

MORE SUSTAINABLE FOOD: FRUIT AND VEGETABLES AT THE SUPERMARKET

Consumers, JULY 2018



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RESUME

This report is the result of the project "Sustainability aspects of fruit and vegetables in the supermarket" that the Consumentenbond conducted in 2017-2018 with funding from the Ministry of Agriculture, Nature and Food Quality. The aim of the project is to inform consumers about various sustainability aspects concerning fruit and vegetables and the policy of Dutch supermarket chains in this area.

The research

The project consists of two parts. A general part consisting of an analysis of the sustainability policy of the largest Dutch supermarket chains (Albert Heijn, Jumbo, Lidl, Aldi, Plus and Ekoplaza) and a quantitative consumer research among 11,506 respondents. Additionally included are case studies of strawberry, banana, pepper and haricot. For these fruits and vegetables are environmental impacts quantified life cycle analyzes. Then its questions on the basis of the results matter submitted to supermarkets and consumers.

Results and conclusions

When fruits and vegetables play sustainability issues that divided this project into two parts: environmental and social aspects. An analysis of sustainability reports and the responses of the supermarket chains have shown that they are aware of sustainability issues playing with fruits and vegetables. They spend it all to a greater or lesser extent. In some areas it is committed to clear targets. Other areas remain behind in this regard and those points can improve the supermarkets.

The main conclusions of the analysis of the supermarket policy are:

- Proof Planet initiative and the Sustainability Initiative of Fruits and Vegetables (SIFAV) initiatives which several supermarket chains participate and which significantly affect the sustainability of fruit and vegetables
- Knowledge of environmental aspects of crops is mainly in the marks and experts involved
- The results of audits of suppliers are not public
- Monitoring of the sustainable (re) supply and seems to be limited by several supermarket chains
- Approvals and standards are a way to sustainability, but have their limitations
- There is great attention to the problem of food wastage, but concrete objectives and understanding of the results of policy are often lacking
- It is not easy to identify which supermarket is the most durable

The case studies show that fruits and vegetables various sustainability issues are important.

- Strawberries: Depending on the season, the environmental impact varies
- Bananas: here mainly play social issues in the field of labor
- Peppers: the environmental impact strongly depends on the type of greenhouse
- Beans: The air transport has a significant impact on the environmental

recommendations

Based on the survey made recommendations for supermarkets and consumers. The most important are:

supermarkets:

- Stimulate the production of sustainable fruit and vegetables
 - Know what the most important sustainability issues are at the different types of fruit and vegetables and speak suppliers and labels on it to Handle purchase offer that space for more sustainable
 - production and place the responsibility herein establish a code of conduct
- Send to products with a low carbon footprint
- Avoid packages or take care of packaging with a limited environmental impact
- Limit the use of (harmful) pesticide producers to help reduce food waste
-
- Help consumers make sustainable (re) selection Provide details on how sustainable vegetable and
 - fruit Indicate when products 'in season' his Indicate when products (not) by air transported his
 - Provide a large and recognizable range more sustainable fruit and vegetables help consumers
 - reduce food waste
 -
 -
- Set concrete goals to reduce food waste and improve monitoring

consumers:

- Choose vegetables and fruit with one or more topkeurmerken
- Choose fresh seasonal produce
- Avoid transported by air fruit and vegetables
- Go against food waste

Publications based on this research

- Article Consumentengids of July / August 2018
- Information on www.consumentenbond.nl/duurzaamgroentefruit

PREFACE

This report contains the findings of the project "Sustainability aspects of fruit and vegetables in the supermarket" that the Consumentenbond conducted in 2017-2018 with funding from the Ministry of Agriculture, Nature and Food Quality.

This project investigates how supermarkets help consumers choose more sustainable fresh produce. We have chosen to zoom in on the part of the supermarket because they have an important role in the food chain of fruit and vegetables. Supermarkets are the key link between producers and consumers of fruit and vegetables. They can encourage consumers in various ways to make sustainable food choices. They can also impact on people and the environment resulting positive effect on the production of fruit and vegetables to corporate social responsibility. Supermarket chains can also counteract with their policy of food wastage in the supply chain and consumers.

Additionally, examined how consumers think about sustainability issues relevant to fruits and vegetables. It also looked at what consumers can and want to do to preserve the fruit and vegetable consumption.

1 STUDY DESIGN

1.1 Research

The aim of the project is to provide information to consumers about various sustainability aspects concerning fruit and vegetables and the policy of Dutch supermarket chains in this area. The project consists of two parts. A general section consisting of an analysis of the sustainability policies of supermarkets and consumer research. We also looked in more detail at two fruits and two vegetables. These are case studies of strawberry, banana, pepper and haricot.

The following questions are answered:

general

Sustainability fruit and vegetables

- Which sustainability issues play a role when fruit and vegetables? What factors influence how sustainable fruit and vegetables?
- Where you can watch as a consumer if you want to buy sustainable fruit and vegetables?

supermarket Policy

- How can supermarkets ensure sustainable fruit and vegetables?
- To what extent are supermarkets engaged in sustainability in fruit and vegetables?

Consumer opinion

- What consumers that the task of supermarkets and suppliers of fruit and vegetables in view of the key sustainability issues?
- How do consumers think about sustainability issues in fruits and vegetables?

case Studies

- Which sustainability issues play in these fruits and vegetables?
- To supermarkets and consumers in these fruits and vegetables make for a more sustainable food chain? And how?
- What consumers that supermarkets should do in view of a number of research results (strawberry, banana, green bean)?

1.2 Scope / Scope

1.2.1 Selection supermarkets

The six supermarket chains policy is examined. These are the five largest Dutch supermarket chain Albert Heijn, Jumbo, Lidl, Aldi and Plus. In addition, the largest organic supermarket chain / food store Ekoplaza included in the study.

1.2.2 Selection of case studies

The starting point for the selection of case studies was to ensure that play various sustainability issues in the chains of the selected products. It was a precondition for choosing eaten many fruits and vegetables.

In a preliminary investigation determined the environmental impact based on three major impact categories of the most commonly eaten fruits and vegetables in the Netherlands. In Appendix B for additional information about these analyzes. Figure 1.1 below shows the result of the preliminary study on the basis of which the selection of the case studies is also determined.

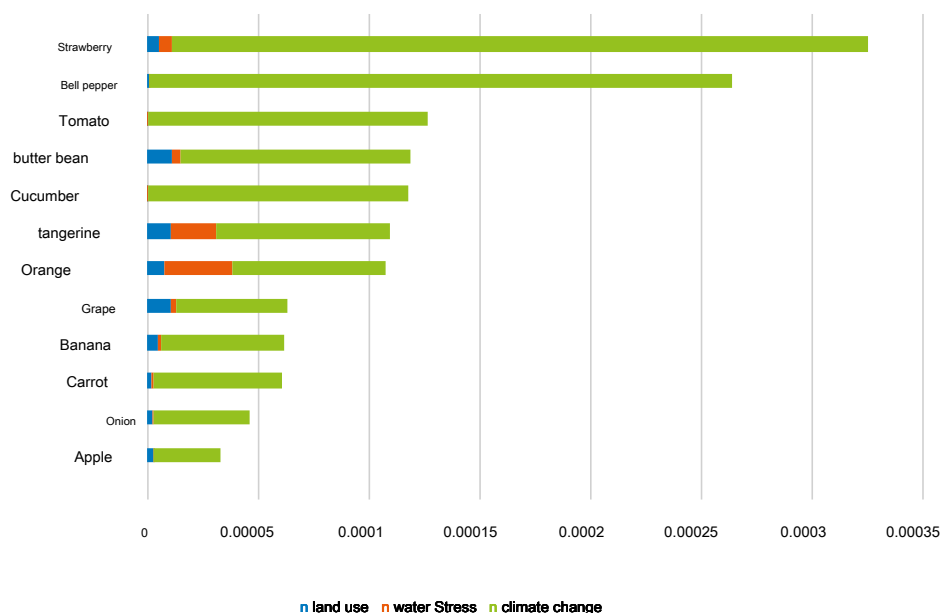


Figure 1.1 ReCiPe endpoint score of fruits and vegetables (points / kg)

Chosen for the two species with the highest final score (strawberry and pepper). In addition, green beans have been selected for the diversity of the countries of origin, and the associated transport means. Banana was chosen because it is a tropical species which play social sustainability issues. Collectively represent four types of a variety of sustainability issues (social, environmental, origin).

1.2.3 Scope of the study

The research focuses on the sustainability policy of supermarkets in relation to fruit and vegetables sold through supermarkets. The study does not address the sustainability policy of supermarkets relating to other product groups such as meat or potatoes. Also, aspects that have to do not specifically studied with for example the housing or the management of supermarkets. have spoken about it 'climate neutral' supermarkets. In such cases, it is the business and not on the choice of including fruits and vegetables on the shelves.

The research focuses on all fresh fruits and vegetables from supermarkets, regardless of brand, origin and how they are offered: loose on the shelf, wrapped in the refrigerator, combined as wok vegetable, etc.

Processed fruit and vegetables, for example, in cans, jars or frozen or processed into sauces, falls outside this scope. Because of the action perspective for consumers, we make an exception in the case study of green beans. Here it looks at the impact of various types of processed beans.

The study looked at the sustainability issues that have the greatest impact on the fruit and vegetable product. These are:

- Energy / climate change
- Water and land use
- Use of pesticides / plant protection
- food waste
- (Plastic) packaging
- Working Conditions

In energy / climate change will also look at the various modes of transport of fruit and vegetables. Here, the soot emissions from container ships like the Vegetable and Fruit Calendar Milieu Centraal is not included in the climate impact of transport by ship. Soot may be indirectly contributing to global warming.

The investigation looked at sustainability labels that provide guarantees for one or more elements from the list above. It was not within the scope of this study to evaluate the labels themselves. As part of the analysis of the case studies also looked at the differences between conventional and organic fruit and vegetables. Given the limited scope of this survey, the results are limited to a few general findings discussed in 2.1.1.

The survey was conducted between December 2017 and June 2018. The report new developments took until May 2018.

1.2.4 Definition and explanation term sustainable

The questionnaire sent to supermarkets included the following remarks:

Where in this questionnaire refers to permanent (or derivatives thereof, such as sustainability) means that the described products (vegetables and fruit) are produced with reduced negative - and preferably positive - impact on people and the environment.

The questionnaire sent to consumers includes the following explanation of the concept:

The more on the cultivation and transport of vegetable / fruit into account the environment and conditions, the more it is sustainable. Sustainable vegetable / fruit has a low environmental impact (and is therefore more environmentally friendly) and cultivated under good working conditions.

1.3 Research Methods

The study is made up of three components:

- Survey of selected supermarket chains (see 1.3.1)
- Consumer research (see 1.3.2)
- Durability Impact case studies (see 1.3.3)

The studies as described under 1.3.1 and 1.3.3 have been carried out in collaboration with external research.

1.3.1 Research supermarket policy

1.3.1.1 General

In February 2018 a first questionnaire to the selected supermarkets sent on overall sustainability in fruit and vegetables. The questionnaire consisted of 52 questions divided into eight topics:

- Purchasing organization fruit & vegetable
- Sustainability General fruit & vegetable
- Environment: Ambition & Policy and Implementation & monitoring
- Social: Ambition & Policy and Implementation & monitoring
- Training & Support
- seasonal Products
- food waste
- Finally

The questionnaire focus is threefold:

1 Understanding ambition and policy

Understand ambitions and policies of participating supermarkets when it comes to durability / sustainability of fresh vegetables and fresh fruit.

2 Implementation of policy

Implementation, control, monitoring and the results of the policy.

2 Transparency

Transparency towards consumers and other stakeholders is important: what information is publicly available about (the implementation of) the policy of the participating supermarkets?

For each subject was asked to answer the questions and a substantiation of this (verification).

For the analysis of the supermarket policies in which to place broader context involved a brief analysis of sustainability initiatives and labels that supermarkets work a lot, like SIFAV Proof and Planet. This analysis consisted of literature together with some telephone interviews.

1.3.1.2 Four case studies

In March 2018, a second questionnaire sent to selected supermarkets on the results of the case studies.

The questions related to (a selection of) the following topics:

- Origin
- environment
- Social (where relevant)
- Food and packaging Loss
- Communication

1.3.1.3 Assessment of results

The returned questionnaires (both the general questionnaire as the questionnaire for case studies) are analyzed and this information is combined with information that sent the supermarkets when returning the questionnaires or where supermarkets reference (like website links).

Any questions about the returned questionnaires are fed back to the supermarkets and the answers are included in the analysis.

The information provided by the supermarkets is basically leading to the results of the investigation. But in addition to this information is also an analysis of other documents supermarkets publicly available, such as sustainability reports, websites and other documents such as codes of conduct, terms of engagement and purchase. An overview of the sources used by drug store in the bibliography. This additional information is used to (1) where the supermarkets themselves provide only limited information in the

questionnaire, if possible, to supplement this information and (2) to verify as much as possible the information provided by the supermarkets. In those cases that supermarkets use of a purchasing or part of an international group is also information from these organizations / groups involved in the assessment.

The analysis is taken into account significant extent the verifiability of the answers and transparency. For example, by checking or policy documents and purchase are available and whether this policy will be communicated externally. Because transparency is created, the possibility for consumers and civil society to address this supermarket.

The final analysis is a qualitative analysis. The breadth and complexity of the subject matter lends itself insufficient for assessment based on a "simple" sum of subscores topics.

1.3.2 Consumer research

There is a quantitative study performed among consumers. The survey took place from 17 to April 25, 2018. The survey was conducted among the Internet panel of the Consumer. The survey was completed by 11,506 respondents (gross sample: 20 678).

The online questionnaire consisted of 13 questions related to sustainability issues in fruits and vegetables in general. Additionally, questions were asked about the case studies. About peppers case study are no questions to consumers.

1.3.3 Research case studies

The environmental impact of the four selected fruits and vegetables are quantified using the Life Cycle Assessment (LCA) methodology. Also looked at the social aspects of the cultivation of bananas and foreign beans. The objective of these studies is to find out what key issues of environmental and social point of view to achieve a sustainable supply.

Annex A for more information on the methodology used.

In addition, for the case studies contribution analyzes have been performed that indicate which chain links / stages to make the largest contributions to the impact of different categories (see appendix D).

The results of the case studies have not been worked out for several months. This information is found in the Vegetable and Fruit Calendar MilieuCentraal (2018-1). This information is then used in the request to the supermarkets.

2 RESULTS

2.1 Initiatives sustainability fruits and vegetables incl. Marks

In this section, we introduce a number of topics relevant to the sustainability of fruit and vegetables. we discuss sustainability labels on fruit and vegetables (2.1.1). We also look at two key sustainability initiatives (2.1.2). We also elaborate on certain themes that touch on this subject: 'UCP', 'living wage', and 'pricing of social and environmental impacts. Finally, not confined to Dutch supermarkets focus on sustainability. Therefore examined how some foreign supermarket chains to deal with these issues.

2.1.1 Sustainability labels fruit and vegetables

Supermarkets have several options if they want to preserve fruits and vegetables. They can choose, for example, fruit and vegetables certified by marks or standards. There are several labels that include environmental and social aspects. We discuss the most important thing in a nutshell (2.1.1.1) and give some feedback of labels again (2.1.1.2).

2.1.1.1 Key sustainability labels



Biological

European organic, Eko and Demeter are organic products. Practically all common fruits and vegetables are also bioavailable, sometimes only in natural foods stores or supermarkets. When growing organic fruit and vegetables are no chemical pesticides and fertilizers used. These labels set no or only very limited demands on human and labor. Honest -together with health, ecology and care or one of the four principles that form the basis of organic farming (BIONEXT, 2018).

Is organic better for the environment than conventional? The question in general answer is tricky. On a number of sustainability ensures biological for reduced environmental impact. In other respects this is not the case. Organic farming distinguishes itself by not using fertilizers but residues as fertilizer and / or compost. This means that there is no chemical fertilizers need to be produced for the purpose of the system. However, there are still nitrous oxide emissions which are released during the use of organic fertilizers. Nitrous oxide emissions are one of the main greenhouse gases in field crops. Partly because the yields of organic

crops (often) are lower, often organic crops not score significantly better on climate change. The lower yield is often also required a larger agricultural land. At the expense of nature. Here are the positive effects of the non use of chemical pesticides and fertilizers opposite. It involves, for example positive effects on biodiversity, soil fertility and water quality (Venkat Kumar (2012), Milieu Centraal, 2018a-c).



On the way to Planet Proof

The hallmark On the way to Planet Proof - the new name for Eco - focuses on incremental improvements in all relevant environmental themes (energy use and water use, crop protection and waste). It makes demands on the use of pesticides and fertilizers in the production of fruits and vegetables so that the environmental impact is limited. Planet Proof required for "integrated cultivation", which is, as it were, between in conventional and organic. Proof Planet focuses on soil, landscape and biodiversity, water, energy production and consumption and climate. There are no requirements for working conditions for production in Netherlands (Planet Proof 2018 Milieu Centraal, 2018b). More and more fruits and vegetables in supermarkets have this label. See also 2.1.2.



Fairtrade

Fairtrade stands for fair trade. Fairtrade International is a label focused on farmers and workers in developing countries. Using the label aims to farmers and laborers to give a fair position in the supply chain, including by providing them with a reliable income. Fairtrade products are genuine export products such as coffee, tea, cocoa and bananas. In the Netherlands, the Max Havelaar Foundation own the Fairtrade mark. Fairtrade started out in 1988 as Max Havelaar in the Netherlands. Later, other countries have taken the initiative and is finally passed into Fairtrade. The main pillar of the Fairtrade mark is the minimum. Buyers who purchase products from Fairtrade certified cooperatives are required to pay a minimum price to producers, in order to provide farmers with financial security. Farmers are organized in cooperatives and workers are united in an employees. In addition to a minimum the fair trade received

Cooperatives Fairtrade premium. Democratically determined where the premium is paid to, for example, to improve productivity or education and health. With the aid of a certification system is monitored by an independent control or the established trading conditions are complied with in the right way. The Fairtrade criteria in addition to requirements in terms of labor demand also included focusing on environmental aspects of the cultivation or production. Composite products come must be at least 20% Fairtrade ingredients (Milieu Centraal, 2018b, Max Havelaar, 2018).



Rainforest Alliance

Rainforest Alliance is a label focused on environmental conservation and working conditions for the production of agriculture, forestry and tourism products. Examples include coffee, tea, bananas and other tropical fruits. The mark makes demands on a production. An important pillar of Rainforest Alliance is the conservation of forests and the protection of flora and fauna. The company guarantees by management furthermore working conditions, working conditions and freedom of association of workers. In addition, just as with Fairtrade requirements regarding pesticide use and water and waste management included. However, a difference is that no price guarantees given to the farmers. The member organizations are audited by an accredited party. Rainforest Alliance works with the standards of the Sustainable Agriculture Network (SAN). Since January 2018 the UTZ label merged with Rainforest Alliance (Milieu Centraal 2018b; Utz, 2018, Rainforest Alliance, 2018).

2.1.1.2. reviews

Several organizations have expressed their views on the sustainability of different labels on the market. In this section, we highlight some results of this comparison studies in a row.

Six sustainability labels by Milieu Centraal (Environment Center, 2018b) as topkeurmerken fruit and vegetables evaluated. Table 2.1 is shown how the score marks on various parts.

table 2.1 Review Milieucentraal labels fruit and vegetables

	Environment (max)	People & work (max)	Control (max ...)	Transparency (max)	Topkeurmerk yes / no
Rainforest Alliance	Yes
The meter	na	...	.....	Yes
European organic	na ¹	...	.....	Yes
Eko	na ¹	...	.....	Yes
On the way to Planet Proof	na	...	.....	Yes
Fairtrade	Yes
Fair for Life	No
Sustainably grown	No

The Sustainability Standards module of the International Trade Center provides information on standards. Table 2.2 shows how the standard score as ITC environmental and social aspects (ITC, 2018).

table 2.2 Review ITC labels fruit and vegetables

	environment	Social
BSCI	4	64
Bio Suisse	41	31
EU organic farming	32	0
Global GAP crops	34	38
Ethical Trading Initiative ETI	0	45
Leaf marque	51	20
Fairtrade international	38	52
Fair for Life	23	43
SA8000	0	56
SIZA	0	38
Sustainably Grown	59	74
SAN / Rainforest Alliance	56	61
USDA Organic	24	0
On the way to Planet Proof	35	24

Apart from Milieu Centraal and ITC have several other (foreign) organizations ruled on labels. This includes concerns Greenpeace Austria (2018) and the Swiss Label information (2018). Striking differences in assessment. While MilieuCentraal Rainforest Alliance takes a topkeurmerk, this label by Greenpeace Austria rated as highly unreliable (it has to do with the recent merger with UTZ Certified, and uncertainty about the direction in which the label will start to move this). The ratings remain subjective, but together give an assessment of the degree of sustainability that is pursued and the level of trust that gives the label.

¹ For tropical vegetables and fruits is rated 'very low'.

The result of the evaluation by Label information is displayed in a pie chart (see example below in Figure 2.1). This demonstrates that labels have an impact on various aspects of sustainability.

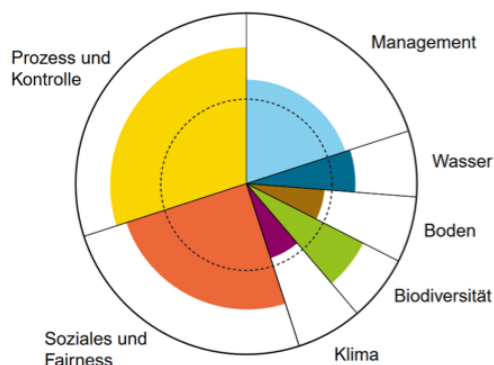


Figure 2.1 Example: assessment by Fairtrade Label information (2018)

2.1.2 Sustainability Initiatives fruit and vegetables

In recent years, two major initiatives launched that affect the sustainability of the supply of fruit and vegetables to a large extent:

- On the way to Planet Proof
- Sustainability Initiative of Fruits and Vegetables (SIFAV)

On the way to Planet Proof

After a long-term campaign of Greenpeace Netherlands who brought the widespread bee mortality attention has to put down a large number of supermarkets decided from 2019 "On the way to Planet Proof" as a precondition for supply of fresh fruit and fresh vegetables of Dutch suppliers. "On the way to Planet Proof" is the new international name for Eco (see 2.1.1).

SMK (the management organization of the label) provides the following information about Planet Proof:

"On the way to Planet Proof" is a label for sustainable grown fruits and vegetables, flowers, plants, trees and bulbs. Producers who meet the rules, so their products "On the way to Planet Proof" display. This label indicates that the product is produced sustainably. [...] Planet Proof focuses on five areas of the Sustainable Development Goals of the United Nations: soil, landscape and biodiversity, water, energy production and consumption and climate. The market gardeners, producers and processors endeavor, inter alia, in cleaner air, fertile soil, water quality and improved circular waste disposal and recycling. "

(Proof Planet,

2018)

Sustainability Initiative Fruit and Vegetables (SIFAV)

The Sustainability Initiative Fruit and Vegetables (SIFAV) is about preserving the import of fruit and vegetables from Africa, Asia and Central and South America. The purpose of the agreement is the purchase of fresh fruits and fresh vegetables from Central and South America, Africa and Asia by the private sector signatories of this agreement, 100 percent preserved in 2020. It was launched in 2012 with 13 Dutch companies and has since grown into a pan-European initiative with more than 40 partners, including retailers, brands, traders and civil society organizations from Belgium, Denmark, Germany, Sweden, Switzerland and the United Kingdom. The supermarkets are surveyed in this study participant SIFAV at Aldi and Ekoplaza after.

SIFAV has developed a so-called 'Basket of Standards'. The SIFAV members use this Basket to identify sustainable products and to measure progress toward the goal of 100% sustainable procurement (it is intended that all products are certified / audited according to at least one environmental and one social minimum standard). The percentage of procurement of sustainable fruit and lasting fruit is measured by the signatories on the basis of the amount kg / tonnage that meets the agreed sustainability standards.

For environmental issues the following standards are included: USDA Organic, Leaf Marque, GlobalGAP Crops, EU Organic Farming, Bio Suisse. Social aspects The following standards are included: BSCI, ETI / SMETA, Fairtrade FloCert, IMO Fair for Life and for Life, SA 8000, SAN / Rainforest Alliance, SIZA, Sustainably Grown (see 2.1.1, IDH, 2017).

Standards can be included in the "basket" if the criteria are publicly available through the ITC Standards Map (see Table 2.2). Furthermore, the standards must meet the requirements of the Global Social Compliance Program (GSCP) and the results should be shared with SIFAV (ITC SIFAV,

2018). Therefore GRASP is not included in the "basket" (personal communication Sonia Cordera, IDH, June 14, 2018).

What is striking is that the listed standards differ in their level of ambition and durability requirements. SIFAV points out that differences between labels reveal (personal communication Daan de Wit, IDH, June 18, 2018).

In both Proof and Planet SIFAV involves initiatives involving both industry and civil society organizations. In both cases, gradually working towards preservation of fruit and vegetables.

2.1.3 Sustainability Themes

The 'sustainability' issue is not static. A number of issues related to growing interest, including: (un) fair trade, living wage, and pricing of social and environmental impacts.

2.1.3.1 Unfair Commercial Practices

The call for fair trade has recently been given a boost by the findings of research by the Financieele Dagblad, published on April 10

2018, which showed that supermarkets increasingly longer to paying their suppliers (New Harvest, 2018a). The EU came up with proposals in April 2018 to prevent unfair practices (European Commission, 2018). It defines unfair commercial thereby as follows:

Unfair commercial practices are among companies that deviate from good commercial behavior and contrary to the principles of good faith and honesty. They are usually unilaterally imposed by one trading partner to another. The supply chain is particularly vulnerable to unfair commercial by large differences in bargaining power.

The EU proposals to put an end to the unequal power relations between the major supermarket chains and small to medium-sized suppliers and producers (both EU and non-EU suppliers). Criticism: it remains a directive, the Member States free to convert this into legislation (and which can distort the market). The proposals have been welcomed by LTO (New Harvest, 2018b), but critically retail. CBL think this is not going to help the farmers a better price because they are not dealing with the supermarkets but the (often large) trading partners. They expect the proposals lead to higher administrative expenses to ensure that consumers ultimately have to pay more (Foodlog, 2018).

The discussion on unfair commercial incidentally plays much longer. Fairtrade is finally established decades ago. The Fairtrade thought leads to a fair trade market with healthy competition, where consumers also benefit from the elimination of unfair distributed power (MO,

2013).

2.1.3.2 Living wage

The CSR Platform defines a living wage as:

"An important human right in the Universal Declaration of Human Rights of the United Nations and part of the labor standards of the ILO. The payment of a living wage is thus an important part of CSR, however inadequately implemented in practice. The determination of what is a living wage, is therefore one of the obstacles. The International Labor Organization (ILO) uses the following definition: a wage that is sufficient to meet the basic needs of a family of average size in a particular economy.

'Living wage' is not the same as 'minimum wage'. A 'living wage' is about being able to pay for the basic needs of a family of average size; the 'minimum' is a policy or public (sector)

agreements set wages for certain activities / hours incurred by employees.

The 'basic needs of a family of average size' are not defined. Looking at international treaties have at least enough food, clothing, housing, education and health care can be achieved for all members of the wages earned, and must be saved for facilities (eg pension).

Supposedly, when determining the amount of the minimum wage takes into account the economy where workers live. Nevertheless, it is not obvious that the minimum wage is equal to a living wage. In many places in the world this is not the case. In the absence of a living wage to undesirable situations arise, such as excessive overtime or the use of children to earn enough money for the family in order to satisfy basic needs.

Many labels are used to pay the minimum wage to workers. The payment of a living wage is only limited addressed in practice. Especially the fact that no definite agreements regarding the calculation of a living wage (hence no standard for determining when the wage is a 'good' living wage) makes it difficult to properly interpret this theme. An example of a label that refers explicitly to a living wage, the Ethical Trading Initiative. In the fair trade Standard for Small Producer Organizations is commented upon pay higher than minimum (see below), but there is no criterion which relates specifically to the need to pay out of a living wage.

