AN ECONOMETRIC ESTIMATION OF POST-HARVEST LOSSES OF CUT-FLOWERS IN PUNJAB, PAKISTAN

M. Usman, A. Ali, *A. Ghafoor, **S. A. Baig, **M. Hashim and **M. Z. Rehman

Institute of Agricultural and Resource Economics, University of Agriculture, Faisalabad, Pakistan
*Institute of Business Management Sciences, University of Agriculture, Faisalabad, Pakistan
**Department of Management Sciences, National Textile University, Faisalabad, Pakistan
Corresponding author's e-mail: usmanghani99@hotmail.com

ABSTRACT: The study was conducted to quantify the post-harvest losses (PHL) of cut-flowers at various levels of market intermediaries' i.e. farm, commission agent, wholesale market and retail levels. Primary data were collected from district Kasur, Lahore, Sheikhupura, and Faisalabad. The respondents were selected by employing the stratified random sampling technique. SPSS was used for the descriptive statistics and multiple regression model analysis for econometric estimation. The econometric estimation revealed that variable of education, experience, floriculture area, picking method; picking time and extension services had a significant impact on losses on farm level, whereas education and infrastructure showed a significant effect on losses at a commission agent level. The determinants of PHL at the wholesale level were experience, loading method, and cold storage, transportation while education, unsold quantity, retailer type, kind of shop and storage place had a significant effect on losses at the retailer level. Proper training and scientific knowledge should be given to traders regarding storage, grading, handling, displaying and processing of flowers. The study suggests adopting a scientific approach to minimize these losses.

Key words: Cut-Flowers, Econometric, Estimation, Market Intermediaries, Post-harvest Losses, Pakistan.

(Received 16-04-2016 Accepted 22-09-2016)

INTRODUCTION

People generally use flowers in almost all their rituals like religious offerings, birthday and marriage day greetings, and wedding and occasionally in historical, political and social events. Flowers are used for conveying or showing the deepest spirit of the beloved ones or accompanying anyone or versifying any believable sentiments. Owing to their diversity in form, color, fragrance, texture and beauty flowers are an essential part of human life (Ikram *et al.,* 2012).

The universal usage has created a real trend of producing flowers on commercial basis to meet growing demand in the market (Haque *et al.,* 2013). Flowers are cultivated in and around one hundred and forty five countries and consumption is in billions of dollars. However, the share of Pakistan is less than 3% in the world market while neighboring country India ranks twenty-fifth in the international trade with export having a growth rate of 12-15% in the floriculture. The Netherland alone contributes more than 5% in the export of floriculture products (Sindhu, 2005).

In a study Sudhagar (2013) reported that there is an increase in the consumption of potted plants and cut flowers at a steady growth rate of 10-15% in almost all the importing countries. The per capita consumption of the floriculture is increasing due to globalization and its impact on income. The consumption of flowers is closely associated with an urban population and gross national product per capita in the developing countries. According to Riza *et al.,* (2007) due to increase in the level of living standard, electronic media and education have encouraged this industry in the current years. The production and consumption of the floriculture has improved over the past decade and this growth is anticipated to endure. But, local use and demand are however to be gratified.

Conventionally flowers are cultivated for its fragrance quality, export of essential oils, in social functions and aesthetic benefits (Byczynski, 1997). Nowadays, floriculture has developed as a profitable venture due to its potential for profit than that other horticultural prospect (Sudhagar, 2013). Mankind has a historical interest in cultivating flowers and gardening in all the civilizations to satiate an aesthetic need. However, in the present world, the flowers are imperative not only for their social values and aesthetic needs but, also for their economic significance (Dadlani, 2003 and Aditya, 1992). Owing to the deviation of the flowers towards more profitable, floriculture crops and their industrial cultivations and usage of flowers for the social ceremonies, the floriculture, is recognized as a potential business in Pakistan (Younis *et al.,* 2002). Due to enhanced profit, the floriculture is emerging on commercial basis (Anderson *et al.,* 2010).

