

# Food losses in primary production: the case of Flanders

Kris Roels<sup>1</sup>, Jürgen Vangeyte<sup>2</sup>, Veerle Van Linden<sup>2\*</sup>, Dirk Van Gijseghe<sup>1</sup>

<sup>1</sup>*Division for Agricultural Policy Analysis, Department of Agriculture and Fisheries, Koning Albert II-laan 35 bus 40, Brussels, 1030 Belgium*

<sup>2</sup>*Agricultural Engineering Department, Technology and Food Science Unit, Institute for Agricultural and Fisheries Research, Burg. Van Gansberghelaan 115, Merelbeke, 9820 Belgium*

\*Corresponding author: [Veerle.Vanlinden@ilvo.vlaanderen.be](mailto:Veerle.Vanlinden@ilvo.vlaanderen.be)

## Abstract

Notwithstanding some important obstacles which hinder robust quantification, estimates on a global and European scale indicate that an important amount of food is lost during its journey through the food production and consumption chain. A broad and diverse set of factors, including technical, economical, behavioral and policy aspects, cause these losses at each link of the chain. Food losses, which appear to be a structural inefficiency of our food system, create a moral, ecological and economic problem. It moreover provides both problems and opportunities in a situation where society strives to establish a sustainable food system able to feed 9 billion people by 2050 without exceeding the world's ecological boundaries.

In response to growing international interest and social concerns with regard to the issue of food losses, the government of Flanders (northern region of Belgium) has taken up the challenge to address food losses. An interdepartmental working group was installed to coordinate research activities from all departments of the Flemish Government. These investments will deliver a knowledge base on which a evidence-based and stakeholder-supported policy concerning food losses can be developed. The entire chain will be reviewed in cooperation with different food chain stakeholders.

This article presents parts of the results of a more extensive research (Roels & Van Gijseghe, 2011) that reviews the existing literature on food losses and produces food loss estimates for primary production. The most important issues in animal production concern livestock mortality, disapproved carcasses in slaughterhouses and loss of milk (e.g. mastitis) and eggs. In the fishing industry, the problem of fish discards as well as losses through market intervention are reviewed. Main losses in agriculture are losses during harvest and storage of cereals, potatoes and sugar beets. Losses in horticulture manifest at both production and auction level. When all figures are aggregated it is estimated that the total food loss in the Flemish primary sector in 2010 was between 534,000 and 817,000 tonnes.

**Key words:** food loss(es), food system, Flanders, primary production, quantification

## 1. Introduction

In the past, several international institutions and organizations (OECD, FAO, European Commission) have focused on losses in the food system. In recent research, Gustavsson et al. (2011) value the overall loss of edible food, from farmer to consumer, at 1.3 billion tonnes. That corresponds to a staggering one-third of worldwide food production or approximately 1.3 tonnes of food for each malnourished person in the world.

The impact of the problem of food losses cannot be underestimated. Food losses, which appear to be a structural inefficiency of our food production and consumption system, create a moral, ecological and economical problem. We are currently unable to feed the world's population as the population will remain to grow. The production and consumption of food have a large environmental impact and the loss of food is a waste of energy and already scarce resources. Finally, financial losses, both in the food supply chain and at the consumer level, reach billions of euros while food prices are rising worldwide and food poverty in Europe is increasing. This situation provides both problems and opportunities as we strive to

establish a sustainable food system able to feed 9 billion people by 2050 without exceeding the world's ecological boundaries.

In response to growing international interest and social concerns with regard to the issue of food losses, the government of Flanders took up the challenge to address food losses. An interdepartmental working group was created to coordinate research activities from all Flemish government departments. This paper presents parts of the results of a more extensive research (Roels & Van Gijsegem, 2011) where the authors reviewed existing literature on food losses and estimate food losses in Flemish primary food production.

After an overview of definitions, the 3<sup>rd</sup> section describes the state of play. The core of the results, the food losses in the Flemish primary production, are addressed in section 4. The 5<sup>th</sup> and final section discusses the findings and gives an overview of the conclusions.

## **2. Definition of food loss and food waste**

The OECD defines *food waste* as any reduction in the available food supply that occurs in the food supply chain. Three categories are used (OECD, 2011).