'Living wage' is a subject acquisition with various initiatives and pilot studies are trying to flesh out this subject. The Global Living Wage Coalition for example, working with finance IDH to a benchmark study focusing on the bananas in Costa Rica. These are plantations that are Rainforest Alliance Certified (IDH, 2018). Additionally Living Wage Lab including Hivos and Food Fair with this topic started (Living Wage Lab, 2018).

2.1.3.3 Pricing social and environmental impacts

In the production and processing of fruits and vegetables can polluting waste, undesirable social impacts, CO₂ emissions, etc. occur. **The cost to address these issues are not always (completely) worn** by the perpetrator, often (partly) by the company. It is discussed increasingly in sustainability committees and governments about these so-called hidden costs - they are not transparent and are virtually excluded from production prices. That makes the growing debate - where a product comes from and how is it made? What does it really us, socially and ecologically? And how can we reduce these costs? - a valid development. To answer these questions, methods are needed to measure impacts. Pricing could be a next step; The added value may lie in the additional insight that

features in the various impacts with each other and the possible equations, tradeoffs and choices arising therefrom. There are several initiatives and organizations that focus on the internalization of costs, but methodologies and terminology differ considerably, and the approach is often not transparent.

Example 1 Study

Several pilot studies done around pricing (true cost / pricing). So introduced Eosta, distributor of organic fruits and vegetables, the 2016 True Cost of food 'campaign for its brand Nature & More. The company was by accountancy office EY and sustainability consultant Soil & More calculate the hidden costs of nine different fruits and vegetables. With her efforts will raise awareness among consumers Eosta more of the hidden costs of food production (see Figure 2.2). Include in Ekoplaza containing products of this brand label which the "real price" appears organic and non-organic products (Eosta, 2017).

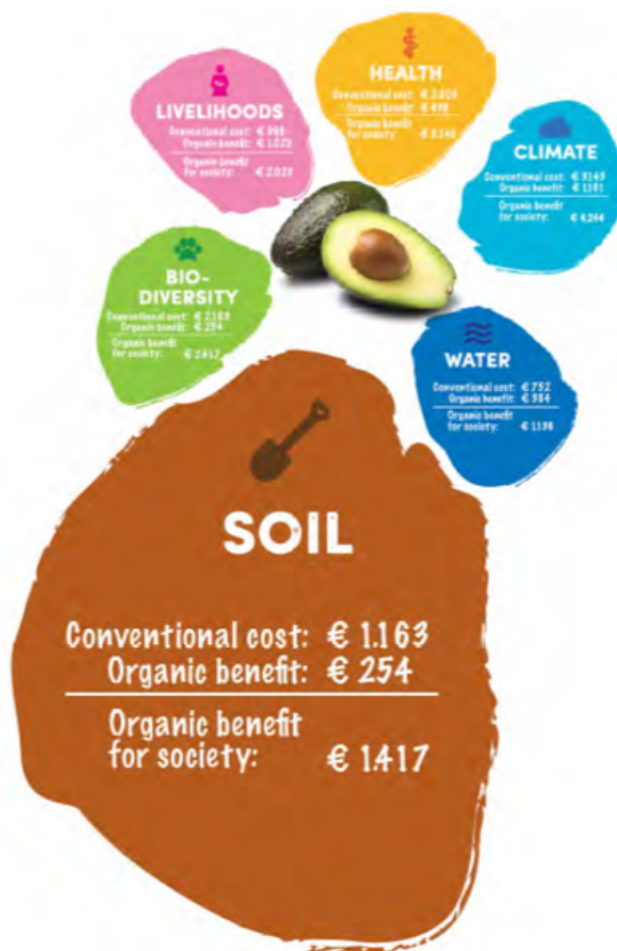


Figure 2.2 The "real" price of organic and conventional avocado

Example 2 Study

Wageningen Economic Research and True Price have developed a methodology that can be positive and negative social impacts of the production and consumption of food in the picture (Baltussen et al, 2017). The methodology gives no absolute judgments about whether something is good or bad, but relative scores to average effects of food. As a case study, this applied to five food including fresh green beans in the open. The study shows that a calculation of the "real" price in euros of food, which all externalities are considered complex and in the short term is not feasible. For that include insufficient data available.

The green beans are green beans studied from the Dutch open field which have not been produced under a non-statutory durability certification scheme. The effects of the production and consumption of beans compared to the average food product and expressed by consumers euros are put in the study in a row. Although production of green beans is not possible without a (negative) effect on the environment, is called as a positive effect of green beans that the effects on water quality, are smaller than for the average food product. Another positive effect is that the production of green beans in the Netherlands does not involve child labor, forced labor and negative welfare aspects. If adverse effects are called the crop has a higher than average negative impact on the following aspects: aquatic ecosystems, soil quality and land use. production of green beans also contributes less to social ties, social cohesion and social status.

2.1.4 International perspective

Retailers in other countries can be an example for the Dutch retailers. This section therefore gives a brief few international examples which approach Sainsbury's and Tesco offers inspiration for a sustainable policy?

Example: Sainsbury's and Ethical trade

Sainsbury's has prepared a position paper on 'Ethical trade' and this policy formulated to give its own interpretation responsibility (Sainsbury's, 2017). This is indicated:

"Sainsbury's are conscious of the responsibility we share with our suppliers for the welfare of workers who produce the goods we sell. We seek to develop long-term partnerships with suppliers who share our values and who are prepared to commit themselves to our Code of Conduct for Ethical Trade-which is consistent with internationally agreed conventions on workers' rights and the Ethical Trading Initiative (ETI) Base Code . "

This premise is supported by the following principles:

- Commitment to Ethical Trade

Sainsbury's indicates that "ethical trade" is a business purpose, for which capacity and budget are released and where continuous attention. They work with suppliers to ensure that they continue to develop in this area, and communicate with stakeholders (including suppliers and employees in the chain) to make clear their commitment.

- Terms of Fair Trading

The aim is to work with long-term suppliers, also knowing that this contributes to good working conditions for their employees. This contract agreements are respected and there is no unnecessary pressure on suppliers.

- Building the Capacity of Ourselves and Others

Employees of both Sainsbury's and suppliers should recognize the importance of ethical conduct, and to be able to identify potential issues in this area and to solve. Therefore gives Sainsbury's guidance, training and support where needed.

- Monitoring our Supply Chains

To ensure that policies are implemented well, are monitoring and evaluation site (possibly corrective action).

- being transparent

The aim is to be transparent on the performance in this area. Suppliers are encouraged (even uncomfortable) to share issues that can be worked on improvements.

- Striving for Improvement

Ethical issues sometimes require quite some time and effort to be addressed. Suppliers are expected to work towards resolving any issues, and they also involve employees (associations).

Example: Tesco and environmental impact

In presenting the approach to achieve less impact on the natural environment, Tesco explains why they are doing this (Tesco, 2018). They describe it as follows:

"As a food business, our long-term success depends on the health of the natural environment. From the fresh fruit, vegetables, meat and fish we sell to the raw materials that go into our other products, They all come from natural ecosystems. Therefore we have a role to play in protecting the environment

- starting from understanding and addressing the impacts of our operations and supply chain. Doing so can ook increasement our resilience to risk, help secure the supply of our products and providence opportunities to save money. "

In consultation with experts Tesco has five themes chosen where they focus on:

- climate

Climate change is seen as the greatest environmental threat. In 2017 Tesco has new science-based **targets for CO₂: determined reduction (compared to 2015 as the base year): 7% reduction in 2020, 35% reduction in 2030 (15% for agricultural emissions).**

- forests

Tesco wants to target zero net deforestation by 2020 to help achieve it. Initial focus is on four causes of deforestation linking the operations of Tesco: palm oil, meat products, soy and timber. For each commodity chains are mapped to understand the context and potential issues, and established sustainable procurement.

- Sea

Tesco wants seafood sustainable procurement to maintain healthy oceans and the work of the fishermen. There is a lot of cooperation to achieve this, such as MSC (as much as possible to get certified products on the market) and the Sustainable Fisheries Partnership (to identify risks in the chain). The aim is to get all wild-caught fish and shellfish under the MSC label. There are also industry-wide initiatives where Tesco participate. Furthermore Aquaculture Requirements set for private label products.

- Agriculture

In agriculture Tesco is responsible for about 60% of the CO₂

footprint in the chain, 97% of the water footprint and the majority of impacts on biodiversity.

Therefore, the following goals are set:

'To Achieve a sustainable footprint on climate, water and biodiversity from our biggest agricultural products by 2020. Specifically:

- 7% reduction in GHG emissions

- Reduction in the use of water-including local reduction targets for water-stressed areas

- Improvement in farmland biodiversity (soil health, pollinators and off-field biodiversity ')

An important part of the necessary efforts to ensure that the agriculture and meat standards used in supply chains, Tesco help meet these objectives. It also worked with suppliers to deploy tools and strategies that help to measure the impact and spur improvements. Besides combating food waste helps to reduce impacts.

- Fresh water

The majority of the use of water will take place in the chains. Tesco is working to identify its most important supply chains to understand their exposure to water risk. It will also consider whether use of water takes place in vulnerable water areas. This provides input to identify priorities for action, for example, reduction targets areas of high water stress or collaboration with other stakeholders in a given area.

2.2 Supermarket Policy sustainability fruit and vegetables

This section presents the results of research based on the general questionnaire, divided into the following topics:

- Purchasing organization Fruit & Vegetables
- Sustainability generally Fruit & Vegetables
- Environment: Ambition & Policy and Implementation & monitoring
- Social: Ambition & Policy and Implementation & monitoring
- Training & Support
- seasonal Products
- food waste
- Finally

By subject is first displayed which questions are put in a table, which answer categories are provided, and on which, in particular, is given in the analysis. Then, a qualitative analysis is given of the manner in which the five supermarkets are different from each other. By supermarket are strengths and weaknesses appointed on the basis of which the supermarket can be typed on a topic. Good / interesting examples of initiatives are highlighted where possible.

2.2.1 Purchasing Organization Fruit & Vegetables

Ask	answer Categories	Analysis
Where one buys supermarket or vegetable in purchasing association?	% Directly from the grower% from wholesalers% at the importer% other, including:	This question provides insight into the extent to which supermarkets have direct contact with growers. This can affect the way a supermarket tries to preserve the range (direct consultation with growers, etc.).
2 Where buy the supermarket purchasing association or vegetables?	% Directly from the grower% from wholesalers% at the importer% other, including:	Same Question 1
3 Which payment conditions for producers apply at the time you bought fruit & vegetable?	% Through price guarantee to producers% over excess wholesale / convenience store % Deposit (payment producer After-sales)% year prices (agreements with growers on average seasonal or year prices)% other:	The income for producers can benefit from price guarantees (eg a longer period and a good price). Market / daily rate and short contracts from this point to be less desirable. The questions provide insufficient basis to draw conclusions on this basis concerning the income of producers and the distribution of financial risks between supermarkets and producers.

Purchase fruit and vegetables

There are major differences between the supermarkets regarding the purchase. While Albert Heijn and Lidl far the most direct purchases from growers, Aldi buys almost everything through wholesalers. The other supermarkets are there in between, with a focus on direct purchase from the grower. This may affect the CSR policy. When there is no direct contact with the grower is the use of labels in order to cover, for example, durability issues more obvious. The possibilities, for example, to train farmers and to support sustainable production will differ as a result. This is also reflected at the four case studies (2,4). Aldi example there has been on average less information than the other supermarkets.

Terms of payment

There are many differences between the point supermarkets, where both price guarantees, annual rates, weekly rates and daily pricing occur through market forces. A supermarket as Ekoplaza focuses mainly on long-term cooperation and price guarantees, and price guarantees to other supermarkets play a much smaller role and working with year rates, weekly rates and pricing through market forces. Although these differences will definitely affect the risks incurred by a producer (and the store itself), this provides insufficient basis to assess supermarkets this from the perspective of fair trade / sustainability. For this, the pros and cons of price guarantees and risks in the various markets in more detail should be mapped.

2.2.2 Sustainability generally Fruit & Vegetables

	Ask	answer Categories	Analysis
4	Do you have an ambition formulated to work towards the sustainability of the range of fruit and vegetables?	Yes, That / verification: No Disclosures:	To what extent are SMART formulated ambitions on the environment (eg. X% range should in year x specific requirements)? this ambition covers the entire range of fruit and vegetables (GF)? To what extent are formulated SMART goals in the social sphere? this ambition covers at least the entire range GF from risk countries? The supermarkets open about this goal, such as inclusion in an annual report, so they can be called to account?
5	If you participate in initiatives aimed at sustainable fruit & vegetable?	Yes, specify: No Disclosures:	Examples are SIFAV initiative Planet Proof initiative and initiatives of civil society.
6	In addition to the aforementioned initiatives working in the field of the preservation of fruit and vegetables together with stakeholders such as suppliers, customers, research institutes and civil society organizations?	Yes Suppliers (specify cooperation): Customers (specify cooperation): Knowledge institutions (specify cooperation): Civil society organizations (co specify): Other (specify cooperation): No Disclosures:	The extent of collaboration with suppliers and research institutions shows how open the supermarkets for the other parties' contribution in formulating and implementing sustainability ambitions.
7	How reports you about your external policy and achievements in the field of sustainable (R) fruit & vegetable?	Sustainability Report Website A monthly magazine Otherwise, namely verification (eg documents or reference website.)	Important ways of external reporting is reporting via the website and reporting via a public Dutch report. There is preferably also reported quantitatively the percentage of sustainable products in the total product range GF.
8	You Promote more sustainable mer fruit & vegetables to the consumer? How?	Yes, through: Positioning in the shelf Offers Information on the website Information in the supermarket magazine, ... Other: Comments / verification: No Disclosures:	Important ways to promote sustainable products promotion on the shelf, promotion on the website and promotional campaigns. Promotion via the shelf and through actions is not verified in the supermarkets themselves in this study.

Sustainability Ambitions general

The supermarkets have all expressed ambitions in the field of sustainability. The initiatives of IDH (SIFAV) Proof and Planet / Milieukeur play an important role. It should be noted that both SIFAV and Planet Proof initiative have a regional focus: SIFAV includes a choice of countries in Asia, Africa and South America and the Planet Proof initiative (100% Planet Proof 2020) is (being) focused on the Netherlands. This means that production in Europe but outside the Netherlands, is still outside the aspirations linked to these initiatives. If the supermarkets buy from other European countries than the Netherlands, they would here also have ambitions

formulation. Albert Heijn is not affiliated with Planet Proof, Aldi and not SIFAV Ekoplaza at neither.

Albert Heijn in collaboration with Nature & Environment launched an improvement program for growers and (TopCrop). The supermarket provides in this context that sustainability is an ongoing process and does not end with certification. This is also the reason that they are not focused on Planet Proof certification. The disadvantage is that this initiative compared to known, independently controlled multi-stakeholder initiatives / certifications harder and harder verifiable is recognizable to consumers. It is also not known in advance where to go TopCrop lead and where the fruit and vegetables from the Netherlands, will meet. Asked about the status of TopCrop reports AH:

"TopCrop is a sub-project aimed at cultivation of field vegetables, which is part of an overarching sustainable project AH, which focuses on all Dutch fruit, vegetables and potatoes. The objective of the project is the environmental damage caused by pesticides to reduce as much as possible. The focus is on the phasing out of the 27 most harmful agents, but there is certainly paying attention to control measures, such as the construction of a phytobac or wetland to reduce leaching of funds to groundwater or surface / appearance. Is also being looked at for example precision farming and making bottom scans of plots, to achieve an optimal gift plant protection or fertilization.

Jumbo has agreed with Greenpeace that all fruits and vegetables from Dutch soil Planet Proof end of 2019. According to a statement from the supermarket chain is now almost 80% of all fruit and vegetables Planet Proof. The shelves this is not always visible, because not all switched all producers in a particular product and Planet proof certified.

Aldi does not participate in SIFAV but using GRASP. GRASP (GLOBALG.A.P Risk Assessment on Social Practice ") is not recognized by SIFAV accepted as a social label (see 2.1.2). Some of the other supermarkets GRASP seen as a suitable approach for low-risk countries, but not for high-risk countries (in accordance with the BSCI list of countries). Positive is that Aldi GRASP mandatory presents all growers.

Ekoplaza performs relatively well by focusing on biological, combined with the attention to Fairtrade. It should be noted that nearly half of the range is Fairtrade or certified by other independent labels, but is controlled by means of the own chain management. This may in practice do not affect social benefits, but it offers less (independent) guarantees for consumers.

Communication / transparency and promotion

Supermarkets provide much information about their sustainability policy through the website and annual reports. The level of detail differs.

What is striking is that the Dutch sustainability report Albert Heijn content relatively limited (but easy to read). For more information English-language report of Delhaize, Ahold should be consulted. This report contains in turn be relatively large quantity (more often than the other supermarkets). The report Lidl is relatively limited in scope. For PLUS is true that the annual report of Superunie relevant. While both reports are relatively easily accessible and organized, it makes an analysis of the sustainability policy any easier. The report by Aldi (no sustainability report, but a general progress report) is available on the corporate level and not for the Netherlands.

Jumbo has a relatively comprehensive CSR report. Ekoplaza also communicates about sustainable rate range (100% organic) and PLUS mention this for fruit and vegetables from the Netherlands (50% Planet Proof).

capture the supermarkets, excluding Ekoplaza, all use general purchase, or engagements standards or codes of conduct for their purchase and thus their minimum ambition for sustainability in procurement. In these purchase requirements often social play than environmental demands a greater role. The degree of transparency about these purchase at different supermarkets. As Lidl Code of Conduct can be found on the internet, but the purchasing fresh fruits and vegetables (which in turn does offer a lot of information) confidential. For Aldi is finding failed to purchasing over the internet. There circulate many country-specific codes of conduct of Aldi on the Internet, but the Netherlands is not found. But Aldi has made a confidential draft summary of purchase fresh fruit and vegetables and a German code of conduct annexed to the purchase. The first is (still) not publicly available, and the second is difficult or impossible to find.

There is little explicit promotion on the websites of the supermarkets (Snapshot April 2018), although often can be found in more or less sustainable products. Albert Heijn shoots positively with a biological "special shop", an overview of seasonal vegetables and a selection option for sustainable, fair trade and organic. At Jumbo consumers can choose for organic (as dietary preference) and Jumbo spends some "source clips" attention to sustainability. With PLUS you can choose within a product group for 'responsible', such as Fairtrade. At Aldi for organic and fairtrade. At Lidl can not. Ekoplaza provides the ability to view the Fairtrade range.

Summarizing can be mentioned the following strengths and weaknesses for supermarkets:

Convenience store	strongly	Weak
Albert Heijn Ambition	<p>G & F from high-risk countries through SIFAV 100% durable standard-SIFAV in 2020. Furthermore, additional demands on it (so-called deal breakers, but unclear what these are). Direct collaboration with Nature & Environment and farmers to sustainable farming in the Netherlands (TopCrop). Albert Heijn also chooses this strong personal commitment and knowledge enhancement. Ambition share of organic products (10% in 2020)</p> <p>Cooperation with various social organizations.</p> <p>Communication / transparency The Ahold Terms of engagement are publicly available.</p> <p>Ahold, Delhaize sustainability report provides relatively much quantitative information.</p> <p>Scores relatively well on online choices for sustainable products.</p>	<p>Ambition</p> <p>TopCrop may not cover all fruits and vegetables from Netherlands and the resulting level of ambition is not immediately obvious. TopCrop thereby also seems to be mainly focused on crop protection, and thus has a narrower scope than, for example Planet Proof. Ambition environmental performance G & F from the rest of Europe appears to be restricted to MRL</p> <p>except ambition organic. The individual approach towards producers, in collaboration with Nature & Environment, the result is more difficult compared verifiable certification.</p> <p>Communication / transparency Dutch sustainability report which briefly. For more info, head to the English-language report Ahold, Delhaize.</p>
Aldi	<p>Ambition</p> <p>G & F from the Netherlands through Planet initiative Proof: 100% Proof Planet in 2020. Cooperation with various social organizations.</p> <p>Bet GRASP for all growers. This is positive when it comes to low-risk countries.</p> <p>Communication / Transparency Online option for organic and fairtrade.</p>	<p>Aldi is not affiliated with SIFAV and states themselves no ambitions outside the Netherlands. The annual report or reports using GRASP, but this is not part of SIFAV. GRASP is sometimes used by other supermarkets for low-risk countries, but not for high-risk countries. No ambition formulated for environmental performance procurement F & V from European countries other than the Netherlands. This is not covered by Planet Proof ambition.</p> <p>Communication / transparency Purchase balances are not available for the Netherlands. Confidential concept of purchasing fresh fruit and vegetables are sent to it later. No sustainability report for the Netherlands, only a general progress report on the corporate level.</p>
Ekoplaza	<p>Focus on 100% organic products, high environmental ambitions. Side note here is that not all biological environmental topics covered as well (eg the limited attention to energy and waste).</p> <p>Strong focus on and coverage by Fairtrade, which is also a strong social ambition.</p> <p>Cooperation with various social organizations.</p> <p>Communication / transparency in annual rates also information about sustainable products (organic and Fairtrade)</p>	<p>Ambition</p> <p>Part of the Fairtrade ambitions via 'own chain management "completed, which is difficult to verify.</p> <p>Communication / Transparency No purchase available, or mentioning in annual purchasing.</p>

	<p>Ambition G & F from high-risk countries through SIFAV 100% durable standard-SIFAV 2020.</p> <p>G & F from the Netherlands through Planet initiative Proof: 100% Proof Planet in 2020. Cooperation with various social organizations.</p> <p>Communication / transparency Jumbo general purchase are publicly available. Advanced CSR report.</p>	<p>Ambition No ambition formulated for environmental performance procurement F & V from European countries other than the Netherlands. This is not covered by SIFAV Proof and Planet ambition.</p> <p>Communication / Transparency Online option for sustainable products (organic and dietary preference).</p>
Lidl	<p>Ambition G & F from high-risk countries through SIFAV 100% durable standard-SIFAV 2020.</p> <p>G & F from the Netherlands through Planet initiative Proof: 100% Proof Planet in 2020. Cooperation with various social organizations.</p> <p>Communication / transparency The 'Lidl Code of Conduct' is available to the public.</p>	<p>Ambition No ambition formulated for environmental performance procurement F & V from European countries other than the Netherlands. This is not covered by IFAV Proof and Planet ambition.</p> <p>Communication / transparency The Lidl sustainable purchasing fresh fruits and vegetables is confidential. Structure of the sustainability report is brief.</p> <p>Offers no online option for sustainable products.</p>
PLUS	<p>Through Superunie: G & F from high-risk countries through SIFAV 100% durable standard-SIFAV in 2020. G & F from the Netherlands through Planet Proof initiative 100% Planet Proof in 2020. Strong commitment to Fairtrade products from high-risk countries.</p> <p>Cooperation with various social organizations.</p> <p>Communication / transparency Superunie Code of Conduct publicly available.</p> <p>Clearly Sustainability Report of both PLUS and Superunie (but has two partly complementary reports). Online options for responsible products.</p>	<p>Ambition No ambition formulated for environmental performance procurement F & V from European countries other than the Netherlands. This is not covered by SIFAV Proof and Planet ambition.</p> <p>Communication / transparency Need combine information PLUS Superunie report makes an analysis of the sustainability reports laborious.</p>

2.2.3 Environment: Ambition & Policy and Implementation & monitoring

2.2.3.1 Environment: Ambition & Policy

Ask	Answer	Analysis
9 What environmental enables you requirements in the procurement of fruit & vegetable?	Local and international laws and regulations Environmental Management System Waste Policy Use of pesticides Use of fertilizers Water use Land use / land conversion Biodiversity Energy consumption and greenhouse gas emissions Other: None Explanation / verification:	Standards are set for all environmental and turns this from procurement criteria and / or initiatives in which the store is connected, such as CSA SIFAV? This applies to all GF?
10 on which part of the chain are the applicable environmental requirements? Have you established policy here?	Direct Indirect suppliers suppliers (who supply direct suppliers) Entire Chain Explanation / verification:	The applicable environmental requirements throughout the supply chain or only to primary production?
11 When it comes to environmental standards: do you differentiate between production in the Netherlands and Europe, and products from risk countries (such as the distinction risk countries by the Business Social Compliance Initiative (BSCI))?	Yes Notes: No Disclosures:	To what extent is there a distinction made between countries of origin and, if so, what is the reason?
12 Are there at the product level on-distinction made when it comes to environmental requirements, for example by appointing one vegetable species different requirements than the other?	Yes, Notes / verification: No Disclosures:	To what extent is there a distinction made between different products and if so, what is the reason? Any crop specific issues are included in the cases (separate report).
13 you Seeks to a reduction the environmental impact of the fruit & vegetable you offer?	Yes, Notes / verification: No Disclosures:	To what extent there is an ambition to continuously improve the environmental performance (see also question 4)?
14 Have you formulated policy to ensure that your requirements in terms of (for example) quality, price and volume do not conflict with the requirements of the environment? Think of a code of conduct for procurement.	Yes, Notes / verification: No Disclosures:	Uses a code of conduct addressing the balance between environmental requirements on the one hand and as price and quality on the other? See also the example of Sainsbury's in 2.1.4. Is this aspect attention in the sustainability report?
15 Any policy to the environmental impact to minimize packaging of fruit & vegetable, for example using the use of recycled or certified sustainably certified materials or, where possible, no packaging?	Yes, Notes / verification: No Disclosures:	Is the grocery this active? The supermarket here SMART objectives formulated? Reports the supermarket on the progress, for example through the annual report?

For most supermarkets true that for all products (also in the rest of Europe outside the Netherlands) minimum environmental requirements are included in general purchase or a code of conduct.

For products covered by the Proof Planet initiative (for Netherlands) and products under the SIFAV initiative for high-risk countries have different requirements. Suppliers located in Europe but outside the Netherlands, only comply with the general purchase of supermarkets. All supermarkets handle general purchasing criteria. These purchase go on durability especially on social issues (usually the ILO core conventions, in the draft purchase fresh fruit and vegetable products from Aldi does not address social issues), but is also referred to environmental concerns. The scope of the environmental requirements in the purchase appears at most supermarkets are very limited, with (at least) comply with environmental laws when it comes to waste, pollutants and emissions. An exception Ekoplaza (all organic), Superunie and Aldi. Superunie demands that natural resources around the production site is not contaminated or may be destroyed and that the impact of the production is established and managed (for chemicals and other pollutants, emissions and waste). How this is implemented / enforced is not clear, but Superunie may be called in or on the page. Aldi requires taking in her "Verhaltenskodex" suppliers to establish their responsibility towards the environment in policies and measures to reduce negative impacts on natural resources and the environment. How this is controlled is not known. Jumbo refers to continuous improvement, but also because the legal environmental requirements to be the lower limit. Aldi refers to the concept of purchasing fresh fruit and vegetables also Planet Proof. In addition, all supermarkets requirements for MRLs and thus also on the pesticides applied for all purchased fruits and vegetables. Differences in policy on MRLs, especially a food safety aspect, are not included in this study.

All supermarkets indicate that the demand for the entire chain funds. They refer here also to the fact that the requirements apply to primary production, as well as for brokering between. Through the purchase monies minimum environmental requirements for all suppliers, including processors. Albert Heijn refers to the purchase also to subcontractors (they must meet the same requirements), Lidl to the "business partners of their business partners" and Superunie the 'suppliers of suppliers.

Differentiation environmental requirements

According to Albert Heijn there is no distinction countries in requirements (this is true for the general purchase and MRLs). In Ekoplaza everywhere talk of organic production. The other supermarkets everywhere require GlobalGAP and handling general purchase, but also via Proof and Planet SIFAV a distinction between products from the Netherlands and from countries in Africa / South America / Asia.

The environmental requirements for different products are in principle similar to supermarkets through codes of conduct and purchasing requirements for suppliers. This does not apply to the requirements that products must meet through various labels. This can and is a distinction to be made for products. Thus, in many supermarkets almost the entire supply of bananas Rainforest Alliance Certified (see 2.4.2).

