

FOOD LOSS AND WASTE IN THE FOOD SUPPLY CHAIN

Maryam Rezaei

is a Food technologist at FAO Nutrition and Food Systems Division (ESN). Her work includes providing technical support to food loss and waste assessment projects and formulation of national strategies on value chain development. She has an MSc. from Ecole Supérieure d'Agriculture d'Angers in France.

An estimated 30% of the food produced for human consumption globally is lost or wasted somewhere along the food supply chain¹. Meanwhile, the world's population is predicted to reach 9.1 billion by 2050 and this will require an increase of 70% in food availability.² A significant part of this growth will take place in developing countries, where steadily increasing urban populations continue to create complex and lengthy food supply chains involving many actors, presenting challenges in delivering safe, nutritious food that is of good quality. Tackling food losses and waste in an efficient, sustainable and integrated way should be considered an opportunity to feed people and optimize the use of natural and financial resources at the same time. The private sector, including the food industry, can play an important and unique role in food loss and waste reduction by optimizing food processing procedures, streamlining supply chains and linking farmers to market, among other things. Reducing the loss and waste of nuts and fruits is especially significant given their nutritional value and great potential for value addition.

What is food loss and waste?

Food loss and waste is defined as a decrease in the quantity or quality of edible food that is intended for human consumption. The redirecting of edible food to be used as animal feed, converting food to bioenergy and dumping into landfills are examples of a decrease in quantity. It is important to distinguish between food *loss* and food *waste* and the circumstances of their occurrence, especially when identifying causes and developing solutions and interventions to address this issue.

Food loss is mainly caused by the malfunctioning of the food production and supply system or its institutional and policy framework. This could be due to managerial and technical limitations, such as a lack of proper storage facilities, cold chain, proper food handling practices, infrastructure, packaging, or efficient marketing systems.

Food waste refers to the removal from the food supply chain of food which is still fit for human consumption. This is done either by choice or after the food is spoiled or expired due to poor stock management or neglect.

Food *waste* typically but not exclusively happens at the retail and consumer levels whereas food *loss* takes place at the earlier stages of the food supply chain – during production, post-harvest and processing stages.

Implications of food loss and waste

Food loss and waste have significant negative food-security, economic and environmental impacts. The value of annual food loss and waste at the global level is estimated at US\$ 1 trillion.¹ Food loss and waste may decrease food availability in the market, which may in turn increase food prices and reduce the capacity of low-income consumers to access food. Moreover, if the quality of food deteriorates so badly that the food has to be sold at a lower price or even discarded, the livelihood of farmers and producers is adversely affected.

Bin Liu

is an officer of Nutrition and Food Systems Division, FAO. His work involves food processing technologies and assessing food loss and waste. Before joining FAO, he worked on value chain development for International Potato Center in the Philippines.

Food loss and waste represent wastage of the water, land, energy and other natural resources used to produce food. In fact, the resources used to produce food that is eventually lost or wasted account for approximately 4.4 gigatonnes of greenhouse gas emissions (CO₂ equivalent) annually, making food loss and waste the world's third largest emitter, after only China and the United States³. Given that climate change has become a major concern among INC members⁴, the nut and dried fruit industry could benefit from climate change mitigation measures, and one effective way is by reducing food loss and waste in their operations.

Where does food loss and waste take place in the food supply chain?

The level of losses differ from one stage of the food supply chain to another, depending on crop type, level of economic development, as well as social and cultural practices in a region. In the case of fruits and vegetables, according to an FAO study,⁵ losses at harvest and during sorting and grading dominate in industrialized regions, probably mostly due to discarding during grading to meet quality standards set by retailers. In developing regions, while losses at harvest and during sorting and grading are also high, losses during processing (14% – 21%) are much higher than those in developed regions (< 2%), as depicted in Figure 1. The distinct difference highlights the need to improve processing technologies for perishable products like fruits and vegetables in developing regions. The food industry can make a substantial contribution in this area by developing and disseminating low-cost and effective techniques such as drying.