Flowers cultivation as a business, farming is highly profitable, which provides a maximum net return in context to its cultivation cost (Jahan, 2009). So, flower cultivation business is increasing at 25% growth rate. The international trade of floriculture is about 11 billion US$ and out of this cut flowers account for 60%. It is expected that it would be double by 2025 (Singh *et al*., 2010). In Pakistan commercial floriculture has emerged well. Gladiolus, roses, carnations, tuberose, marigold, jasmine, gerberas, lilies, statice and chrysanthemum, etc. are the most popular floriculture crops for the trade of potted plants and cut flowers in Pakistan (Younis *et al.,* 2002). The climate of Pakistan is subtropical and is favorable for cut-flowers production. The floriculture industry can be established by providing essential amenities which can surely procure millions of dollars as foreign exchange (Nawaz *et al.,* 2009).

In Pakistan growing floriculture is a fast and profitable venture for the small farmers. About ten to twelve thousand tons of cut-flowers is estimated per annum in Pakistan. Investment in this sector has obvious increased due to increase in number of greenhouses, nurseries, flower auction centers and flower markets. All kinds of potted plants, floriculture crops, and cut flowers can be grown in Pakistan during all seasons due to diverse agro-climatic conditions. In Pakistan, flower cultivation is a very lucrative industry, if done appropriately on a commercial basis. As farm holdings are small, therefore, a farmer hardly makes his both ends meet from this venture. It is high time that innovative methodologies should be employed by the growers to enhance their income (Younis *et al.,* 2002).

An empirical estimation of the major determinants of post-harvest losses at farm, commission agent, wholesaler's and retailer's level is inevitable. Therefore, this study was conducted with an objective of estimating PHL of cut-flowers at different levels of market intermediaries to identify the major determinants of losses.

MATERIALS AND METHODS

Study Area, Sampling and Data Collection: The planned study was conducted in the province of Punjab, where district Kasur, Lahore, Shhikhupura, and Faisalabad were selected as the study areas as these were the prominent areas for the production of cut-flowers in Punjab, Pakistan. Chrysanthemum, jasmine, marigold, tuberose, statice, gladiolus and cut rose flowers were selected to collect data. Primary data was collected for the production year of 2013 by employing a well-structured and field pre-tested questionnaire. Marketing data was collected from different market intermediaries i.e. farmers, commission agents, wholesalers and retailers. During current study, stratified random sampling technique was used for the selection of the respondents.

Selection of the Respondents

Producers: A sample of 250 producers was taken for the study purpose. In the present study, a total of 100 respondents were selected from each tehsil of Pattoki and Chunnian of district Kasur, 25 producers were interviewed from each district of Lahore and Sheikhupura. Several farmers were growing from 1-4 varieties of the selected cut-flowers.

Commission Agents: Thirty three commission agents were interviewed to collect this data. There were 30 commission agents in the Pattoki, dealing with cut flowers i.e. Cut-rose, Tuberose, Gladiolus, and Statice cut-flowers. In Tara Ghar village market of tehsil Pattoki, there were only three commission agents; who were interviewed for the collection of data who were dealing with Jasmine, Marigold and Chrysanthemum cut flowers.

Wholesalers: 70 out of 200 wholesalers were interviewed including twenty-five wholesalers from Pattoki market, 20 from Tara Ghar and 25 from Lahore market. There was no wholesale market in the Faisalabad.

Retailers: A total of 80 retailers were interviewed to collect data. Forty retailers were selected from Lahore, 30 from Faisalabad and 10 from Kasur.

Analytical Framework: In order to estimate the losses, descriptive statistic (average and frequency) was used, whereas the impact of the major determinants of post-harvest losses in cut-flowers was estimated through multiple regression test. The total post-harvest losses of the selected cut-flowers were added at each level of the marketing chain. In this study, an effort was made to estimate econometric models for post-harvest losses at four different levels i.e. farm, commission agent, wholesaler and retailer levels which were as under:

Model at Farm Level

$$L_1 = \beta_0 + \beta_1 W_1 + \beta_2 W_2 + \beta_3 W_3 + \beta_4 D_1 + \beta_5 D_2 + \beta_6 D_3 + \varepsilon$$

L_1 = Total quantity of post-harvest losses at farm level in Nos.
W_1 = Education of the farmers in years.
W_2 = Flower growing experience of the farmers in years.
W_3 = Floriculture area in acres.
D_1 = Dummy variable for picking method.
D_1 = 1, if picked with a scissor.
D_1 = 0, if picked manually.
D_2 = Dummy variable for picking time.
D_2 = 1, if picking time was morning.
D_2 = 0, if picking time was evening.
D_3 = Dummy variable for extension services (i.e. regarding post-harvest losses).
D_3 = 1, if extension services were available.