Ambition environmental requirements

All supermarkets strive to reduce the environmental impact of the offered range GF. For this purpose, for example, a reference to Planet Proof, SIFAV and TopCrop, see also question 4.

Tailoring environmental requirements and demands (for example) quality, price and volume

The extent to which account is taken of potential conflicts between requirements in terms of (for example) quality, price and volume on the one hand and environmental requirements on the other hand, is only explicitly mentioned by some supermarkets, such as Ekoplaza, Lidl and Jumbo. When Ekoplaza in the Annual Report, at Lidl in a non-public policy piece and by Jumbo covertly in the annual report. This does not mean that other supermarkets not producers and growers together in a good way, but apparently this is not stipulated in the purchase or codes of conduct and is not communicated that way. Through a 'buyer-supplier Mutual code of conduct or a position paper on fair terms of trading "could indicate the supermarkets where they like to buyer will keep the light of the sustainability policy.

Environmental requirements packs

SMART objectives regarding the environmental performance of packaging is still limited. Albert Heijn, Ekoplaza and (partly) PLUS are positive exceptions. PLUS mentions in the CSR Report 2017 ambitions for 2018 that all products are packed as possible. However, a percentage is not mentioned. If a packaging is necessary, then this should be recyclable and / or of renewable raw materials. This applies to 100% of the packaging. It should be noted that a package which is recyclable, in principle, is not necessarily recycled.

Summarizing can be mentioned the following strengths and weaknesses for supermarkets:

Convenience store	strongly	Weak
Albert Heijn	<p>See Question 4: G & F from high-risk countries through SIFAV 100% durable standard-SIFAV 2020.</p> <p>Direct collaboration with Nature & Environment and farmers to sustainable farming in the Netherlands (TopCrop). Ambition share of organic products (10% in 2020)</p> <p>SMART environmental objectives in the field of packaging</p>	<p>TopCrop may not cover all fruits and vegetables from Netherlands and the resulting level of ambition is not immediately obvious. The scope of TopCrop is limited, namely sustainable crop protection.</p> <p>Environmental requirements in general purchasing limited to (minimum) laws. Requirements (if defined in policy and communication), so at least for purchase outside the scope of SIFAV and TopCrop program, such as products from the rest of Europe. No formal attention to balance environmental requirements on the one hand and the conditions that supermarkets create this, for example through a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.</p>
Aldi	<p>See Question 4 G & F from the Netherlands through Planet initiative Proof: 100% Proof Planet in 2020. In the 'Verhaltenskodex' are statutory requirements to reduce the impact on natural resources and the environment.</p>	<p>Aldi's Code of Conduct (Verhaltenskodex) is only available in German. No SMART environmental packaging.</p> <p>No formal attention to balance environmental requirements on the one hand and the conditions that supermarkets create this, for example through a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.</p>
Ekoplaza	<p>See question 4. All purchase organic</p> <p>Explicit attention to price in relation to environmental requirements. SMART environmental packaging.</p>	<p>Attention in biology for environmental themes such as waste and energy consumption is limited.</p> <p>No formal attention to balance environmental requirements on the one hand and the conditions that supermarkets create this, for example through a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.</p>
jumbo	<p>See Question 4 G & F from high-risk countries through SIFAV 100% durable standard-SIFAV 2020.</p> <p>G & F from the Netherlands through Planet initiative Proof: 100% Proof Planet in 2020.</p>	<p>Environmental requirements in general purchasing limited to (minimum) laws. So minimal requirements for procurement outside the scope of Proof and Planet SIFAV, such as products from the 'rest of Europe'.</p> <p>No SMART environmental packaging.</p> <p>No formal attention to balance environmental requirements on the one hand and the conditions that supermarkets create this, for example through a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.</p>

	<p>See Question 4: G & F from high-risk countries through SIFAV 100% durable standard-SIFAV 2020.</p> <p>G & F from the Netherlands through Planet initiative Proof: 100% Proof Planet in 2020. Lidl indicates that the demands of its leading Planet Proof; Certification is not required.</p> <p>Research on reducing environmental impact of packaging. Recent 20% target for reducing plastic use by Lidl in 2025 and 100% recycling of plastic.</p>	<p>Environmental requirements in general purchasing limited to (minimum) laws. So minimal requirements for procurement outside the scope of Proof and Planet SIFAV, such as products from the 'rest of Europe'.</p> <p>No SMART environmental packaging, except for plastic. No formal attention to balance environmental requirements on the one hand and the conditions that supermarkets create this, for example through a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.</p>
PLUS	<p>See Question 4 Through Superunie: High ambitions for G & F from high-risk countries through SIFAV 100% durable standard-SIFAV 2020.</p> <p>High ambitions for G & F from the Netherlands through Planet initiative Proof: 100% Proof Planet in 2020.</p> <p>The Superunie Code of Conduct imposes additional (statutory) environmental requirements for suppliers.</p> <p>SMART target for material deployment packages.</p>	<p>No formal attention to balance environmental requirements on the one hand and the conditions that supermarkets create this, for example through a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.</p>

2.2.3.2 Environment: Implementation & monitoring

Ask	Answer	Analysis
16 How shall verify that stated environmental requirements are met? (See also Question 17)	<p>This is verified by an independent third party (not related to you). This is covered by the use of independently controlled, multi-stakeholder labels. See question 19 This is controlled by ourselves on the production. This is verified by our supplier.</p> <p>Different: No control Explanation / verification:</p>	Is there independent monitoring and / or independently verified multistakeholder initiatives?
17 See previous question, you can activate show what% of purchased fruit & vegetable is checked in the manner specified by you? [% On the basis of acquired volume; please indicate if you use a different unit at answering this question]	<p>Yes%%%%%</p> <p>No, this is not possible because ...</p>	Known what part of the range independently verified environmental requirements (excl. GlobalGAP) and what is the percentage? See also question 19.
18 Are results of checks public (whether anonymous or at the level of a product), so that consumers can ascertain which environmental issues play in the production of fruit & vegetable and improvement which have been identified by producers?	<p>Yes, Notes / verification: No Disclosures:</p>	Communicated the results of audits? For example, a link is established with the effectiveness of the supermarket policy?

marks or audit	<p>systems are used to cover the environmental requirements set by you?</p> <p>Identify% of purchased fruit & vegetables are purchased under the said marks or audit systems. [% On the basis of acquired volume; please indicate if you use a different unit at answering this question]</p>	<table><tr><td></td><td>% vegetable</td><td>% fruit</td></tr><tr><td>Rainforest Alliance</td><td></td><td></td></tr><tr><td>Ecolabel</td><td></td><td></td></tr><tr><td>Biological</td><td></td><td></td></tr><tr><td>....</td><td></td><td></td></tr><tr><td>....</td><td></td><td></td></tr><tr><td>....</td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table> <p>Explanation / verification:</p>		% vegetable	% fruit	Rainforest Alliance			Ecolabel			Biological								<p>With supermarkets know which part of the range is certified by independent, multi-stakeholder environmental labels and if so, what is this stock?</p> <p>GlobalGAP is left out of consideration here.</p>
	% vegetable	% fruit																									
Rainforest Alliance																											
Ecolabel																											
Biological																											
....																											
....																											
....																											
20	<p>What happens if during con- checks demonstrate non compliance with all requirements?</p>	<p>Explanation / verification:</p>	<p>How the compliance procedures look at the various supermarkets? Given producers the opportunity to ensure compliance by means of an improvement within an agreed timeframe? Is with continued non-compliance product not purchased?</p>																								

independent monitoring

Supermarkets use lots of third party, multistakeholder labels to check implement environmental requirements and (have). Also included among the labels and the SIFAV Planet Proof label below. These labels are checked independently. Supermarkets work with GlobalGAP. GlobalGAP Crops accepted by SIFAV as environmental standards for products from a country selection in Africa, Asia and South America. There are the supermarkets provided little information to make good decisions on the percentage of independent verification of environmental requirements that go beyond GlobalGAP. This is remarkable for supermarkets, all operating with sustainability. It would appear to be obvious to the share of certified and independently controlled products continuously monitor the entire range.

Transparency non-compliance

Supermarkets indicate regarding non-compliance to the following procedure: warning, improvement, stop taking if no improvement. This is also the procedure to follow most labels, which connect at many supermarkets.

The transparency on non-compliance is limited for all supermarkets. It is important for consumers to score insight into how individual producers on environmental requirements. The insight is limited to whether or not certified and therefore (if certification is a purchasing requirement) to or may not be available at the supermarket. No insight is offered in the results of audits. It can also be argued that this is going too far when a producer in the event of non-compliance can still work on improving. At constant non-compliance, transparency regarding

producers which the redemption is put stop may well have added value. A similar approach is for example used by some banks for companies that do not pass (more) investment criteria. This transparency provides insight applies to the extent that the purchasing bank / supermarket and works. Such information is already shared between supermarkets via eg BSCI (focused on social demands).

Share of certified fruit and vegetables

Except Ekoplaza the proportion not verify properly certified sustainable produce. Besides Ekoplaza (100% organic) PLUS, and Jumbo seem to rank highest in the share of certified fruit and vegetables by the large proportion of vegetable / fruit with Eco. Albert Heijn does have an extensive environmental program but chooses, for Europe, not always for certification. This makes it possible to assess how much is sustainable offer and how sustainable is this offer.

These results show that an independent verification of the share of certified fruits and vegetables in supermarkets could be a good step to inform consumers about the offer in supermarkets. The responses of supermarkets show that such data are often not readily available. Where does data provided can not be independently verified.

Strengths and weaknesses supermarkets Environment: Implementation & monitoring

Convenience store	Weak	strongly
Albert Heijn Share	<p>sustainably certified fruits and vegetables not clear in total supply of fruit and vegetables. No independent verification from 2020 all fruit and vegetables from Netherlands through Planet Proof (bet on TopCrop). No independent verification of environmental fruit and vegetables from throughout Europe unless sold under the label (such as organic).</p> <p>Limited transparency regarding environmental producers. On non-compliance is not communicated externally.</p>	<p>From 2020 independent control of fruit and vegetables from Africa, Asia and South America via SIFAV.</p>
Aldi	<p>Share sustainably certified fruits and vegetables not clear in total supply of fruit and vegetables. No independent verification from 2020 all fruit and vegetables from Africa, Asia and South America via SIFAV standards.</p> <p>No independent verification of environmental fruit and vegetables from throughout Europe unless sold under the label (such as organic).</p> <p>Limited transparency regarding environmental producers. On non-compliance is not communicated externally.</p>	<p>From 2020 independent audit of all fruit and vegetables from Netherlands through Planet Proof.</p>

	Limited transparency regarding environmental producers. On non-compliance is not communicated externally.	100% independent control 100% organic range.
jumbo	<p>Share sustainably certified fruits and vegetables not clear in total supply of fruit and vegetables. No independent verification of environmental fruit and vegetables from throughout Europe unless sold under the label (such as organic).</p> <p>Limited transparency regarding environmental producers. On non-compliance is not communicated externally.</p>	From 2020 independent audit of all fruit and vegetables from Africa, Asia and South America via SIFAV. From 2020 independent audit of all fruit and vegetables from Netherlands through Planet Proof.
Lidl	<p>Share sustainably certified fruits and vegetables not clear in total supply of fruit and vegetables. No independent verification of environmental fruit and vegetables from throughout Europe unless sold under the label (such as organic).</p> <p>Limited transparency regarding environmental producers. On non-compliance is not communicated externally.</p>	From 2020 independent control of fruit and vegetables from Africa, Asia and South America via SIFAV. From 2020 independent audit part of the fruit and vegetables from Netherlands through Planet Proof. The remainder have independent control, but no certification.
PLUS	<p>Share sustainably certified fruits and vegetables not clear in total supply of fruit and vegetables. No independent verification of environmental fruit and vegetables from throughout Europe unless sold under the label (such as organic).</p> <p>Limited transparency regarding environmental producers. On non-compliance is not communicated externally.</p>	From 2020 independent control of fruit and vegetables from Africa, Asia and South America via SIFAV. From 2020 independent audit of all fruit and vegetables from Netherlands through Planet Proof.

2.2.4 Social: Ambition & Policy and Implementation & monitoring

2.2.4.1 Social: Ambition & Policy

	Ask	Answer	Analysis
21	represents Which social aspects you require the purchase of fruit & vegetables?	Local and international laws and regulations Forced labor Child labor Freedom of association and collective bargaining, discrimination Healthy and safe working conditions Employment contracts Hours Minimum wage Living wage Equal pay for men and women for equal work Other: Comments / verification:	All eight core conventions of the ILO covered? To what extent attention is paid to a living wage? Is this included in the policy of the supermarket and it is mentioned in the annual report and / or purchasing requirements?
22	on which part of the chain are social requirements apply? Have you established policy here?	Direct Indirect suppliers suppliers (who supply direct suppliers) Entire Chain Explanation / verification:	The requirements for primary production, regardless of any brokering? The requirements also apply to other links in the chain, including processors?
23	When it comes to social demands: do you differentiate between production in the Netherlands and Europe, and products from risk countries (such as the distinction risk countries by the Business Social Compliance Initiative (BSCI))?	Yes Notes: No Disclosures:	Get high-risk countries, extra attention? The requirements for low and high risk countries should be equal, but high-risk countries deserve extra attention in terms of the risk of undesirable working conditions. This is also the reason why this distinction in BSCI.
24	Are there at the product level on-distinction made when it comes to social demands, for instance by setting on one type of vegetable different requirements than the other?	Yes, Notes / verification: No Disclosures:	To what extent is there a distinction made between different products and if so, what is the reason?
25	You aim for reduction the social impact of the fruit & vegetable you offer?	Yes, Notes / verification: No Disclosures:	To what extent there is an ambition to continuously improve the social performance (see question 4)?
26	Have you formulated policy to ensure that your requirements in terms of (for example) prices and delivery terms do not conflict with your social needs? Think of a code of conduct for procurement.	Yes, Notes / verification: No Disclosures:	Uses a code of conduct addressing the balance between social demands on the one hand and as price and quality on the other? Is this aspect attention in the sustainability report?

Purchasing requirements based on the core conventions of the ILO

All supermarkets focus on social aspects when purchasing fruit and vegetables, usually through a code of conduct, purchase or standards of engagement "(see a list under" Environment "). The supermarkets are transparent here, in the sense that to find these documents on the Internet, and / or the policy is included in the annual report.

All supermarkets pay attention to the ILO core conventions through the aforementioned codes of conduct, purchasing and independent labels such as Fairtrade. PLUS distinguishes itself by being a number of products, including bananas, offering exclusively Fairtrade certified products.

Remarkably Ekoplaza previously made a selection of Fairtrade own principles in CSR Annual Report 2016 which do not cover all the core conventions of the ILO. This seems to be no logical choice. The core conventions are international generally accepted. Ekoplaza only mentions the following conditions: child labor, slave labor, minimum wages and working hours. Other issues, such as discrimination, equal pay and freedom of association, are not mentioned. In the case of long-term relationships with suppliers, it is advisable to be fully in the social requirements so consumers and civil society to address the supermarket it. Asked for a response to this investigation indicates Ekoplaza to have done so because of a request from an organization like this that looked specifically mentioned on the website. Honest cooperation is not limited Ekoplaza according to these conditions. The chain indicates look at the update of its CSR report, how to formulate it in the future.

Aldi has requirements are specified in the social sphere in the "Anlage zum Kaufschein Ergänzungen der Allgemeinen Einkaufsbedingungen (Stand: 8.14) Verhaltenskodex ", and in the draft purchase conditions for fresh AGFproducten. Aldi herein indicates that all producers should be tested against GRASP. In GRASP come back the ILO core conventions. In the case of Aldi is tracing the appropriate documents otherwise not easy. There circulate various codes of conduct on the Internet and sent out by Aldi 'ALDI Einkauf GmbH & CO. OHG Essen - Anlage zum Kaufschein Ergänzungen der Allgemeinen Einkaufsbedingungen (Stand: 8.14); Verhaltenskodex 'is not found online, and is apparently only available in German.

Differentiation social demands

Most supermarkets distinguish between low-risk and high-risk countries. Aldi does not. however desirable from a risk perspective is a distinction. Of distinction in social criteria crops (logically) no to supermarkets. Important reason is that there is international consensus on the social requirements that companies should pay attention (the aforementioned core conventions). The extent to which these requirements are relevant to the various crops can be, of course, vary. For mushrooms is a special initiative created (Fair Produce) as a result of abuses in the past.

Ambition social demands

All supermarkets are working on improving social aspects. See question 4. AH Foundation is an interesting tool to work on improvement through projects, in addition to the conventional approach using labels. In 2007 Albert Heijn with fresh suppliers set the AH Foundation. This mainly invests in local projects in the areas of housing, education and health. The AH Foundation works closely with ICCO and Fair Match Support. They assist in the selection of projects, for example in the field of water supply and education.

Tailoring social demands and requirements (for example) quality, price and volume level taking into account potential conflicts between requirements in terms of (for example) quality, price and volume on the one hand and the social requirements on the other hand, only by a few supermarkets explicit appointed as Ekoplaza, Lidl and Jumbo. When Ekoplaza in the Annual Report, at Lidl in a non-public policy piece and by Jumbo covertly in the annual report. This does not mean that other supermarkets not producers and growers together in a good way, but apparently this is not stipulated in the purchase or codes of conduct and is not communicated that way. Through a 'buyer-supplier Mutual code of conduct or a position paper on fair terms of trading "could indicate the supermarkets where they like to buyer will keep the light of the sustainability policy. See also the example of Sainsbury's in 2.1.4.

Strengths and weaknesses supermarkets Social: Ambition & Policy

Convenience store	strongly	Weak
Albert Heijn integrate	<p>social aspects well recorded in the "Ahold Standards of engagement.</p> <p>Ahold required BSCI or equivalent for suppliers in high-risk countries. G & F from high-risk countries through SIFAV 100% durable standard-SIFAV in 2020. Furthermore, additional demands this (deal breakers) Bet AH Foundation for local sustainability projects.</p>	<p>No formal attention to balance on the one hand and the conditions supermarket creates this social needs, such as a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.</p>
Aldi	<p>to integrate social aspects set out in the "Anlage zum Kaufschein Ergänzungen der Allgemeinen Einkaufsbedingungen (Stand: 14.08) Verhaltenskodex.</p> <p>Aldi required GRASP for all fruit and vegetables. This is an important part of the social aspects of all fruit and vegetables covered.</p>	<p>Aldi is not affiliated with SIFAV and therefore has not defined the ambition to be carried out in 2020 100% of the purchase of high-risk areas under social labeling / audits. Strong commitment to GRASP. These complement GlobalGAP is not recognized by SIFAV in the 'basket of standards. No formal attention to balance on the one hand and the conditions supermarket creates this social needs, such as a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.</p>
Ekoplaza	<p>Ekoplaza has a policy that all products Ekoplaza sells fairly, produced according to fair trade principles. To this end long relationships are established with suppliers and working with established partners.</p>	<p>Fair trade works is linked to a selection of the ILO core conventions in the 2016 annual report, instead of all ILO core conventions. Discrimination is not mentioned, for example.</p>

	to integrate social aspects set out in Jumbo's' General purchase. G & F from high-risk countries through SIFAV 100% durable standard-SIFAV 2020.	No formal attention to balance on the one hand and the conditions supermarket creates this social needs, such as a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.
Lidl	to integrate social aspects set out in the 'Lidl Code of Conduct. G & F from high-risk countries through SIFAV 100% durable standard-SIFAV 2020.	No formal attention to balance on the one hand and the conditions supermarket creates this social needs, such as a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.
PLUS	to integrate social aspects set out in the 'Superunie code of conduct. For some products, including bananas, choosing 100% Fairtrade certification. Through Superunie G & F from high-risk countries through SIFAV 100% durable standard-SIFAV 2020.	No formal attention to balance on the one hand and the conditions supermarket creates this social needs, such as a "buyer-supplier Mutual code of conduct 'or' Position on fair terms of trading.

2.2.4.2 Social: Implementation & monitoring

	Ask	Answer	Analysis
27	How shall verify that Asked the social demands are met? See also question 28	This is verified by an independent third party (not related to you). This is covered by the use of independently controlled, multi-stakeholder labels. See question 30 This is controlled by ourselves on the production. This is verified by our supplier. Different: No control Explanation / verification:	Is there independent monitoring and / or independently verified multistakeholder initiatives?
28	See previous question, you can activate show what% of purchased fruit & vegetable is checked in the manner specified by you? [% On the basis of acquired volume; please indicate if you use a different unit at answering this question]	Yes%%%%%% No, this is not possible because ...	Known what part of the range independently controlled to social demands and how high this percentage? See also question 30.
29	Are results of checks public (whether anonymous or at the level of a product), so that consumers can ascertain which social issues play in the production of fruit & vegetable and improvement which have been identified by producers?	Yes, Notes / verification: No Disclosures:	Communicated the results of audits? For example, a link is established with the effectiveness of the supermarket policy?

marks or audit	<p>systems are used to hedge the social demands made by you?</p> <p>Identify% of purchased fruit & vegetables are purchased under the said marks or audit systems. [% On the basis of acquired volume; please indicate if you use a different unit at answering this question]</p>	<table><tr><td></td><td>% vegetable</td><td>% fruit</td></tr><tr><td>Fairtrade</td><td></td><td></td></tr><tr><td>BSCI</td><td></td><td></td></tr><tr><td>Rainforest Alliance</td><td></td><td></td></tr><tr><td>....</td><td></td><td></td></tr><tr><td>....</td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table> <p>Explanation / verification:</p>		% vegetable	% fruit	Fairtrade			BSCI			Rainforest Alliance								<p>With supermarkets know which part of the range is certified by independent, multi-stakeholder environmental labels and if so, what is this stock?</p>
	% vegetable	% fruit																						
Fairtrade																								
BSCI																								
Rainforest Alliance																								
....																								
....																								
31	<p>What happens if during con- checks demonstrate non compliance with all requirements?</p>	<p>Explanation / verification:</p>	<p>How the compliance procedures look at the various supermarkets? Given producers the opportunity to ensure compliance by means of an improvement within an agreed timeframe? Is with continued non-compliance product not purchased?</p>																					

Check

Supermarkets make for monitoring social demands extensive use of third-party, multi-stakeholder approvals and audit systems, such as Fairtrade, Rainforest Alliance and BSCI (classified under SIFAV as a social aspects mark). The labels have joined SIFAV is thereby committed to high-risk countries in 2020 to 100% purchase that meets standards of the SIFAV 'basket or standards. Lidl indicates now sit on 80% for the purchase of fruit and vegetables within the scope SIFAV (fruit and vegetables from Africa, Asia and South America). Ekoplaza scores on independent monitoring on the one hand high because more than half of the products Fairtrade certified, but then this supermarket also indicates that a portion of the range takes place via personal check (by Ekoplaza or chain partners).

An audit organization also called multiple times (eg Albert Heijn and Jumbo) is SIM: Supply Chain Information Management. SIM is a private party that supports companies in the supply chain management and the collection, validation and retrieval of data through software suppliers and contacts with suppliers. Although SIM in a sense, one of the supermarkets independent party has of course been a commercial customer / supplier relationship. SIM is in that sense not comparable to an independent audit as conducted for labels such as Fairtrade and Rainforest Alliance.

Aldi aims as regards the monitoring of social requirements GRASP. This is an additional module on top of GlobalGAP and will be monitored simultaneously in practice. These controls are however independent, but is not recognized by GRASP SIFAV to cover social aspects in high-risk countries.

Aldi itself states that GRASP is not a certification or audit system, but (for Aldi) mandatory assessment tool that is used together with a GlobalGAP audit.

Share socially sustainable products range

There are provided by the supermarkets too little information to make good decisions on the part of the entire range of fruit and vegetables which are independently audited on social aspects. Where data (percentages) they are usually reinforced cover the high-risk countries, which is understandable from a social standpoint. Since a product can be controlled in several ways (for example, audit BSCI, and a fair trade label), said percentages can not simply be added together. Ekoplaza is an exception to the figures which they cite in their report. Aldi scores well on GRASP (end of 2018 is 100% to meet the purchase), but this is not included in the "basket of standards" of SIFAV. This makes it possible to have a good choice for a low-risk countries,

Transparency non-compliance

Analogous to the environmental requirements for consumers to score insight into how individual producers to social demands. The insight is limited to whether or not certified, and often also to whether or not present in the store. If not met the requirements of the supermarket products will, after all, if the property is not end up in the supermarket. No insight is offered in the results of audits. It can also be argued that this is going too far in the case of a producer that noncompliance can still work on improving. At constant non-compliance, transparency regarding producers which the redemption is put stop may well have added value. A similar approach is for example used by some banks for companies that do not pass (more) investment criteria. This transparency provides insight into the extent to which the policy is applied by the bank / supermarket and works. Such information is already shared between supermarkets via eg BSCI.

Strengths and weaknesses Social: Implementation & monitoring

Convenience store	strongly	Weak
Albert Heijn From	2020 independent audit for all fruit and vegetables from Africa, Asia and South America via SIFAV.	Share socially-sustainable certified fruits and vegetables not clear in total supply of fruit and vegetables. No independent verification of social performance fruits and vegetables from Europe (mostly low-risk area), unless sold under social label. Limited transparency regarding social assessment producers. On non-compliance is not communicated externally.
Aldi	Entire range has been independently verified by GRASP social aspects.	Share socially sustainable certified fruits and vegetables not clear in total supply of fruit and vegetables. No independent verification from 2020 all fruit and vegetables from Africa, Asia and South America via SIFAV standards. GRASP is not accepted for high-risk countries. No independent verification of social performance fruits and vegetables from Europe (mostly low-risk area), unless sold under social label. Limited transparency regarding social assessment producers. On non-compliance is not communicated externally.
Ekoplaaza	Largely range (54%) is independently verified social (Fairtrade) requirements.	46% of the assortment is not independently verified social performance, but through 'own chain management. Limited transparency regarding social assessment producers. On non-compliance is not communicated externally.
jumbo	From 2020 independent audit of all fruit and vegetables from Africa, Asia and South America via SIFAV.	Share socially sustainable certified fruits and vegetables not clear in total supply of fruit and vegetables. No independent verification of social performance fruits and vegetables from Europe (mostly low-risk area), unless sold under social label. Limited transparency regarding social assessment producers. On non-compliance is not communicated externally.
Lidl	From 2020 independent audit of all fruit and vegetables from Africa, Asia and South America via SIFAV.	Share socially sustainable certified fruits and vegetables not clear in total supply of fruit and vegetables. No independent verification of social performance fruits and vegetables from Europe (mostly low-risk area), unless sold under social label. Limited transparency regarding social assessment producers. On non-compliance is not communicated externally.

	From 2020 independent audit of all fruit and vegetables from Africa, Asia and South America via SIFAV.	Share socially sustainable certified fruits and vegetables not clear in total supply of fruit and vegetables. No independent verification of social performance fruits and vegetables from Europe (low risk area), unless sold under social label. Limited transparency regarding social assessment producers. On non-compliance is not communicated externally.
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2.2.5 Training & Support

	Ask	Answer	Analysis
32	Trains to buyers in environmental considerations in the procurement of fruit & vegetable?	Yes; If so, who are trained, how often and how? (Substantiation / verification) No; explanation:	To what extent buyers are trained periodically and / or internally supported (via internal consultation, etc.) on the environment?
33	Being offered support producers to meet environmental requirements to set purchase?	Yes, we give ourselves workouts. Yes, our suppliers provide training. Yes, approval agencies provide training. Yes, we provide information about better production methods and labels that can meet the requirements. Yes, other: Explanation / verification: No Disclosures:	Supports supermarket growers themselves in meeting environmental requirements (indicating a high commitment and contribution to knowledge regarding the opportunities and challenges in practice)? Or left to mark where the bodies supermarkets use (involvement and resulting knowledge is less, but the support can of course be good quality)?
34	If yes, what% of producers annual environmental achieved with this training?	..... % of producers Explanation / verification:	Is known to the supermarkets which part of the growers this training is achieved and if so, what is that range?
35	Trains to buyers in social aspects in the purchase of fruit & vegetables?	Yes; If so, who are trained, how often and how? (Substantiation / verification) No; explanation:	To what extent buyers are trained periodically and / or internally supported (via internal consultation, etc.) in the social field?
36	Being offered support producers to meet purchasing requirements laid down in the social field?	Yes, we give ourselves workouts. Yes, our suppliers provide training. Yes, approval agencies provide training. Yes, we provide information about better production methods and labels that can meet the requirements. Yes, other: Explanation / verification: No Disclosures:	Supports supermarket growers themselves in meeting social demands (indicating a high commitment and contribution to knowledge regarding the opportunities and challenges in practice)? Or left to mark where the bodies supermarkets use (involvement and resulting knowledge is less, but the support can of course be good quality)?
37	If yes, what% of producers annually achieved with this training in the social field?	..... % of producers Explanation / verification:	Is known to the supermarkets which part of the growers this training is achieved and if so, what is that range (training is available to everyone)?

