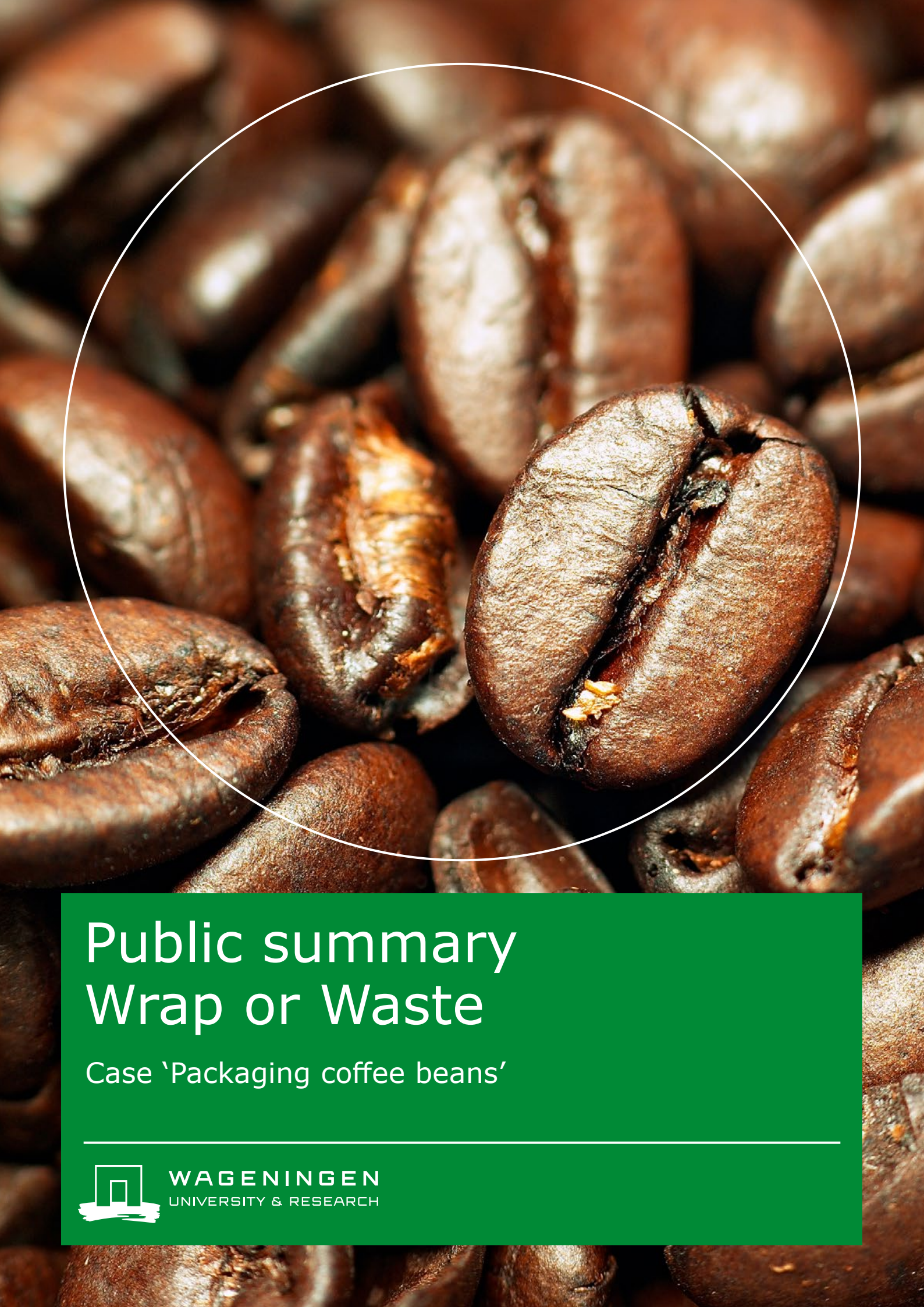

Public summary Wrap or Waste

Case ‘Packaging coffee beans’

WAGENINGEN
UNIVERSITY & RESEARCH

Many packaging companies face dilemmas in their search for more sustainable packaging. Which packaging is more sustainable under which conditions? How do you compare various types of packaging regarding sustainability? We Wonder Company focuses on selling sustainable coffee (and tea). The company wants to organise its entire chain as sustainably as possible and it therefore also wants to offer products in sustainable and environmentally friendly packaging. This case was tackled within the Wrap or Waste PPP project by researchers from Wageningen University & Research (WUR), with funding from TKI Agri Food and the companies involved.

Packaging dilemma: Roasted coffee beans

Roasted coffee beans quickly lose their aroma. In order to keep their pleasant smell, they are usually packed in packaging with an air barrier that excludes oxygen, and sometimes with a pressure relief valve. This is typically multi-layer, flexible packaging that may include a solid layer of aluminium to create a virtually absolute oxygen gas barrier. Such packaging is not recyclable under the current Dutch recycling system.