D_3 = 0, if is extension services was not available.
ε = Disturbance term.
β_0 is a constant term (intercept) and β_1……. β_6 are the coefficients of estimates in the model.

Model at Commission Agent Level

$$L_2 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 D_4 + \varepsilon$$

Where
L_2 = Total quantity of post-harvest losses at commission agent level in No.
X_1 = Education of the commission agent in years.
X_2 = Experience of the commission agent in years.
D_4 = Dummy variable for Infrastructure (proper cut flower markets, electricity and flower display centers etc.).
D_4 = 1, if Infrastructure facilities were available.
D_4 = 0, if Infrastructure facilities was not available.
ε = Disturbance term.
β_0 is a constant term (intercept) and β_1……. β_3 are the coefficients of estimates in the model.

Model at Wholesale Market Level

$$L_3 = \beta_0 + \beta_1 Y_1 + \beta_2 Y_2 + \beta_3 D_5 + \beta_4 D_6 + \beta_5 D_7 + \varepsilon$$

L_3 = Total quantity of post-harvest losses at wholesaler level in No.
Y_1 = Education of the wholesaler in years.
Y_2 = Experience of the wholesaler in years.
D_5 = Dummy variable for loading method.
D_5 = 1, if the produce was loaded in boxes.
D_5 = 0, if the produce was openly loaded.
D_6 = Dummy variable for cold storage transportation.
D_6 = 1, if transportation was in cold storage.
D_6 = 0, if transportation was normal.
D_7 = Dummy for Infrastructure of transportation.
D_7 = 1, if roads were metaled.
D_7 = 0, if roads were non-metaled.
ε = Disturbance term.
β_0 is a constant term (intercept) and β_1…….. β_5 are the coefficients of estimates in the model.

Model at Retail Level

$$L_4 = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 D_8 + \beta_5 D_9 + \beta_6 D_{10} + \varepsilon$$

Where
L_4 = Total quantity of post-harvest losses at retailer level in No.
Z_1 = Education of the retailer in years.
Z_2 = Experience of the retailer in years.
Z_3 = Unsold quantity in Kgs.
D_8 = Dummy variable type of retailer.
D_8 = 1, if the respondent was a shopkeeper.
D_8 = 0, if the respondent was a hawker/vender.
D_9 = Dummy variable for kind of shop.
D_9 = 1, if the respondent has own shop.
D_9 = 0, if a respondent's shop was on the open road.
D_{10} = Dummy variable for storage.
D_{10} = 1, if cold storage.
D_{10} = 0, if normal storage.
ε = Disturbance term.
β_0 is a constant term (intercept) and β_1.. β_6 are the coefficients of estimates in the model.

RESULTS AND DISCUSSION

Post-harvest Losses (PHL) of Cut-Flowers at Various Levels of Market Intermediaries: PHL was the loss that occurred from the point of the harvest of flower in the field till it reached in the hands of final consumers. PHL of the cut-flowers occur at various levels due to different reasons such as delay in harvesting, during plucking, over maturing, packing and assembling, during loading and unloading, pressing, during sorting and cleaning, due to improper and transportation and multiple handling, while making flower vase and unsold stock. PHL at the retail level occurred due to rain and the sun because the majority of the retailer's shops were on the roadside in the open. Therefore, rain and the sun fade the eminence of flowers, as a result, the price of flowers becomes low.

The results of the study purported that total PHL value of the rose cut-flower at the different levels of the marketing chain was Rs. 54.35 (33 flowers). The gladiolus had the highest monetary value of PHL (Rs. 58.80) at the farm level as compared to the other selected flowers. The total value of PHL of the gladiolus in the marketing chain was RS. (153.44) (15 flowers). After the rose and gladiolus, the tuberose was the most delicate and perishable flower. The total value of PHL of tuberose and statice in the flower marketing chain was Rs. 31.43 (22 flowers) Rs.28.32 (41 flowers). The shelf life of marigold was shorter than that of gladiolus, rose, tuberose and statice. The findings of the study indicated that total PHL of marigold was about Rs.5.92 i.e. sixty flowers.