Key results Training & Support

Training on environmental and social aspects are not generally offered to buyers from supermarkets, unless it is interpreted broadly: buyers are guided internally and kept informed of the CSR requirements through procurement meetings.

Part of supermarkets offering by providing information support to growers' better agricultural practices and to indicate with which marks the environmental requirements of the supermarket can be met. This also applies to social demands. Plus and Jumbo give not to do this yourself. The labeling organizations where supermarkets offer them work in many cases, support to producers in the form of education and training. Lidl supports growers in meeting environmental requirements Proof and Planet Albert Heijn with Nature & Environment developed a yardstick for the sustainable cultivation of fruit and vegetables. The insight is limited in the range of producers, including through the support of labeling organizations. Albert Heijn and Lidl seem at this point relatively good score.

Strengths and weaknesses supermarkets Training

Convenience store	strongly	Weak
Albert Heijn	Internal awareness training buyers on CSR. Active participation by developing ruler sustainable cultivation of Nature and Environment. Range growers is estimated at 100% on the basis of evaluations season, for meetings, etc.	
Aldi	Internal awareness training buyers on CSR. Aldi shows that can get 2018 support producers for Planet Proof.	Range training to growers is not well known.
Ekoplaza	Internal awareness training buyers on CSR. Information to farmers about production.	Range training / education of farmers is not known.
jumbo	Internal awareness training buyers on CSR.	No own active contribution to training farmers. Range training to growers by others is not known.
Lidl	Internal awareness training buyers on CSR. Support farmers (in the Netherlands) in meeting the requirements of Planet Proof. Dutch growers reach 100% by plan Sustainable purchasing fruit and vegetables.	Range training to producers in countries SIFAV unknown.
PLUS	Internal awareness training buyers on CSR.	No active contribution to training farmers. Range training to growers by others is not known.

2.2.6 Seasonal Products

	Ask	Answer	Analysis
38	<p>Have you formulated policy regarding the sale of seasonal vegetables & -fruit *?</p> <p>* That's vegetables and fruit at a certain time of year - So in the spring, summer, autumn or winter - harvested on Dutch soil. Fruit and vegetables of the season are less damaging to the environment than species that are imported from countries outside Europe are transported by air, or grown in a heated greenhouse. (Source: Nutrition Center)</p>	<p>Yes, Notes / verification: No Disclosures:</p>	<p>The supermarket a policy to offer only seasonal fruits and vegetables? Is there a preference for seasonal products, or refrain from a year round offer if seasonal products are not available?</p>
39	<p>Do you stimulate sales seasonal fruit & -fruit?</p>	<p>Yes, Notes / verification: No Disclosures:</p>	<p>Be seasonal actively promoted and if so, how?</p>

Policy seasonal

Aldi jumps out positively because it indicates to offer some products year round if this is not possible through seasonal products. Which products, however, is not clear and it is not completely supported by the data in the case studies where products from other countries also appear to be involved, and data are not always available.

The other supermarkets, with the exception of Albert Heijn, give to give preference to products from Dutch soil, but let it not be at the expense of the (year round) range. Incidentally, a product of Dutch origin is not always better to score (all) environmental and social aspects.

All supermarkets pay attention to the promotion of seasonal fruits and vegetables. This does not have to be motivated by environmental considerations.

2.2.7 Food waste

	Ask	Answer	Analysis
40	Have you formulated policy the field of food waste?	Yes, Notes / verification: No Disclosures:	The supermarket previously formulated policy, for example by prices on products at the date and not exploit sold or difficult to sell products through a specific offer in-store, food bank or other initiatives?
41	you spend attention to reducing food waste in earlier links in the chain, for example in the cultivation or transportation?	Yes, Notes / verification: No Disclosures:	Focuses on food waste beyond the focus on unsold products? The food waste in the supply chain links before the supermarket are generally greater than the losses in the retail and after sales.
42	Have objectives formulated in food waste?	Yes, namely ... ; Explanation / verification: No Disclosures:	The supermarket also SMART objectives formulated food waste or only focus on action without a (quantitative) target is linked to here?
43	How is waste of fruit & vegetable whose quality deteriorates during the shelf time as much as possible?	No specific measures Timely offer at a lower price Offering via special apps or websites, namely ... Timely processing of takeaway meals and processed products, such as Offering of restaurants offering food to the other: Explanation / verification:	Are several ways to prevent food waste / restricted use? Are there big differences between the supermarkets and / or interesting innovations?
44	Please measures quantify? [% By volume bought fruit & vegetables; please indicate if you use a different unit at answering this question]	Yes:% No specific measures% offer timely at a lower price% Offering via special apps or websites, namely% Timely processing example takeout meals or processed products % offer at restaurants % offer to the food % other: Explanation / verification: No, because:	With supermarkets known what part of the GF range through these measures (still) be used? This is important in order to assess the effectiveness of the measures.

fruit	Because of the risk ge appearance not on the shelf ends up somewhere new?	No, this is as organic waste / residual discharged for further processing (see question 47) Still (separately) offer in the supermarket Offering to restaurants Processing in takeaway meals or processed products Other:	How do the supermarkets with products that are discarded solely on appearance often? Try the supermarket to give itself here still a good destination, products controlled return to the supplier (which products may still get lost) or they are discharged through a waste treatment (fermentation., Composting)?
46	Please measures quantify? [% By volume bought fruit & vegetables; please indicate if you use a different unit at answering this question]	Yes: ...% drainage and organic waste / residual anyway ...% (separately) offer in the supermarket ...% ...% restaurants offer to processing in takeaway meals or processed products ...% other: Explanation / verification: No, because:	With supermarkets known what part of the GF range that does not meet the desired appearance through these measures (still) be used?
47	How is it with you and waste / residual drained vegetables and fruit processed? [% By volume bought fruit & vegetables; please indicate if you use a different unit at answering this question]	... ..% vegetable compost to% vegetable to feed% Vegetables for fermentation% Vegetable, to: % Fruit to compost Fruit%, to feed Fruit%, to fermentation% fruit to: Explanation / verification:	Do the supermarket what happens to this waste stream and sent here?
48	Do you communicate the direction consumers about their ability to home to avoid food waste?	Yes, Notes / verification: No Disclosures:	Gives the supermarket actively information about consumers and how? Here are interesting / innovative initiatives undertaken in?
49	you monitor your performance field of combating food waste over the years?	Yes, Notes / verification: No Disclosures:	Monitored the impact of the measures taken? The supermarket also communicates about this, for example through an annual report?

Food waste policy

All supermarkets have been working with food banks. They also pay attention to smart purchasing and most supermarkets offer products at the best before date at discounted prices. Jumbo and Ekoplaza mention not. Interesting initiatives are the "Misfits" and INSTOCK Albert Heijn, the Yes / No fridge sticker Nutrition Center which is spread through Jumbo and ordering each at Ekoplaza. Whether this policy really made a significant difference in the

terms of total food wastage in the supply chain, is not to give the basis of available information.

All supermarkets pay attention to food waste in the supply chain, if only through climate during transport. An interesting initiative is the optimaal.nl website Lidl, aimed at preventing food waste. Supermarkets spend almost all attention to food waste by consumers, which is positive. There are also fun activities, such as the Lidl site and making dishes with food scraps (Albert Heijn).

SMART objectives and monitoring

Strikingly, only Albert Heijn SMART objectives formulated on food waste. Or CBL Climate Plan (see below), which includes attention to food waste, quantitative targets to members prescribes is not clear, but it appears based on the information on the website CBL unlikely. Also notable is that figures on food waste does not appear to be monitored separately. The success of this policy will be difficult to establish. The monitoring of the percentage of fruit and vegetable non-sold, therefore, seems to be a logical step, as well as the percentage of fruit and vegetables which ultimately is discharged through waste processing (this is indicated by Albert Heijn: 2%). Supermarkets, with the exception of Albert Heijn, are cautious about the results of their actions on food waste. From the standpoint of sharing successes that is unfortunate.

Central Food Retail, the 'CBL Climate Plan' drawn. Supermarkets also work in this regard to reducing food waste. It states that CBL CBL and FNLI within the Food Preservation Alliance work to make harmonization and standardization of monitoring, to end at product level to bring transparency into the extent and causes of waste streams. For this purpose, they will actively cooperate with Wageningen UR and the European Fusion Network.

concrete measures

Supermarkets differences when it comes to the use of products that are rejected on the basis of appearance. From the perspective of sustainability and consumer awareness is there something to be said for that products that look less beautiful just offered in supermarkets. Albert Heijn and Ekoplaza do this, but separately. Processing in own processed products is also a good option. Which of the two options is most effective to reduce food waste is not known. Monitoring the products to be assigned another destination because appearance does not occur. In what is recommended if you want to deal in a serious way with food waste, except for minimal amounts.

The residual stream as discharged AGF is fermented or composted (Ekoplaza). All supermarkets are thus known.

The results of the section on food waste submitted to Toine Timmermans, food waste expert at Wageningen UR (personal communication, April 5 and June 5, 2018). The article in the Consumer Guide on this issue we took the next saga pass this on:

It is estimated that in the Netherlands every year about 2 million tons of food is wasted, which is more than 100 kilograms per person. About 41 kilos of it is wasted by consumers at home, the rest elsewhere in the chain. The supermarkets do not spend as much, but have much influence on the rest of the chain. "Food waste occurs when the chain is not functioning properly and supply and demand do not fit together," explains Toine Timmermans, food waste expert at Wageningen UR in. Precisely by offering easy to adjust to demand, supermarkets can ensure that the amount of food that is wasted is minimized. In the stores, but also before it is in stores and in consumers' homes. "What is lacking are concrete ambitious goals of the supermarkets to reduce food waste," said Timmermans. That shows that they take too little responsibility for the problem.

Strengths and weaknesses supermarkets Food Waste

Convenience store	strongly	Weak
Albert Heijn	<p>Developed an explicit policy on food waste, including chain. SMART has set targets.</p> <p>Offering products with different physical characteristics still or turn them into processed products. Interesting initiatives like Misfits, INSTOCK and cooking with leftovers. Relatively open about the results achieved in the field of food waste through annual reports.</p>	Limited information on the results of the policies on food waste.
Aldi	Developed an explicit policy on food waste, including chain.	<p>Well SMART goals, but not publicly.</p> <p>Little to no information on the results of the policies on food waste.</p>
Ekoplaza	Developed an explicit policy on food waste, including chain. Provides products with different physical characteristics anyway.	<p>No SMART formulated objectives.</p> <p>Little to no information on the results of the policies on food waste.</p>

	Developed an explicit policy on food waste, including chain.	No SMART objectives formulated, though the supermarket claims to be the ambition to be the leading supermarket where no edible food is thrown away. But do not depend on timing. Provide little or no information on the results of the policies on food waste.
Lidl	Developed an explicit policy on food waste, including chain. Interesting initiative online platform food waste.	No SMART formulated objectives. Limited information on the results of the policies on food waste.
PLUS	Developed an explicit policy on food waste, including chain.	No SMART formulated objectives. Little to no information on the results of the policies on food waste.

2.2.8 Final questions: challenges and responsibilities of supermarkets

biggest challenges

What the supermarkets are the greatest challenges to environmental and social sustainability in terms of the offering fruit & vegetable? The consequences of climate change, living wage, bee mortality, cooperation in the chain and the lack of a global level playing field "are mentioned as challenges.

supermarket challenge	
Albert Heijn	Living wages, shortages in the global climate change impact on water availability and crop land available, especially for organic cultivation of fruits and vegetables.
Aldi	Sustainable procurement through cooperation in the chain, so we have good, healthy and sustainable products at affordable prices to make available to a broad group of consumers. Explanation of what is sustainable and healthy for consumers.
Ekoplaza	Increasing total area of organic farming.
jumbo	The growing importance of the Asian market. We see this as a threat. These countries certainly less demanding with regard to certification, pay less and have a relatively high demand. Global demand increases from countries where standards are lower, which is the challenge for us in securing available product and volume associated with our requirements. It is in that respect a gap in global demand, which can put pressure on availability for our European market. In addition, climate change is an important factor, by changes in climate are some products more susceptible to disease / fungus. The restriction of genetic modification of plants EU legislation is an increase in resistant crops partially in the road.
Lidl	One of the challenges is that the last thirty years the number of bees has decreased tremendously. We see this as a very important challenge given the huge role of bees in food production. As stated in our policy "Sustainable purchasing fruit and vegetables NL Lidl" We are working together with suppliers by reducing the use of pesticides and encouraging greater biodiversity around the cultivation land. This year we will focus extra on this topic.
PLUS	Availability AGF medium term under environmentally / socially friendly conditions.

Roles and responsibilities supermarket

How do supermarkets their roles and responsibilities when it comes to reducing the negative impact on people and the environment associated with the cultivation of fruit and vegetables?

Convenience store	Roles and responsibilities
Albert Heijn	Reducing pesticides and water. As close as possible and as far as necessary. As many seasonal product. Support sustainable development chain.
Aldi	Sustainable procurement through cooperation in the chain, so we have good, healthy and sustainable products at affordable prices to make available to a broad group of consumers. Explanation of what is sustainable and healthy for consumers.
Ekoplaza	Active in the organic sector, linking factor.
jumbo	By imposing statutory requirements we contribute to a reduction of environmental impact. As we strive to do this in the conventional cultivation we make this a great contribution without sacrificing yield and product availability.
Lidl	The effects of climate change worldwide for man and nature noticeable. We want to reduce the negative impact of our operations on the world. It is therefore our ambition to make our product range more and more responsible, so that sustainable and healthy food affordable and accessible to everyone. We do this by working closely with suppliers and solid step to the sustainability of our products. So we now and in the future, our customers can provide the "highest quality at the lowest price.
PLUS	Within about Superunie make agreements and fulfill them. Role supermarket herein is big and important.

2.2.9 Summary of results by supermarket chain

The article in the Consumer Guide July / August 2018 the results by supermarket highlighted as follows:

Albert Heijn

The largest supermarket chain has a comprehensive sustainability policy. This includes specific detailed objectives, such as 15% less packaging and increasing the share of organic vegetables for 10% in 2020. Albert Heijn also committed to responsible use of pesticides. The chain does not contribute to the sustainability initiative Planet Proof, but opts for a different approach. The outcomes are less predictable.

Aldi

Aldi has not subscribed to the Sustainability Initiative Fruit and Vegetables "for products from outside Europe. In addition, the German-born chain give us little information about the cultivation of fruit and vegetables, possibly because many chain buys through wholesalers rather than directly with growers themselves. Aldi says in his purchase - unlike many other supermarkets - do additional environmental requirements.

Ekoplaza

All fruits and vegetables are organically grown at Ekoplaza. That means no chemical fertilizers and pesticides are used. That's good for biodiversity and soil. Devotes much attention to the chain honest cooperation with growers, all these efforts are not always independently verified. The organic supermarket takes action against plastic, using compostable packaging.

jumbo

Jumbo sells much fruit and vegetables On the way to Planet Proof. The shelves this is not always visible, because not all switched all producers in a particular product. The aim is that all fruits and vegetables of Dutch soil in 2020 when Jumbo Planet Proof mark. Other supermarkets have joined here. Jumbo spends several ways attention to food waste, but no concrete targets.

Lidl

Lidl is working with a small, fixed group of Dutch growers of fruit and vegetables and therefore has a lot of insight into the growing conditions. The origin of German chain has set specific targets for the reduction of plastic packaging and recycling of plastic waste. Lidl gives consumers via optimaal.nl about food waste, but itself has no quantitative targets for reducing waste.

Plus

Plus presents itself on the theme of fair trade and therefore opted for a wide range of Fairtrade products. The website also provides the supermarket relatively much practical information. The supermarket has recently presented a new packaging policy. If a package is necessary, he should have been recycled and / or renewable raw materials. Plus no concrete own targets for reducing food waste.

2.3 Consumer research

In this section the results of the quantitative consumer survey presented by the Internet panel of the Consumer.

2.3.1 The concept of sustainability

Figure 2.3 shows what consumers think at sustainability in fruit and vegetables. It shows the most answers, the font associated with the frequency of occurrence of that word. Respondents had as yet received no other information in the questionnaire about the concept of sustainability.



Figure 2.3 When it comes to durability vegetables and / or fruit, what comes as before with you?

2.3.2 Purchase of vegetables and fruits

The vast majority of respondents buy vegetables and / or fruit at the supermarket (Figure 2.4).

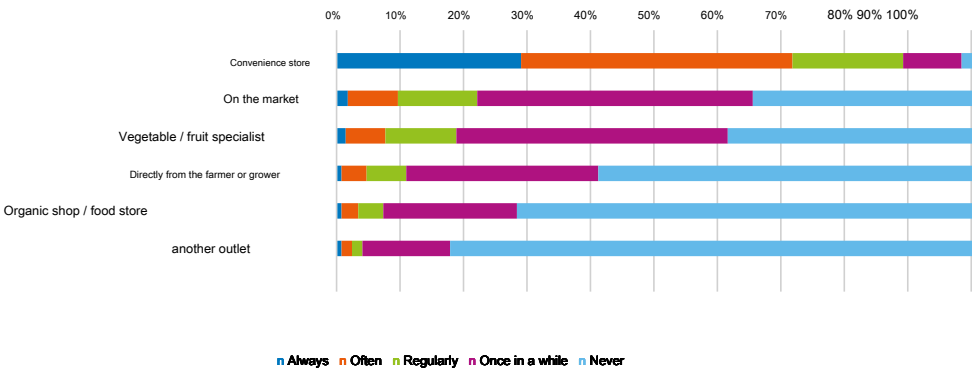


Figure 2.4 How often do you buy vegetables and / or fruit at the mentioned outlets? (N = 11506)

Respondents most often go to Albert Heijn, Lidl, Jumbo, Plus and Aldi for fruit and vegetables (Figure 2.5). In the organic / health food stores Ekoplaza is the most popular (figure 2.6).

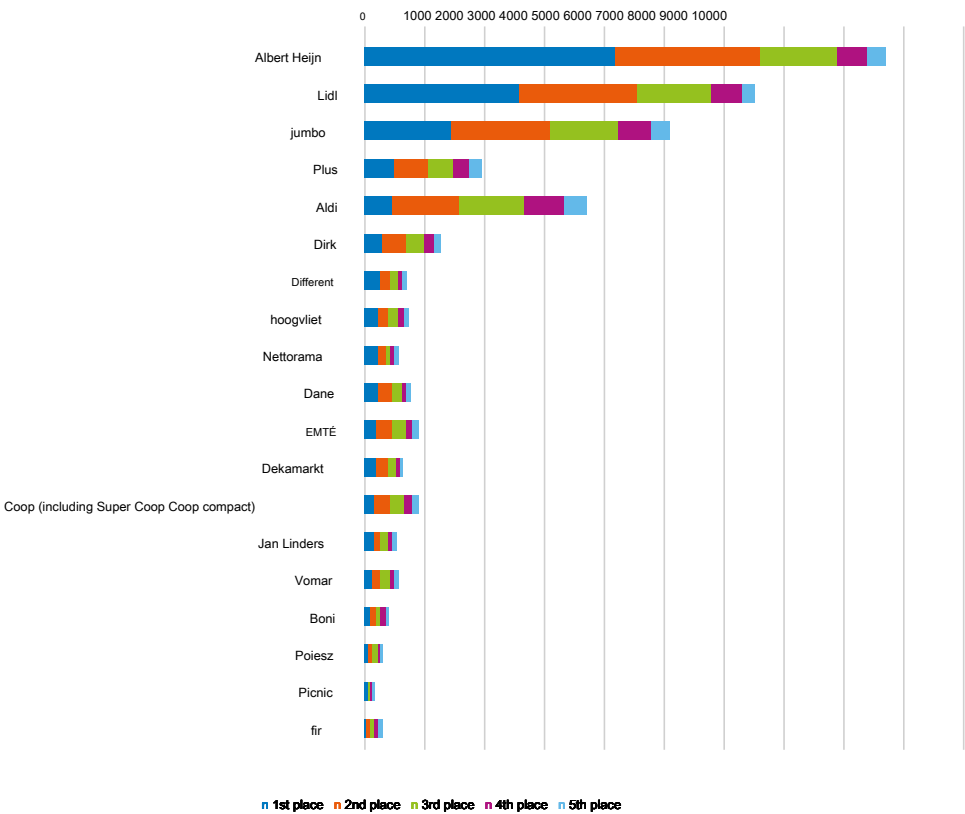


Figure 2.5 In the supermarket you buy most often vegetables and / or fruit? (N = 11303)

Respondents could choose up to five circuits on this topic in order of frequency of visits.

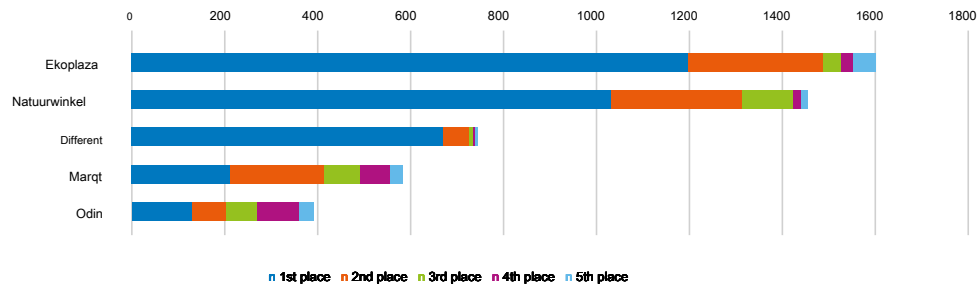


Figure 2.6 Where organic store / food store you buy most often vegetables and / or fruit? (N = 3275)

Respondents could choose up to five circuits on this topic in order of frequency of visits.

2.3.3 Consumers sustainability in fruit and vegetables

Good working conditions are important, many consumers (Figure 2.7). Respondents also indicate important to find environmentally friendly cultivation and transport. Few respondents know exactly what to look for if they want to opt for sustainable vegetable and / or fruit. 51% have a need for more information.

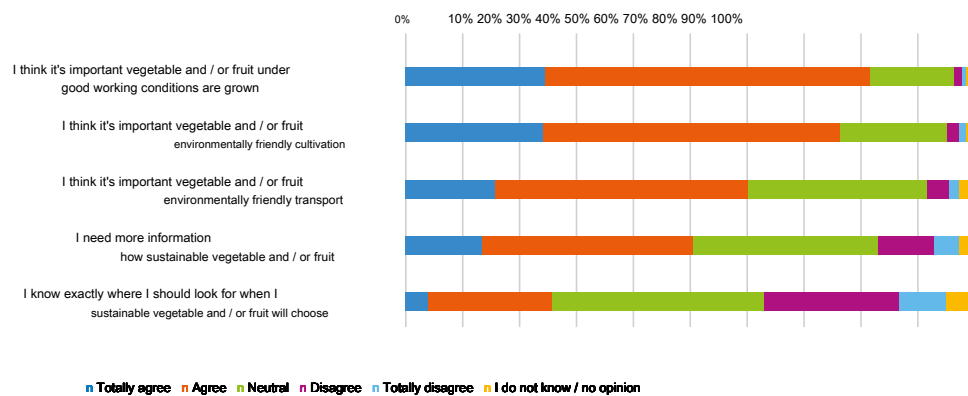


Figure 2.7 Propositions sustainability fruit and vegetables (N = 11417) Question: "to what extent do you agree with the following statements?"

A majority of respondents believe that it is the responsibility of the provider to improve the sustainability of vegetable and / or fruit and the transparency thereof. Many consumers will be not limited to the offer of sustainable vegetable and / or fruit alone (Figure 2.8).

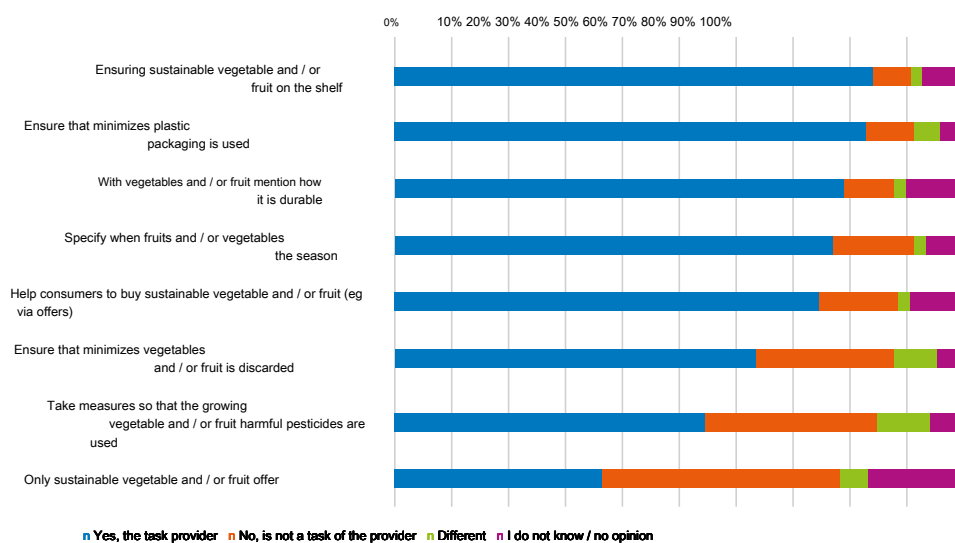


Figure 2.8 Which of the actions can be found or not job of the provider? (N = 11417)

Figure 2.9 shows the extent to which consumers recognize themselves in a number of statements on labels. Quite some panelists want to choose in the store for fruit / vegetable sustainability labels. Yet less than a quarter of the survey participants on sustainability labels when they buy vegetables / fruits. It also appears that sustainability labels but to convince a small part of the consumer that is taken into account in the cultivation environment and / or working conditions.

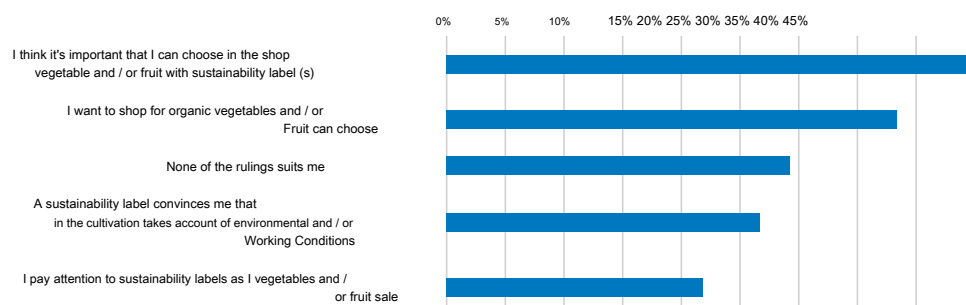


Figure 2.9 Statements about durability marks (N = 11417)

Question: "Which of the following statements applies to you? Multiple answers possible"

2.4 Results Case Studies

In this section the results of the case studies discussed by product. First, an overview of the origin and characteristics of the product. Then follow the results of the life cycle analysis for each impact category. This is followed by an analysis of the responses of the supermarkets questions. Finally, following the results of the questions about the consumer survey.

For each case study, a number of research data are shown in schematic "passports". This involves a simplification of the reality. Subsequent analyzes provide detailed and comprehensive information about the particular vegetable or fruit.