- *Food losses* are all elements that are removed deliberately from the food supply chain, e.g. non-edible food elements.
- *Food discards* are edible food that is disposed of or food that becomes inedible due to small (cosmetic) inadequacies.
- The third OECD category is *the inefficient use of food* leading to a reduction in food supply or reduced nutritional value of the food.

Based on the broad OECD definition, we define food loss as *any reduction in the food available for human consumption in the food supply chain, from harvest to consumption*. We make a distinction between unavoidable (non-edible food elements) and avoidable (edible food elements) food loss. We prioritize avoidable food losses and the third category, the inefficient use of food, is not taken into account. Pre-harvest losses are not considered. Our main goal is to create a framework for the very broad concept of food loss.

## **3. Food losses: state of play**

In the European Union, the total food loss (avoidable and unavoidable) is estimated at 89 million tonnes per year or 179 kg per person. The agricultural sector is not included in this estimate. Households and the food industry have the largest share in that loss, being responsible for 43% and 39% of food losses, respectively (Monier et al, 2010).

With the total food loss estimated at 3.6 million tonnes per year, Belgium has the 8th place in the European ranking. The Belgian food industry and households are responsible for the largest portion of this loss. In Wallonia (southern region of Belgium) households waste between 14 and 23 kg per inhabitant per year, representing an annual financial loss of 174 euro per household (Vandercammen, 2008). The region around Brussels (Belgium's capital) wastes an average of 15 kg of food per person per year, totaling 15,000 tonnes for all inhabitants of Brussels (RDC-Environment, 2004a). The total food loss in the rest of the Brussels chain is estimated at 54,350 tonnes (RDC-Environment, 2006).

In Flanders, the only available data come from a study of the mixed household waste fraction of Flemish households: 12% of this fraction is food, of which 5% was avoidable food loss (OVAM, 2011).

## 4. Food losses in the Flemish primary sector

### 4.1 Purpose and methodology

Because little systematic data is available about food losses in Flanders, our aim is to improve the quantification of food losses. We focus on the first link in the chain: primary production (plant and animal production and fisheries). The methodology we used combines statistical data from government and private data sources with expert estimates and own calculations. After the definition of the boundaries of the production systems, we identified possible types of losses. The available data and the estimates were then used to come to loss percentages and absolute loss numbers (tonnes) for the most important agricultural sectors and products in Flanders. These results should be treated with care because the figures are best estimates. More detailed figures and calculations including references are given by Roels & Van Gijsegem (2011).

### 4.2 Findings

The most important issues concern livestock mortality, disapproved carcasses in slaughterhouses, loss of milk and eggs in animal production, discards and market intervention in the fishery industry, harvest and storage losses in arable agriculture and process losses in horticulture at both production and auction levels.

#### 4.2.1 Livestock

Losses in meat production include livestock mortality and disapproved carcasses in slaughterhouses.

In 2009, 366,205 pig carcasses, 29,327 sow carcasses and 265,523 units of piglets (special containers) were collected at farms (41,529 tonnes in total). In the same year 112,969 bovine and calves carcasses (18,970 tonnes) and 54,303 poultry units (5,430 tonnes) (chickens and other poultry) were counted. The mortality rate per category is showed in Table 1 under 'loss percentage', representing the total loss in proportion to all animals on the farm<sup>1</sup>. For comparison of mortality rate, the same definition and calculation method is used for all types of livestock farming.

In both 2009 and 2010, less than 0.3% of the slaughtered animals (cattle, calves and pigs) were rejected in Flemish abattoirs. For poultry, 1.6 and 1.45% of the slaughtered animals were rejected in those respective years.

Milk loss can arise from clinical mastitis, quality problems which result in a delivery ban, and contamination of milk with antibiotics.

Mastitis is one of the leading causes of milk losses. Combined with decreasing milk production, lameness and fertility problems, mastitis is one of the main reason to cull a cow. There are no clear data on the amount of milk losses available. An online survey among 281 Flemish dairy farmers with a mean quota of 560,000 litres and an average herd of 66 dairy cows in 2010 resulted in an average amount of 3.88% cases of clinical mastitis per month (M-team, 2010). Extrapolation of these figures results in a total annual loss of 17,700,000 L milk. Such amounts obviously call for more robust data on the impact of clinical mastitis in Flanders.

