



Life Cycle Analysis of fresh produce products: memo on fresh produce handling

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Introduction

This memo has been prepared to provide guidance in calculating the environmental impact of fresh cuts, for which modelling rules are not included in the 2nd draft of the FreshProducePEFCR. The goal of the FreshProducePEFCR is to develop a consistent and specific set of rules to calculate the environmental impact of fresh fruits and vegetables. This enables sector actors to make comparisons and comparative assertions wherever this is feasible, relevant and appropriate. The FreshProducePEFCR and this memo, follows to the best extent possible, the recommendations of the most recent guidance for developing Product Environmental Footprint Category Rules (PEFCR) published by the European Commission.

This document first defines the scope of this memo, i.e. the additional handling steps that are covered. In the second part this memo gives recommendations on how to model these steps in line with the FreshProducePEFCR.

Disclaimer

Environmental footprint results calculated with the FreshProducePEFCR and this memo shall not be compared to results calculated outside of this PEFCR as different modelling rules can provide an unfair comparison.

Scope

The FreshProducePEFCR is developed for fresh produce products that are marketed fresh and directly to the consumer (i.e., without transformation of the product itself). A complete overview of products falling in scope of the FreshProducePEFCR can be found in section 3.1 of the FreshProducePEFCR. Processing (i.e., transformation of the product itself) of fruits and vegetables with potentially adding ingredients falls outside the scope of the FreshProducePEFCR. Cutting, slicing and compiling of products is not seen as 'processing' in the FreshProducePEFCR, but fall under 'handling'.

This memo addresses modelling rules for these handling steps (cutting, slicing and compiling). The product under study can be a single fresh produce product (e.g. lettuce) or be a mix of various fresh

products (e.g. lettuce mix). If the product under study is a mix of two or more products, the composition shall be listed. Fresh herbs that are in scope of the FreshProducePEFCR are seen as fresh produce and are in the scope of this memo. The fresh produce shall (cumulatively) add up to 100% of the total mass. This means that products that contain canned/frozen/dried or otherwise preserved products are not included in the scope of this memo since the fresh produce does not add up to 100% of the total mass. Fresh produce in products that use preservatives fall under the scope of this memo, however the preservatives itself are excluded from this memo as it is expected to have a negligible impact.

Handling steps included in the scope of this memo are listed in box 1. Examples of products that that fall in the scope of this memo are: pre-cut vegetable mixes, bags of washed spinach and washed kale (see box 2).

Box 1 – Handling steps included in the scope of this memo

Sorting, washing, drying (of water used for washing), peeling and taking of other inedible parts (e.g., apple cores), cutting/slicing/grating and compiling.

Box 2 – Examples of products included in the scope of this memo



Products that go through other processing steps than those listed in box 1, such as dry-aging or cooking are not included in the scope of this memo. This means that products such as dry-aged beet steak or fried vegetable snacks do not fall in the scope of this memo.

Box 3 – Examples of products **not** included in the scope of this memo



To summarize, this memo covers products that match the following scoping criteria:

- Criteria 1:** the handling of fresh fruits and vegetables is mentioned in box 1.
- Criteria 2:** 100% of the mass consists of fresh produce product falling in scope of the FreshProducePEFCR
- Criteria 3:** fresh produce that use preservatives are in scope of this memo, however the preservatives itself are not included in this memo.

System boundary

The system boundaries of this memo are identical to the ones adopted in the FreshProducePEFCR (see figure 1 in this memo, and section 3.1 of the FreshProducePEFCR). The handling steps covered in this memo fall under the life cycle stage 'post-harvest treatment, storage and handling'. The

stages occurring before this life cycle stage ('raw material acquisition, pre-processing and starting material' and 'cultivation') are assumed to be identical for fresh produce product marketed directly to the consumer and fresh cuts. Therefore the rules in the FreshProducePEFCR applies (see section 6.1 and 6.2) and no changes shall be made. The same applies to the life cycle stage 'End-of-Life'.