Strawberry



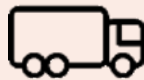
Edible:
95%



packing:
Cardboard box + foil



Origin:
The Netherlands



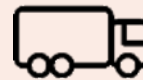
Transportation:
Truck



cultivation:
Greenhouse / tunnel / open field



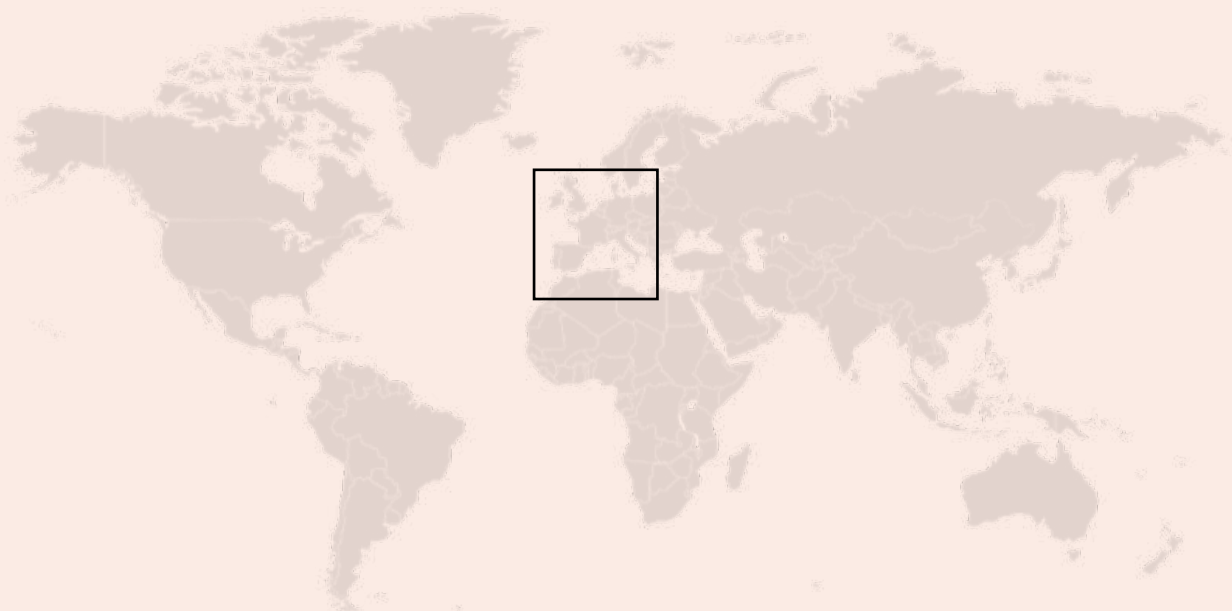
Origin:
Spain



Transportation:
Truck



cultivation:
Open field



2.4.1 Strawberry

2.4.1.1 Environmental impact

is based on the following average data in the study of the environmental impact of strawberries from the Netherlands:

Transport origin	from growing location	Manufacturing	Energy in glasshouse product loss in the supply chain	
76% Netherlands	Truck	50% open area 46% 4% tunnel greenhouse	100% boiler	Transport Foreign growing location for distribution in the Netherlands: 2% Transport Dutch production location for distribution: 1% of transport distribution to supermarket: 1% In store: 5% For consumers: 8.5%
20% - Spain	Truck Open field		Does not apply	
2% - Portugal	Truck Open field		Does not apply	
2% - Egypt	Aircraft / ship	Open field	Does not apply	

carbon footprint

Carbon footprint of strawberries to the supermarket are presented in Figure 2.10. In blue are numbers listed are used in the calculation of the Dutch mix (low). In green are the results of the additional calculations are made for the sensitivity analysis on impact of higher yields of strawberry cultivation in greenhouses (145 tonnes instead of 98 tonnes per hectare), more information in Appendix C1. These higher revenues from the greenhouse is then calculated a new market mix (market mix high), see Appendix C1.

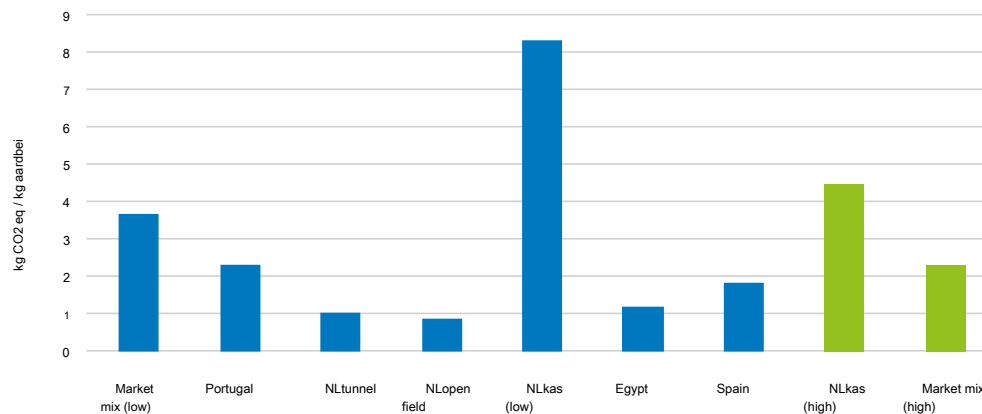


Figure 2.10 Carbon footprint of strawberries from different countries and calculated Dutch market mix

Carbon footprint of most strawberry crops are around 1 to 1.5 kg CO₂. However equivalents skip the strawberries from the Dutch greenhouse is quite out. And that is mainly because of the natural gas used to heat the greenhouse. There can be achieved significant profit when the greenhouse is not fired boiler but is heated with geothermal energy or CHP². The difference with other cultivation techniques clearly demonstrates that strawberry field or tunnel have a lower carbon footprint.

Since the share of Dutch strawberries from the greenhouse is high on the market mix, the carbon footprint of strawberries therefore quite high on the Dutch market. Even when the strawberries in the greenhouse with a higher yield is calculated on the market mix, strawberries greenhouse gas continue to perform relatively poorly.

land use

Land use of different strawberries in the Dutch supermarket below are presented in Figure 2.11.

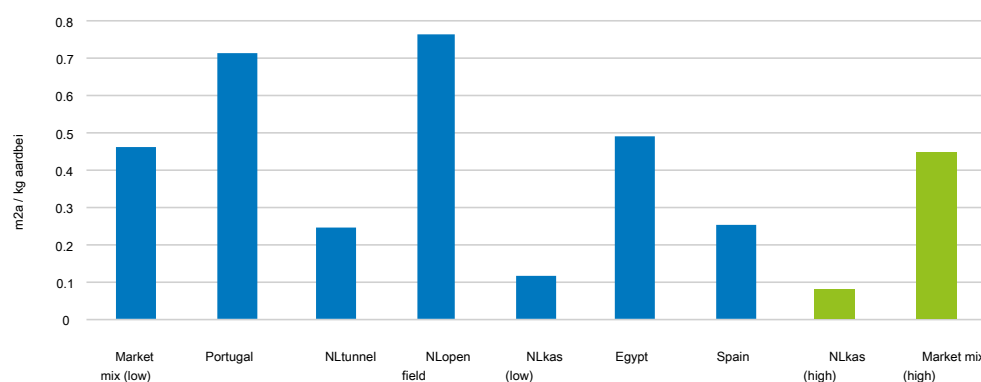


Figure 2.11 Land use strawberries from different countries and calculated Dutch market mix

Land use strawberries runs the country using different alternatives quite different, and the reason is not only that the average yields per hectare are so different. To open production scenario in the Netherlands is also straw nabbed as a bed for strawberry cultivation. The amount is quite significant at 10 tonnes per hectare, based on figures from KWIN-AGV (2015). Other technologies, such as greenhouses and tunnels use positions so that the use of straw as a bedding material is superfluous. Moreover, the production yields of strawberries in tunnels and greenhouses are generally higher so net land use is lower than for field crops.

² Strawberries have less heat than other crops such as cucumbers, tomatoes and peppers (KWIN, 2015). Because of the high (er) investment in cogeneration and geothermal are less likely to apply these systems for strawberry crops because the pay is much higher in strawberry cultivation. It is therefore assumed that boiler fired greenhouses are used.

water use

Water consumption for strawberry cultivation in different countries and cultivation techniques are shown in Figure 2.12.

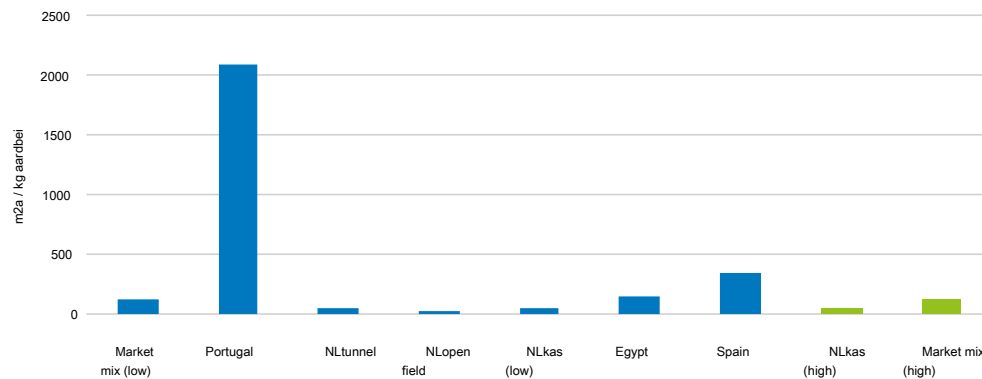


Figure 2.12 Water consumption of strawberries from different countries and calculated Dutch market mix

It is expected that water consumption per kg of strawberries from countries in the Mediterranean countries is higher than in the Netherlands because of different climatic conditions. However, the Portuguese water for strawberries extremely high. This can be put questioned. Dutch strawberries fluctuate between 25 and 35 liters of water per kg of strawberries in the supermarket, Spanish strawberries around 135 liters and 329 liters in Egypt.

2.4.1.2 Supermarket Policy

Origin as declared supermarkets

origin	assumption research	Albert Heijn	Aldi	Ekoplaza	Jumbo	Lidl	PLUS
The Netherlands	76%	Conforms	to 87% assumption	75%	98%	65%	Conforms assumption
Spain	20%	8%		25%	2%	35%	
Portugal	2%	<1%					
Egypt	2%	<1%					
Belgium		3%					
Morocco		1%					

Several supermarkets can provide exact percentages here. Albert Heijn and Jumbo mostly involve very high percentages strawberries from Netherlands. This applies mostly to give the image that supermarkets, that they preferred to source as locally as possible.

The origin of strawberries as used for the analyzes 2.4.1.1 largely correspond to the list of supermarkets.

Transportation from growing location

Supermarkets indicate no or hardly any changes in the said transport mode. This seems to be a 'question' when purchasing or anything that is sent.

Manufacturing

The production is not known to the majority of supermarkets. Positive exceptions are Albert Heijn, Jumbo and Lidl. The importance of this seems familiar to the environmental footprint of the product.

Energy in greenhouse

In general seem supermarkets, except Ekoplaza and Albert Heijn, not knowing exactly how it is with energy consumption in the production, which is certainly an important factor in the environmental impact of the product. Albert Heijn called boiler and CHP together, so that the profit made on this point is not likely to adopt.

Product loss in the supply chain

Despite the policies that have supermarkets around food loss and the importance of minimizing food loss is apparently often no policy to monitor shrinkage rates. Some supermarkets also see the shrink further back in the chain are not their responsibility (just as the property of the supermarket). Albert Heijn seems only to have more specific figures based on research and Jumbo may indicate what the store shrinkage.

Used sustainability labels

For almost all supermarkets there is GlobalGAP certification. Additionally, organic certification is made and Planet proof regarding environmental and ETI Smeta Grasp and socially. As expected, refer also to the supermarkets Planet Proof target for strawberries from Dutch soil.

environmental cultivation

	carbon footprint
3	Research suggests that strawberries grown in greenhouses in the Netherlands higher carbon footprint than strawberries grown in tunnels or open fields in the Netherlands. Are you aware? If so, take specific measures here, for example by sending the type of energy in the greenhouse?
4	Please note the environmental score of strawberries in your selection of the Vegetable & Fruit Calendar Milieu Centraal? So it is advised here that offer strawberries from Egypt and the Netherlands should be avoided in several months of the year. See: https://groentefruit.MilieuCentraal.nl/
	Plant protection
5	Research shows that several pesticides used in the cultivation earth Beien. What are your requirements for the use of pesticides on strawberries, for example, the use of biological pesticides? 6 Are the pesticides used in the cultivation known to you? 7 Uses a list of banned pesticides for growing strawberries?

8	Imagine requirements on the maximum dosage of the (authorized) protection of plants (on based on active substances)? 9
	If the frequency / dosage of applied pesticides known to you? 10 How does monitoring of pesticide use instead?
	water use
11	Research indicates that water use for strawberries imported from abroad are (Spain, Portugal, Egypt) is higher than for Dutch strawberries. Are you aware? If so, take specific measures here?

carbon footprint

The difference in carbon footprint of different cultivation methods appear at most supermarkets or to be known, but it is not always controlled by the type of energy in greenhouses. Control which turns out to be carried out on growing method (preferred for growing outside of the greenhouse, also for reasons of cost), and whether or not to perform a year round supply. Aldi and Ekoplaza give offer to only strawberries in season possible unheated cultivation. Jumbo indicates not to import from Egypt strawberries, also in terms of quality and taste.

Plant protection

Regarding pesticides use supermarkets often statutory requirements in terms of MRLs. In addition, supermarkets are working on a reduced use of pesticides through Proof and Planet 'TopCrop' initiative, the collaboration between Albert Heijn and Nature & Environment. Ekoplaza products are organic, so as no chemical pesticides are used. Lidl operates within the initiative "Sustainable purchasing fruit and vegetables NL Lidl 'with CLM to a more sustainable procurement. this attention are crop protection, minerals, biodiversity, water and energy. The purpose of Lidl for strawberries Dutch soil is output in accordance with Planet Proof, biological or similar.

Own knowledge at the supermarkets on the applied pesticides appears to be limited, except for the own control of supermarkets MRLs. Monitoring and control is further left to other experts considered left parties, such as SIM (private party in the area of supply chain management and data), GlobalGAP auditors and labeling organizations. All supermarkets indicate at least meet to set the legal requirements regarding the use of pesticides and through initiatives such as Proof and Planet Organic also statutory requirements. For the dosage and frequency of dosage of plant protection, and for the monitoring of the use reference is made to the independent control for GlobalGAP, Planet Proof and organic. The supermarkets do not do this.

water use

Regarding water consumption abroad supermarkets referring to the preference for products Dutch products for licensing in other countries and to focus on water use

GlobalGAP. The supermarkets here seem to have formulated or monitor it in any specific policy.

Food and packaging Loss

	packing
12	Imagine using sustainability requirements on the packaging in the chain or supply on the shelf (FSC paper, bioplastics, etc.)? 13
	Further to the previous question: Can you identify any% of the packaging must meet the durability requirements?
	food Loss
14	With a view to preventing food waste, you understand the requirements of Council different consumer groups when it comes to packaging sizes of strawberries? 15 Do you take other measures specific to strawberries to prevent product loss in the supermarket itself and within other links in the chain?

packing

All supermarkets to give attention to the sustainability of packaging in the supply chain and on the shelf. This mainly concerns the prevention of plastic packaging (Ekoplaza), to the use of FSC-certified cardboard (Aldi) and for innovative solutions, thereby saving on packaging, such as the use of a top seal of (partly) recycled plastic in place of a cover. This policy applies to the entire range, including the requirement for all FSC cartons. More specific percentages for sustainable solutions are not given. Albert Heijn indicates no sustainability requirements apply to the packaging on the shelf. Probably it refers to the shelves of the Albert Heijn policy applies itself (reduce, reuse, recycle, renew).

food Loss

Supermarkets indicate that they reflect as much as possible through the pack size in consumer demand and supply in the season. Ekoplaza indicates that no large packs used by organic strawberries have a shorter shelf life. Albert Heijn gives various examples of other measures to reduce product loss in strawberries, including refrigerated supply on the shelf, improved microclimate using the top seal, the shift from open field to rack cultivation, careful handling and a demand driven supply chain ("We grow what we sell and sell what we grow "). Lidl also gives work on together with growers to minimize product loss.

Communication

Keeps you on your offers into account the environmental score of strawberries under the Vegetable & Fruit Calendar MilieuCentraal, for example, only offers from strawberries with an A or B score?
See: <https://groentefruit.MilieuCentraal.nl/>

Supermarkets indicate that promotion is tailored to the season in which the offer from the Netherlands is up. Jumbo deviates indicating that virtually all their strawberries all from the Netherlands (98%) and will soon be grown products under Planet Proof. Promotion tune into an environmental rating of Milieu Centraal as supermarkets do not need.

summarizing

By far the bulk of the supply of strawberries in the supermarket comes from Netherlands and supermarkets here also prefer not only for environmental reasons, but also in terms of quality and taste. Jumbo and Albert Heijn mainly sell strawberries from Netherlands, other supermarkets also have a significant share in Spain (from open ground). While indicating the supermarkets know that energy deployment in greenhouses is a major factor in the environmental impact of strawberries, no supermarkets here has developed specific policies, for example by focusing on cogeneration and geothermal. The use of renewable energy is increasingly under demand Planet Proof.

Aldi and Ekoplaza show (almost) only offer strawberries in those seasons where cultivation is possible in the open ground. They thus take for granted that a year-round supply is not possible.

All supermarkets are working on the sustainability of the supply of strawberries. Albert Heijn does this through TopCrop initiative Nature & Environment, the other supermarkets through Planet Proof. Also, food waste / loss and product packaging are covered, with Albert Heijn seems to put more steps than other supermarkets.

2.4.1.3 Consumer research

Information provided to participants consumer research:

Strawberries are available year round, but only in the period June to September, Dutch strawberries in season. Outside these months are offered strawberries grown in heated greenhouses or who come from abroad. Because it takes more energy out of season to grow strawberries, they are therefore less environmentally friendly and therefore less cultivated sustainably.

Consumers are generally more interested in where strawberries are grown. Part of the respondents does not buy strawberries out of season. Approximately half of the panel is partially or totally agreed with the statement that strawberries out of season should not be offered.

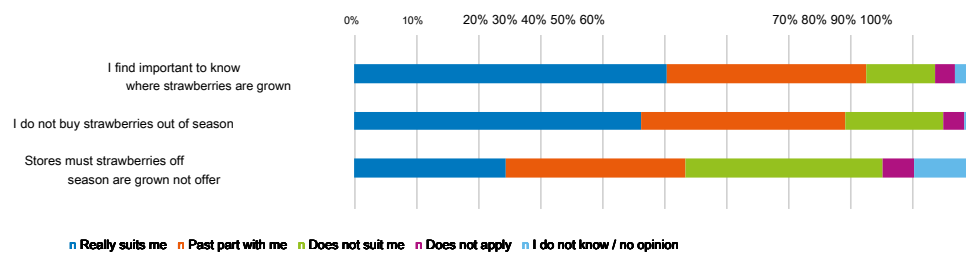


Figure 2.13 Statements about strawberries (N = 11417) Question: To what extent match the following statements for you? "

Banana



Edible:
70%



packing:
Cardboard box + foil



Origin:
Central and South America



Transportation:
ship



cultivation:
Plantation



2.4.2 Banana

2.4.2.1 Environmental impact

has gone into investigating the environmental impact of bananas sold in the Netherlands of the following average data:

origin	Transportation from growing location	Manufacturing	Product loss in the supply chain
56% - Ecuador	ship	Plantation	Transport Foreign growing location for distribution in the Netherlands: 2% of transport distribution to supermarket: 1% In store: 5% For consumers: 8.5%
30% - Colombia Ship		Plantation	
10% - Costa Rica Ship		Plantation	
4% - Mexico	ship	Plantation	

Carbon footprint of bananas

Carbon footprint of bananas to the supermarket are presented in Figure 2.14.

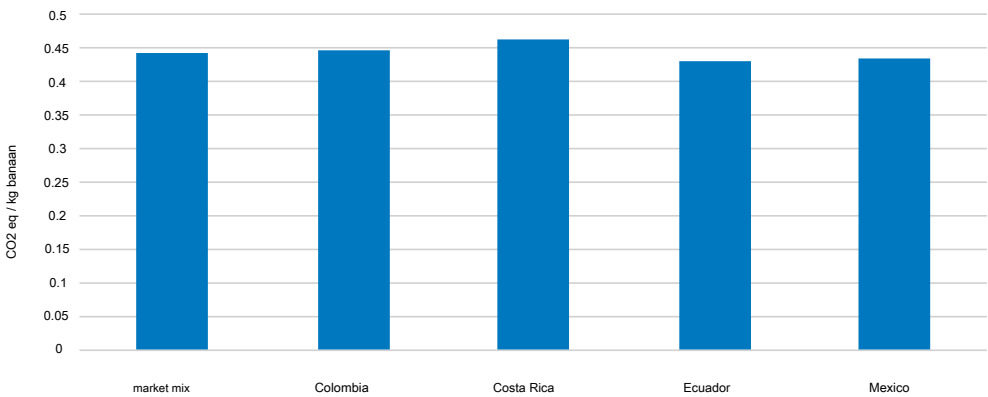


Figure 14.2 Carbon footprint of bananas from different countries and calculated Dutch market mix

Interestingly, the carbon footprint of bananas in the Dutch supermarkets from different countries is not much different. Explanation for this is that the cultivation method for all bananas is the same, and that drive mode, and transport distances are similar.

Land use bananas

Land use of several banana production are presented in Figure 2.15.

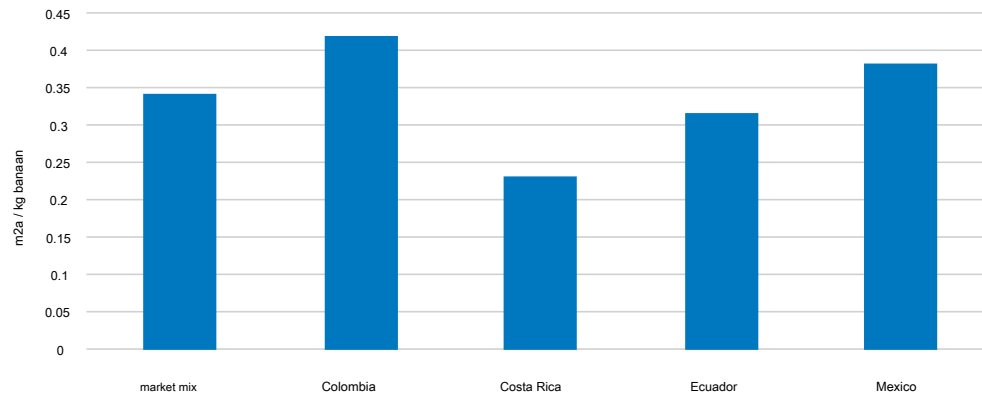


Figure 2.15 Land use bananas from different countries and calculated Dutch market mix

Unlike the carbon footprint, there are land use or to find differences between the countries. On average, bananas from Costa Rica require the least land area (0.23 m2 per kg banana), and Colombia is the highest (0.41 m2 per kg banana), Ecuador and Mexico are in between (respectively 0.31 and 0.38 m2 / kg banana). Differences are mainly due to the revenue between the countries.

Water consumption of bananas

Water consumption per kg of bananas in the supermarket are presented in Figure 2.14.

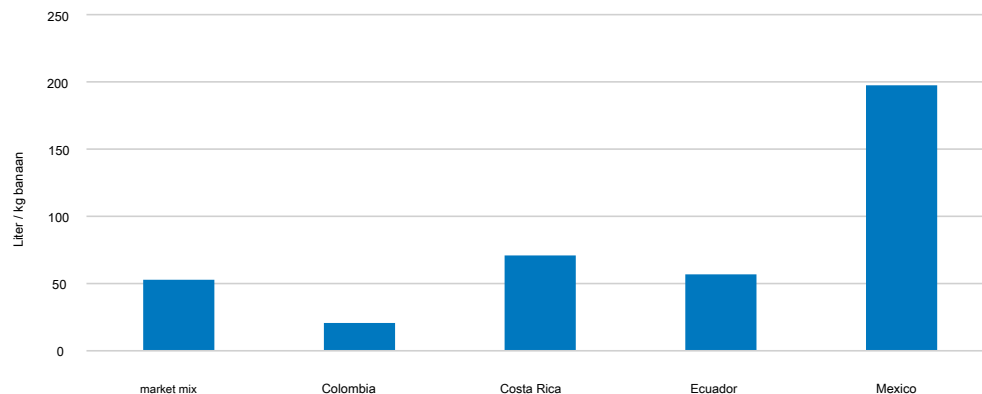


Figure 2.16 Water consumption of bananas from different countries and calculated Dutch market mix

Large differences are seen for the use of water per kg of bananas from different countries. The major differences between countries can be explained in various climatic conditions of the country. These aspects are considered in the determination of irrigation for different countries crop combinations (Mekonnen and Hoekstra, 2010). Bananas from Mexico in Dutch supermarkets have the highest cumulative water: almost

200 liters of water per kg of banana, followed by Costa Rican bananas (71 liters / kg), Ecuador (56 liters / kg) and Columbia (19 liters / kg).

2.4.2.2 Social impact

Fairtrade and Rainforest Alliance bananas

The Dutch supermarket are both bananas with the Fairtrade available as the Rainforest Alliance label. The Dutch market is about 18% of the bananas certified under the Fairtrade label (Max Havelaar, 2018). The Fairtrade bananas are mainly grown in Colombia, the Dominican Republic, Peru and Ecuador (Rijn et al., 2016) (ITC,

2017).

About 15% of the world's exported bananas are standard produced by the Rainforest Alliance. The production of Rainforest Alliance certified bananas is mainly in Colombia, Ecuador and Peru (ITC, 2017).

Social issues in countries producing Fairtrade and Rainforest Alliance bananas

The countries where bananas are grown for export are mainly located in Central and South America and the Caribbean.

The Human Development Index (development index) is an index of the United Nations (UNDP) and brings poverty, illiteracy, education and life in a healthy country. It gives an indication of development and opportunities for people in a particular country. If we look at this index, Colombia, Dominican Republic, Peru, Ecuador and Costa Rica in the following locations (HDI 2016): Colombia

	95 (High Human Development)
Dominican Republic	99 (High Human Development)
Peru	87 (High Human Development)
Ecuador	89 (High Human Development)
Costa Rica	66 (High Human Development)

In the following table are issues that are applicable to most countries. In addition, there are also issues that are specifically linked to banana production. Research (BASIC, 2015), these specific issues have been identified. The following list indicates whether an issue is potentially addressed by one of the two hallmarks: Fairtrade (FT) and Rainforest Alliance (RA).

issue	Description	Issue addressed by FT or RA criteria
Corruption	In Latin America is much corruption. Research by Transparency International (Pring, 2017) has shown that people feel that corruption has increased in the region in recent years. In the Dominican Republic, 46% come into contact with the respondents bribery to gain access to public service (Pring, 2017).	
Poverty	In Ecuador, the government set a minimum price for bananas, but the pressure on prices make many small farmers are not enough to make ends meet (Basic, 2015). If we look at the international poverty line (income below \$ 1.9 per day): 5.5% Colombia, Dominican Republic 1.9%, 4.8% Ecuador, Costa Rica 1.6%, Peru 3.0% (World Bank Group, 2017a-e)	FT RA
Health and health care	The use of chemicals to combat pests and diseases provide many health problems among workers on banana plantations (Basic, 2015). Poor Latin Americans often lack access to basic health care (20%). In addition, the region has a high ratio of non-communicable diseases such as hypertension, diabetes, obesity and cancer (The Borgen Project, 2016)	FT RA
Unemployment	Unemployment increased in 2017 in Latin America and the Caribbean. In this region in 2016 were 25 million people looking for work. The unemployment rate was 8.1%, the highest rate in 10 years (ILO, 2016).	
Child labor	In recent years, considerably reduced child labor in Latin America. Nevertheless, work still 5.7 million children, mainly in the agricultural sector.	FT RA
Discrimination	In the Dominican Republic, many migrants (mostly refugees from Haiti) face discrimination and underpayment (BASIC, 2015). In Costa Rica, many migrants (from Panama and Nicaragua) access to legal rights, such as health care and pensions (Basic, 2015).	FT RA
Labor law: freedom of association and the right to collective bargaining	Costa Rica has a strong anti-union culture originated (Basic, 2015).	FT RA

Environmental issues producing countries

The cultivation of bananas on a large scale also creates a number of environmental issues in the producing countries. Thus, the bananas are mainly grown in a monoculture and a considerable amount of chemicals, such as pesticides, insecticides and herbicides used to protect bananas from pests and diseases. The use of these agents causes health problems among workers. Additionally, certain methods of production lead to contamination of land and water and the loss of biodiversity (Basic, 2015). Both labels have for example established criteria regarding the use of pesticides and the protection of workers.