We Wonder Company and the researchers have looked for alternative packaging that sufficiently protects the roasted coffee beans, to guarantee consumer satisfaction without increasing food waste. A calculation tool developed within the project was used to quantify the sustainability effects of different packaging choices for coffee beans.

An analysis was conducted to calculate the greenhouse gas emissions of the entire production chain of the packaged product, including possible effects of the packaging on the shelf life and loss of the product. In addition, factors such as recyclability and the risk of litter formation were quantified for each product-packaging combination. Scenarios were also used to examine the sensitivity of the calculation to various assumptions, such as the number of times a packaging is reused.

Assumptions

Selection of alternative packaging

Based on a literature study and discussions between the researchers and We Wonder Company, the following packaging concepts were selected to be included in the analysis of coffee packaging for the business market:

- The current packaging as a reference: Pouch made of an aluminium-based multi-layered flexible packaging film with a pressure relief valve
- Reusable steel can with sturdy resealable plastic lid
- A kraft paper pouch with a PLA inner layer and a pressure relief valve

Sustainability analysis – calculation tool

The sustainability of the packages of different films have been assessed with a calculation tool. This calculation tool has calculated the greenhouse gas emissions related to the packaged products, including the effects of shelf life and food losses and waste. Besides, aspects such as the recyclability and circularity of the different packages are quantified.

Shelf life and loss of freshly roasted coffee beans

The level of acceptance of taste flattening is subjective and highly dependent on how demanding the customer base is. The researchers estimated the expected shelf life of the coffee in the various types of packaging and the related food losses. This estimate was made on the basis of an expected consumer acceptance limit for taste change due to the absorption of oxygen in the coffee and the oxygen permeability of the packaging materials.

Results

CO_2-impact of product + packaging

Using the calculation tool, two scenarios were calculated for the reusable steel can, based on 20 and 40 reuses. Figure 1 shows the calculated greenhouse gas emissions for the various packaging types. These are divided into contributions related to the production of the coffee beans, the production of the packaging, recycling processes, such as washing the cans, the processing of the packaging waste, and the greenhouse gas emissions avoided through recycling or the energy generated by incinerating the packaging waste. The emissions released during the composting of food losses are also included as a category.

Figure 1 shows that, for all packaging combinations, the production of the coffee beans represents by far the greatest contribution to greenhouse gas emissions (>90%). This is true even the coffee beans are produced sustainably.

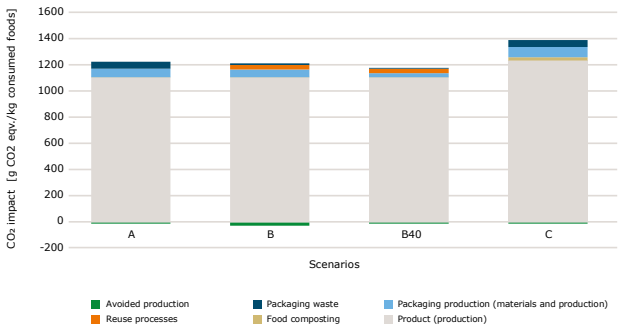

Figure 1 Greenhouse gas emissions for the various packaging options (A = Aluminium reference, B= Reusable steel can (20 x), B40 = Reusable steel can (40 x) C=Paper/PLA pouch) [g CO_2 eq./kg consumed product]

Table 1 shows that, in these scenarios, the focus lies on lowering emissions with respect to the reference and that emissions are lower with more frequent reuse. The paper/PLA bag produces higher emissions. This is mainly due to the higher estimated food losses with this type of packaging (10.8%). These food losses are estimated to be higher due to the higher oxygen transmission value and therefore lower shelf life (7 days). For the other packaging types, a loss of 0.4% is estimated with a shelf life of 1 year. The higher losses in the paper/PLA pouch mean that more product and packaging is needed to meet the same coffee consumption, and the higher losses also lead to extra emissions related to the composting of the discarded coffee beans.

Table 1 Greenhouse gas emissions for the various packaging types, g CO_2 eq. calculated per kg of consumed product. Percentages are relative scores with respect to the aluminium reference (100%)

	Aluminium reference	Reusable steel can (20x)	Reusable steel can (40x)	Paper/PLA pouch
Product	1105 (100%)	1105 (100%)	1105 (100%)	1257 (114%)
Packaging	102 (100%)	76 (75%)	56 (55%)	116 (114%)
Total	**1207** (100%)	**1181** (98%)	**1161** (96%)	**1373** (114%)

Impact of number of reuses

The greenhouse gas emissions related to the steel can only become lower than the reference packaging after a few reuses. Figure 2 shows that the turning point is approximately 12 reuses. It is also clear that the packaging results in much higher emissions if this number is not achieved. It is therefore essential to set up a good system of collection and reuse. In the case of We Wonder Company, much thought has been given to the actual reuse of the cans: for example, deposit on the cans, which promote the collection of the cans. In addition, the can is designed to last several rounds.