The marigold had the highest average number of flower losses as compared to statice, tuberose, and gladiolus with comparatively lesser market value; the reason was that the average price per hundred flowers of the marigold was lower than that of statice, gladiolus, tuberose, and gladiolus. The total flower losses of the chrysanthemum and jasmine in the marketing chain were 81 flowers i.e. Rs. 17 and 91 flowers i.e. Rs. 6.07. Jasmine was the most perishable flower than the other selected flowers. Bagchi and Raha (2011) also reported similar results of the post-harvest losses of the cut-flowers.

Factors Affecting PHL of Cut-Flowers at Various Levels of Market Intermediaries

Determinants of PHL at Farm Level: Education of the farmers had a significant impact on the losses of the cut flowers. The findings of the study revealed that with a 1 % increase in the years of schooling of the growers the losses decreased by 2.81 percent. Farmers having more

experience in the cultivation of the flowers showed fewer losses as compared to their counterparts who were less educated. An increase in the floriculture area increases the losses. For every one acre increase in floriculture area, post-harvest losses decreased about 6 percent. Farmers having more acreage of the flower have more expertise in the production, handling, and marketing of the flowers. When flowers were picked with a scissor, the losses are 24 percent less than the losses with manual picking. If the flowers were picked in the morning, the losses increased 23 percent than picked in the evening. Therefore, the picking time and picking method had a significant effect on the post-harvest losses. It is suggested that flowers should be picked with a scissor and at the evening. Picking methods and picking times are very important regarding post-harvest losses (Ahmad *et al.,* 2015; Gangwar *et al.,* 2007; Murthay *et al.,* 2007; Bari, 2004; Ragni and Berardinelli, 2002; Mohyuddin, 1998). The role of the extension agent is very important in the production and marketing of the cut-flowers. The farmers having the availability of extension services when required had fewer losses (30 percent) as compared who have not access/availability of these services. The R^2 value was 0.39 and F-value (9.89) indicated the overall fitness of the model. Coefficients show that all the variables have an inverse relationship with losses (Table 1).

Determinants of PHL of Commission Agent Level : The results of Table 2 revealed that education of the farmers had a negative and insignificant impact on the PHL at the commission agent level. The coefficient of experience indicated that with one year increase in the experience of the commission agent the losses decreased about 0.999 times. The experienced people have more expertise in the handling, grading, and sorting, etc. of the flowers as compared to their counterpart who are less experienced in the business of the floriculture. There was insufficient space within the flower market. It was creating difficulties in auctioning of the flowers, particularly throughout peak seasons. Owing to the occurrence of disorganized market infrastructure facilities like platforms, shops, light, sewerage, and roads etc. were not prevailing in the markets. All the negotiating activities were being accomplished by standing by different intermediaries. The results of the study indicated the availability of infrastructure facilities in the auction markets of cut-flowers reduce losses of about 10 percent. The R^2 and F-value were 0.30 and 3.72.

Determinants of PHL at Wholesaler Level: At the wholesale market level, the findings of the econometric model showed that the variable years of schooling have the negative and insignificant impact of the losses. The coefficient of experience showed that one percent increase in experience results and 82 percent reduction in post-harvest losses. The dummy variable of loading method, cold storage, and infrastructure, transportation reduces the losses significantly. The losses during loading cartons (boxes) were 9.43 percent less than in the open loading method. Chances of losses during open loading are more because of pressing, injury, etc. Means of transportation like vehicle, road infrastructure, etc. play a major role in the post-harvest losses (Ayandiji *et al.,* 2009; Chohan and Ahmad, 2008; Aujla *et al*., 2007; Udas *et al.,* 2005; Bari, 2004; Basappa *et al.,* 2001; Bachmann and Earles, 2000; Kader, 1992; Liu, 1990). On transporting flowers in cold storage, the vehicle losses decreased up to 11.75 percent and with metaled road decreased by about 3 percent (Table 3). Reports showed that better cold storage facilities decreases the post-harvest losses (Ahmed *et al.,* 2015; Adeoye *et al.,* 2009; Basavaraja *et al.,* 2007; Bari, 2004; Kader, 1992). So, the statistical analysis results indicated that we should have a good transportation infrastructure, modern technology for storage and improved handling techniques. All the variables had a negative and significant impact on the losses except an education that was insignificant. The R^2 value was 0.34 and F-value of 4.60.