In a study of Agro Fair (Agro Fair, nd), a comparison is made between three different banana plantations (three types of plantation (Fairtrade and conventional), countries, climates and use of pesticides). Using a Life Cycle Assessment (LCA) is an insight into the impact of pesticide use on "human toxicity". Here you can see a big difference between the plantations. Thus, the results show that a Fairtrade plantation impact "human toxicity" is significantly lower. This is partly because certain (highly toxic) pesticides, such as Terbufos, are not permitted under the fair trade criteria. This drug is not prohibited under the criteria of Rainforest Alliance. Furthermore, the climate plays a big role in whether or not use of pesticides. This study indicates that it is important that pesticides are excluded by the respective labels. In addition, the site also specifies which pesticides are used, because not the same diseases and pests are everywhere.

Impact of Fairtrade and Rainforest Alliance labels

Several studies on the impact of Fairtrade and Rainforest Alliance label, both economic and social aspects and environmental aspects. There is little independent research on the effects of these labels to collect sufficient evidence on the impact of labels (DeFries, Fanzo, Mondal, Remans & Wood, 2017). The study assessed 2400 papers, only 24 papers on set criteria (independent, accurate crop certification program) met to take part in the analysis. In the case of bananas, only two papers were found to meet the criteria. Based on the available data, the researchers concluded that

certification programs sometimes play a positive role in achieving sustainability goals. At 347, the response variables is 34% from the positive bus, 58% does not give a significant difference, and a negative result is true for 8% of the variables. The main conclusion from this research is that additional and independent investigation is needed to assess the effectiveness of certification programs.

A study by NRI in 2009-2013 divided the findings on income benefits of Fairtrade and Rainforest Alliance (Nelson & Martin, 2013). This study examined the situation in the production of tea in Kenya and India and cocoa in Ghana and Ecuador. In addressing poverty, these certificates do not prove sufficient, and additional action is needed.

The biggest problems in the banana plantations according to research by Oxfam (Humbert & Brasel, 2016) for not overcome the German market through a Fairtrade or Rainforest Alliance certification. Oxfam notes that the biggest problems, such as pesticide use and violation of labor rights, this can not be resolved.

Commissioned by Fairtrade International LEI Wageningen UR (Rijn et al. 2016) in three countries (Colombia, Dominican Republic and Ghana) examined the impact of Fairtrade and non-Fairtrade certified banana plantations. Here, economic, social and empowerment issues into consideration

taken. It is striking that in all three countries emerges that the Fairtrade certificate appears to have little effect on the primary wage of workers. Indeed, there is little difference between the primary wage a Fairtrade and non-Fairtrade plantation. The difference is mainly in the in-kind benefits that Fairtrade certified plantations. As in the Dominican Republic access to education, transportation and health care. Also in Colombia is the positive effect especially in the in-kind benefits. Furthermore, employees give the Fairtrade plantations in both countries to experience greater job security than workers in non-Fairtrade plantations. In Colombia, many of the criteria concerning working conditions already guaranteed by law or collective agreements, So here is the difference between Fairtrade and non-Fairtrade plantations very small. Moreover, some of the investigated plantations in Colombia had a Rainforest Alliance certification, which obviously affects the results. Employees of Fairtrade plantations in the Dominican Republic and Colombia have experienced more empowerment. This is mainly due to the in-kind benefits, such as training and access to healthcare.

In northern Colombia, research (Ostertag, Sandoval, Barona, and Mancilla, 2014) commissioned by Fairtrade shows that Fairtrade has had a positive impact on small-scale banana plantations, the workers and the community. For example, with the aid of the "Fair Trade Premium" which production cost is lowered, and is the standard of living of the households on it improved. For example, improved housing, better access to medicine and education. Nevertheless, 23% of surveyed small farmers still face food problems, because their yields are relatively low because of their small farms.

In 2016, a study (Bellamy, Svensson, van den Brink & Tedengren, 2016) carried out the environmental impact of Rainforest Alliance certification on banana plantations in Costa Rica. As indicators of ecosystem health are the insect and bird diversity mapped certified and non-certified plantations. Here, a comparison was made with the results on a biological banana plantation. Surprisingly, the results show that Rainforest Alliance certified farms showed lower insect diversity than non-certified farms. There was also little difference between the farms regarding bird diversity. Organic farms did show more diversity.

2.4.2.3 Supermarket Policy

Origin as declared supermarkets

origin	assumption research	Albert Heijn	Aldi	Ekoplaza Jumbo	Lidl	PLUS
Ecuador	56%	3%	Unknown even Guatemala		1%	X%
Colombia	30%				42%	X%
Costa Rica	10%	26%			53%	X%
Mexico	4%					
Panama		63%				
Peru		8%			4%	
Dominican Republic				Almost 100%	X%	50% kids banana

All supermarkets can provide exact percentages here about the origin of the bananas offered.

2.4.2.1 In addition to the mentioned countries of origin are also Panama, Guatemala, Peru and the Dominican Republic back as producing countries.

Product loss in the supply chain

There are limited data on loss rates. Some supermarkets also see the shrink further back in the chain are not their responsibility (just as the property of the supermarket). Albert Heijn seems only to have more specific figures based on research and Jumbo may indicate what the store shrinkage.

Used sustainability labels

For almost all supermarkets there is GlobalGAP certification. In addition, independent is widely used, multi-stakeholder certification for both environmental and social. This involves:

Convenience store	Biological	Rainforest Alliance	Fairtrade	SA8000
Albert Heijn	8% (also fair trade)	100% (Chiquita)	8% (including biological)	100%
Lidl		97%	3%	
Aldi	4.5%	95.5%	4.5%	
jumbo	5%	95% (100% regular banana)	5%	
Ekoplaza	100%			
PLUS	Unknown		100%	

environmental cultivation

The survey asked the following question:

Research shows that the cultivation of bananas on a large scale creates a number of environmental issues in the producing countries. Thus, the bananas are mainly grown in monoculture and used a considerable amount of chemicals to protect bananas from pests and diseases. The use of these agents causes health problems among workers. In addition, lead from one type of production to pollution of land and water and the loss of biodiversity. The biggest problems in the banana plantations according to research by Oxfam Germany not overcome even by Fairtrade or Rainforest Alliance certification.

Are these issues familiar to you? If so, take specific measures here?

result supermarkets

The supermarkets give them to be aware and refer in particular to producers and labels who work it. However, labels appear (yet) be able to solve all problems, see 2.4.2.2.

Food and packaging Loss

The survey asked the following questions:

	packing
4	Sets using sustainability requirements on the packaging in the chain or supply on the shelf (FSC cardboard, bioplastics, etc.)? 5
	Further to the previous question: Can you identify any% of the packaging must meet the durability requirements?
	food Loss
6	Please measures specifically for bananas to prevent product loss in the super-market itself and within other links in the chain?

packing

All supermarkets to give attention to the sustainability of packaging in the supply chain and on the shelf. It is, inter alia, a reference to the producer (Chiquita, Albert Heijn), and to Planet Proof.

food Loss

Supermarkets indicate that they take measures in both the chain and on the shelf. The shelf is about the presentation on special mats / waves and in the long chain mature schemes, transport thermo covers, purchasing the right color and the ordering (bananas on the shelves as soon as possible).

summarizing

Striking in the supply of bananas from six grocery stores is the high percentage of certified products. The supermarkets say they are aware of the sustainability discussions on banana production and speak producers or leave this to the labeling organizations.

Each store pays attention to packaging and food waste. Albert Heijn is the most extensive in the steps that are put to prevent food losses.

2.4.2.4 Consumer research

Information provided to participants consumer research:

Plantation workers in banana cultivation do not always work under good conditions. They may have to deal with health problems through the use of pesticides. It is also known that they frequently receive low wages, and they have to work long hours.

A considerable proportion of respondents good working conditions important in the banana production and to be a part says willing to pay more to do so (Figure 2.17).

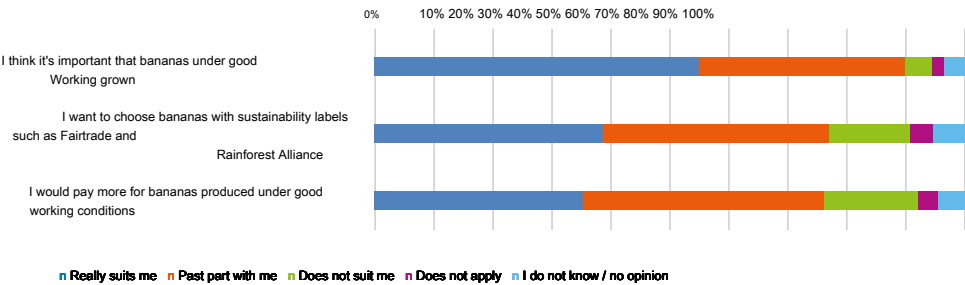


Figure 2.17 Statements about bananas (N = 11417) Question: To what extent match the following statements for you? "

Almost half of the respondents consider it a duty of the operator to ensure proper working conditions (Figure 2.18). The respondents 'different' filled out, then gave often that it is a shared responsibility between providers and consumers, growers, governments and / or the whole society.

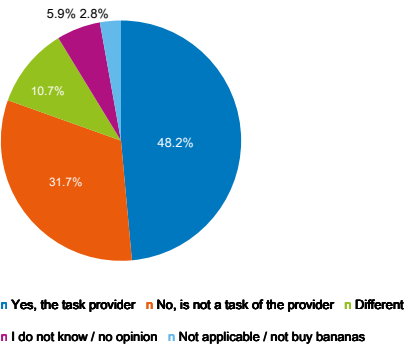


Figure 2.18 Do you find it a task for the vendor from whom you buy bananas to ensure good working conditions in banana cultivation? (N = 11417)

Bell pepper



Edible:
80%



packing:
Plastic bag



Origin:
The Netherlands



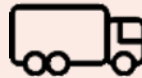
Transportation:
Truck



cultivation:
cash



Origin:
Spain



Transportation:
Truck



cultivation:
Tunnel



Origin:
Israel



Transportation:
ship



cultivation:
Tunnel



2.4.3 Paprika

2.4.3.1 Environmental impact

is based on the following average data in the study of the environmental impact of peppers from the Netherlands:

origin	Transportation from growing location	Manufacturing	Energy in greenhouse	Product loss in the supply chain
80% - Netherlands	Truck	cash	71% CHP boiler 20% 9% geothermal	Transport Foreign growing location for distribution in the Netherlands: 2% Transport Dutch production location for distribution: 1% of transport distribution to supermarket: 1% In store: 5% For consumers: 8.9%
10% - Spain	Truck	Tunnel	Does not apply	
10% - Israel	ship	Tunnel	Does not apply	

Carbon footprint of peppers

Summary of the carbon footprint of the different countries of origin and cultivation technologies are presented in Figure 2.19. The market mix is made up of different cultivation systems, as shown in the table above and in Appendix A. More information on the calculation of the different cultivation systems can be found in Annex C3.

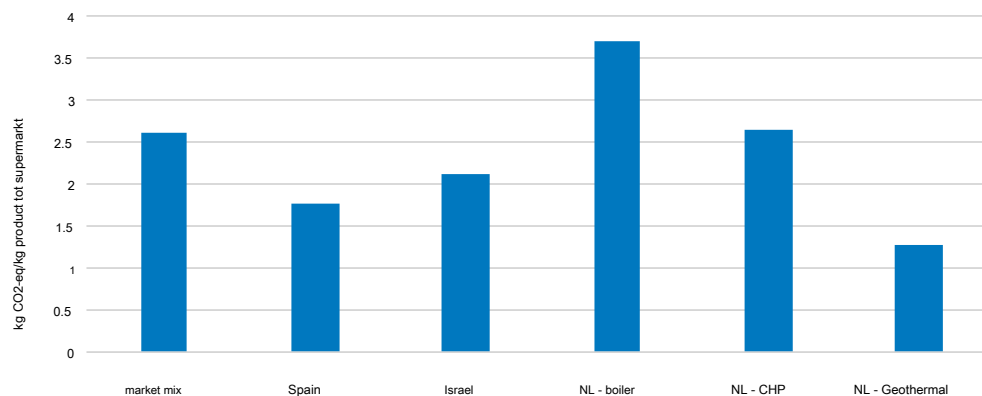


Figure 2.19 Carbon footprint of peppers from different countries and different technologies

There are striking differences between the carbon footprint of peppers from different countries and growing systems. Despite the greater transport distances for imported peppers, the environmental impact of these vegetables are lower than the calculated average Dutch. It has to be said that for both the assumption is that the products are not flown.

All Dutch peppers come from Dutch greenhouses, but the way in which the greenhouse is heated has a major impact on the environmental performance of the product. Greenhouses fired boiler (natural gas) have the highest environmental impact. Followed by CHP fired greenhouses. The CHP fired greenhouses need more gas, but this is compensated because they produce both heat and electricity. This is because the principle of this method, the net surplus is subtracted to the electricity system, with which the carbon footprint for this cropping system drastically decreases. Potential of geothermal energy is clearly visible: it has the lowest greenhouse gas emississies all alternatives. Here, a coverage ratio of geothermal energy of

87.1% believed remainder of the heat was completed by a boiler. A lower coverage of geothermal energy will lead to a higher carbon footprint of the product. Dutch geothermiepaprika have with that assumption 3 times less carbon footprint than Dutch peppers in greenhouses fired boiler.

Land use of peppers

Overview of land use of the different countries of origin and cultivation technologies are presented in Figure 2.20.

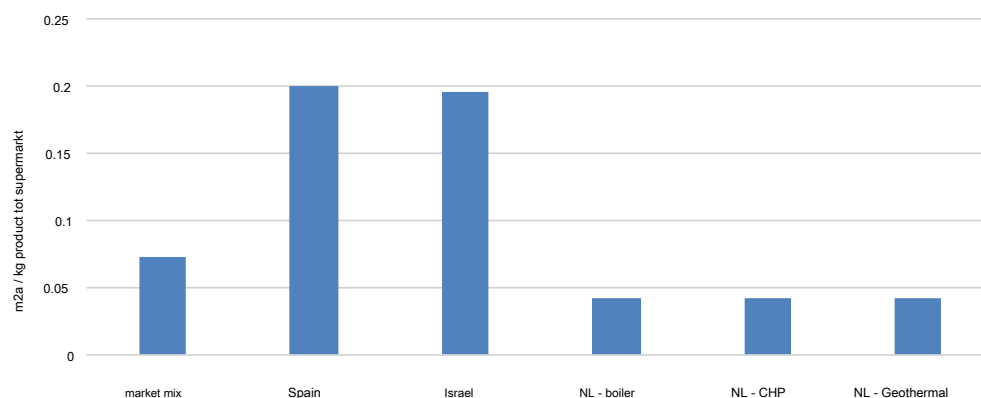


Figure 2.20 Land use of peppers from different countries and different technologies

Again we see large differences between countries. Land use is almost the same during the cultivation of the crop solely by the land use. Since the average yields per hectare are scoring much higher in the Netherlands than in Spain and Israel Dutch peppers this well. For Dutch crops is the same yield per hectare was adopted, and therefore there is no difference for land use is visible between the various heat techniques. Dutch peppers have 4 to 5 times less land than the imported peppers.

Water use of peppers

Overview of water use in the different countries of origin and cultivation technologies are presented in Figure 2.21.

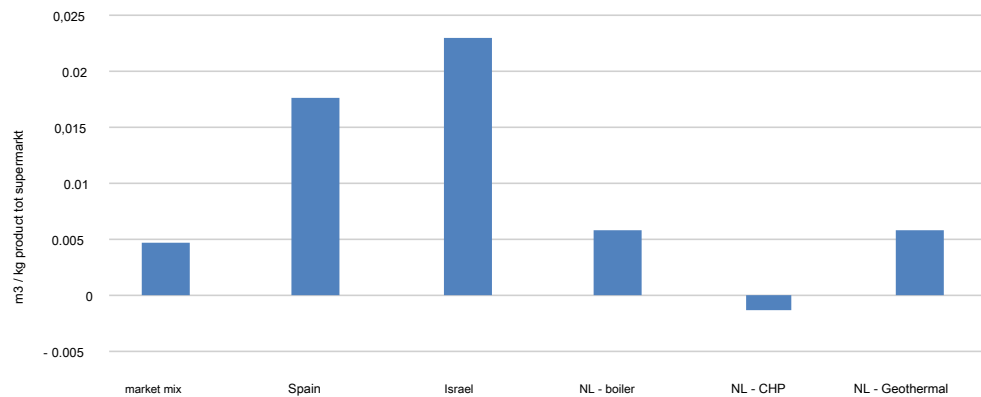


Figure 2.21 Water use of peppers from different countries and different technologies

Main process that consumes water is irrigation. Water use for Spanish and Israeli cultures is significantly higher than for Dutch crops. For Dutch peppers from CHP heated greenhouses true even negative water. This is due to the effects of 'avoided' electricity. Since water is normally used in the production of electricity, stays at the subtraction of the electricity is also required for this water to be deducted according to the PAS-2050 (BSI, 2012).

2.4.3.2 Supermarket Policy

Origin as declared supermarkets

origin	assumption research	Albert Heijn	Aldi	Ekoplaza Jumbo		Lidl	PLUS
The Netherlands	80%	59%	Unknown	In accordance with assumption	70%	80%	60%
Spain	10%	36%			20-25% X%		40%
Israel	10%				5-10%	X%	
Morocco		5%				X%	

Netherlands and Spain seem to pepper the main countries of origin. Transportation includes truck, ship and aircraft (task Jumbo). Aldi does not monitor this. The peppers are grown in the greenhouse (Netherlands) and tunneling (Spain, Morocco, Israel). Aldi, Ekoplaza PLUS and provide information about it. Only Albert Heijn and Lidl provide information on energy commitment to growing in the greenhouse. This is mainly CHP and Albert Heijn also the use of a wood chip heater.

Product loss in the supply chain

With regard to product loss provided little information. Albert Heijn seems only to have more specific figures based on research and Jumbo may indicate what the store shrinkage.

Used sustainability labels

For almost all supermarkets there is GlobalGAP certification. In addition, the following labels are used:

Convenience store	Planet Proof	Biological	BSCI	ETI Smeta	SIFAV
Albert Heijn	Ned: 24.2	Ned: 1.4% Spain 1.4%	Morocco: 60% Senegal: 24%	Morocco: 100%	
Lidl	> 80% 2020: 100%				2020: 100%
Aldi	2020: 100%	10% (22% of red pepper)			
jumbo	50-70% 2020: 100%	2-3%			
Ekoplaza		100%			
PLUS	2020: 100%	X% (unknown)			

environmental cultivation

The survey asked the following questions:

	carbon footprint
3	Research has shown that Dutch peppers from boiler fired and fired cogeneration banks have the largest carbon footprint. Dutch peppers in greenhouses that are heated with geothermal energy have the lowest carbon footprint; This is lower than that of imported peppers from Spain and Israel. Are you aware? If so, take specific measures here, for example by sending origin or the type of energy in the greenhouse?
	Crop protection
4	Research indicates that several pesticides used in the cultivation of pepper. What are your requirements for the use of pesticides in peppers, for example, the use of biological control or prohibition of certain resources?
	The pesticides used in the cultivation known to you?
5	Uses a list of banned pesticides for the cultivation of pepper?
6	Imagine requirements on the maximum dosage of the (authorized) protection of plants (on based on active substances)? 7
	If the frequency / dosage of applied pesticides known to you?
8	How does monitoring of pesticide use instead?
	water use
11	Research indicates that less water and land needed for growing peppers from the Lower inhabitant of greenhouse than for imported peppers from Spain and Israel. Are you aware? If so, take specific measures here?

carbon footprint

Except Ekoplaza and PLUS give the supermarkets that they are aware of energy consumption by boiler-fired and cogeneration fired greenhouses. For the attention we refer to Planet Proof by most supermarkets. Albert Heijn gives boost to the use of geothermal energy.

Plant protection

Regarding pesticides use supermarkets often statutory requirements in terms of MRLs. In addition, supermarkets are working on a reduced use of pesticides through Proof and Planet 'TopCrop' initiative, the collaboration between Albert Heijn and Nature & Environment. Ekoplaza products are organic, so as no chemical pesticides are used.

Own knowledge at the supermarkets on the means used appears to be limited, except for the own control of supermarkets MRLs. This is left left to other knowledgeable parties deemed as SIM (private party in the area of supply chain management and data), GlobalGAP auditors and labeling organizations. All supermarkets indicate at least meet to set the legal requirements regarding the use of pesticides and through initiatives such as Proof and Planet Organic also statutory requirements. For the dosage and frequency of dosage of plant protection, and for the monitoring of the use reference is made to the independent control for GlobalGAP, Planet Proof and organic. The supermarkets do not do this.

water use

Regarding water consumption abroad refer supermarkets to the preference for Dutch products and to focus on water in GlobalGAP. The supermarkets here seem themselves to have formulated any specific policy or to monitor this.

Food and packaging Loss

The survey asked the following questions:

	packing
11	Imagine using sustainability requirements on the packaging in the chain or supply on the shelf (FSC cardboard, bioplastics, etc.)?
12	Further to the previous question: can you identify any% of the package, the sustainability requirements apply?
	food Loss
13	Please when choosing whether or not to offer packaging to consumers (Such as foil) takes account of the prevention of food waste?
14	Do you take other measures specific to peppers to prevent product loss the store itself and within other links in the chain?

packing

The answers are the same as the answer in strawberries: All supermarkets have to give attention to the sustainability of packaging in the supply chain and on the shelf. More specific percentages for sustainable solutions are not given.

food Loss

Albert Heijn indicates that green and yellow peppers are offered packaged to the consumer so as to ensure the quality of the peppers and prevent food waste. Aldi and Jumbo also point to the importance of (plastic) containers. PLUS has no answer to this question, but is expected to be connected to the previous PLUS answers to this question (general initiatives on food waste). Other measures mentioned are a demand-driven supply chain (Albert Heijn), limiting the range of different variants of the same product (Aldi) and offering a red desired by the consumer / red / yellow mix instead of a red / yellow / green mix (PLUS). Albert Heijn indicates that they want to increase the 'Misfits' accepting less beautiful vegetable by the customer. A portion of the misfits paprika is then processed into cut vegetable mixes (as the quality of these products allows).

summarizing

Netherlands and Spain are the main countries of origin for pepper offered by supermarkets. The knowledge of the crop (in the greenhouse or tunnel, and the method of heating), appears to be limited. Albert Heijn gives boost to the use of geothermal energy.

All supermarkets are working on the sustainable production of paprika. Albert Heijn does this through TopCrop initiative Nature & Environment, the other supermarkets through Planet Proof. Supermarkets allow again the focus on the use of plant protection products (type, dosage and frequency) largely on GlobalGAP and the labeling organizations.

Food waste / product loss and achieve the sustainability of packaging at all supermarkets in the same way as attention to other crops. The use of a (plastic) package is seen as paprika as an important way to reduce product losses.

butter bean



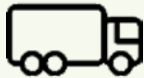
Edible:
95%



packing:
Plastic bag



Origin:
The Netherlands



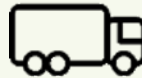
Transportation:
Truck



cultivation:
Open field



Origin:
South Europe



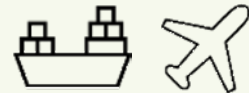
Transportation:
Truck



cultivation:
Open field



Origin:
Africa



Transportation:
Ship / aircraft



cultivation:
Open field



2.4.4 Green Bean

2.4.4.1 Environmental impact

is based on the following average data in the study of the environmental impact of green beans from the Netherlands:

origin	Transportation from growing location	Manufacturing	Energy in greenhouse	Product loss in the supply chain
59% The Netherlands	Truck Open field		Does not apply	Transport Foreign growing location for distribution in the Netherlands: 2% Transport Dutch production location for distribution: 1% of transport distribution to supermarket: 1% In store: 5% For consumers: 8.9%
26% Morocco	ship	Open field	Does not apply	
9% - Kenya	Plane	Open field	Does not apply	
6% - Egypt Ship		Open field	Does not apply	

Carbon footprint of fresh green beans

Carbon footprint of green beans to the supermarket are presented in Figure 2.22. In blue are shown the data used for the calculation of the Dutch market mix. In green are additional calculations are made for the sensitivity analysis on impact of transport mode of Kenyan green beans.

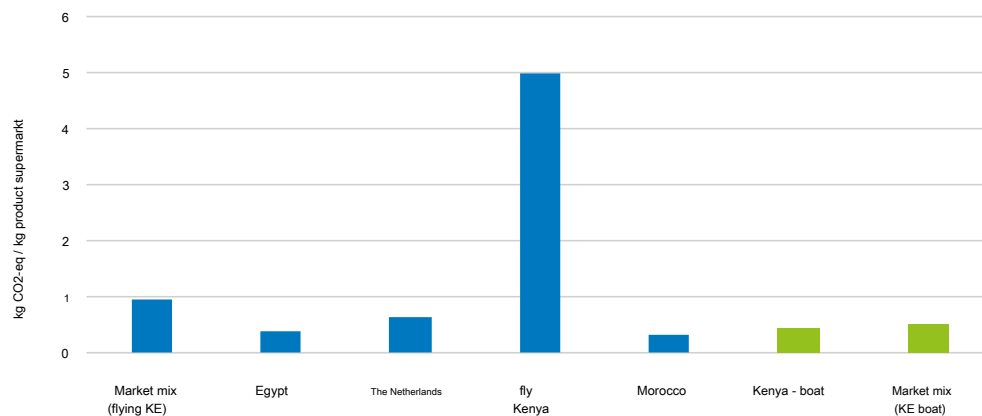


Figure 2.22 Carbon footprint of green beans from different countries and Dutch market mix

The market mix of green beans of the Dutch supermarket comes to nearly 1 kg CO₂ eq. This is made up of the proportion of different countries of origin with the corresponding transport mode. Remarkably Kenyan green beans have a much higher carbon footprint (5.0 kg CO₂ eq / kg). The reason for this is the assumption that the green beans have been flown to

The Netherlands. In yellow is considered the effect if we assume that transport by ship happens. Effects of Kenyan beans arriving by boat in the Netherlands have a significantly lower carbon footprint. Despite the calculated share of Kenyan green beans is only 9%, the shift from flying to ship as a transport mode a **significant effect on the Dutch market mix (0.9 kg CO₂/ kg to 0.5 kg of CO₂/ kg)**. This endorses the effect of flying in goods to the Netherlands.

Land use fresh green beans

Land use of green beans in the various countries is shown in Figure 2.23.

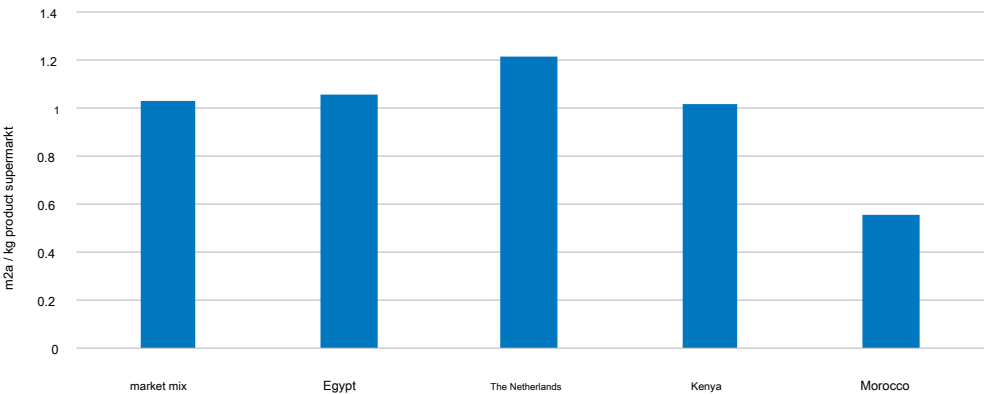


Figure 2.23 Land use of green beans from different countries and Dutch market mix

Land use is almost exclusively during the production phase by the land use. Yields per hectare for beans from the Netherlands (nearly 9 tons / ha), the lowest of the four countries studied, assuming the FAOstatistieken. Egyptian and Kenyan green beans are about the same land area (1 m₂) required per kg bean as calculated Dutch market

mix. High revenues in Morocco (almost 20 tons / ha) provide a significantly lower land use.

