of the road. Lipinska et al (2019) also found more mechanical damages and losses on dairy products during transportation to distribution centers due to the nature of the road.

For farmers' willingness to reduce post-harvest loss, most past studies focused on farmers' willingness to pay for crop insurance premiums as a way of reducing post-harvest loss and farm disaster risks. For instance, Ellis (2017) examined cereal farmers willingness to pay for crop insurance in the Eastern Region of Ghana. More than

half (52.9%) of the farmers interviewed expressed interest in crop insurance as a way of reducing post-harvest loss uncertainties on their farms. Ellis (2017) suggested the need for innovative insurance products to incite the demand for crop insurance.

In Pakistan, Fahad and Jing (2018) investigated farmers' willingness to pay for crop insurance. They found 30% of the farmers willing to pay for crop insurance premiums as the mechanism for post-harvest loss and farm disaster risk reduction. Fahad and Jing (2018) proposed the need for Pakistani government subsidize insurance scheme for farmers. Another study in Malaysia determined farmers' willingness to pay for crop insurance scheme in Selangor Integrated Agricultural Area. They found only 7.6% of the farmers were willing to pay for crop insurance scheme (Amin et al., 2014). The authors proposed policymakers and stakeholders finance insurance scheme for paddy farmers.

Similar study in Indonesia by Mutaqin and Usami (2019) also identified farmers' willingness to pay for crop insurance. They found 81% of farmers willing to pay for crop insurance in Indonesia. The authors proposed more education for farmers on agricultural crop insurance products to increase their awareness. In Finland, Liesivaara and Myyrä (2014) investigated farmers' willingness to pay for crop insurance. They found high demand for crop insurance especially in younger farmers and farmers with more arable lands.

In addition, other studies also showed that farmers are willing to pay for post-harvest refrigeration unit as a way of reducing post-harvest losses. For instance, a study by Maalouf and Chalak (2019) investigated farmers' willingness to pay for a common refrigeration unit to reduce post-harvest losses in Bekaa Valley, Lebanon. The authors found 80% of farmers willing to pay varying amounts for the post-harvest refrigeration unit.

3. Methodology

3.1 Data Collection

The questionnaire survey and field observation were used to collect data from the field. The field observation was carried out in February 2022 to test the questionnaire. The questionnaire was later administered in March 2022. The respondents were fruit and vegetable farmers. The fruit farmers selected were farmers who were into orange, banana, avocado and mango production. Vegetable farmers were also farmers who were into tomato, onion, pepper, cabbage, okra and garden egg. A total of 70 and 100 fruit and vegetable farmers from five communities were purposely sampled at Sekyere-Kumawu District in the Ashanti Region of Ghana. The five communities are Besoro, Domeabra, Abotanso, Banko and Woraso.

With a population of 65,402 people, the Sekyere-Kumawu District in the Ashanti Region has over 11,598 households engaged in agriculture activities. Major crops grown in the district include maize, rice, onion, pepper, garden egg, cassava, plantain, orange, banana, mango and avocado (Ghana Statistical Service, 2014).

The district is also well known for vegetable and fruit production. According to the 2018 National Census of Agriculture Report, there were 198 fruit farmers and 2,605 vegetable farmers at Sekyere-Kumawu District. These farmers were smallholder farmers who owned small farm plots (Kyei et al., 2025).

3.2 The Study Hypotheses

To better understand the factors contributing to farmers' willingness to reduce post-harvest losses, the following hypotheses were developed based on the review of past studies:

Hypothesis 1: Training on post-harvest handling practices have a significant effect on farmers' willingness to reduce post-harvest losses.

Hypothesis 2: The presence of storage infrastructures has a significant effect on farmers' willingness to reduce post-harvest losses.

Hypothesis 3: The presence of processing facilities has a significant effect on farmers' willingness to reduce post-harvest losses.

Hypothesis 4: The availability of ready market has a significant effect on farmers' willingness to reduce post-harvest losses.

Hypothesis 5: The nature of farm road has a significant effect on farmers' willingness to reduce post-harvest losses.

