Food loss Solutions

October 2023

Food loss and waste in the banana supply chain for the Netherlands

The growing recognition of the economic, social, and environmental consequences of food loss and waste (FLW) has spurred a call to action among stakeholders in the food system. The United Nations' Sustainable Development Goals (SDGs) responded to this urgency through SDG 12.3, which aims to reduce global food waste by 50% before 2030. However, the question remains: where should one begin?

For companies, the target-measure-act approach provides a way of taking purposeful steps toward FLW reduction. By establishing concrete reduction targets, tracking progress, and taking corresponding actions, the challenging task of reducing FLW can be made manageable and transparent.

This factsheet serves as a stepping stone in embracing this approach. The information and statistics presented here aim to empower stakeholders to target FLW in the food supply chain and formulate their objectives accordingly. The data in this factsheet are the outcome of a collaborative effort between the Sustainability Initiative Fruit and Vegetables (SIFAV) and researchers at Wageningen University & Research (WUR), and have been complemented by literature sources and expert insights.[1] The factsheet includes a description of the national and global banana market, the FLW figures, and insights into potential causes and interventions.

Banana supply chain

Bananas ranked as the most popular fruit among Dutch consumers in the first half of 2021, closely followed by apples and oranges[3]. As this tropical fruit does not grow in the Netherlands, the market is totally dependent on its import. In 2021, the Netherlands imported 1,114 kilotons of bananas, with a value of 699 million euros[4]. Not all of these bananas are actually consumed within the Netherlands. A significant portion – 830 kilotons – is exported to neighbouring countries, especially within the European Union, after ripening[4] (Figure 1). This is equivalent to 74% of the total imported volume, and is therefore an example of the pivotal role of the Netherlands in the distribution of fruits and vegetables. The global trade in bananas consists of about 23,336 kilotons of imports and 24,584 kilotons of exports[11]. These substantial import and export volumes come with potentially significant economic, social and environmental consequences, making it crucial to address FLW throughout the banana supply chain.

Figure 1 Import and export of bananas in the Netherlands (2021).

Table 1 Food loss and food waste % + std. dev for bananas

Supply chain stage	**Production**	**Export** in-country handling	**Import** handling & distribution	**Retail**
Mean FLW percentage & standard deviation	3.8% ± 5.0%	10.2% ± 3.6%	0.1% ± 0.1%	4.3% ± 5.0%
Sample size	N = 11	N = 3	N = 6	N = 3

Food loss and waste (FLW) in the banana supply chain

This factsheet uses the FAO's definition of food loss and waste (FLW). FLW refers to the decrease in quantity or quality of the edible portion of raw, semi-processed or processed food intended for human consumption that is redirected to other non-food uses or productive use. Productive use includes animal feed, industrial use, and other uses (e.g. use as fertiliser and ground cover). Industrial use includes biofuels, fibres for packaging material, creating bioplastics, making traditional materials such as leather or feathers (e.g. for pillows), and rendering fat, oil or grease into a raw material to make soaps, biodiesel or cosmetics. FLW also includes the decrease in the nutritional value, food safety or other quality aspects from the time food is ready for harvest or slaughter to consumption. Food that has suffered a qualitative loss or waste but is still eaten by humans is not considered a quantitative loss or waste[12].

The difference between food loss and food waste is based on the stakeholder involved. Food loss is the decrease in the quantity or quality of food resulting from decisions and actions by food suppliers from the production stage in the chain, excluding retail, food service providers and consumers. Food waste is the decrease in the quantity or quality of food resulting from decisions and actions by retailers, food services and consumers[11].

Food loss and waste data

The data collection process consisted of templates distributed among SIFAV members, who in turn shared them with their downstream partners. Table 1 shows the results of the data collection[2] by presenting the mean FLW percentage relative to the total produced or inbound product, and the standard deviation, for a simplified supply chain. Additionally, the number of companies that shared their data is reported. The producing and exporting countries included in the sample were Ecuador, Peru, Colombia and Costa Rica. The reported SIFAV data is partially in line with the data reported in literature. At farm level, the reported percentage of 3.8% is slightly higher than the average found in literature, which is 2.2% (n=3)[5,6,7]. Literature validation for losses incurred at the exporter/importer stage is complicated, due to the fact that studies have looked at FLW in different supply chain configurations. These differences include chains varying in terms of the total volume being handled, the number of supply chain actors involved, and their respective target markets. At the retail stage, the reported average of 4.3% is somewhat lower than the average found in literature, which is 5.7% (n=3) [5,8,9].

