POSTHARVEST LOSSES IN TRANSPORTATION AND STORAGE FOR FRESH FRUITS AND VEGETABLES SECTOR

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Abstract

It is expected that total food consumption will especially increase in strong economies due to growing world population and changes in consumption habits. This situation increases the pressure on resources and causes negative effects on the environment and health. Reducing losses in the fresh fruit and vegetable sector also contribute to resource efficiency while creating economic opportunities. In addition, policies aimed at reducing post-harvest losses and assessing food waste developed in countries are also causing new markets for secondary raw materials.

This study is an important source in terms of showing post-harvest losses in the fresh fruit and vegetable sector, the current situation regarding the assessment of food waste and the training needs of the sector employees. Also, it reveals the causes of food losses in the post-harvest sectors in Romania and the vocational training needs of the sector workers to reduce these losses.

Keywords: *postharvest, losses, fresh vegetables, fresh fruits, transportation, storage*

1. INTRODUCTION

The European Union, European Commission, European Council and the member states have as priority in politic – economical agenda to fight against food wastage. Working on strategies and concrete measures to reduce to half till 2025 the food wastage on entire supply chain, to grow up production efficiency and to sensitize public opinion on a topic ignored from many points of view. E.U. has reached to these conclusions after an estimation that only in Europe, each year, there are post-harvest wastages worth 4 billion Euros.

The Government of Romania adopted by GD 831/2004 the Norms on permissible limits of perishability of goods in the marketing process. According to these rules, by perishability, it is meant the decreases occurring during the transport, handling, storage and disposal of goods caused by natural processes such as drying, evaporation, volatilization, spraying, hydrolysis, cooling, freezing, melting, oxidation, adhesion to walls of wagons or vessels in which they are transported, decomposition, leakage, soak, thickening, spreading, crushing, breakage, including fermentation processes or other biophysical processes, in the sales process in the distribution network wholesale, retail and catering). According to these regulations, losses during transport and storage must be maximum 0.5% and 0.4% respectively.

Loss of food is a waste of resources used in production such as water and energy and food that will not be consumed will lead to a decrease in its economic value. In addition, food losses along the marketing chain lead to ethical, social and food consequences as well as environmental and health implications, given that huge amounts of unconsumed food contribute to global warming by transforming it into waste which generates methane that is a greenhouse gas twice as strong as CO_2.

Food losses occur throughout the supply chain from the stages of agricultural production to the stages of storage, processing, distribution, management and consumption. The true causes of food loss vary widely across the globe and are dependent on country-specific conditions and circumstances. In general terms, loss of food can influence the efficient use of crop land, capacity and internal infrastructure, marketing chains and distribution routes, consumer purchasing and how to use food.

Another important cause that generates considerable food losses is strictly related to the fact that there is no possibility for retailers to sell at a lower price, at the end of the day, the unsold fresh food which contribute even more to losses accumulation on the supply chain.

Overproduction, misdirection of products (unsuitable shape or size), product of packaging damage, the marketing rules (appearance issues or packaging defects) or an inappropriate management and marketing strategies represents vectors which may causes food losses.

In conclusion, the causes of foodstuffs losses are not always the same; they differ according to the stage of food supply chain, the type of product and the place where the food are wasted.

Dividing the food chain into five sectors (agricultural production, management and storage, processing, distribution and consumption), it can be seen how different behaviors in each sector leads to the elimination of perfectly edible food: starting with recording losses during harvesting and storage to transport unsafe transport conditions, labeling mistakes and consumers' habits.

The full responsibility for the fight against avoidable food waste, when is possible, belongs entirely to the actors of the food supply chain (Kitinoja & Kader, 2015).

In the study called "Save Food Initiative" F.A.O. (FAO, 2012) stated that 45% of the global production of fresh fruit and vegetables suffers losses, the study being made on zonal areas and on the food chain stages (agriculture, post-harvest, processing, distribution, consumption).

In the European countries, the fresh fruits and vegetables losses were about 20% at harvest, 4% at post-harvest, 1% by processing, 8% by distribution and 15% at consumption, its total losses being on the second place after industrialized countries from Asia.