3.3 Data Analysis

For the analysis, the binary logistic regression analysis was used to determine the factors leading to post-harvest loss of fruit and vegetable farmers in the region. Here, the dependent variable was farmers' willingness to reduce post-harvest loss of fruit and vegetables and the independent variables were a mix of qualitative and quantitative variables. The qualitative variables include the availability of storage and processing facilities, available training on post-harvest handling practices, ready market for harvested crop products and nature of farm roads to markets. The quantitative variables include farmers socio-demographic characteristics such as age, education, years of farming experience, household size and total area of crop production.

In the binary logistic regression, the coefficients of the independent variables interpret how farmers in the study area are more willing or less willing to reduce post-harvest losses. The mathematical representation of the binary logistic regression is defined as follows;

Logit (P) = $A + B_1X_1 + B_2X_2 + B_3X_3$

where A is the intercept, x_1 and x_2 are the independent variables, b is the slope and logit (P) is the dependent variable (Kumar et al, 2011).

4. Results and Discussion

4.1 Farmers' Willingness to Reduce Post-Harvest Losses

The results from the questionnaire survey showed that over 90% of farmers involved in fruit and vegetable production at Sekyere-Kumawu District are willing to reduce post-harvest losses. Only few farmers (around 5%) were not keen on reducing post-harvest losses (Figure 1). Studies by Maalouf and Chalak (2019) confirm this finding. A T-Test comparing the acceptance level between fruit and vegetable farmers shows vegetable farmers are significantly more willing to reduce post-harvest losses (p-value<0.05).

4.2 Determinants of Fruit Farmers' Post-Harvest Loss

The results from the binary logistic regression analysis revealed that six independent variables were significant and had influence on fruit farmers post-harvest loss reduction in the study area (Table 2). The six independent variables include farmers age, education, household size, Land size, storage facilities and market readiness for harvested fruit products.

The resulting equation produced from the logistic regression model is given by:

$Y = 1.464 + 0.011X_1 + 0.0181X_2 + 0.071X_3 + 0.138X_4 + 0.022X_5 + 0.017X_6$

Where Y is the dependent variable (Farmers' willingness to reduce post-harvest loss), age (X_1), education (X_2), household size (X_3), land size (X_4), availability of storage facilities (X_5) and market readiness availability (X_6).

The results imply that the presence of storage facilities and available ready market for harvested fruit products were very significant and positive in determining farmers' willingness to reduce post-harvest loss at Sekyere-Kumawu District. Hypothesis 2 and 4 support these findings. Studies by Tefera et al (2011) and Singano et al (2019) confirm these findings. Tefera et al (2011) study found household metal silos very effective in the reduction of more post-harvest loss of maize in many developing countries. Singaro et al's study also examined the performance of a range of storage facilities in the reduction of post-harvest loss of maize in southern Malawi. Their findings showed that the hermetic bags were very effective in the reduction of post-harvest loss of maize.

Moreover, age, education, household size and size of land were found to be very significant and positive in determining farmers' willingness to reduce post-harvest losses. This implies that farmers who are older and had acquired some level of education tends to be more willing to reduce post-harvest losses than younger farmers with lower educational background.

In addition, farmers with huge household and land sizes tends to reduce more post-harvest loss than farmers with less household and land sizes. The socio-demographic characteristics of fruit farmers with regards to age, education and household size confirm these results. According to Table 1, 37% of fruit farmers were aged between 50 and 59 years, 51% had education up to senior high school level and over 40% had household members between 6 and 10.

4.3 Determinants of Vegetable Farmers Post-Harvest Loss

Out of the eleven independent variables, only five were significant and had influence on vegetable farmers post-harvest loss reduction in the study area. The five independent variables from the binary logistic regression analysis include education, experience, processing facilities, storage facilities and nature of farm road (Table 3).

The resulting equation produced from the binary logistic regression model is given by:

$$Y = 0.851 + 0.001X_1 + 0.007X_2 + 0.035X_3 + 0.096X_4 + 0.022X_5$$

Where Y is the dependent variable (Farmers' willingness to reduce post-harvest loss), education (X_1), experience (X_2), processing facilities (X_3), storage facilities (X_4) and nature of farm road (X_5).

These results indicate that the presence of processing facilities, storage facilities as well as nature of farm road leading to distributing centers were key determinants of vegetable farmers willingness to reduce post-harvest losses at Sekyere-Kumawu District. Hypothesis 2, 3 and 5 support these findings. These findings also confirm studies of Adewoyin (2017) and Kuyu et al (2019). Adewoyin's study showed that good storage conditions and proper packaging are vital in the shelf life extension of pepper fruit in Nigeria. Kuyu et al (2019) also found more post-harvest loss in fruit and vegetable crops due to the poor quality of farm roads in Ethiopia.