Water use fresh green beans

Water use of various products to the supermarket are presented below for beans.

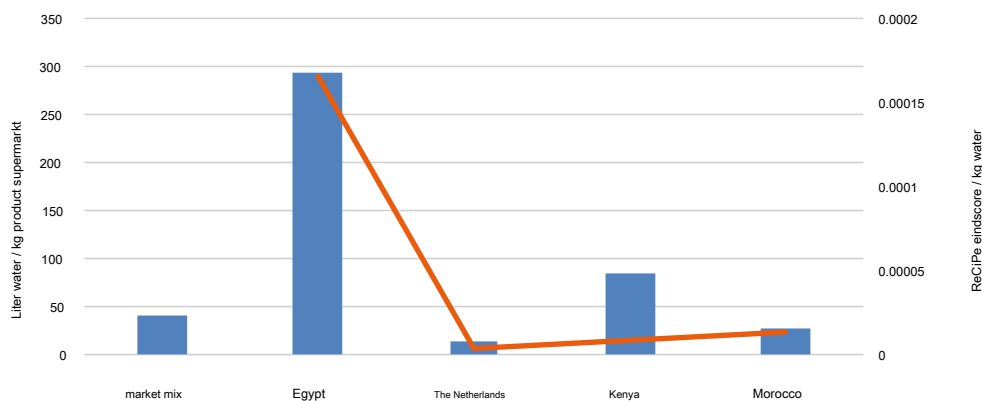


Figure 2.24 Water consumption of green beans from different countries and Dutch market mix

Large differences are seen for the use of water per kg of green beans from different countries. Egyptian beans require up to 290 liters of water per kg of product, Kenyan around 80 liters, 25 liters and Moroccan around the Dutch around 12 liters. The major differences between countries can be explained by differences in climatic conditions. These aspects are considered in the determination of irrigation for different countries crop combinations (Mekonnen and Hoekstra, 2010). The right axis is also presented the ReCiPe water stress factor per kg of water. This is to make the water in Egypt is much more harmful than in other countries. For water and more water stress seems a wise choice to make Egypt green beans are left. It should however be noted that water stress factors, it is a country specific number. It may in practice be that Egyptian beans are grown in regions where there is no water shortage.

Effects of fresh and processed products

In the supermarket, consumers can choose between fresh produce and processed green beans from different countries: frozen, canned or bottled. But what is the most sustainable choice? In the equation below, to display the environmental performance of fresh and processed products. For processed products means that throughout the chain are fewer losses, but the environmental impact of packaging are higher. Key assumption is that processed products from Dutch fields are derived. Environmental performance of different types of beans per kilogram eaten product are listed below.

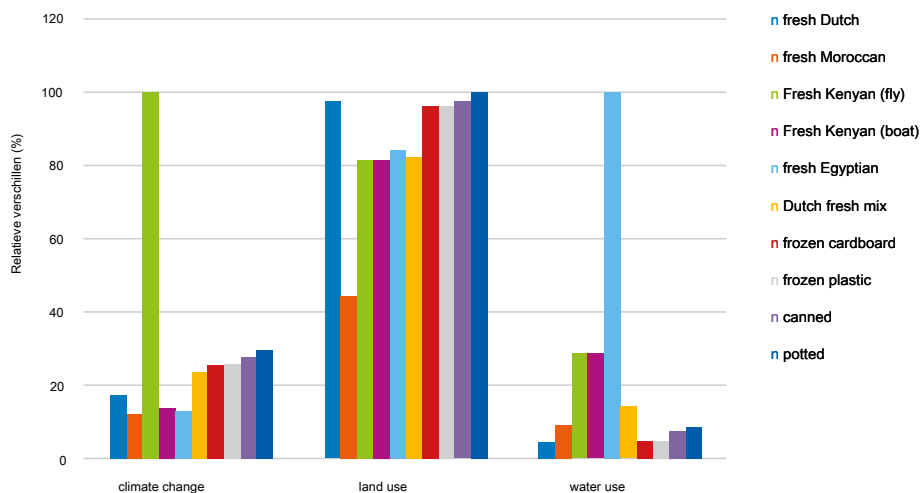


Figure 2.25 Relative differences of consumption beans of different packages

In the area of climate change, fresh products score better than processed products unless the product is flown. Boat imported beans score better than Dutch processed products because the effect of transport is outweighed by the increased greenhouse gas emissions from Dutch beans. Dutch beans have a higher carbon footprint through a combination of higher fuel economy and lower revenue than foreign crops.

Regarding land use fresh produce that is somewhat lower than for processed products. Because revenues for green beans abroad are higher than in the Netherlands, it takes less land.

An opposite effect is seen for water. Fresh green beans score quite high and that is mainly because more irrigation is required for foreign cultures. For canned and packaged beans in glass water consumption is higher than for frozen products and that is because the production of glass and tin is relatively water intensive.

2.4.4.2 Social impact

Fairtrade beans (haricots verts)

The Dutch supermarket supply Fairtrade fresh green beans small. In the speed range can be in only one supermarket in green beans (young / fine green beans) the standard offered by Fairtrade label.

These are available at PLUS Supermarkets³. Only a very small part of the supply of fresh green beans (haricots verts) from abroad is a Fairtrade mark available in Dutch supermarkets.

Social issues in Kenya

Kenya is an important and well-developed horticultural export sector emerged in recent years. Exports of horticultural products (mainly vegetables, tea and flowers) make a significant contribution to employment and income of foreign currency in the country. 2015

³ <http://maxhavelaar.nl/news/plus-blijft-kampioen-in-fairtrade> (accessed on Feb. 1, 2018)

the agricultural sector accounted for about 26% of the gross domestic product and provides over 40% of the population employment⁴. Only a very small part of the country (20%) is suitable for agricultural production. The productivity of agriculture is suffering severe drought, flooding and climate change. In addition, 46% of Kenyan population lives below the poverty line and have an income of less than \$ 1.00 a day, to do 36.5% of the population with food insecurity and 35% of children under five are malnourished⁴. The export of agricultural crops, such as haricot beans, can therefore be seen as being controversial (James et al., 2013). The majority (77%) of the haricot verts are using irrigation, grown mainly in the areas surrounding Mount Kenya (Kirinyaga, Meru, Embu and Murang'a) (Puffin, 2012). In the case of the cultivation of beans in Kenya, mainly in large-scale and commercial companies, working conditions are not always good. For example, discrimination (gender, disabled and minorities) reported and there are cases of sexual harassment, no agreement on maternity leave, low wages and poor working conditions known (Republic of Kenya & ILO, 2016, Loon, 2012)

The Human Development Index (development index) is an index of the United Nations (UNDP) and brings poverty, illiteracy, education and life in a healthy country. It gives an indication of development and opportunities for people in a particular country. If we look at this index Kenya ranks 146, meaning Medium Human Development (HDI 2016). For comparison, the Netherlands ranks seventh (Very High Human Development) and the country in last place (188) is the Central African Republic (Low Human Development).

⁴ <http://www.fao.org/kenya/fao-in-kenya/kenya-at-a-glance/en/>

(Accessed on Feb. 1, 2018)

Kenya play various (social) issues. The following table provides an overview of these issues. In addition, indicate whether an issue is addressed possible by the Fairtrade criteria.

issue	explanation	Issue addressed by Fair Trade criteria
Poverty	46% of the population in Kenya live below the poverty line of one dollar a day ⁵	X
Access to health care and clean drinking water	Kenya has only one doctor per 10,000 people, 50% of doctors working in Nairobi, where lives only a small part of the population (Deloitte, 2016). Medications are not available for free, allowing poor people often can not be treated. Access to clean water is also a problem in Kenya. Approximately 41% of the population is dependent on unreliable (drinking) water supplies.	X
Access to quality education	Kenya offered free primary education. This has resulted in approximately 85% of young people enrolled in school. However, if parents can not pay for school uniforms and books for their children, they can not go to school. In addition, according to the primary UNESCO not of sufficient quality and comes even after following primary, illiteracy still frequently (Deloitte, 2016).	X
Malnutrition and food insecurity	In the arid and semi-arid areas (80% of Kenya) affected 369,000 children under five with acute malnutrition ⁶ . Annually have 2 to 4 million people need external food aid in Kenya ⁷ .	
Corruption	Despite the tightening of anti-corruption legislation, the implementation of these laws is not effective. There are still reported numerous cases of corruption, conflict of interest and nepotism in Kenya (USAID, 2016).	
Labor law: freedom of association and the right to collective bargaining	Kenya, however, labor rights enshrined in law, enforcement is inconsistent (USAID, 2016).	X
Diseases: HIV / AIDS	In Kenya, HIV / AIDS leading cause of death, die each year around 80,000 people with this disease. In recent years has improved the situation awareness (World Health Organization (WHO), 2015).	
Discrimination and violence and against women, children, the disabled, people with HIV / AIDS or albinism	In influential positions, women are underrepresented in Kenya. Moreover, they often have no access to education, land and jobs. Especially in the rural areas they play a traditional role. (Republic of Kenya & ILO, 2016)	X

⁵ <http://www.fao.org/kenya/fao-in-kenya/kenya-at-a-glance/en/> (accessed on Feb. 1, 2018)

⁶ <http://www1.wfp.org/countries/kenya> (accessed on Feb. 1, 2018)

⁷ <https://www.usaid.gov/what-we-do/global-health/nutrition/countries/kenya-nutrition-profile> (accessed at February 1, 2018)

	Kenya is child labor. Approximately 35.6% of working children between 5 and 14 years. About 23% of children between 7 and 14 years combining work and school. Also in the agricultural sector are children involved, for example in the production of coffee, tea, miraa, rice, flowers and cotton (BUREAU OF INTERNATIONAL LABOR AFFAIRS, 2016)	X
Political tensions in recent years	creates political tensions round elections, violence and incidents. In August 2017 Uhuru Kenyatta was named president. However, the Supreme Court invalidated the election because of irregularities. During the re-election, he was re-elected, while the opposition has boycotted the elections ⁸ .	
Terrorism	In recent years, Islamic militants from al-Shabab, in Somalia, committed several attacks in Kenya ⁹ .	
Drought	The absence of rain encounter some areas in Kenya extreme drought, the effects of food insecurity and malnutrition. The green beans are otherwise not cultivated in areas of extreme drought ¹⁰ .	X

This study did not look specifically at working with the beans cultivation in Morocco or other countries. Research from 2013 (SOMO 2013) shows that the Moroccan crop beans were problems with working conditions. The researchers pointed to inconsistencies between supermarket policies and the reality of the working site.

2.4.4.3 Supermarket Policy

Origin as declared supermarkets

origin	assumption research	Albert Heijn	Aldi	Ekoplaza Jumbo		Lidl	PLUS
The Netherlands	59%	40%	Unknown	X%	40%	%	X%
Morocco	26%	18%			34.6%	X%	
Kenya	9%	(Extra fine)					
Egypt	6%	19%		X%	5.7%		X%
Senegal		21%	X%		18.2%	X%	
France		2%	X%			X%	
Belgium						X%	
Ethiopia					1.4%	X%	
Spain			X%	X%			

⁸ <http://www.fao.org/kenya/fao-in-kenya/kenya-at-a-glance/en/>

(Accessed on Feb. 1, 2018)

⁹ <http://www1.wfp.org/countries/kenya> (accessed on Feb. 1, 2018)

¹⁰ <https://www.usaid.gov/what-we-do/global-health/nutrition/countries/kenya-nutrition-profile>

(Accessed on Feb. 1, 2018)

Albert Heijn and Jumbo can provide exact percentages here. Albert Heijn and Jumbo buy less than half of Dutch growers. Senegal also is mentioned as an important country of origin, in addition origin countries such as Spain and France. Insufficient statistics for Senegal were available to take on the environmental impact of green beans in 2.4.4.1.

Transportation from growing location

Supermarkets indicate that transportation from Morocco takes place not only by ship but also by truck. Transportation from Senegal takes place by plane or ship and truck. Transportation does not directly a concern when purchasing or anything that is sent.

Manufacturing

Regarding the production indicates that Dutch green beans come from the open field. Green beans from other countries in the open field or greenhouse. Aldi is not familiar with the production. Concerning energy consumption in greenhouses provide all supermarkets that this is not relevant (no heated cultivation).

Product loss in the supply chain

Despite the policies that have supermarkets around food loss and the importance of minimizing food waste often seems to be a policy to monitor shrinkage rates. Albert Heijn provided only more specific figures on product losses in the chain. Jumbo can indicate what is the store shrinkage.

Used sustainability labels

For almost all supermarkets there is GlobalGAP certification. In addition, the following labels are used:

Convenience store	Planet Proof	Biological	BSCI	ETI Smeta
Albert Heijn		Ned: 0.6%	Morocco: 60% Senegal: 24%	Morocco: 40% Senegal: 76% Egypt: 100%
Lidl	2020: 100%			
Aldi	2020: 100%			
jumbo	2020: 100%	2%		
Ekoplaza		100%		
PLUS	2020: 100%			

environmental cultivation

The survey asked the following questions:

	carbon footprint
3	Research shows that green beans flown in from Kenya, a much higher carbon footprint than beans from the Netherlands, Morocco and Egypt. Are you aware? If so, take specific measures here? 4 Please supply your account the environmental score of beans according to the Vegetable &
	Fruit Calendar Milieu Centraal? So it is advised here that offer green beans from Egypt in the majority of the month and year round from Kenya must be avoided. See: https://groentefruit.milieucentraal.nl/
	water use
5	Research shows that water for Egyptian beans is much higher than the water for beans from the Netherlands, Morocco and to a lesser extent Kenya. Are you aware? If so, take specific measures here?

carbon footprint

Albert Heijn indicates that transport takes place by truck, if this is possible. Kenya only "extra fine" beans flown. Lidl, Aldi, Jumbo and PLUS indicate not to buy from Kenya. Jumbo buys from Morocco and Egypt in the months that Dutch green beans are not available. Supermarkets take into account the availability of beans from the Netherlands, but do not use the Vegetable & Fruit Calendar Milieu Centraal.

water use

Regarding water use in Egypt shows Albert Heijn that this water is not higher than in Morocco and Senegal. Using drip irrigation. Aldi refers to GlobalGAP, PLUS indicates that suppliers use their own wells and have a policy to prevent water wastage. Ekoplaza raise goes to the growers. Lidl does not buy in from Egypt. It is interesting to see that the supermarkets seem to have relatively much view.

social aspects

The survey asked the following question:

Research shows that social issues play in the cultivation of beans in Kenya, Morocco and Egypt, including in the field of labor. For example, reported discrimination (gender, disabled and minorities), and cases of sexual harassment, no agreement on maternity leave, low wages and poor working conditions.

Are these issues familiar to you? If so, take specific measures here?

All supermarkets, except Ekoplaza indicate to devote attention, mostly through audits and certification. Albert Heijn proposes social compliance requirements (BSCI or equivalent) and have long relationships with the growers, Aldi uses Grasp (end of 2018 for all producers), Jumbo SMETA / SEDEX or similar and PLUS with BSCI. Lidl refers to SIFAV and also points

the positive contribution of culture to local revenue. Ekoplaza gives to spend on this attention.

Food and packaging Loss

The survey asked the following questions:

	packing
7	Imagine using sustainability requirements on the packaging in the chain or supply on the shelf (FSC paper, bioplastics, etc.)? 8
	Further to the previous question: Can you identify any% of the packaging must meet the durability requirements?
	food Loss
9	Do you like when choosing whether or not to offer packaging to consumers charged with combating food waste?
10	With a view to preventing food waste, you understand the requirements of Council different consumer groups when it comes to packaging sizes of green beans? 11 Do you take other measures specific to green beans to product loss against go to the supermarket itself and within other links in the chain?

packing

All supermarkets to give attention to the sustainability of packaging in the supply chain and on the shelf. More specific percentages for sustainable solutions are not given.

food Loss

Regarding the packaging choice in relation to food losses presents Albert Heijn to present green beans in the original packaging (box). These are PE coated to ensure optimum humidity. Aldi mainly packed in plastic to prevent drying while Jumbo for unpackaged chosen so that consumers can choose the desired amount. Also PLUS provides loose, but also indicate that the shelf life is influenced positively by a package. Supermarkets indicate that they reflect as much as possible through the pack size in consumer demand. As for other measures, especially Albert Heijn offers additional information: Optimizing plenishment re-packaged presentation of products which have a lower rotation, transport optimization (balance road / sea), proper cooling in the chain,

Communication

The survey asked the following question:

Keeps you on your offers into account the environmental score of strawberries under the Vegetable & Fruit Calendar MilieuCentraal, for example, only offers of beans with an A or B score? See: <https://groentefruit.MilieuCentraal.nl/>

The majority of supermarkets says to make no use of it. Albert Heijn indicates that promotion is tailored to the season in which the offer from the Netherlands is up.

summarizing

Most supermarkets buy green beans from the Netherlands, Morocco, Egypt, Senegal, Spain and France. Part of the beans from Kenya and Senegal are transported by air. The cultivation of the beans takes place almost exclusively in the field or in unheated greenhouses, making it during cultivation of energy plays no significant role.

Except Ekoplaza supermarkets seem relatively well aware of water use in the production countries. As Albert Heijn indicates that the alleged high water consumption in Egypt is not correct. Regarding working in Egypt refer supermarkets to the standards they set, the long relationships they sometimes have with growers and certifications that they use, such as GRASP, ETI and BSCI. This should be possible to overcome any problems.

Regarding the relationship between packaging and food waste there appear two strategies should be used: no packaging so that consumers can choose the quantity and well packaged to prevent dehydration. It lacks independent research makes clear what the most sustainable approach. The contribution analyzes (see Appendix D) shows that the impact of packaging is often relatively small. However, given the problems plastic soup-less plastic or better (Reporting Packaging, 2018 Plastic Soup Foundation, 2018).

2.4.4.4 Consumer research

Information provided to participants consumer research:

Depending on where and when beans are grown, they may be more or less environmentally friendly and therefore more or less sustainable. For example it is less environmentally friendly and green beans are transported by plane or grown in areas where water is scarce.

In response to the information were presented respondents, giving a part to have a need for more information about how sustainable green beans. The study also demonstrated that there are relatively few (Consumer visible) labels for green beans. Only a small proportion of respondents said also to buy only sustainable beans. Sees something more than half of the respondents (in part) something in the argument that supermarkets should offer only sustainable green beans (Figure 2.26)

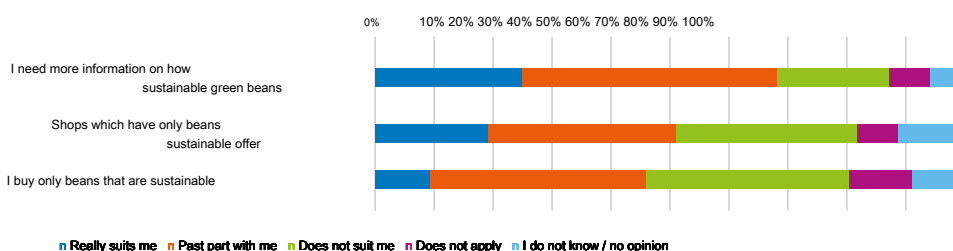


Figure 26.2 Statements about beans (N = 11417) Question: To what extent match the following statements for you? "

3 CONCLUSIONS AND RECOMMENDATIONS

In this study we looked at the most important sustainability issues in fruits and vegetables, and policies and actions of the largest Dutch supermarket chains in this area. In this chapter, followed by part conclusions and finally recommendations are presented based on the research.

3.1 Conclusions

3.1.1 Supermarket Policy

When fruits and vegetables play sustainability issues that divided this project into two parts: environmental and social aspects. An analysis of sustainability reports and the responses of the supermarket chains have shown that they are aware of sustainability issues playing with fruits and vegetables. They spend it all to a greater or lesser extent. In some areas it is committed to clear targets. Other areas remain behind in this respect.

All surveyed supermarkets have well cooperated with the investigation, despite the large number of questions to be answered in a limited time. This is a clear improvement over 2013. As part of the supermarkets decided very limited cooperate with the investigation of the Consumers' Association and other European consumers. Also there appears substantive improvement noticeable.

Ambition, policy and purchase are (largely) publicly available

The supermarkets are quite transparent in terms of the sustainability ambitions and sustainability policy that they have mapped out and purchase that they use. Many documents can be found online and all supermarkets carry a sustainability report. This does not mean that the image is therefore immediately clear to every supermarket. In some cases, multiple reports have to be combined to arrive at an overall picture.

Major initiatives for sustainable fruit and vegetables

In recent years, important initiatives started affecting the sustainability of the supply of fruit and vegetables to a large extent:

- Proof Planet initiative
- The Sustainability Initiative of Fruits and Vegetables (SIFAV)

Several of the surveyed supermarkets participate. Civil society organizations cooperate. We work with labels that provide guarantees about specific efforts on environmental and / or

social area. Proof and Planet SIFAV initiatives in development which is working to clear targets and consequent demands tightened periodically. It is therefore important that there is urgency continues to remain committed to further sustainability. This can be done by lifting the aspirations and demands within labels over time to a higher level. This is not only an important task for the supermarkets and the organizations, but also for governments and civil society organizations with an interest in the outcome of these initiatives, such as environmental organizations and development organizations.

It is important to realize that purchasing from Europe, from countries other than the Netherlands is not covered by the above initiatives. This means that usually only for the European countries, the general purchase (whether specifically for fruits and vegetables) are relevant. In general terms are environmental requirements in most cases limited to compliance with legislation or, at best, to identify and manage environmental impacts. From this point of view it would be good if the 'Planet Proof approach' is widened from Netherlands to Europe. Some supermarkets have already indicated that this may happen. Social requirements are often for the entire purchase.

Knowledge of environmental aspects of crops is mainly in the marks and experts involved

The survey shows that on issues such as energy consumption, water consumption and pesticide use very lean supermarkets standards and labels that they use, such as GlobalGAP, Proof and Planet Rainforest Alliance. The insight into the environmental aspects of crops seems to supermarkets themselves are limited. This is something to see any difference between the studied supermarket chains. Supermarkets, in cooperation with farmers and civil society organizations are actively involved in increasing the sustainability of crops will have more knowledge.

Results audits suppliers not public

(Compliance certification or for evaluating whether to purchase in the area of sustainability) is not reported on the results of external audits. There is no understanding of any non-compliance by suppliers. Supermarkets exchange such data among themselves via initiatives like BSCI (Business Social Compliance Initiative). Whether, to what extent and on what grounds suppliers are excluded from delivery is not visible to consumers and civil society. This limited understanding of how the policy works out supermarkets in practice.

Monitoring seems limited sustainable supply

The extent to which the supermarkets sustainable supply monitoring and transparent about it seems limited. Data rates are sustainable certified products but to come in dribs and drabs over the table. This data is not standard or collected by supermarkets, or they are not completely transparent about this. A periodic, independent measurement

This offer would from this point can be a good step that provides insight for consumers and civil society.

Approvals and standards are a way to sustainability, but have their limitations

Both supermarkets and consumers are certified products a way to get assurances about certain aspects of sustainability. When it comes to reliable, independent standards and labels that actually lead to sustainability is a good development. Yet there are also post comments. Thus, the real impact of the different labels is not always clear, the existence of 'non-compulsory standards' inside labels that some issues (such as biodiversity) are not always adequately covered, certification can be costly and would hallmarks is a continuous improvement in the road may be (if you meet the requirements, you are ready to). It is important to stay alert to these pitfalls. On the other hand labels offer a certain guarantee of independent monitoring and an ability to identify these products on the shelves. Possibly in the future 'new' sustainability themes like 'living wage', 'pricing of social and environmental impacts "and" (un) fair trading' also will be integrated in demand labels.

Great attention to food waste, little understanding of the results

All supermarkets pay attention to reducing food losses, for example by preventing product loss in the adoption by products that sit on the shelf life cheaper to offer and by offering products to food banks. At the same time formulate most supermarkets on this subject few concrete (SMART) objectives and there seems relatively little to be monitored in terms of the results of the various activities or supermarkets are not transparent here. If data are missing on the results obtained, it is difficult to control to reduce food losses. It is then not well known what works and what does not. The exchange of best practices will therefore be hindered.

Not easy to identify which supermarket is the most durable

At the level of the supermarket does not indicate good supermarket which scores the best when it comes to the sustainability of fruit and vegetables. This depends on how it is assessed as the proportion of sustainably certified products in the range, the degree of transparency, attention to food waste and supporting producers in implementing improvements. was chosen given the breadth and complexity of the themes for a qualitative analysis where strengths and weaknesses of the studied supermarket chains are indicated. Supermarkets can learn from each other's strengths. There are international leaders with their policies and measures can be a source of (sustainable) inspiration for the studied supermarket chains.

3.1.2 Consumer research

In the study, consumers have indicated a high importance to sustainability in fruit and vegetables. Efforts supermarkets are valued by consumers in this area. Good working conditions are a lot of respondents important. Respondents also indicate important to find environmentally friendly cultivation and transport. It should be noted that not examine to what extent these intentions translate into purchasing behavior. That is an important task for providers and especially for supermarkets, since that is where consumers buy mainly fruit and vegetables. They may encourage consumers to truly sustainable purchasing.

Consumers in this study indicated not knowing exactly what to look for if they want to opt for sustainable vegetable and / or fruit. More than half of the respondents also need more information on how sustainable produce. A large majority of respondents believe that it is the responsibility of the provider to ensure sustainable fruit and vegetables on the shelves.

A large proportion of respondents also a task of the suppliers of fruit and vegetables to ensure that as little plastic used to package fruit and vegetables. Many supermarkets are working on new or modified policies in the field of packaging. Some fruits and vegetables such as green beans and peppers (see case studies) some brands opt for packing in plastic.

3.1.3 Case Studies

3.1.3.1 Strawberries

The environmental impact varies with the season

Strawberries come in the period from June to September in the Netherlands and then grown in the open field. Strawberries are beyond the Dutch market mainly grown in Dutch greenhouses or in Spain. Strawberries grown in greenhouses in the Netherlands have a higher carbon footprint than strawberries grown in tunnels or open fields in the Netherlands. The carbon footprint of these strawberries is higher than for the strawberries from Spain. For strawberries imported from Spain, is more water than for Dutch strawberries.

Although the supermarkets say they know that the energy stakes in greenhouses is a major factor in the environmental impact of strawberries, none of the supermarkets has developed this specific policy. Some supermarkets give out to offer year round strawberries. Consumers find out where strawberries are grown and important part of the respondents say they do not buy strawberries out of season.

3.1.3.2 Bananas

Not always grown under good conditions

Consumers will find good conditions for banana important. But plantation workers do not always work under good conditions. They may have to deal with health problems through the use of pesticides. It is also known that they frequently receive low wages, and they have to work long hours.

More than a third of respondents said more willing to pay for bananas grown under good working conditions. Many consumers want to choose bananas with durability features such as Fairtrade and Rainforest Alliance. Many supermarkets offer these (only) to. That is a step in the right direction, though also evident from this survey that there is little reliable independent studies on the impact of these labels.

Almost half of consumers surveyed find a job in the supermarket / supplier to ensure good working conditions in banana cultivation. Some consumers stressed that the joint efforts of consumers, supermarkets, farmers and governments.