According to FAO STAT, Eurostat/Comext, between 2009 and 2013 Romania is in top ten U.E. producers and consumers of fresh fruits and vegetables, on the first two places being Italy and Spain.

Fruit and vegetable producers in Romania can be broadly grouped into 3 categories: small farmers; groups of farmers and cooperatives.

Small farmers, who operate farms of less than 2 ha, with limited access to resources and technology, dominate the fruits and vegetables production sector (https://ec.europa.eu/eurostat/statistics). These small farmers generally show relatively little interest in postharvest and marketing activities which are primarily undertaken by middlemen.

Groups of farmers target different markets, and show a gradient in their production capabilities, limited access to financial resources and technology and low returns from their agricultural production.

Cooperatives operate modern marketing systems which integrate a cold chain, alongside the traditional marketing system.

2. MATERIALS AND METHODS

The first step of the study was to investigate the losses on selected fruits (grapes, cherries, tomatoes and figs) and the state of the art in Romanian agriculture in terms of producers and their associations.

The second step was to identify in transporters, big storage houses and small storage houses how they manage the losses.

Two questionnaires were used. One for transporters and the other one for people working in storage houses.

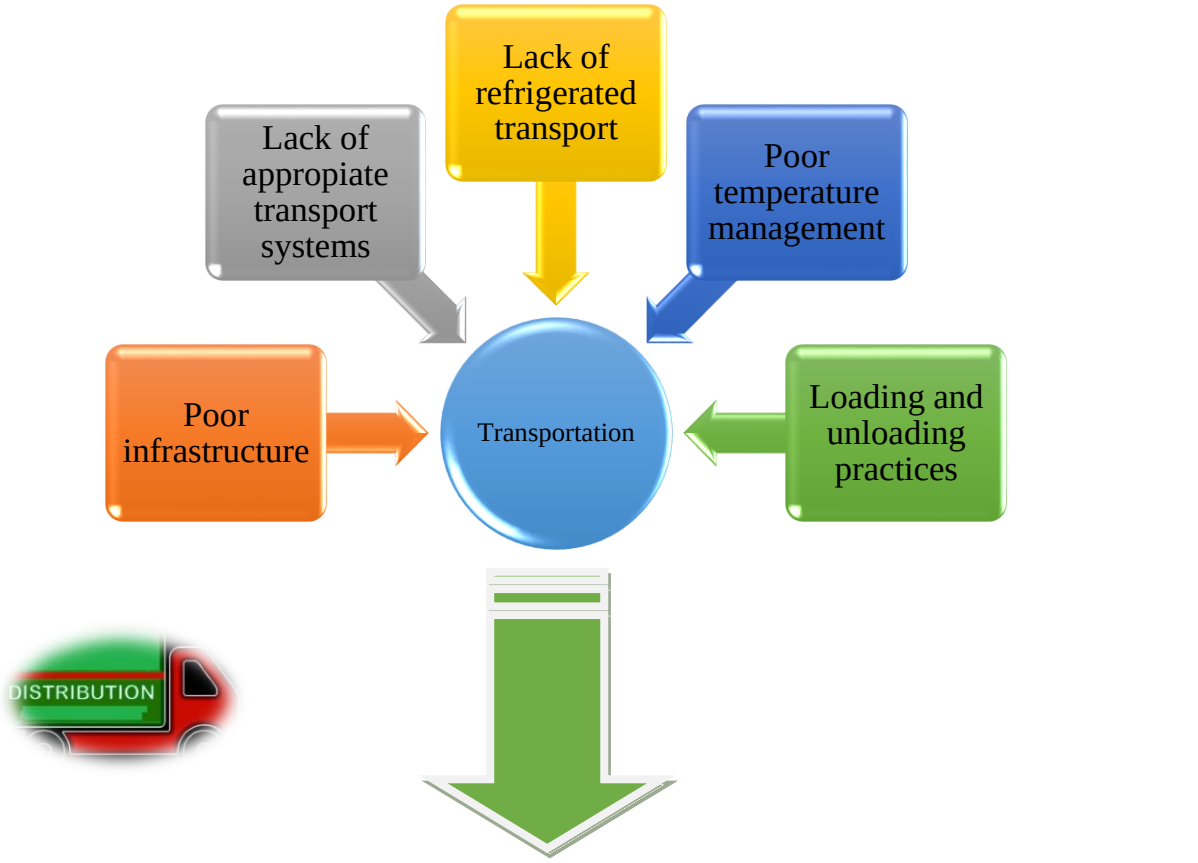
Data was collected and analyzed to identify the main problems.