Moreover, education and years of farming experience were also found to be significant and positive in determining vegetable farmers' willingness to reduce post-harvest losses. This means experienced farmers who had acquired some level of education seems to reduce more post-harvest loss of vegetable crop products than the inexperienced with lower educational background. However, gender was not identified as one of the determinants of post-harvest loss for both fruit and vegetable farmers in the study area. This finding is contrary to studies by Aidoo et al (2014) and Folayan (2013). Aidoo et al (2014) found a positive correlation between

gender and post-harvest loss of tomato production in the Offinso north district of Ghana. Folayan (2013) on the other hand identified gender as one of the determinants of post-harvest loss of maize in Nigeria.

5. Conclusion

This paper investigated the determining factors of farmers' willingness to reduce post-harvest loss of fruit and vegetables in the Ashanti Region. The findings revealed that the factors that determines fruit farmers' willingness to reduce more post-harvest losses include storage facilities and available market for harvested fruit products. Fruit farmers' socio-demographic characteristics such as age, education, size of household and land size were also found to be very significant and positive in their willingness to reduce post-harvest losses.

Regarding vegetable farmers, factors such as processing facilities, storage facilities and nature of farm road to distributing centers were found to be very significant and positive from the binary logistic regression analysis. Other socio-demographic characteristics of farmers such as education and years of farming experience also had significant association with their willingness to reduce post-harvest losses.

We recommend the Ghanaian government build more storage facilities within farming communities to enable smallholder farmers store their harvested crop products. Also, the Ghana government can partner with private organizations to build more processing facilities to process farmers' harvested crop products into other value-added products which can be exported outside the country.

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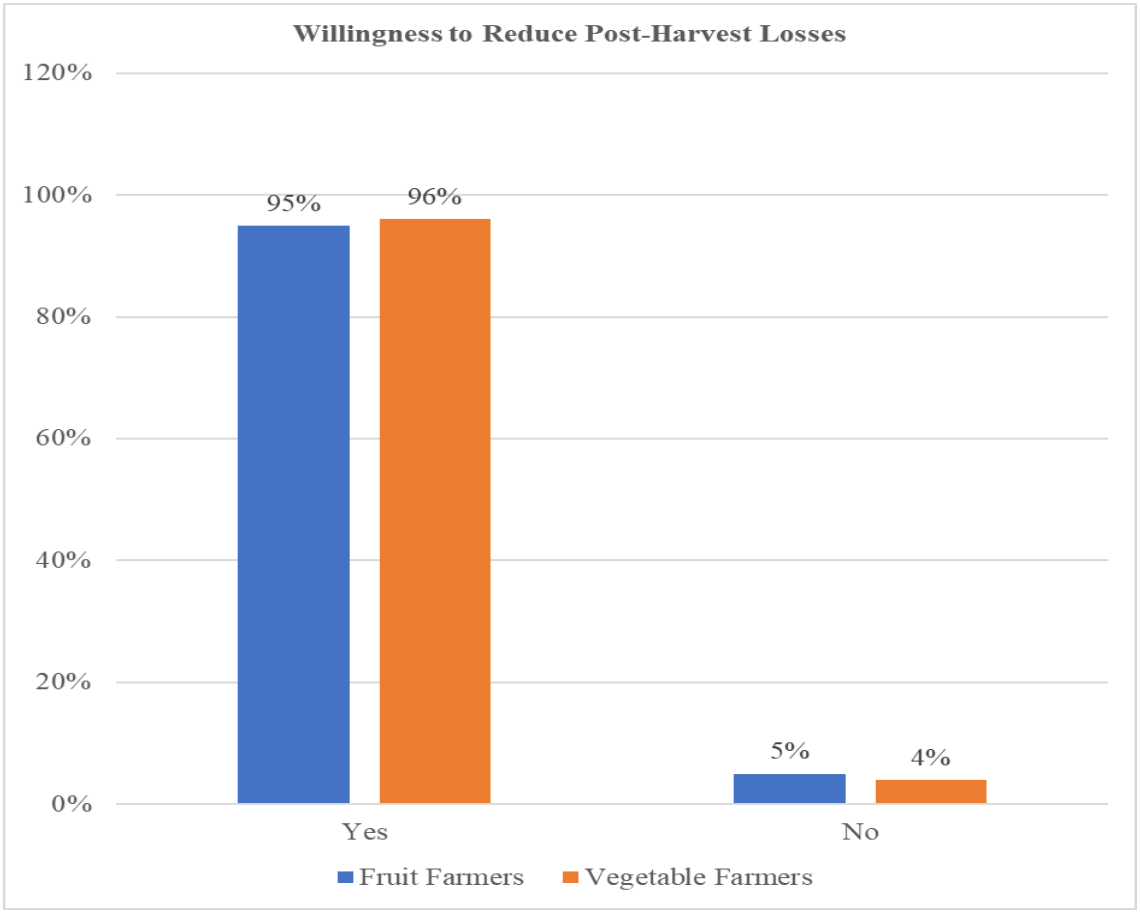