This memo provides additional modelling rules for the following life cycle stages: 'post-harvest treatment, storage and handling', 'distribution', 'consumer packaging', 'retail' and 'use stage'. Those rules are additional prescribed in the FreshProducePEFCR, therefore this memo should be read in conjunction with the respective sections in the FreshProducePEFCR.

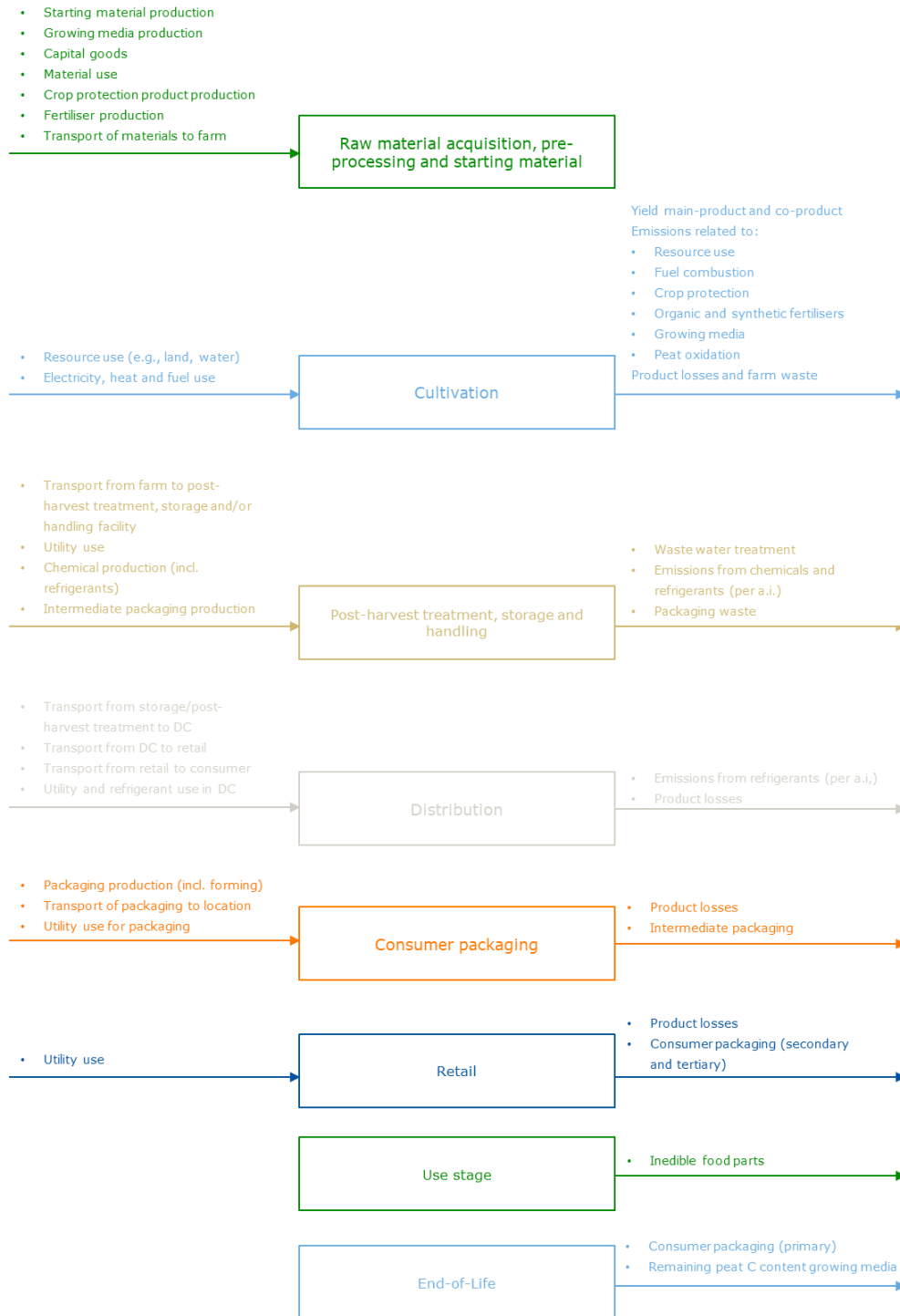


Figure 1 System boundary diagram FreshProducePEFCR

Source: own work of researchers, Wageningen Social and Economic Research

Additional modelling rules per life cycle stage

This chapter provides the additional modelling rules for the life cycle stages where the products covered in this memo deviate from those covered in the FreshProducePEFCR

Post-harvest treatment, storage and handling

The additional handling steps for the fruits and vegetables such as cutting, slicing and washing require input of electricity, water, and chemicals. The electricity and water use shall be included and company specific data shall be used. Electricity shall be modelled following the rules described in Section 5.8 in the Fresh Produce PEFCR.

Factory-wide data allocation

If data on electricity, chemicals and water use is available factory-wide instead of on product level, allocation based on output mass shall be applied. Different allocation methods were considered, for which the considerations are listed below.

- *Economic allocation*: this is allocation based on revenue of the product compared to the total revenue of the factory. Revenue can sometimes be a good indicator of the added value of a product. However, due to marketing strategies and economic fluctuations, revenue is not always connected to applied handling steps (and therefore utility use). It is possible that a product that requires many handling steps (and thus has a high energy and water use) is sold for a low price whereas a product that is created in the same factory and sold for a high price can require low energy and water inputs. Based on economic allocation, the product with the higher price (with lower electricity and water use) would get a bigger share of the factory-wide electricity and water use than the product with the lower price (with higher electricity and water use). Therefore, we do not consider economic revenue as an appropriate basis for allocation of factory-wide electricity, chemical and water data to products.