3. RESULTS

The total annual production of tomatoes is decreasing in 2015 and drastically decreased in 2016. Annual winemaking grapes production fluctuated because it increased in 2015 and declined drastically in 2016. The production of table grapes fluctuated as in the case of winemaking grapes, but the

decrease in total production was much lower. In the case of cherry production, the annual production in 2015 is drastically decreased than 2014, the trend being kept in 2016 and a slight increase in 2017.

Consumers demand fresh products of good physical quality (appearance) which is safe. Losses in fresh horticultural products are directly related to quality degradation. Quality loss is the result of improper storage and transportation of fruits and vegetables. The general problems identified in postharvest loses are summarized in fig.1 respectively fig.2.



Recommendations:

- **Create awareness on proper transport system management;**
- **Use horticultural value chain vision;**
- **Provide financial incentives both in terms of front and back ends;**
- **Encourage investments;**
- **Provide laws that provide investors with assurance of security.**

Fig. 1. Problems and recommendations in transportation of fruits and **vegetables**

Fruits and vegetable are generally transported using vans, trucks, and on occasion, refrigerated vehicles. Mechanical injury during transportation often leads to considerable quality loss. Transportation is a major bottleneck in the marketing chain for fruits and vegetables.

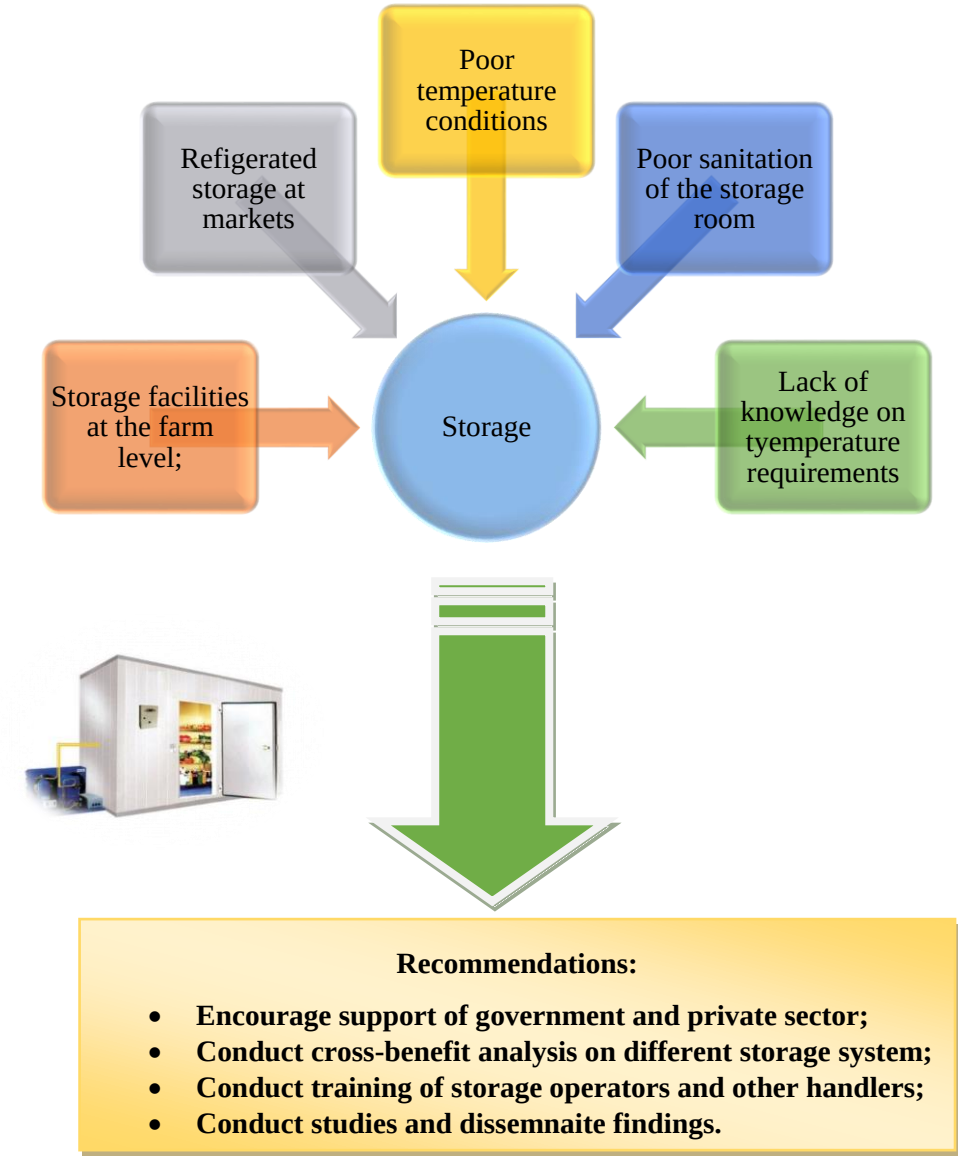


Fig. 2. Problems and recommendations in storage of fruits and vegetables