Determinants of PHL at Retailer Level: The coefficient of education was -0.580 which is significant. The results revealed a significant decrease in the losses of retailers with one percent increase in the education. Flowers are used to celebrating different religious, social and political ceremonies. Education of the retailers plays an important role in decorating all the ceremonies with flowers. The variable of experience was negative and significant. Ahmed *et al.,* (2015) also reported similar results. The results of the study indicated that with percent increase in the quantity of unsold flowers at retail the level the post-harvest losses increased about 53 percent. Ahmed *et al.,* (2015) reported that retailer's business is run on a daily basis, i.e. they purchased and then sell out daily. Therefore, unsold quantity on a daily basis causes great post-harvest losses to retailers. Ahmed *et al*. (2015); Bari (2004) and Liu (1990) also indicated that unsold quantity was lost daily and also retailers don't have enough resources to store their unsold commodity. The retailer's type is also an important factor causing post-harvest losses. There are two types of retailers one is small shopkeepers and second are hawkers/vendors. The findings of the retailer's econometric model revealed that when the retailer type is a shopkeeper, the losses were 5.32 times less than that of hawker retailer type. The majority of the retail shops in the study area was on the open road. The losses of retailers whose shops are on the open road are 4.84 times more than their counterpart who have proper a flower shop. Flowers are delicate and have a short shelf life. The retailers who have the availability of cold storage facilities have fewer losses (5.46 times) than those retailers who have normal storage (Table 4). Ahmed *et al.,* (2015) reported that Losses at retailer level

are obvious because he is unaware about the daily sales and he buy according to their experience and bears the losses in the shape of unsold quantity. Retailers should have their own shop to get good returns. The R^2 value was 0.31 and F-value of 5.47.

Table 1: Results of Multiple Regression Analysis at Farm Level.

Variables/Unit	Coefficients	Std. Error	t-value	Sig.
Constant	199.343	23.889	8.345	0.000
W_1 (Education in years)	-2.808	1.528	-1.838	0.069
W_2 (Flower growing experience in years)	-1.891	0.904	-2.092	0.039
W_3 (Area under floriculture in acres)	-6.424	1.851	-3.472	0.001
D_1 (Dummy variable for picking method)	-23.991	11.536	-2.080	0.040
D_2 (Dummy variable for picking time)	22.276	10.966	2.031	0.045
D_3 (Dummy variable for extension services)	-30.168	10.683	-2.824	0.006
R^2		0.39		
Adjusted R^2		0.35		
F-value		9.89		

Table 2: Results of Multiple Regression Analysis at Commission Agent Level.

Variables/Unit	Coefficients	Std. Error	t-value	Sig.
Constant	63.897	8.925	7.159	0.000
X_1 (Education in years)	-0.863	0.670	-1.288	0.209
X_2 (Experience in years)	-0.999	0.349	-2.861	0.008
D_4 (Dummy Variable for Infrastructure)	-10.354	5.202	-1.990	0.057
R^2		0.30		
Adjusted R^2		0.22		
F-value		3.72		

Table 3: Results of Multiple Regression Analysis at Wholesale Market Level.

Variables/Unit	Coefficients	Std. Error	t-value	Sig.
Constant	63.888	6.443	9.916	0.000
Y_1 (Education in years)	-0.323	0.479	-0.674	0.504
Y_2 (Experience in years)	-0.826	0.400	-2.067	0.045
D_5 (Dummy variable for loading method)	-9.435	3.984	-2.368	0.022
D_6 (Dummy variable for storage)	-11.752	3.954	-2.972	0.005
D_7 (Dummy variable for Infrastructure of transportation)	-3.042	4.295	-0.708	0.482
R^2		0.34		
Adjusted R^2		0.27		
F-value		4.60		

Table 4: Results of Multiple Regression Analysis at Retail Level.

