

Supplementary Comments of the Stiftung Initiative Mehrweg Regarding the Brief Version of the Study on The Sustainability of Packaging Systems for Fruit and Vegetable Transport In Europe - Life-Cycle Analysis

The supply of fresh fruit and vegetables fulfils fundamental human needs and serves to maintain human health. But how can this supply be accomplished in an environmentally friendly manner in increasingly international markets?

In this study commissioned by Stiftung Initiative Mehrweg, the Department for Life Cycle Engineering (GaBI) at Stuttgart University and PE International took a closer look from a life-cycle analysis point of view at commonly used transport systems: **multi-way plastic crates**, **one-way cardboard boxes** and **one-way wooden boxes**. How fruit and vegetables were cultured was not considered.

Briefly, following results were obtained in the scientifically accepted categories:

One-way cardboard boxes displayed highest levels of contamination in all five categories of environmental effects studied: Eutrophication¹, Acidification², Photooxidant Formation³, Ozone Depletion⁴ and Global Warming⁵.

In four of five criteria multi-way plastic crates achieved best results. As regards Global Warming effects results are however similar to those of wooden boxes.

One-way wooden boxes show lowest contamination levels in the category of Ozone Depletion. They are followed by multi-way plastic crates.

In the comparison of Primary Energy Demands between the different systems a distinction is made between renewable and non-renewable Primary Energy. The consumption of non-renewable Primary Energies is comparable in both plastic crates and cardboard boxes; wooden boxes give the best result. They benefit from the fact that disposal of the boxes releases more non-renewable energy than their production consumes. Growing wood, also used as a raw material for cardboard, naturally captures a large amount of solar energy. This is not the case with plastic boxes.

Regarding life-cycle costs, multi-way plastic crates prove to be the cheapest, followed by one-way wooden boxes, with one-way cardboard boxes in third place.

¹ **Eutrophication** is the nutrient enrichment of a body of water and associated excessive growth of water plants. It is generally caused by effluents.

² **Acidification** refers to acid forming exhausts which, amongst others, cause acid rain.

³ **Photooxidants** are highly reactive oxidising agents formed by (sun-) light incidence. They can cause a range of chemical reactions in the environment. Ozone is the best known photooxidant; low level ozone is a significant contributor to summer smog.

⁴ Gaseous halogen compounds cause **Ozone Depletion**. UV light is no longer absorbed to the natural extent, with negative effects for people and the environment.

⁵ The effect of **Global Warming** means that the surface temperature of the planet is higher than if there were no radiation absorbent gases in the atmosphere (green house gasses, including steam). It is caused by the combustion of fossil fuels, resulting in enrichment of carbon dioxide (CO₂) in the atmosphere, and the emission of other green house gasses such as methane, laughing gas, partially halogenated fluorinated hydrocarbons and sulphur hexafluoride.

In the brief version of the study diagrams depict the situation. The numbers are as follows:

Emissions (in %)	One-way cardboard box	Multi-way plastic crate	One-way wooden box
Eutrophication	100%	81% less	63% less
Acidification	100%	72% less	59% less
Photooxidant Formation	100%	51% less	30% less
Global Warming	100%	53% less	48% less
Ozone Depletion	100%	38% less	53% less

Primary Energy Consumption			
Non-renewable	comparable		Energy release higher than production demands due to recycling, i.e. burning of wood.
Renewable	Wood fibre as starting material for paper	Very low consumption of renewable energies (depending on electrical power supply)	14% less than cardboard

Life-Cycle Costs	One-way cardboard box	Multi-way plastic crate	One-way wood box
	100%	62% less	17% less

Potential for optimisation	Optimised dimensions to reduce material requirements	Increased cycle numbers, i.e. longer useful life-span	Reduced distances in wood delivery
	Usage of recycled materials	Usage of recycled granulate or high grade granulate recycling	Usage of more efficient wood types (e.g. poplar)
		Optimisation of energy consumption during cleaning	Weight reduction

In addition to the results of this study, SIM would like to emphasise that, when considering the sustainability of multi-way systems, there is an absolute need to take a view of optimising the entire system. The user of a crate has a vested interest in having it returned. This is a clear example of responsibility for a product, an aspect of virtually complete self-regulation which is of immeasurable importance in a sustainable economy. In the case of one-way boxes there is further need for (legal) regulation of disposal. Otherwise low disposal costs are seen as the only packaging characteristic to be taken into account.