Proper storage of fruits and vegetables is critical to enhancing their shelf-life. Limited availability of suitable storage compromises quality and leads to considerable wastage. Losses along the fruit and vegetable chain result from: limited availability of silos, and storage facilities.

A number of technical and economic factors constrain postharvest in Romania. Major technical constraints include limited awareness and knowledge of farmers, limited facilities for the distribution of produce and the inadequacy of postharvest equipment. The unavailability of cold chain systems also poses a serious constraint to the postharvest handling of vegetables. Major economic constraints include high investment and daily operation costs. Entrepreneurs engaged in postharvest activities, generally have a lack of capital.

Mitigating these problems would necessitate: education of producers and distributors; improved control of transportation, distribution and storage of fruits and vegetables; building a suitably integrated fruit and vegetable chain for cooling, transportation, sorting, grading, storage, packaging and marketing of fruits and vegetables in different regions of the country.

The data collected on storage and transportation problems of fruits and vegetables in Romania are presented below. The studied group consists in producers, big storage houses, small storage houses and transporters (Fig.3.).

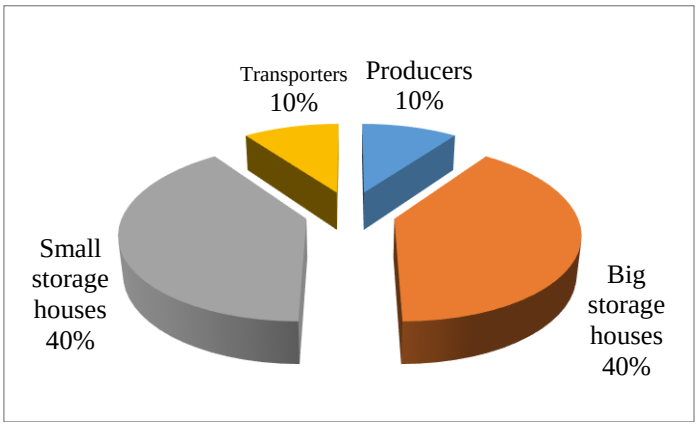


Fig. 3. The structure of the studied group

Small storage houses included the ones with only one type of fruit or vegetable (tomatoes for example) and big storage houses, the ones with more storage cells with different storage parameters for different products. The focus was especially on storage, because the main problems are here.