Variables/Unit	Coefficients	Std. Error	t-value	Sig.
Constant	142.654	5.871	24.296	0.000
Z_1 (Education in years)	-0.580	0.276	-2.099	0.039
Z_2 (Experience in years)	-0.241	0.153	-1.577	0.119
Z_3 (Unsold quantity in Kgs)	-0.531	0.252	-2.110	0.038
D_8 (Dummy variable of type of retailer)	-5.300	2.246	-2.359	0.021
D_9 (Dummy variable for kind of shop)	-4.840	2.264	-2.138	0.036
D_{10} (Dummy variable for storage)	-5.464	2.389	-2.287	0.025
R^2		0.31		
Adjusted R^2		0.25		
F-value		5.47		

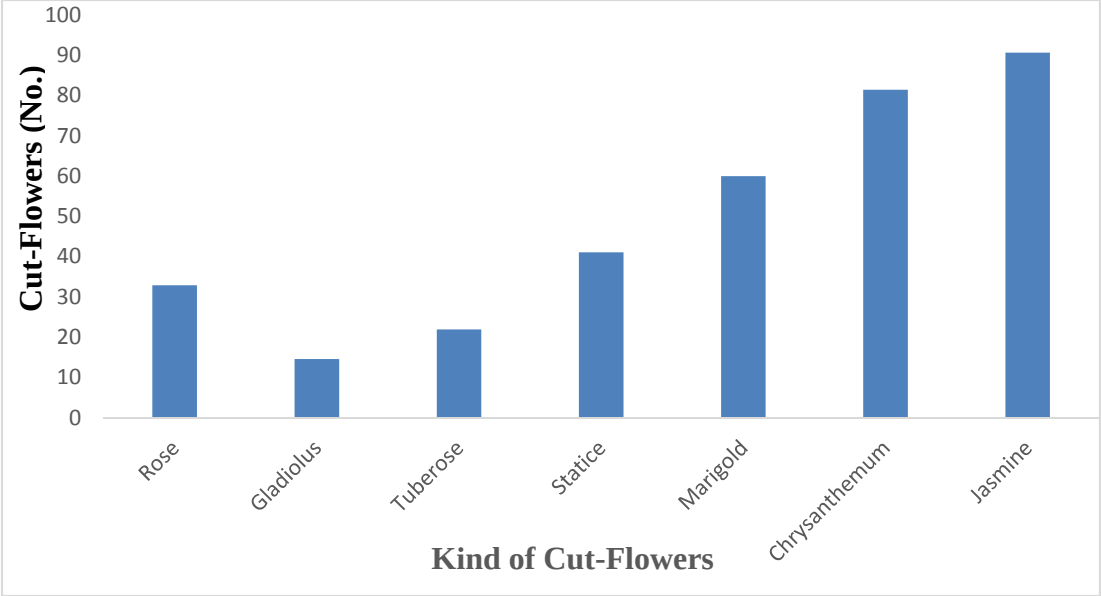

Figure 1: Total PHL of Cut-Flowers in Marketing Chain (No.)