Destinations of discarded bananas

Figure 2 shows the destinations of discarded bananas not suitable for human consumption anymore, as reported by the participating SIFAV members. The visualisation is based on 'Moerman's Ladder', which ranks the value of valorisation options from high to low. The icons correspond with the supply chain stages, and the presence of an icon indicates that at least one actor mentioned this category as a destination of discarded bananas.

Impact of food loss and waste of bananas

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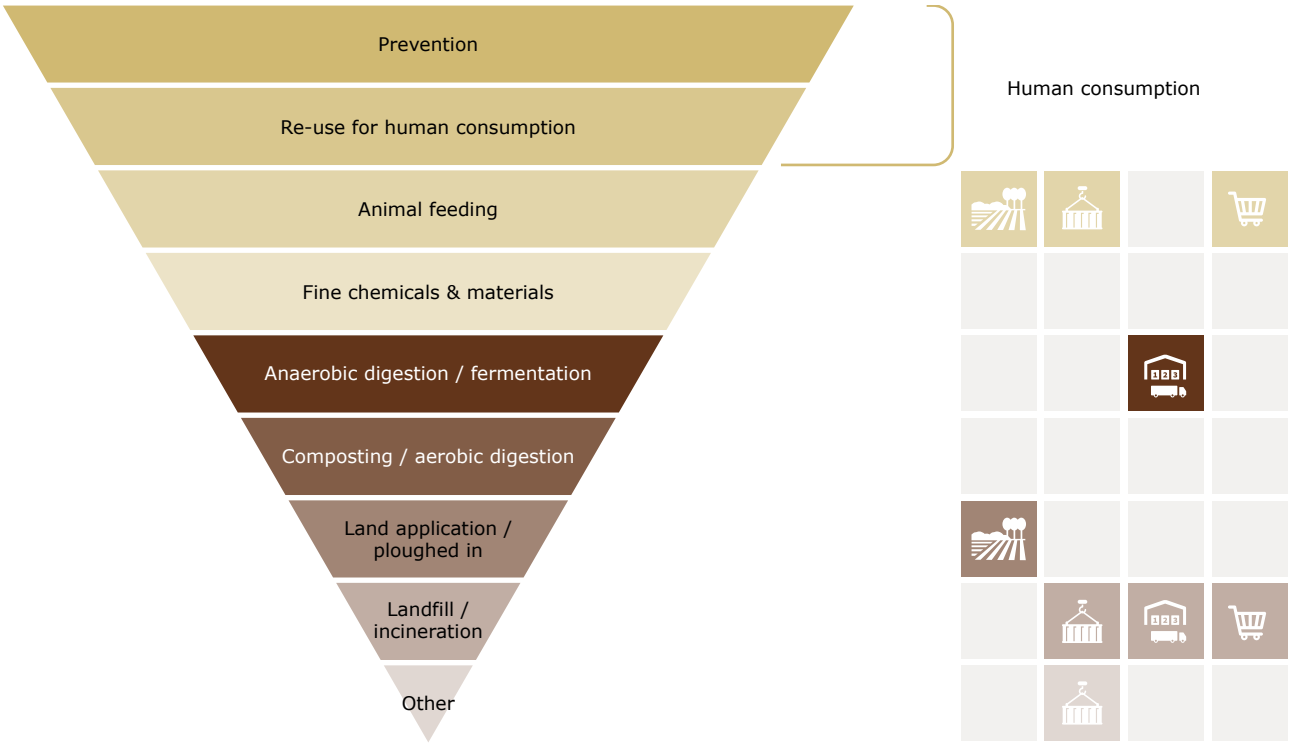

Figure 2 Destinations of discarded bananas

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Causes of FLW in each supply chain link

Table 2 shows the causes of FLW for bananas, per supply chain stage. These causes are generic and are applicable to a variety of other perishable food items. Banana-specific examples are provided in brackets. This information has either been sourced from literature or been provided by an expert.