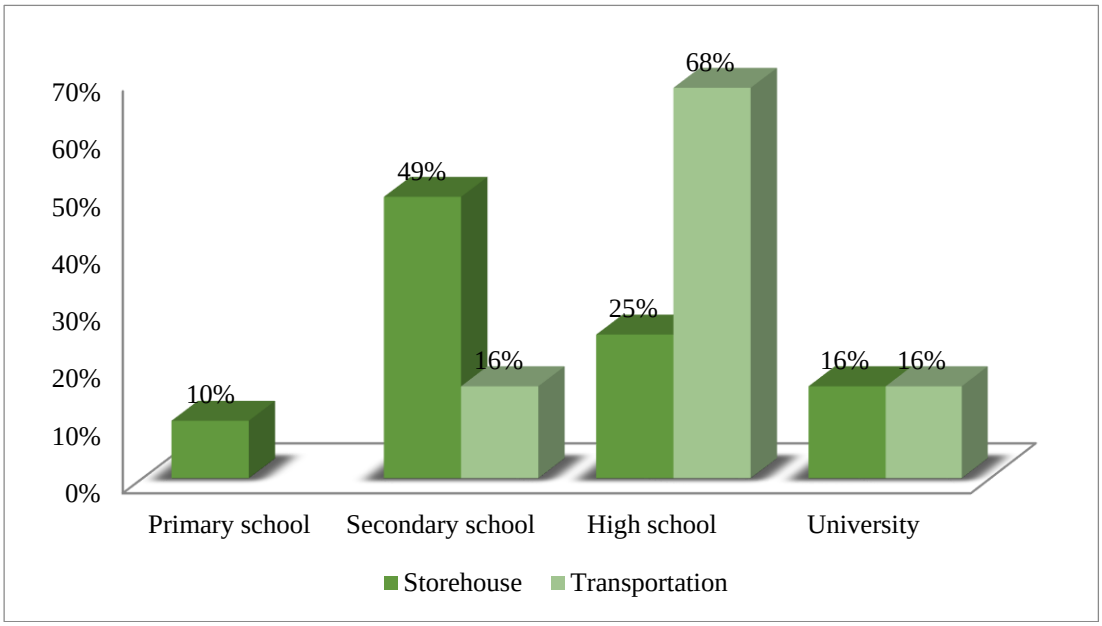


Fig. 4. The level of education of the staff

In terms of staff education levels, most have graduated from secondary school, only 10% graduated from primary school, working in unskilled jobs. 25% graduate from high school and coordinate certain activities, and 16% have university studies and have more responsibilities.

In transportation, most graduated high school 68 % and 16 % secondary school respectively 16 % universities.

Al those interviewed are familiar with controlled atmosphere.

Next question:

Is there a product loss due to storage? If yes, what are the reasons for you?

Most often mentioned was: Absence of modern technology. Followed by: Inadequate number of cold storage houses and Inadequate distribution of cold storage warehouses according to production area only one from interviewed answered positively to Lack of technical knowledge on storage conditions of fresh fruits and vegetables (Fig. 5)

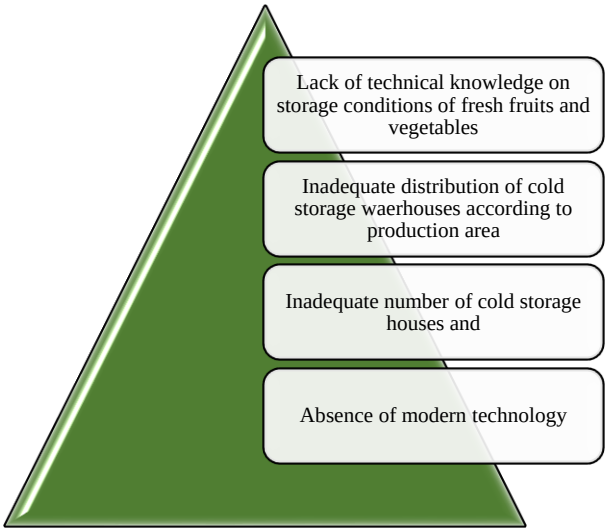


Fig. 5. Question: Is there a product loss due to storage? If yes, what are the reasons for you?