Figure 1. Farmers' Willingness to Reduce Post-Harvest Losses

Table 1. Socio-Demographic Characteristics of Farmers

Variable	Category	Fruit Farmers Frequency (%)	Vegetable Farmers Frequency (%)
Age	20-29	8 (12%)	2 (2%)
	30-39	14 (20%)	15 (15%)
	40-49	2 (2%)	38 (38%)
	50-59	26 (37%)	18 (18%)
	60 and above	20 (29%)	27 (27%)
Gender	Female	14 (20%)	30 (30%)
	Male	56 (80%)	70 (70%)
Education	No education	3 (4%)	44 (44%)
	Junior High School	29 (41%)	16 (16%)
	Senior High School	36 (51%)	12 (12%)
	Tertiary	2 (3%)	28 (28%)
Household Size	1-5	20 (29%)	32 (32%)
	6-10	29 (41%)	52 (52%)
	11-15	21 (30%)	12 (12%)
	15 and above	0	4 (4%)
Years of Experience	1-10	30 (43%)	26 (26%)
	11-20	19 (27%)	33 (33%)
	21-30	17 (24%)	28 (28%)
	31-40	4 (6%)	12 (12%)
	41 and above	0	1 (1%)
Total		70	100

Table 2. Results of the Binary Logistic Regression Model showing Correlations among Fruit Farmers

Variable	Description	Coefficients	Standard Error
Intercept		1.464	0.378
Age	Respondent's age	0.012*	0.006
Gender	Female (0) Male (1)	0.117	0.216
Education	Years of Schooling	0.018*	0.023
Experience	Years of Involvement in Farming Activities	0.026	0.013
Household Size	Number of people depending on respondent	0.071*	0.033
Land Size	Area of farm cultivation	0.138*	0.094
Training on Post-Harvest Handling Practices	No (0) Yes (1)	0.268	0.123
Processing Facilities	No (0) Yes (1)	0.288	0.146
Storage Facilities	No (0) Yes (1)	0.023*	0.175
Ready market for harvested products	No (0) Yes (1)	0.017*	0.160
Nature of farm road	Bad (0) Good (1)	0.372	0.116
R – Square		0.465	
Adjusted R – Square		0.364	
Significance F		5.4E-05	
Number of Observation		70	

*P-Value<0.05

Table 3 Results of the Binary Logistic Regression Model showing Correlations among Vegetable Farmers

Variable	Description	Coefficients	Standard Error
Intercept		0.851	0.161
Age	Respondent's age	0.002	0.004
Gender	Female (0) Male (1)	0.028	0.065
Education	Years of Schooling	0.001*	0.005
Experience	Years of Involvement in Farming Activities	0.007*	0.004
Household Size	Number of people depending on respondent	0.004	0.009
Land Size	Area of farm cultivation	0.022	0.021
Training on Post-Harvest Handling Practices	No (0) Yes (1)	0.120	0.071
Processing Facilities	No (0) Yes (1)	0.035*	0.072
Storage Facilities	No (0) Yes (1)	0.096*	0.107
Ready market for harvested products	No (0) Yes (1)	0.028	0.093
Nature of farm road	Bad (0) Good (1)	0.022*	0.062
R – Square		0.078	
Adjusted R – Square		0.037	
Significance F		0.756	
Number of Observation		100	

*P-value <0.05