Table 2 Causes of FLW in each supply chain link

Supply Chain Link	Causes of FLW
Farm	• Poor harvesting and post-harvest practices[8] (e.g. bruises due to rough handling) • Pest damage or disease infections[8] (e.g. Black Sigatoka)
Exporter	• Damage due to inadequate packaging (e.g. scuffing of bananas) • Non-conformance with export standards (e.g. too large or small)
Importer	• Quality rejection at arrival (e.g. yellow bananas due to inadequate maturity stage at harvest or wrong temperature settings during shipment) • Inadequate storage conditions (e.g. too high concentrations of ethylene causing overripening)
Retailer	• Inventory management[8] (e.g. overstocking or suboptimal storage conditions) • Consumer preferences[8] (e.g. oddly shaped or overripe yellow-brownish bananas)

Interventions to prevent and reduce FLW

Table 3 provides potential interventions for FLW reduction for bananas, per supply chain stage. The information in the table has been either derived from literature or provided by an expert. In Table 3, interventions are classified into three categories: interventions related to hardware, software and orgware. Hardware refers to the physical assets that are needed to adequately handle and preserve the product throughout the chain. Interventions related to software are about the skills, knowledge and communication that guide daily operations and decision-making. Lastly, orgware relates to the organisational aspect, being about the roles and responsibilities throughout the chain[12]. Addressing all three categories ensures a comprehensive approach to developing strategies to decrease FLW.

Take-home message

- The percentage of FLW in the international supply chain of bananas to the Netherlands is 19.3% in total, with on average 3.8% attributed to primary production, 10.2% to export, 0.1% to import and 4.3% to retail.
- Most of the losses appear to occur during the export phase, possibly because of the natural variability in the incoming produce during this stage. The lower percentage of losses observed in the downstream stages may be attributed to the standards applied by these stakeholders, resulting in rejects which are not seen nor registered as losses.
- The main root causes of FLW for bananas include pest damage, damage from weather events, cosmetic defects, inappropriate packaging and loss due to maturation.
- The main interventions for FLW reduction for bananas include pest-preventing measures, appropriate packaging, and carefully controlled ripening processes.

Acknowledgements

We would like to express our appreciation to SIFAV for their efforts and active involvement during the data collection process, which have provided valuable insights into FLW across various fruit and vegetable supply chains. Furthermore, we would like to express our appreciation to the Ministry of Agriculture, Nature and Food Quality. This project received financial support from the Knowledge and Innovation Agenda for Agriculture, Water and Food, which also funded the development of this factsheet.

Table 3 Potential interventions for FLW reduction per supply chain link

	Hardware	Software	Orgware
Farm	• Proper, smooth packaging to protect products against heat, insects, friction and bumping during waiting and transport • Simple temperature-controlled storage and cooling/pre-cooling techniques	• Implement Good Agricultural Practices (GAP) • Implement and supervise Standard Operational Procedures (SOPs) • Understanding grading and quality specification of the market	• Short lead times from harvest to cooling • Obtain timely supply of proper insecticides, fungicides, fertiliser and other inputs • Access to internet, network, and ICT tools and services • Digitised traceability systems • Aggregation services with quality control procedures
Exporter	• Proper temperature-controlled infrastructure (cooled trucks, reefers and cooled processing and storage facilities) • Good post-harvest product treatment	• Good compatibility, temperature and ethylene management in the warehouse (e.g. right temperature settings and combined storage) • Streamline border crossings by making sure official documents are complete and filled out correctly	• Short lead times from arrival to departure • Good communication, coordination, planning and forecasting with suppliers and clients (digitised traceability systems – with temperature logs)
Importer	• Create good demand and forecasting technology • Monitor side-streams automatically	• Carefully control ripening process to avoid over-ripening • Good compatibility, temperature and ethylene management in the warehouse	• Eliminating the delay between reefer delivery and quality checking • First-expired-first-out warehouse management system • Match supply and demand by delivering based on weekly programmes with clients
Retailer	• Quality-based pricing system • Monitor side-streams automatically	• Good compatibility, temperature and ethylene management in the shelfs • Interventions that persuade consumers to buy products that deviate from the standard	• Lower aesthetic standards to lower the rejection of edible food on cosmetic grounds in preceding supply chain links • Promoting imperfect fruits and vegetables, and products made from ingredients that otherwise would be wasted