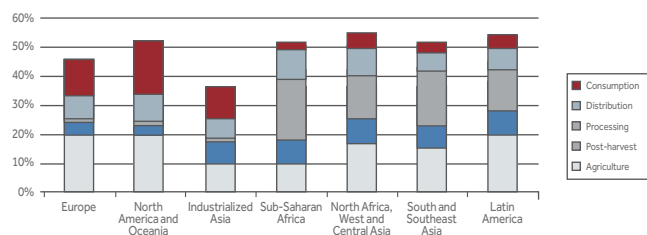


Figure 1. Percentage of the initial production lost or wasted at different stages of the FSC for fruits and vegetables in different regions. "Agriculture" indicates losses occurring during harvest operation and subsequent sorting and grading. "Post-harvest" indicates losses occurring during handling, transportation and storage immediately after harvest and before processing.

Strategies and solutions to reduce food loss and waste

Developing efficient solutions to reduce food loss and waste lies in the recognition of interlinkages among different stages of the food supply chain. In other words, the performance of each actor and cost of activities in upstream segments of the chain could determine the quality of the product further down the food supply chain. In this integrated supply chain approach, special attention should be paid to the impact of technical interventions on the social context

and environment and the cost of the solutions proposed should not exceed the cost of food that is lost. For instance, improving on-farm storage facilities to reduce post-harvest losses should be coupled with proper strategies and interventions to enhance access to markets. In low-income countries, solutions should first and foremost take a producer's perspective, e.g. by improving harvest techniques, farmer education, storage facilities and cooling chains. In industrialized countries on the other hand, solutions at the producer and industrial levels would only be marginal¹ if consumer education and appropriate stock management at retail level is not in place. Moreover, government investment on capacity building for agriculture and infrastructure and policy support to facilitate market access for farmers and to provide an enabling environment for private sector investment is a non-negotiable factor that cuts across most measures to reduce food loss and waste.

The food industry has long relied on technological advances to reduce losses and increase efficiency, and the nut and dried fruit sector is no exception. A few examples and scenarios will follow to illustrate the impact of different solutions on reducing losses and waste with a focus on nuts and fruits:

One of the major causes of losses in the nut sector in particular when the supply is procured from small farmers, is the absence of proper on-farm drying facilities. Many farmers employ traditional sun-drying during the summer, which could be compromised by sudden weather changes. This is often combined with a lack of knowledge and training on the best handling practices and tools to measure the crop humidity after drying. As a result, higher moisture content leads to biological contamination of the crop with mould and toxins during storage and eventual loss of quality, food safety and economic value. Therefore, training farmers and facilitating their access to basic tool kits to measure the moisture content of the crop and provision of alternative drying methods such as

hot air, fluidized bed, infrared and solar should be considered when formulating solutions to reduce losses in the nut sector.

An example of reducing losses in fresh fruits by using effective drying techniques is developing dried mango product in Kenya. More than half of the mango production in Kenya is lost before reaching market. To address this problem, the German Corporation for International Cooperation (GIZ) partnered with a Nairobi-based company called Azuri Health to develop a dried mango product^{6,7} under the FAO's initiative to reduce food loss and waste. With the financial and technical assistance of GIZ and other SAVE FOOD members, Azuri obtained solar driers and packaging facilities and successfully developed a dried mango product that meets the safety and quality requirements for entering the formal market in Kenya. In autumn 2016, Azuri started to build a new production site near Nairobi, with the long-term goal of entering markets such as Europe and the US.


Two more examples are the application of freeze drying to cosmetically imperfect fruits in US and the introduction of a new packaging system to an Italian nut company.^{8,9} In the former case, fruits rejected by retailers but perfectly fit for human consumption are made into dried fruit products. Thanks to the freeze-drying technique, their nutrients are preserved without adding preservatives. In the latter case, the loss of raw materials (nuts) in the packaging step is reduced to less than 1%. Considering that nut and dried fruit products can often demand high prices, reducing loss and waste is particularly significant.

In addition to processing technologies, simple strategies such as improved coordination and collaboration among value chain actors can often lead to reduction of losses.