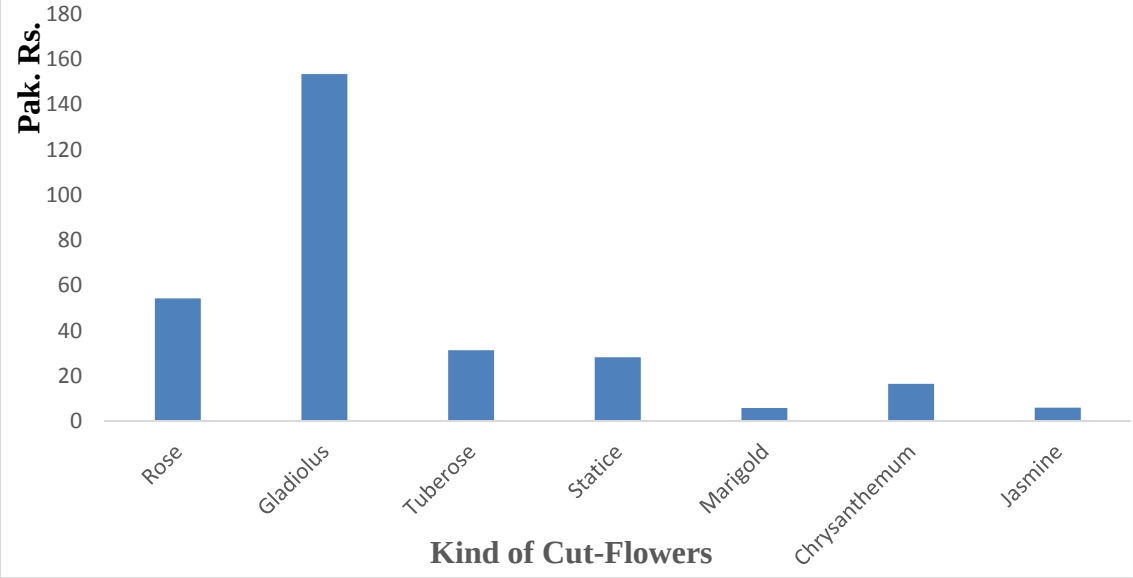

Figure 2: Total Value of PHL of Cut-Flowers in Marketing Chain (Rs.)

Conclusion: The econometric estimation revealed that variable of education, experience, floriculture area, picking method; picking time and extension services have a significant impact on losses on farm level, whereas education and infrastructure showed a significant effect on losses at a commission agent level. The determinants of post-harvest losses at the wholesale level were experienced, loading method, and cold storage and transportation; while education, unsold quantity, retailer type, kind of shop and storage place had a significant effect on losses at the retail level. The study suggests the following recommendations on the basis of the findings. Value addition and post-harvest management of flowers which can fetch about five to ten times more prices in the cut-flower markets. Storage losses could be reduced by providing small size cold storage units in the production centers. It is the need of the time that private and public sector should take the initiative to establish storage facilities. Growers should be trained about the modern technology and production practices related to this new profitable business. Proper training and scientific knowledge should be given to the traders regarding grading, handling, displaying and processing of the flowers. Most modern, well-equipped flowers markets

should be developed near the production areas. Permanent wholesale and retail markets should also be established by the government and local government. A well-organized extension program is a bridge between field application and research. The current department should provide well-equipped extension service program to extend valuable guidelines to the growers regarding flower farming, retaining of quality and reducing wastage during harvesting and enhancing the storage life of flowers. Extension services should be provided to different stakeholders involved in cut-flower business by the press and electronic media.

REFERENCES

Adeoye, I. B., O. M. O. Odeleye, S. O. Babalola and S. O. Afolayan (2009). Economic Analysis of Tomato Losses in Ibadan Metropolis, Oyo State, Nigeria. African J. of Basic and Aplid Sci. 1 (5-6): 87-92.

Aditya, D. K (1992). Floriculture in national economy. Proceedings of the 6th National Horticultural Conference and Symposium. BSHS, Pp. 30-35.

Ahmed, U. I., L. Ying, K. Mushtaq and M.K. Bashir (2015). An Econometric Estimation of

Post- Harvest Losses of Kinnow in Pakistan. Int. J. of Eco. Com. and Mng. 3 (5): 773-783.

Anderson, N. O., A. Younis and Y. Sun (2010). Intersimple sequence repeats distinguish genetic Asian J. Pharm. Biol. Res. 2:84-89.

Aujla, K.M., M. Abbas, K. Mahmood and S. Saadullah (2007). Marketing System of Fruits, Margins and Export Potential in Pakistan. Pakistan J. of Life Soc. Sci. 5 (1-2): 34-39.

Ayandiji, A., A. L. Kehinde, O. R. Adeniyi and O. Omotosho (2009). Gross margin analysis of post-harvest losses in Citrus spp in Ife ADP zone of Osun State, Nigeria. J. of Agric. Ext. and Rural Dev. 1(3): 77 - 84.

Bachmann, J. R. Earles (2000). Post-harvest handling of fruits and vegetables, Horticultural Technical Note, August 2000.

Bagchi, M. and S. K. Raha (2011). Post-Harvest loss of flower and its impacts on flower marketing in Bangladesh. Eco. Affairs. 56: 205-211.

Bari, A (2004). Economic assessment of post-harvest losses of mango in Multan and Rahim Yar Khan Districts. A postgraduate research thesis in department of Agricultural Economics, University of Agriculture Faisalabad.

Basappa, G., J. B. Deshmanya and B. L. Patil (2001). Post-Harvest Losses of Maize Crop in Karnataka - An Economic Analysis, Karnataka. J. of Agric. Sci. 20 (1): 69 – 71.