Quality problems can also cause milk loss. If milk collected from a farm is repeatedly deemed to be poor quality, the farmer is temporary banned from delivery (average duration of 5 days). This results in both milk loss and significant economic loss for the farmer. With an average of 45.2 dairy cows per Flemish dairy farm in 2010, we calculated a total of 4,429.6

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<sup>1</sup> This is the ratio of the number of dead animals, stillbirths included, to the sum of the initial stock, internal transfer of animals on the farm to another animal category (e.g. from piglet to pig), livestock purchased and animals born and stillborn.

cows with an average annual milk production of 6,954 L being banned. This results in an annual loss of 422,000 L milk.

When high levels of antibiotics are measured in milk, the product can be deemed contaminated and unsalable. However, losses of milk through this route has been nearly insignificant: 0.04% of all deliveries totaling 1.934 billion litres in 2010 or 773,600 litre milk loss.

In one year the total identified milk loss in Flanders is 18,895,600 L. The total milk delivery (circa 2 billion liters in 2010/2011) in Flanders this is a loss percentage of 0.95%.

The loss of eggs was also considered. The amount that is not used for human consumption is estimated to be smaller than 1%.

#### 4.2.2 Fishing industry

From 2004 on, the Institute for Agricultural and Fisheries Research (ILVO) has sampled discards of the most important commercial fish species. Concrete data is only available for those commercial species. In total an average 25% of the catch is discarded. An extra loss (1-3 %) is caused by low prices resulting in a market intervention.

#### 4.2.3 Arable agriculture

Losses in cereals are small in arable agriculture. Data are hard to find. Loss during harvest and storage are estimated at 2 to 3%. Similar loss percentages (2.6 - 3.6%) are found for sugar beets.

Potato harvesting and sorting result in higher losses. First, part of the area planted is not harvested (not quantified in this study). During harvest 7.5% is lost; losses during sorting total 5 to 15%. Losses in storage are estimated at 2.5%.

#### 4.2.4 Horticulture at farm and auction level

In horticulture, losses vary greatly, depending on the type of horticulture and the scale at which different loss types occur. Quantities vary from nearly 0% (some vegetables in open air) to rather high rates. E.g. 30% of the production of cherries under bad weather conditions. At the level of the auctions losses are relatively limited (<1%) with 3.627 tonnes lost for human consumption.

#### 4.2.5 Total losses in Flemish primary sector

If all figures are brought together, the total loss in the Flemish primary sector (2010) is estimated to be between 534,000 and 817,000 tonnes of food materials (Table 1).

### 5. Discussion and conclusions

Several definitions of food loss exists, but we choose to define food loss as any reduction of the food available for human consumption in the food supply chain from harvest to consumption. Food losses can be divided into avoidable and unavoidable food losses.

We estimate total loss in the Flemish primary sector in 2010 to be between 534,000 and 817,000 tonnes of food (materials). It is very important to stress that the figures given in this paper are estimations and therefore the results should be treated carefully.

In relative terms primary production is quite efficient. Some sectors still have room for improvement. A large part of food losses are valorized in one way or another, however valorization has not been mapped in this research.

Table 1: Overview of types of losses, loss percentages and absolute loss, per (sub)sector

(sub)Sector	Type of losses	Loss percentage	Absolute loss (tonnes)
<b>1. Livestock</b>			
1.1 cattle	dead animals	1,6 - 6,9 %	18,970
	rejection in abattoirs	0,20 %	-
1.2 pigs	dead animals	2,9 - 17,4 %	41,529
	rejection in abattoirs	0,22 %	-
1.3 chicken	dead animals	3,8 - 6,8 %	5,430
	rejection in abattoirs	1,45 %	-
1.4 milk	loss of milk	0,95 %	18,896
1.5 eggs	loss of eggs	< 1 %	1,054
<b>2. Fisheries</b>			
2.1 fish	fish discards	25 %	4,647
	market intervention	1-3 %	422
<b>3. Arable agriculture</b>			
3.1 cereals	harvest	1 %	11,776
-	storage	2 %	23,316
3.2 potatoes	harvest	7,5 %	154,736
-	sorting	5 - 15 %	95,421 - 286,262
-	storage	2,5 %*	40,554
-	-	2,5 %**	45,325
3.3 sugar beets	harvest + cleaning	2,6 - 3,6 %	40,264 - 55,750
<b>4. Horticulture</b>			
4.1 vegetables – open air	process losses	5 -10%	34,676 - 73,204
-	-		
4.2 Belgian endive	process losses	20 - 25%	9,750 - 13,000
4.3 lettuce	process losses	20% (head lettuce)	11,472
-		6% (lamb's lettuce)	732
4.4 cucumber, tomato, bell pepper	process losses	1 - 2%	2,811 - 5,679
4.5 apples	process losses	1 - 5%	3,155 - 16,441
4.6. pears	process losses	2 - 8%	5,751 - 24,502
4.7 cherries	process losses	5 - 30%	243 - 1,983
4.8 strawberries	process losses	2 - 10%	611 - 3,327
4.9 auctions	total loss	<1 %	3,627
<b>5. Primary production – total loss</b>	-	-	<b>534,614 – 817,309</b>