In Australia (1996-99), a study showed that around 37,000 tonnes of bananas are lost every year due to rejection at the pack house because they don't meet customer specifications for sale

as fresh fruit. Thus banana growers started to work with packaging companies, state primary industry departments and retailers to identify the major causes of fruit damage in the supply chain and to identify solutions. They found out that losses also occur due to fruit damage in transport, storage and handling and in supermarkets due to poor staff handling (inadequate training) and consumer handling (lack of awareness). As a result of extensive collaboration and coordination, the supply chain became more streamlined. Research led by a major Australian retailer led to the introduction of cluster packing, the development of the six-per-layer carton, absorbent paper for sap control as well as the development of product specifications and systematic quality assurance to monitor fruit outturn at points along the chain and implementation of improved cold chain and processes from harvest through to retail.¹⁰

Conclusion

Reducing loss and waste throughout the food supply chain should be considered an effective solution to reduce the environmental impacts of agriculture, to improve the income and livelihood of the chain actors and to improve food and nutrition security for low-income consumers. An increasing urban population, changing food consumption pattern and trade globalization have rendered food supply chains extremely complex and lengthy, which calls for a change of mindset from the traditional way of addressing the causes of food loss at each stage of the food supply chain to an integrated approach. Investing in efficient, low-cost and sustainable processing technologies, adequate storage and packaging solutions, road infrastructure and market linkages as well as providing training and education to chain actors, including consumers, are among the tried and proven interventions which increase the efficiency of the chain and therefore lead to a reduction in food loss and waste. 

References

1. FAO. 2015. Global Initiative on Food Loss and Waste Reduction. Rome, FAO. (also available at <http://www.fao.org/3/a-i4068e.pdf>).
2. FAO. 2009. How to Feed the World in 2050. Background paper for High Level Expert Forum - How to Feed the World in 2050. Rome, FAO. (also available at http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf).
3. FAO. 2013. Food wastage footprint: Impacts on natural resources. Rome, FAO. 61 pp. (also available at <http://www.fao.org/docrep/018/i3347e/i3347e.pdf>).
4. International Nut and Dried Fruit Council. 2015. World Nut and Dried Fruit Congress sets a new road map for the industry. In: PR Newswire [online]. [Cited 14 April 2017]. <http://www.prnewswire.com/news-releases/world-nut-and-dried-fruit-congress-sets-a-new-road-map-for-the-industry-505979831.html>
5. FAO. 2011. Global food losses and food waste - Extent, causes and prevention. Rome, FAO. 29 pp. (also available at <http://www.fao.org/docrep/014/mb060e/mb060e00.pdf>).
6. Bloom, J. 2016. Kenyan farmers fight food loss by drying, selling mangoes. In: National Geographic | The Plate [online]. [Cited 14 April 2017]. <http://theplate.nationalgeographic.com/2016/01/22/kenyan-farmers-fight-food-loss-by-drying-selling-mangoes/>.
7. Anonymous. undated. SAVE FOOD SUCSESSES: the Mango Project. In: SAVE FOOD [online]. [Cited 14 April 2017]. http://www.save-food.org/cgi-bin/md_interpack/lib/pub/ft.cgi/Mango_Project.html?oid=54660&lang=2&ticket=g_u_e_s_t.
8. Anonymous. 2016. U.S.: Freeze-dried fruit and the fight against food waste. In: FreshFruitPortal.com [online]. [Cited 14 April 2017]. <http://www.freshfruitportal.com/news/2016/05/31/u-s-freeze-dried-fruit-and-the-fight-against-food-waste/>.
9. Anonymous. 2017. Italian nut supplier cuts waste with new machine. In: FreshPlaza.com [online]. [Cited 14 April 2017]. <http://www.freshplaza.com/article/169824/Italian-nut-supplier-cuts-waste-with-new-machine>.
10. Dr. Karli Verghese et al. 2013. Final report; role of packaging in minimising food waste in the supply chain of the future, Australia. (also available at file:///C:/Users/rezaei/Downloads/RMIT%20study_The%20role%20of%20packaging%20in%20minimising%20food%20waste%20in%20the%20supply%20chain_June%202013_FINAL.pdf).

Copyright: Food and Agriculture Organization of the United Nations (FAO). The views expressed in this publication are those of the authors, and do not necessarily reflect the views or policies of the Food and Agriculture Organization of the United Nations.