- *Input mass allocation*: this is allocation based on the mass of the product used as input into the factory. When a product enters the factory, no handling actions such as cutting have taken place. Therefore it is a more pure product. Allocating factory-wide data on basis of this mass however does not give us the share of electricity and water use per output product. It could be that a certain input product results in two output products. Splitting it from the input product over those output products gives another allocation issue. Since this approach does not solve the allocation problem we were facing, we do not consider this as appropriate basis for allocation of factory-wide electricity, chemical and water data to products.
- *Output mass allocation*: this is allocation based on the mass of the output products of the factory. This mass allocation would be in line with the FreshProducePEFCR. According to this mass allocation heavy output products take a higher share of the factory electricity and water use than lighter products. This is often used in LCA and data collection is easy. Although weight doesn't necessarily correlate to electricity and water use, it can be used as a proxy. We consider this approach to be far from perfect, but the best option available for allocation of factory-wide electricity, chemical and water data to products.

Chemicals

Often a type of physical, chemical and gaseous treatment is used in order to maintain the quality of the vegetables and fruits after washing/cutting/slicing them. Company-specific data shall be collected on types of chemicals and/or gases used in post-harvest treatments and handling. This data involves the specific active ingredient and its CAS number, the use rate in grams per year per crop weight unit for the crop under study.

For the production of chemicals and gases secondary data may be used. Wherever possible, product type specific datasets shall be used. Transport of these products to location shall be omitted.

In case the chemical agent is dissolved into or mixed with water (e.g. via washing). Chemical agents are assumed to go to wastewater-treatment and shall be modelled as such. More specific data may be used if available.

Inedible fractions

During the handling steps, the inedible parts are removed from the fruits and vegetables. Product-specific inedible fractions shall be used. If available, primary data on inedible fractions shall be used. If not, these fractions shall be taken from Appendix 6 of the FreshProducePEFCR. In case the product is not available in this table, the nearest proxy within the same sub-category shall be chosen.