\* after 5 % sorting loss

\*\* after 15 % sorting loss

Notwithstanding some important obstacles hindering a robust quantification of food loss, the estimates indicate that an important part of the food we produce is lost. In order to take a system's approach on the issue, an interdepartmental working group was created to coordinate research activities from all of the departments of the Flemish government. Next to the results on food losses in the primary sector, the Public Waste Agency of Flanders (OVAM) is carrying out a research project called "Food Losses in Chain Perspective". This research project brings together relevant stakeholders from field to fork to identify food losses throughout the food chain, to investigate opportunities for chain collaboration on this issue and to deliver policy recommendations. The project will produce estimates for other food chain branches (from food industry to consumers). Combined, these investments will deliver a knowledge base on which a stakeholder-supported policy concerning food losses throughout the food chain can be developed.

To conclude we can state that a broad and diverse set of factors, including technical, economical, behavioural and policy factors, are causing these losses at each step of the food chain. Food losses appear to be a structural inefficiency of our food system, and create a moral, ecological and economic problem. Priority should be given to prevent food losses, re-

introduce food into the food system or reprocess food materials into new food products. Unavoidable food losses furthermore require a maximal valorisation, which respects a cascade of valorisation steps and which puts human consumption at the top of the cascade.

We recommend a better quantification of food loss, more research into the underlying causes of food loss, and the inclusion of food loss in the global food debate. The loss estimates for the primary sector can play a role in further research focused on the reduction and optimal valorisation of food losses at the farm level.

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## 6. References

Gustavsson, J., Cederberg, C., Sonesson, U., Van Otterdijk, R., & Meybeck, A. (2011). Global food losses and food waste, Extent, causes and prevention. Rome: FAO.

Kantor, L.S., Lipton, K., Manchester, A., & Oliveira, V., (1997). Estimating and addressing America's Food losses. Food Review, 20, 1, 2-12.

Monier, V., Mudgal, S., Escalon, V., O'Connor, C., Anderson, G., Montoux, H., Reisinger, H., Dolley, P., Ogilvie, S., & Morton, G., (2010). Preparatory study on food waste across EU27. European Commission DG Environment. Brussels: EC - DG Environment.

M-Team. (2010). De Grote Mastitis Enquête. Gent: Universiteit Gent, M-team. [http://www.m-team.ugent.be/pages/m-news/nl/2010/M-news\\_november\\_2010.pdf](http://www.m-team.ugent.be/pages/m-news/nl/2010/M-news_november_2010.pdf)

OECD Working Party on Agricultural Policies and Markets. (2011). Waste management in the food chain: scoping paper. Paris: OECD.

OVAM. (2011). Nulmeting van voedselverspilling bij Vlaamse gezinnen via sorteeraanlyse van het restafval. (in Dutch). Mechelen: Openbare Vlaamse Afvalstoffenmaatschappij.

RDC-Environment & SITA. (2004). Analyse de la fraction organique des déchets ménagers, Bruxelles: RDC-Environment.

RDC-Environment. (2006). Évaluation des quantités de déchets alimentaires en Région de Bruxelles-Capitale. Bruxelles: RDC-Environment.

Roels, K. & Van Gijsegem, D. (2011). Verlies en verspilling in de voedselketen. (in Dutch). Brussels: Department of Agriculture and Fisheries, Division for Agricultural Policy Analysis.

Vandercammen, M., (2008). Le gaspillage alimentaire: mieux le comprendre pour mieux le prevenir. Brussels : Centre de recherche et d'information des organisations de consommateurs.