Also they mentioned:

- Predictability of the amount of vegetables on the market;
- Missing of the market outlet;
- Missing technical condition;
- Missing workers;
- Lack of cooperation between storage houses and producers;
- Lack of information storage disponibility.

In terms of: What is the rate of product loss due to storage? These are „10 % from total depends on vegetable type strictly on storage. There were cases 100%" but mainly 15 – 25 %.

Q 6: What are the challenges in storage? What are your suggestions?

- The use of preservation processes;
- Obtaining juices, canned products, drying;
- To have adequate storage areas and processing conditions depending on product quality and reception date;
- To create associations of suppliers to have certificates in the area;
- Buffer storages for ingathering and delivery;
- High performance harvesters to reduce losses and to assure a high % percent of product conformity;
- To keep the costs low as much as we can until the end of April – May. Storage will be a necessity;

- Pre-treatments for the products;
- Ventilation and control of respiration and of metabolits;
- To control the storage parameters and degree of loading;
- To have shorter storage time;
- Implementing new technologies in storage;
- Short distribution chains.

In transportation area, the question:

Is there a product loss due to transportation? If yes what are the reasons for you?

Not to transport product in suitable atmosphere was the main problem, followed closely by Product damages due to rough and hard mechanical processing. Next was: Transportation of unsuitable products together and Transportation of unsuitable products together (Fig. 6).

The product loses due to the transportation are relatively reduced comparing with storage no more than 5 %.

Q 9: What are the challenges due to transportation? What are your suggestions?

- Appropriate conditions for transportation and packing (bulk or transport packaging bags, chests, boxes etc.);
- To have the possibility to transport in the summer fruits and vegetables with different transportation parameter;
- To adapt the capacity of the vehicle to the quantity produced;
- Appropriate conditions for transportation;
- Quality packaging for quality assurance;
- The air condition unite for transport vehicles.

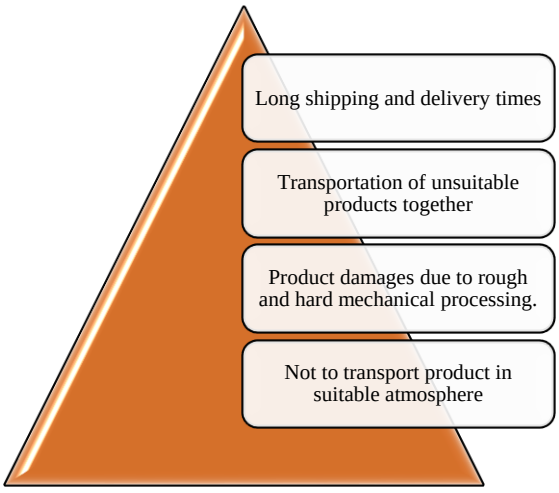


Fig. 6. Is there a product loss due to transportation? If yes what are the reasons for you?

90 % from employees have sufficient technical knowledge about the storage of fresh food products and 80 % from the employees have sufficient technical knowledge about the transportation of fresh food products.

Only one said that the vocational training materials for the storage of fresh products adequate respectively transportation are partly adequate, all the interviewed answered that these materials are adequate.

Taking into account these aspects, vocational training is recommended for both storage and transportation of fruits and vegetables.

4. CONCLUSIONS

This study was made at the beginning of POSTHARVEST ERASMUS+ Project (www.postharvestproject.com).

The study has been done to identify problems in the transport and storage of vegetable products and to highlight the need for staff training correlated with its level of education.

There were interviewed people working in small warehouses, large warehouses, processors and transportation. The level of education was predominantly secondary school storage and high-school transport.

The main problems in transportation (transportation of unsuitable products together, quality packaging for quality assurance and others) and in storage (lack of technical knowledge on storage conditions of fresh fruits and vegetables, implementing new technologies in storage, pre-treatments for the products), they pointed out that vocational training is needed.

ACKNOWLEDGMENTS

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