The treatment of waste from the handling steps covered in this memo (including the removed inedible parts), shall be modelled according to the default background dataset for biowaste in the EF 3.1 database. In case more specific information is available, it shall be modelled using company specific data.

If the inedible part is used in other food products that are covered by this FreshProducePEFCR, this inedible part comes free from environmental impact. This is in line with the FreshProducePEFCR as the inedible part is seen as waste.

Storage and packaging

After the handling steps, the product needs to be stored in a cooled storage. If available, company-specific data for refrigerated storage shall be used. If no primary data is available, default data for refrigerated storage from the PEF guidelines shall be used.

In case any packaging (excluding consumer packaging) is added to the product, it shall be accounted for according to the modelling rules in section 5.7 of the FreshProducePEFCR.

Distribution

Following the FreshProducePEFCR, outbound transport, from location of cultivation or first handling activity, is a mandatory company-specific process. The distribution route might be different when the fruits and vegetables are washed/cut/sliced. For distribution after outbound transport, supply-chain specific data shall be used if available.

In case no supply-chain specific information is available for the other transport legs than the first, the following default scenario shall be used:

- 1200 km, by truck (>20t EURO 5), 100% Loading Factor (LF), from latest destination (this shall not be the farm itself) to DC;
- 250 km, by truck (>20t, EURO 5), 100% LF, from DC to retail;
- 3.1 km, by passenger car, from retail to consumer (the allocation rules described below shall be applied to this distance);
- 0.25 km, by truck (<10t, EURO 5), 20% LF, from retail to consumer.

How to allocate the burdens between the transported products shall be calculated following section 6.4 in FreshProducePEFCR.

The storage for cut/sliced/washed vegetables needs to be cooled and shall be modelled using the default data for storage activities described in section 6.4 from the FreshProducePEFCR.

The waste of products during distribution shall be included in the modelling. The default loss rate for distribution is derived from the PEF method (EC, 2021) and corrected for the losses at retail (2.1%). A waste percentage of 7.9% shall be applied. If more specific data is available, this may be used.

Consumer packaging

Consumer packaging shall be modelled following the modelling rules in section 6.5 of the FreshProducePEFCR.

Retail

Retail shall be modelled following section 6.6 in the FreshProducePEFCR as cooled fruits and vegetables. The default values described in this section should be used unless better primary data values are available.

Use stage

The use stage shall be modelled according to the modelling rules described in section 6.7 of the FreshProducePEFCR except for the food waste. Since the inedible parts are already removed at the handling steps, the waste of inedible parts is not included in the use stage for products covered in this memo. Therefore, there is no treatment of inedible parts covered in the use stage.

Company-specific handling inventory data

For the life cycle stage 'post-harvest treatment, storage and handling' additional company-specific data shall be collected. For the other life cycle stages, no additional data-point shall be collected. A description of the data that shall be collected can be found here below, an overview can be found in table 1.

Utility use shall be collected of the additional handling steps. If applicable, data on leakages of refrigerants (per type), on use of other energy sources (per type) and direct emissions shall also be collected.

Company-specific data shall be collected on types of chemicals and/or gases used in post-harvest treatments and handling for among others preservation of the fruits and vegetables. This data involves the specific active ingredient and its CAS number, and the use rate in grams per year per crop weight unit for the crop under study.

Table 1 overview of mandatory company-specific data

Post-harvest treatment, storage, and handling	
Energy use	
Water use	
Refrigerants leakage	If applicable
Direct emissions	If applicable
Chemicals used in post-harvest treatments	<ul style="list-style-type: none">Active ingredients and CAS number;Use rate in grams per year per crop weight unit
Gases used in post-harvest treatments	<ul style="list-style-type: none">Active ingredients and CAS number;Use rate in grams per year per crop weight unit
Rest of life cycle stages	
As described in	
FreshProducePEFCR	

More information

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