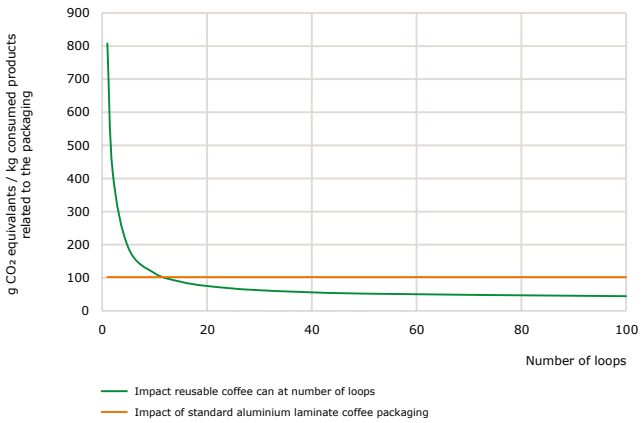

Figure 2 Break-even analysis of reusable metal can and aluminium-based pouch (reference)

Reusable steel can positive on all sustainability indicators

The reusable steel can also scores well on other sustainability indicators (Figure 3).

Recycling indicators

Both the aluminium reference and the paper-based packaging are non-recyclable and therefore have to be incinerated. They have a value of 0 for the recyclability indicator and the recycling chain indicator. The steel can is recyclable and will be recycled after frequent reuse (in the Netherlands). If the cans are rejected by We Wonder Company for further use after many reuses, they can be recycled. Since the cans are owned by We Wonder Company, both the steel and the plastic caps can be recycled, which means that recyclability is very high (99%). The reusable steel can is made mainly of steel (86%), and the recycling efficiency of steel is very high, such that the recycling chain indicator for this packaging type is also very high (about 90%)

Material circularity indicator

The material circularity indicator (MCI) of the reusable steel can is very high (99%) due to the high recycling efficiency of steel and the reusable nature of the can, which is expected to be reused several times. For the aluminium pouch, the MCI is low because it is disposable packaging and it is made from non-renewable raw materials. For the paper/PLA pouch this indicator is approximately 50%, because the packaging is made from renewable raw materials.

Litter prevention indicator

The Litter Prevention Indicator is also very high for the reusable steel can (99%) due to multiple reuse. For the

paper packaging, it is also high (89%), due to the biodegradable nature of paper. The aluminium pouch's litter prevention indicator is the lowest of the three packaging types (75%).

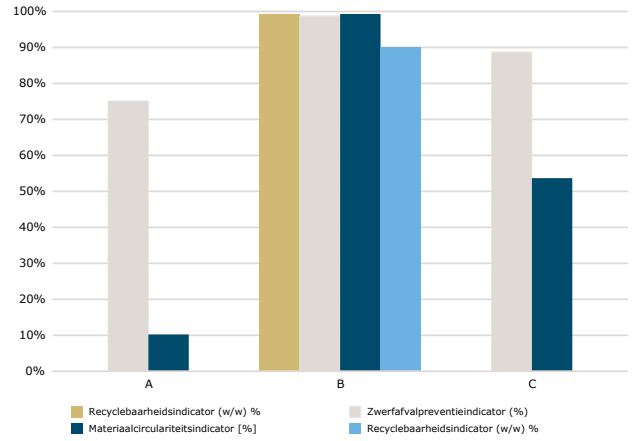

Figure 3 Other sustainability indicators for the 3 packaging types. (A = Aluminium reference, B= Reusable metal can (20 x), C = Paper/PLA pouch)

Conclusions

The calculations in this case reveal that coffee beans packaged in a reusable steel can, which are reused 12 or more times, have lower CO_2 emissions per amount of product consumed than the standard aluminium stand-up pouch currently on the market. The reusable can also performs better on all other sustainability indicators, such as recycling, circularity, and litter prevention. The paper/PLA-based alternative has slightly higher greenhouse gas emissions than the reference, but scores better on a number of other sustainability indicators (prevention of litter and material circularity). If the 12 cycles of reuse can be guaranteed, the reusable steel can is therefore the most sustainable packaging option.

The results of this analysis show a nuanced picture in which the actual sustainability of the alternatives depends on the context in which the packaging is produced, used and processed. The results can be used by companies to make well-founded decisions about sustainable packaging choices.

More information about the project

In the Wrap or Waste public-private partnership project, various product, packaging and recycling experts from Wageningen University & Research and industrial partners join forces to find a new, more sustainable balance in packaging and packing. In this project, concrete business cases are used to compare current packaging and alternatives on sustainability indicators throughout the entire life cycle of the packaging, including effects related to recyclability and effects on shelf life and potential food losses. The intended goal is to use the knowledge and tools developed in this project to help companies make an informed decision about what option is most sustainable and what the consequences are for farming. This will not only lead to the use of sustainable materials, but also contribute to more sustainable production chains: from fresh products to waste processing and recycling. For more information, see the Wrap or Waste PPP website.

Information

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