Basavaraja, H., S. B. Mahajanshetti and N. C. Udagatti (2007). Economic Analysis of Post-harvest Losses in Food Grains in India: A Case Study of Karnataka. Agric. Eco. Res. Rev. 20: 117 – 126.

Byczynski, L. (1997). The Flower Farmer: An Organic Growers Guide to Raising and Selling Cut Flowers. White River Junction, VT: Chelsea Green Publishing Company.

Chohan, T.Z. and S. Ahmad (2008). Post-Harvest Technologies and Marketing Channel in Tomato Production in Danna Katchely, Azad Jammu Kashmir. P. J. of Life and Soc. Sci. 6 (2): 80-85.

Dadlani, N. K (2003). Global Positioning of Bangladesh Floriculture. A paper presented in International Floriculture Conference on 6th November 2003, BARC, Farmgate, Dhaka.

Gangwar, L. S., Singh, D. and D. B. Singh (2007). Estimation of post-harvest losses in Kinnow Mandarin in Punjab using a modified formula. Agric. Eco. Res. Revl. 20 (July-December, 2007): 315 - 331.

Haque, M.A., M. A. Monayem Miah, S. Hossain and M. Alam (2013). Profitability of Rose Cultivation in Some Selected Areas of Jessore District. Bangladesh J. Agri. Res. 38(1): 65-174.

Ikram, S., U. Habib and N. Khalid (2012). Effect of different potting media combinations on growth and vase life of tuberose (*Polianthes tuberosa* Linn.). Pak. J. Agri. Sci. 49:121-125.

Jahan, H. (2009). Production, Post-Harvest Handling and Marketing of Cut Flowers in Bangladesh: An Agribusiness Study. SAARC J. Agri. 7: 1-14.

Kader, A.A. (1992). Post-harvest research technology of horticultural crops. University of California, Division of agriculture and natural resources, Oakland, California, USA. PP. 296.

Liu, F. W. (1990). Post-harvest handling of horticultural crops in Asia. Department of Horticulture, National Taiwan University.

Mohyuddin, Q. (1998). Post-harvest losses in agricultural commodities and their containment. Eco. Rev. May 1, 1998.

Murthy, D. S., T. M. Gajanana, M. Sudha and V. Dakshinamoorthy (2007). Marketing Losses and Their Impact on Marketing Margins: A Case Study of Banana in Karnataka. Agric. Eco. Res. Rev. 20: 47 – 60.

Nawaz, A., S. Gul., M. A. Anjum and F. Naveed (2009). Effect of Various Sucker Sizes and Planting Times on Growth and Flower Yield of Chrysanthemum. Pak. J. Agri. Sci. 46 (1): 7-12.

Ragni, L. and A. Berardinelli (2002). Postharvest Technology: Mechanical Behavior of Apples and Damage during Sorting and Packaging. J. Agric. Eng. Res. 78 (3): 273-79

Riaz, T., S. N. Khan, and A. Javaid (2007). Scenario of Gladiolus Production in Punjab, Pakistan. Pak. J. Bot. 39: 2389-2393.

Sidhu, S. (2005). Proceedings of the Seminar On "Diversification in Floriculture Trends and Avenues" held at University of Arid Agriculture, Rawalpindi.

Singh, B. K., E. S. Rakesh, V. P. S. Yadav and D. K. Singh (2010). Adoption of Commercial Cut Flower Production Technology in Meerut. Indian Res. J. Ext. Edu. 10: 50-53.

Sudhagar, S. (2013). Production and Marketing of Cut flower (Rose and Gerbera) in Hosur Taluk. Int. J. Bus. Manag. Inven. 2 (5): 15-25.

Udas, S., B. K. Rai, M. Gurung, R. Thapa and P. P. Khatiwada (2005). Assessment of Postharvest Handling Systems of Vegetables in the Eastern Hills of Nepal. Proceedings of 5th International Post harvest Symposium. Acta Horti., 682, ISHS 2005.

Younis, A., A. Riaz and M. Qasim (2002). Development and management of green spaces on Sumundri road, soil as affected by liming. nutr. cycl. Agro. eco.sys. 64:213-224.