References

1 Please be aware that the reliability of the SIFAV data presented in this factsheet is constrained by the sample size at each supply chain stageportion.

2 Deviating from the FAO definition, feed is reported as being FLW in the analysis.

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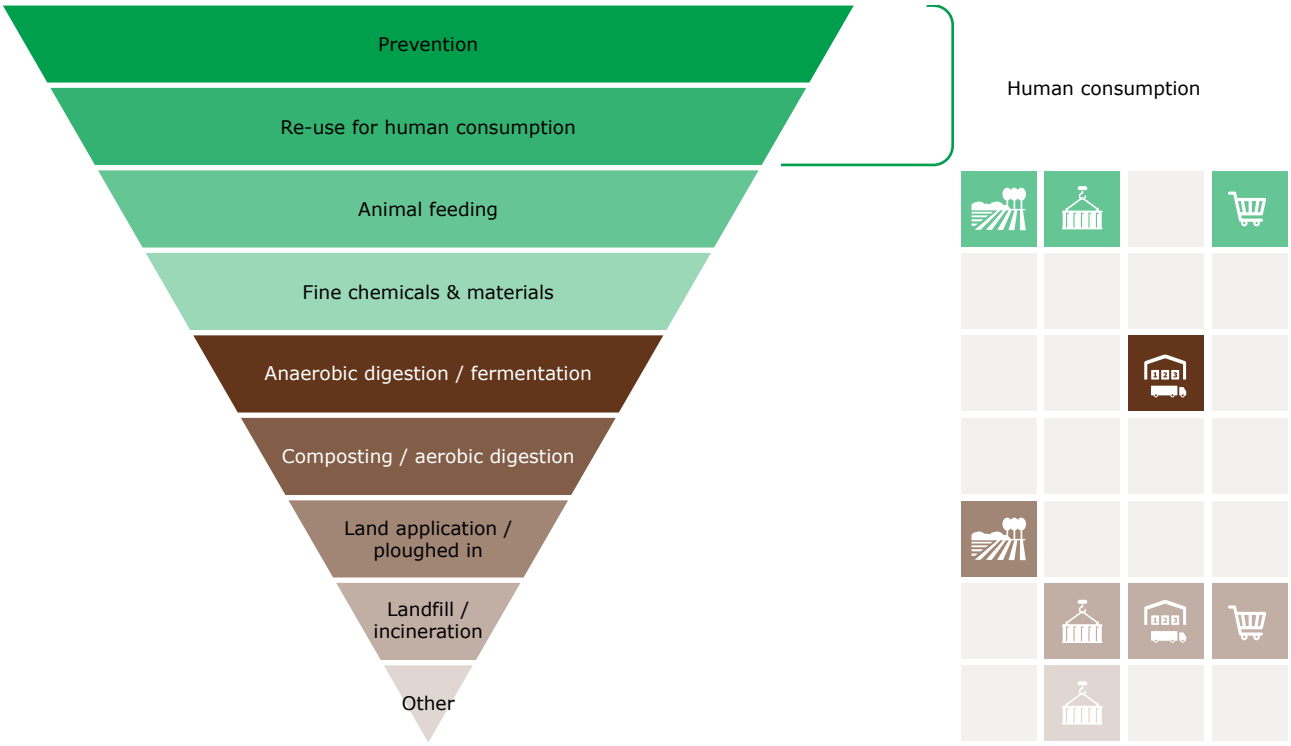

Figure 2 Destinations of discarded bananas

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