



Postharvest loss reduction for sustainable food and environmental security

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ABSTRACT

Food is lost or wasted throughout the food supply chain which has become serious global challenge today. Reduction of post-harvest food losses is a critical component to ensure food and environmental security for a world growing population. There is a need for an integrated and innovative approach to the global effort of ensuring sustainable food production and consumption.

Postharvest loss can be defined as the degradation in both quantity and quality of food from harvesting to till its consumption. Quality losses include those that affect the nutrient content as well as acceptability and edibility of the product. Food is lost or wasted throughout the food supply chain, from its initial agricultural production down to its final consumption at the household level. These postharvest supply chain include harvesting, handling, storage, processing, packaging, transportation and marketing. Food wastage refers to any food lost or waste. Food losses refer to the decrease in edible food mass or nutritional value of food that was originally intended for human consumption (FAO, 2013). Food losses take place at production, postharvest and processing stages in the food supply chain (Parfitt *et al.* 2010). Food losses are mainly due to poor infrastructure and logistics, lack of technology, insufficient skills, knowledge and management capacity of supply chain actors and lack of markets. Food waste refers to food appropriate for human consumption being discarded, whether or not, it is kept beyond its expiry date or left to spoil. Food waste occurs at retail and final consumption in the food chain and can be finally related to retailer' and consumers' behavior. Most food loss occurs during production in low-income countries whereas food waste is done at the consumption stage in developed countries (Hodges *et al.* 2011).

Although, the current food situation shows that almost 1.2 billion people are going hungry in the world but 1.3 billion tons per year of food produced will never be consumed by humans (Liu *et al.* 2013). Fruits and vegetables account for

approximately one-third of these losses and grains account for about one-fifth (Kader, 2005). In India, around 67 millions tonnes of food is wasted every year which has been valued at around Rs. 92,000 crores. Fruits and vegetables which are living parts of the plant are more likely to deteriorate faster since these continue to lose water after harvesting through an increase in physiological changes caused by high temperature, low atmospheric humidity and physical injury. Food wastage is not only a waste of food but also a waste of human effort, farm inputs, livelihoods, investments and scarce nature resources such as water. All these losses can be related to improper and insufficient storage and processing facilities or increasing urban population, the shift of lifestyle and diet patterns of the rising economic countries.

Food losses and waste are becoming increasingly critical to sustainable food and environmental security. A report by the Food and Agriculture Organization shows that while about 54% of the world's food waste occurs 'upstream' during production, postharvest handling and storage, only 46% happens 'downstream,' at the processing, distribution and consumption stages (FAO, 2013). This food loss and waste represent not only a missed opportunity to improve global food and nutrition security but also an unnecessary use of environmental resources. The current agricultural practices use 4.9 Gha (global hectares or 4931 million hectares) of the total 14.8 Gha (14894 million hectares) of land surface on the earth.



Table 1: Causes of Food Losses and Wastes at Different Steps of the Food Supply Chain

| | Harvest | Transportation | Storage | Processing | Consumers |
|-----------------------|--|---|--|---|--|
| Causes of loss | Pests Mechanical damage Spillage Crop sorting | Spillage Degradation Spoilage Bruising | Spillage Degradation Pests Drying out | Spillage Degradation Crop Spoiling | Inedible food discarded Edible food discarded with edible Discarded in packaging Thrown away after expiry dates |

Adapted from (Liu *et al.* 2013)

Agricultural production, in addition, uses 2.5 trillion m³ of water per year and over 3% of the total global energy consumption and with estimated food losses of about 30-50% of total production, this translates to wasting 1.47-1.96 Gha (global hectares or 4931 million hectares) of arable land, 0.75-1.25 trillion m³ of water and 1% to 1.5% of global energy (Fox and Fimeche 2013). This shows that food losses have negative environmental impacts on land, water and non-renewable resources such as fertilizer and energy that are used to produce, process, handle and transport food that no one consumes. Also, intensive farming practices, without allowing fields to lie fallow and replenish, contribute to soil degradation and excessive pressure on soil resources. Also, a low percentage of all food wastage is composted: much of it ends up in landfills and represents a large part of municipal solid waste. Methane emission from landfills also represents one of the largest sources of green houses gases (GHG) emissions from the waste sector. Food wastage's carbon footprint is estimated at 3.3 billion tonnes of CO₂ equivalent of GHG released into the atmosphere per year. These gases finally act like a blanket that absorbs IR radiation and prevents it from escaping into the outer surface, leading to global warming. The real costs of food wastage include societal costs which are currently borne by nature and people. Food losses and waste are, therefore, not only causing major economic losses but also wreaking significant harm on the natural resources that humanity relies upon to feed.

There is a need for an integrated and innovative approach to the global effort of ensuring sustainable food production and consumption. Nowadays, the reduction of postharvest losses to reduce food insecurity has become an important component of the efforts of many agencies. Obviously, one of the major ways of strengthening food security is by reducing food losses. A systematic analysis of each commodity production and handling system is the logical first step in identifying an appropriate strategy for reducing postharvest losses

(Bell *et al.* 1999; Kitinoja and Gorny, 2010). Techniques to reduce food losses require cultural and economic adaption since all food losses occur in a particular socio-cultural environment. There is a wide range of technologies available that can be adopted to improve the quality and quantity of food during the logistic food chain approach by smallholders and larger producers.

The postharvest losses can be reduced by improving on-farm operations through technological interventions like primary on-farm processing; storage and conservation solutions; improving transportation like integrated cold chain, use of plastic crates; increasing food processing capacity; establishing food banks and creating public awareness. The division of Post Harvest Technology, ICAR-IARI, New Delhi has also contributed in generating several technologies including post harvest management practices for extension of shelf life, long distance marketing, on-farm storage, alleviation of chilling injury; value added products from horticultural crops. These include RTS health drinks, jamun juice concentrate, dehydrated carrot shreds, ripe mango slices, dehydrated onion slices, frozen red capsicum, ginger slices; and processed products from grains like quick cooking dhal, roasted soy nut, extruded bajra puffs, sorghum flakes etc.

Reducing the amount of wasted food is a key element in developing a sustainable system. The benefits to consumers from reducing losses include lower prices and improved food security. In addition, well managed postharvest activities such as processing and marketing can create employment (thus income) and better food security in the agricultural sector. Also, the prevention of food loss and waste is generally associated with the increased availability of food for human consumption, enhanced efficiency and eventually more effective recycling of resources leading to savings in natural capital as well as lower resource use and GHG emissions. It is also of high importance in the effort to combat hunger, raise income and improve food security and livelihoods.



Postharvest losses are increasingly recognized as part of an integrated approach to realizing agriculture's full potential to meet the world's increasing food and energy needs. Specific and well-targeted policy interventions are needed to educate the farmers as well as the consumers on how to reduce post-harvest food losses and waste. These strategies can help farmers for better integration of provided technical advice and affordable solutions into agricultural programmes. Thus, postharvest loss reduction will increase food availability without increasing the use of land, water and agricultural inputs.

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