3.1.3.3 Paprika

The environmental load depends on the type of greenhouse

Peppers come mostly from the Dutch greenhouse and also from Spain and Israel. The carbon footprint of Dutch peppers is very dependent on how the greenhouse is heated. The energy-economical are greenhouses which are heated with geothermal energy (geothermal heat). The carbon footprint is lower than that of imported peppers from Spain and Israel. Greenhouses that are heated directly by gas have the greatest carbon footprint. Peppers from CHP fired greenhouses have a carbon footprint that is higher than that of greenhouses with geothermal energy, but lower than that of the boiler fired greenhouses. Consumers know the rule is not from the peppers from which type of greenhouse, supermarkets can select it here. In their comments they refer to Planet Proof. For foreign peppers need more water and land.

3.1.3.4 Green Beans

By plane transported beans have the highest carbon footprint

Most supermarkets buy green beans from the Netherlands (in the summer), Morocco, Egypt, Senegal, Spain and France. The cultivation of the beans takes place almost exclusively in the open field or in unheated greenhouses, so the energy does not play a major role for the environmental impact during cultivation. Energy consumption by transport does have a major impact here. Part of the beans (or green beans) from Kenya and Senegal transported as declared by the supermarkets by plane. Green beans flown in a much higher carbon footprint.

Fresh green beans in terms of carbon footprint score better than frozen, canned and hold potted products. These have preserved if

Dutch soil, however, a lower carbon footprint than flown beans. In the case of the cultivation of beans in Kenya, Morocco and Egypt are working not always good.

Regarding the relationship between packaging and food waste there appear two strategies should be used: no packaging so that consumers can choose the quantity and well packaged to prevent dehydration. It lacks independent research makes clear what the most sustainable approach.

3.2 Recommendations

Preserving the fruit and vegetable production and consumption is a joint effort of producers, supermarkets, consumers and governments. The study focused on what supermarkets (can) do. Some of the recommendations for supermarkets can also be performed through the use of policies and measures by governments. In addition, looking at prospects for action for consumers.

3.2.1 Recommendations for supermarkets

- Stimulate the production of sustainable fruit and vegetables
 - Know what the most important sustainability issues are at the different types of fruit and vegetables and speak suppliers and labels accordingly.
 - Handle purchase which allow for a more sustainable production and place the responsibility herein establish a code of conduct.
 - Send to products with a low carbon footprint (see below for further details)
 - Avoid packages or take care of packaging with a limited environmental impact
 - Limit the use of (hazardous) pesticides, for example by joining one of the multi-stakeholder independent sustainability initiatives
- Help consumers make sustainable (re) selection Provide details on how sustainable vegetable and
 - fruit, for example by making clear what labels mean and what the environmental benefits of fruit and vegetables 'in season'. Indicate when products 'in season' his Indicate when products (not) are transported by plane Provide a large and recognizable range of sustainable fruit and
 - vegetables help consumers reduce food waste
 -
 -
 -

The recommendations resulting from the investigation into the general store policy:

- Take care of practical overviews of sustainability ambition, sustainability policy, purchasing and sustainable supply. Much information is now available, but it is for stakeholders (too large)

challenge of the puzzle to get a complete picture. The availability of this information in Dutch contributes to a better understanding.

- Monitor and communicate on the proportion of sustainably certified products in the total range of fruit and vegetables (total and per product), so that consumers know what is the sustainable supply and what is the result of our sustainability policy.
- Broaden sustainability initiatives, possibly in modified form, to the other countries of Europe so that the sustainable production of vegetables and fruit can be guaranteed.
- Set concrete goals to reduce food waste and improve the monitoring in order to better assess the effectiveness of policies. Share best practices.

The following recommendations emerge from the case studies. The carbon footprint can be lowered in the following ways:

- Avoid imported by plane: transport by air provides a higher carbon footprint compared to transport by boat. It is only possible to import a particular product by plane only because of distance or lack of proper infrastructure? Then it might be worth considering to import from other countries or to provide a product (fresh) in a given period.
- Switch to geothermal: the kasgeteelde geothermal technologies has a much lower carbon footprint than boiler and CHP-heated greenhouses. This is something supermarkets and governments can play in.
- Encourage selling fresh seasonal produce: fresh products generally have a lower impact than frozen, canned and / or products in a glass jar.
- Reduce food losses: reducing food waste leads to a lower carbon footprint per unit and less impact on the environment (soil, water, etc.).

3.2.2 Recommendations for consumers

Consumers in the following ways actively contribute to the sustainability of fruit and vegetables:

- Choose vegetables and fruit with one or more of the so-called topkeurmerken:
 - European organic, Eko and Demeter Planet
 - Proof Rainforest Alliance, Fairtrade
 -
 -
- Choose fresh seasonal produce
- Avoid transported by air fruit and vegetables
- Go against food waste

In the article on the website and these concrete recommendations for consumers.

CONSULTED LITERATURE

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APPENDIX A

METHODS AND ACCOUNTABILITY CASE STUDIES

A1 Research Methodology

A1.1 Methodology environmental influences

The environmental impact of fruit and vegetables are quantified using the Life Cycle Assessment (LCA) methodology. Major advantages of the method are:

The entire product range of fruit and vegetables are included in the study, from raw material production to consumption of the product by consumers and ultimately dispose of the packaging materials. With LCA methodology can be expressed in several environmental impact categories, including climate change, land use and water use. A drawback of the method is that social and economic aspects can not be included in the analysis. The results merely go about environmental performance. There exist developments of social life-cycle analyzes (SLCA), but data and methodology is not of sufficient quality to make a proper analysis. Hence, the social aspects of fruit and vegetables have been treated differently in the study. The study is conducted on the basis of the four phases proposed by the ISO 14040 standard on LCA studies (ISO 2006). These four stages are:

Purpose and scope: describes the boundaries of the study, the different products are analyzed and the functional unit is the basis of comparison in the study.

Life cycle inventory (LCI) describes the product systems and the data necessary to determine the environmental impact of different products.

Life cycle impact assessment (LCIA) describes the different indicators that are used to determine the effects on the environment and displays the results for the various products.

Interpretation: In this phase, the results of the analysis, and all the choices and judgments are made in the course of the analysis, evaluated in terms of reliability and robustness.

A1.2 Approach social aspects

This study also looked at the social aspects of the cultivation of bananas and foreign beans. This two labels are considered: Fairtrade and Rainforest Alliance. This is inserted in a qualitative manner. First mapped how the Fair Trade and / or Rainforest Alliance market looks in the Netherlands for these products and where the products come from. In a next step is looking at the specific social issues that arise in these countries, such as corruption, child labor, access to education and

workers' rights. The criteria of the labels Fairtrade and Rainforest Alliance are then placed next to these issues

A2 Purpose and scope

The first phase of the LCA methodology determines the initial choices that apply to the rest of the study. First of all, the purpose of the study is formulated, then the alternatives are determined and functional unit in the scope. The functional unit is the basis of comparison in the next steps of the study.

A2.1 Aim of the study

The Consumers want more insight into the environmental effects of fruit and vegetables and the action perspective of supermarkets in the area of environmental and social sustainability. Instead of treating dozens of fruits and vegetables, was chosen two types of vegetables and two fruits to analyze broader and deeper into case studies. Based on these case studies, the following question is answered: Can supermarkets and consumers push for a more sustainable food chain? And how?

To answer this question, the average Dutch market mix is first determined for different products based on production and trade statistics. The environmental and social aspects of the average market share is the reference for action perspective supermarkets. Then there are different scenarios outlined for the selected products. Here, products may perform better or worse than the average market share. The goal is to determine what action perspective to sustainable food chains.

The quantitative analysis of the environmental impacts of various fruits and vegetables are displayed for climate change, water and land use and aggregate / final score of the three impact categories.

A2.2 Scope of the study

Based on data on food consumption (VCP) and screening study these fruits and vegetables are selected by the Consumers' Association. an environmental analysis conducted for these products and serves as a baseline for the next steps.

table A1 Included fruits and vegetables, packaging and preparation for this study

Vegetable	packing ¹¹	Preparation:	Fruit	packing	Eaten as:
Tomato	Cardboard box + plastic	-	Apple	Cardboard box	New Child
butter bean	Plastic bag	Cook	Banana	Cardboard box	shelled
Carrot	Plastic bag	Cook	Orange	Cardboard box	shelled
Cucumber	plastic sleeve	-	tangerine	Cardboard box	shelled
Onion	Plastic bag ¹²	Cook	Grape	Cardboard box	New Child
Bell pepper	Plastic bag	-	Strawberry	Cardboard box + plastic	without crown

Scope of different growing countries is determined by the market mix. The market mix is determined on the basis of FAOSTAT data on production and trade statistics for various fruits and vegetables.

¹¹ Data on packaging were part of a study carried out for the RIVM several years ago. The same assumptions are maintained in this study.

¹² Onions are often packaged in plastic tidy. In the model it is assumed that a mesh bag a has similar environmental pressure as a plastic bag since the material and weight is approximately equal.

Market shares of most consumed fruit and vegetables

Calculated consumption mix for not featured fruits and vegetables that are used in the comparison below.

Table A2 Products, country of origin, cultivation technology, consumption mix and mix adjusted for different kinds of fruit

Product	cultivation country	Cultivation Technology	Consumption mix (%)	Adjusted mix (%)
Apple	The Netherlands	Orchard	53.23	60.88
Apple	Chili	Orchard	11:32	12.95
Apple	France	Orchard	7.90	9:03
Apple	New Zealand	Orchard	6.79	7.76
Apple	Belgium	Orchard	5:23	5.98
Apple	South Africa	Orchard	2.97	3:40
Orange	South Africa	Orchard	36.72	45.41
Orange	Spain	Orchard	25.01	30.93
Orange	Morocco	Orchard	8.82	10.91
Orange	Egypt	Orchard	8.79	10.86
Orange	Brazil	Orchard	1:53	1.89
tangerine	Spain	Orchard	46.62	61.48
tangerine	Morocco	Orchard	12:29	16:21
tangerine	Argentina	Orchard	9:13	12:04
tangerine	Peru	Orchard	7.80	10:28
Grape	South Africa	Orchard	30.30 *	41.01
Grape	Chili	Orchard	24.96 *	33.78
Grape	Brazil	Orchard	6:19 *	8:38
Grape	Greece	Orchard	5.66 *	7.65
Grape	Italy	Orchard	4.77 *	6:45
Grape	Spain	Orchard	2:02 *	2.73

Table A3 Products, country of origin, cultivation technology, consumption mix and mix adjusted for different types of vegetables

Product	cultivation country	Cultivation Technology	Consumption mix (%)	Adjusted mix (%)
Tomato	The Netherlands	cash	81.80	81.06
Tomato	Spain	Tunnel	11.63	18.94
Carrot	The Netherlands	Open field	91.58	93.71
Carrot	Israel	Open field	3:28	3:35
Carrot	Belgium	Open field	1:47	1:50
Carrot	Spain	Open field	1:41	1:44
Cucumber	The Netherlands	cash	84	84.39
Cucumber	Spain	Tunnel	14	15.61
Onion	The Netherlands	Open field	89.57	94.54
Onion	France	Open field	1:56	1.64
Onion	Egypt	Open field	1:36	1:44
Onion	Poland	Open field	1:17	1:23
Onion	Spain	Open field	1:09	1:15

is a comprehensive case study conducted for two vegetables (Green Bean & Pepper) and two kinds of fruit (Banana & Strawberry). For each of the four products are various scenarios where specific sustainability aspects will be investigated. The various scenarios are shown below.

A2.3 System limits

Environmental impact of all products are presented by product eaten based kilograms. This means that the entire product life cycle, from production to consumption, falls within the scope of the study. In the scope of the comparison are included in all stages of the life cycle, from the production of raw materials to the consumption of the product. A schematic representation of the system boundaries are shown in Figure A1.

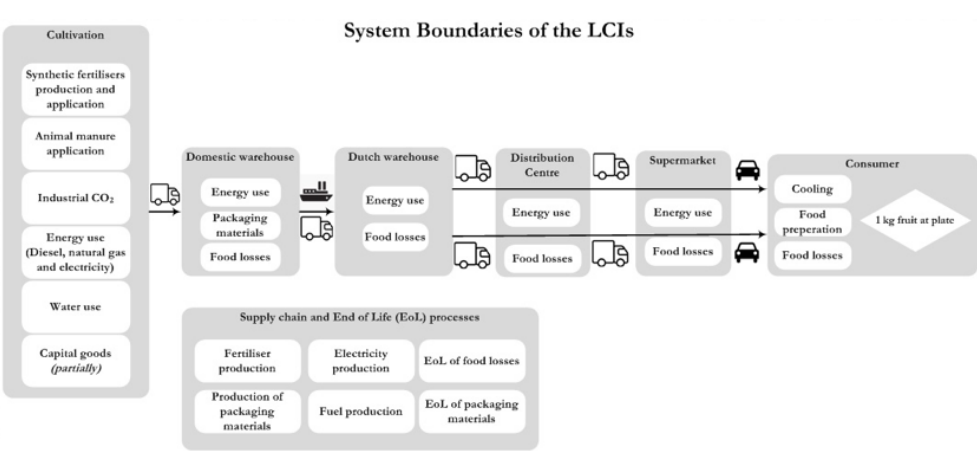


Figure A1 Schematic representation of system boundaries for fruit and vegetables.

The chain begins with the agricultural phase of the product. Based FAOhandelsstatistieken the Dutch market mix is determined by country of origin. For the collected main and largest production countries is covered data until there is an acceptable market share (+ 70% market share). The remaining share is then divided by the ratio of included countries. A list of approved production countries with its market share and adjusted mix for the four featured products are shown in Table A4. Country of origin of the other products can be found in the appendix.

table A4 Products, country of origin, consumption mix and mix adjusted for different types of fruit and vegetables

Product	cultivation country	Cultivation Technology	Market Mix (%)	adjusted mix
Bell pepper	The Netherlands	Greenhouse, boiler	15.48	16.02
Bell pepper	The Netherlands	Kas, CHP	54.95	56.86
Bell pepper	The Netherlands	Kas, geothermal	6.97	7.21
Bell pepper	Spain	Tunnel	9.83	10.17
Bell pepper	Israel	Tunnel	9.42	9.74
butter bean	The Netherlands	Open field	46.00	59.15
butter bean	Morocco	Open field	19.91	25.59
butter bean	Kenya	Open field	6.85	8.81
butter bean	Egypt	Open field	5.01	6.45
Strawberry	The Netherlands	cash	30.73	35.10
Strawberry	The Netherlands	Tunnel	2.31	2.64
Strawberry	The Netherlands	Open field	33.04	37.73
Strawberry	Spain	Tunnel (50%) Open field (50%)	17.42	19.89
Strawberry	Egypt	Tunnel	2.03	2.34
Strawberry	Portugal	Tunnel	1.99	2.30
Banana	Ecuador	Orchard	40.87	55.91
Banana	Colombia	Orchard	21.83	29.86
Banana	Costa Rica	Orchard	7.41	10.13
Banana	Mexico	Orchard	3.00	4.10

The study aimed to analyze the products as completely as possible. But are not captured all aspects. A list of included and excluded processes are shown in Table A5.

Table A5 Overview of included and excluded aspects of the various product phases

product phase	fi Including	• Excluded
Cultivation of crops	Use and production of fertilizer use and production of fuels Capital (part) Water for irrigation	Production of pesticides
Transport to transfer point	Transport distances, country-specific Transport Modality losses during transport (1 to 2%)	Capital Secondary and tertiary packaging ¹³
processing products	Energy processing / washing water for processing / wash losses during processing	Capital goods
packaging products	Materials for Energy type of packaging for packaging plastic (thermoforming)	Capital goods
Distribution	Transport Refrigeration distribution during distribution Lighting during distribution losses in distribution (1%)	Capital Secondary and tertiary packaging
Convenience store	Transport Supermarket Refrigeration in supermarket lighting in supermarket grocery Heating Losses in retail (5%)	Capital Secondary and tertiary packaging
Consumer	Cooling in consumer energy for cooking product Mass Losses during preparation product Avoidable losses at consumer Disposal of packaging	Capital Transport consumer Secondary and tertiary packaging

A2.4 Selection of environmental impact categories

For this study the environmental impact of fruit and vegetables are three impact categories observed. It comes to climate change, land use and water use. The effect of the various products is determined by the same ReCiPe impact categories (hierarchical version). An overview of the indicator unit per impact category can be found in Table A6.

table A6 Indicator units for ReCiPe impact categories

impact category	indicator unit
climate change	kg CO₂ equivalent
Agricultural land use	m2 per year
water consumption	m3 of water

¹³ Primary packaging in direct contact with the product and this is included. All around it, such as the boxes boxes are not included.

A2.4.1 Climate Change

Climate change refers to the change in weather patterns. These changes affect the quality of life on earth. Climate change is caused by several factors, such as biotic processes, plate tectonics, variations in solar radiation received by Earth, volcanic eruptions. In addition, human activities have a significant impact on climate change. In LCA studies are only the effects considered. Examples of human activities are fossil fuel combustion, agriculture and deforestation. These processes result in a higher concentration of greenhouse gases (GHG) in the atmosphere. CO₂ is one of the greenhouse gases (GHG) that the climate change impact. There are also other greenhouse gases that contribute to global warming, such as methane and nitrous oxide. These other gases, with an impact on climate change, are also included and expressed as CO₂ equivalents. More powerful greenhouse gases include, for example, methane (36 kg CO₂-eq / kg) and nitric oxide (298 kg CO₂-eq / kg).

A2.4.2 Agricultural land use

Country on earth that's available is limited for cultivation. Land Occupancy refers to the field of rural or urban areas which is occupied for a certain period of time for the production of crops. Land use is derived revenue from a given crop year. Reference unit is land use square meters per kg of product per year. Reducing the impact minimize the number of square meters (m²) per year which is used to produce a particular product.

A2.4.3 Water Consumption

For water consumption, it is important to make a clear distinction between water and waterconsumptoe. As water evaporates or is used as input for the production of concrete from chemicals, water lost from that area is. But if the water is consumed but released near the point of consumption, it can be argued that the water is not lost and does not cause water shortages. An example of this is the use of cooling water in power stations, where the force of the water is discharged into the same body of water where it comes from. It is also important to note that the consumption of water only 'blue water consumption' is included (Mekonnen and Hoekstra, 2010).

A2.4.4 Final Score

Also, a final score is presented for the different impact categories. Methodology and weighting of the three impact categories are based on the weighting of ReCiPe 2016 Endpoint hierarchical version.

This is a way to aggregate the environmental impact of different categories. Side note is that toxicity is not included because the

pesticides used by most countries / producer / certification schemes are not released.

A3 Life Cycle Inventory

The life cycle inventory data, and describes the data sources that have been used for the calculations environmental impact of the different crops. First of all, following is a general, but rather extensive, description of the sources of data as to the cultivation of the crops. Then the choices for the remaining phases are discussed. Specific dates for the various products are highlighted later. Product specific information, in particular the growing phase can be found in Annex C.

A3.1 Growing Stage

Only the aspects relevant for land, water and climate of the different products for the growing phase mentioned here. Data on heavy metal emissions from eutrophication and pesticides all have no effect on the selected impact categories and therefore are not covered.

crop Yields

Data on yields per hectare of the 'general' cultivation for each country is based on statistics from FAOSTAT (FAO, 2017). This data can be used if there is outlined one scenario for a land-crop combination. If there are more scenarios, additional data is needed. Eg for strawberry cultivation specific dates in Netherlands needed for cultivation in greenhouses, tunnels and open field.

Fertilizer: fertilizer, chemical fertilizer, and CO₂ use

Method as to quantity and the use of animal manure has been described on the basis of the methodology in Feed Print (Vellinga et al., 2013). This is believed to total manure per country is evenly distributed across the available arable land. Since orchards, greenhouses, tunnels and non-arable land animal manure for this crop technologies included in the analysis.

Use fertilizer for all crops in terms of NPK requirement is based on literature and country-specific crop. Dutch crops are often on the basis of information from the KWIN-arable (Wageningen University, 2015). For other countries use different data sources. Overview of data and sources of NPK requirement per crop can be found in Table A7.

table A7 Fertilizer used for different case studies (kg / ha)

Crop	country	Source and possible comment	N	P2O5	K2O
butter bean	The Netherlands	(Kuling & Scholten, 2015)	300	48	87
butter bean	Morocco	(Kuling & Scholten, 2015)	99	35	43
butter bean	Kenya	(Kuling & Scholten, 2015)	99	35	43
butter bean	Egypt	(FAO, 2006)	36	71	57
Bell pepper	The Netherlands	(From Paassen, 2016)	1157	612	1978
Bell pepper	Spain	(Berrios, Arredondo, & Tjalling, 2007)	276	42	417
Bell pepper	Israel	(Haifa, nd)	221	57	330
Strawberry	Netherlands - open field	(Kuling, Valencia-Martinez, and Scholten, 2015)	100	0	120
Strawberry	Netherlands - tunnel	(Broekema & Blonk, 2010a)	100	150	50
Strawberry	Netherlands - cash (Kuling et al, 2015).		490	105	490
Strawberry	Spain	(Kuling et al., 2015)	100	25	135
Strawberry	Portugal	(Regional Directorate of Agriculture of Entre Douro e Minho, nd)	200	135	335
Strawberry	Egypt	(FAO, 1996)	547	107	228
Banana	Ecuador	(Kuling et al., 2015)	245	0	120
Banana	Colombia	(Kuling et al., 2015)	150	20	210
Banana	Costa Rica	(Kuling et al., 2015)	252	9	9
Banana	Mexico	(FAO, 2006)	100	20	120

NPK breakdown into the various fertilizers is based IFA statistics of most common fertilizers per country (IFA, 2017). To avoid double counting of NPK requirement is used the same methodology as that described in Agri-footprint methodology report (Durlinger, Koukouna, Broekema, of Paassen, and Scholten, 2017).

For horticultural production is assumed in the Netherlands that provides industrial CO₂ has been used in the cultivation of various crops. The amount of CO₂ which has been used in the cultivation is on the basis of data from the KWIN-horticulture (Wageningen University, 2014). This CO₂ emissions are 50% allocated to the greenhouse cultivation, and the remaining 50% to the industry (BSI, 2012).

Energy: diesel, natural gas and electricity

Diesel for Use Dutch cultivation of arable crops on the basis of KWIN-arable (Wageningen University, 2015). For other countries, the same numbers are used. With the exception of:

is used for cultivation in Morocco (12.3 l / ha) For green beans data from Jones (2006). The same data is used for Egypt and Kenya.

Dutch greenhouse can be heated in different ways. The options included in the study, using the heating boiler, heat and power (CHP) and geothermal. Data on gas for the boiler and CHP are the KWIN-greenhouses (Wageningen, 2014). The surplus of electricity which is realized as a result of the use of a combined heat and power, of the system may be subtracted (so-called "expansion system" in terms LCA). This allocation method is

Based on the PAS2050-1 (BSI, 2012). Methane leakage at the CHP should also be included in the analysis and amounts to 2.3% of the total natural gas in accordance with the input PAS2050-1.

Paprika-based geothermal energy is calculated in accordance with Annex C3.

water use

Amount of irrigation use is based on the 'Blue water footprint (Mekonnen and Hoekstra, 2011). The term 'water-Blue' includes groundwater and surface water which has been used for the purpose of the product. Numbers are crop and country specific and are expressed in cubic meters per ton of product. "Green water footprint, or rain, is not included in the analysis.

Land use change

Effects of land use change are included in the analysis and are based on calculations of the 'Direct Land Use Change Tool V2014.1 (Blonk Consultants, 2014). This is included under the effects of other deforestation. The effects of land use change and agriculture are crop specific.

substrate

For cultivation in greenhouses, it is assumed that the cultivation takes place on rock wool mats. Effects of stone wool production is based on primary data from a wool producer (Kool & Blonk, 2011).

Capital goods

Effects of the production and processing of greenhouses and tunnels are included in the analysis. Greenhouses are on the basis of Venlo-type (van der Meer, 2016) on the basis of tunnels Rovero type S 960 (from Tuijl, 2016).

A3.2 Treatment of crops

Energy consumption for processing of products based on energy consumption of seven different processes (Sanjuán, Stoessel, and Hellweg, 2014). Three of the seven processes always take place: selection and cutting, washing and spinning. The other four processes are optional and depend on the product state of the product (canned, frozen, etc.).

table A8 Modeled processing steps that are taken for different scenarios of vegetables

Crop	scenario	Selection & to cut	wash centrifuge	fugeren	Blanching	peel Verhit-	at	To freeze
Bell pepper	Fresh	x	x	x				
butter bean	Fresh	x	x	x				
butter bean	look	x	x	x			x	
butter bean	Glass	x	x	x			x	
butter bean	Frozen	x	x	x	x			x

Besides energy consumption, water use is also included for processing in the study. Water use is on the basis of Letho et al. (2014). Source announces a range of values from which the average is taken.

A3.3 products Packaging

Various packaging options are included in the study. It is assumed that all the packaging material is 100% of the primary origin and is not taken into account any balance of the recycling of packaging materials. List below the packaging options shows the corresponding weights of different materials.

table A9 Amount of packaging material for the different packaging type (kg of material per kg of product)

packaging Type	Cardboard	PP	Paper	Steel	GM Starch	EPS	Glass
Glass jar			0.0005	0.0242			0533
look			0.0025	0112			
Cardboard box	0.0733						
Plastic bag - frozen		0.0225					
Plastic bag - fresh		0009					
Plastic film / bag		0011	0.0003				

The same amounts of packaging material are also used in the consumer phase in order to determine the effects of processing of packaging material.

A3.4 Distribution

For refrigerated products, energy consumption 50 kWh / tonne of product for frozen products adopted 90 kWh / ton (Kuling & Scholten, 2015). Additionally, there for all products 40 kWh / ton nabbed for lighting during distribution (Broekema, Durlinger, & Kramer, 2013).

A3.5 Supermarket

At supermarket level is an electricity consumption of 30 kWh per tonne of product nabbed for refrigerated products and 50 kWh / tonne for frozen products. Energy consumption for lighting is 36 kWh / tonne product and 284.4 MJ / ton for heating the supermarket (Albert Heijn, 2013).

A3.6 Consumer

If the product is stored refrigerated or frozen for this is once again reeled electricity. Any cutting losses are nabbed for various products based on plant-specific data from the RIVM. If the product is prepared here are also linked any energy input in the form of natural gas and electricity. During the preparation process, it may be that the product "shrink" or "turn off". This so-called "raw-to-preparation" factors are also taken into account, and are also based on method of preparation and product-specific data from the RIVM.

A3.7 Food losses through the chain

It is assumed food losses during the food chain are the same as sort of similar studies which Blonk Consultants has carried out for the RIVM. These food losses:

- 1% of Dutch crops and 2% of foreign washed to Dutch transfer point.
- 1% for processed products. But for processed beans in glass, cans and frozen 5% loss adopted on the basis of comparable study (Broekema & Blonk, 2010b). This number is based on the 'inedible part' of green beans, on the basis of data from the RIVM.
- 1% loss during distribution
- 5% loss in the supermarket (1% canned / frozen products and products in glass)
- Loss of inedible parts of the various products, based on data from RIVM. See Table A10.
- Loss during preparation of product. In the current study is only assumed that green beans are cooked. Data based on RIVM Table A10.
- 8.9% loss of fruit and 8.5% loss of fruit between production and consumption, based on data on 'avoidable losses' of fruit and vegetables CREM (Van Westerhoven & Stone House, 2010).

table A10 Parameters adopted during the consumption phase for all investigated products

Product	Preparation edible Group		Group after preparation	Avoidable losses (%)
Tomato	-	0.95	na	8.9
French beans (fresh)	Cooked	0.95	0.88	8.9
French beans (processed)	Cooked	1	0.88	8.9
Carrot	Cooked	0.9	0.9	8.9
Cucumber	-	0.9	na	8.9
Onion	Cooked	0.85	0.81	8.9
Bell pepper	-	0.8	na	8.9
Apple	-	0.8	na	8.5
Banana	-	0.7	na	8.5
Orange	-	0.7	na	8.5
tangerine	-	0.75	na	8.5
Grape	-	0.95	na	8.5
Strawberry	-	0.95	na	8.5

A3.8 Transport through the chain

Overview of the assumed transport distances and type of crop land to Dutch department store are shown in Table A11. For all of the transport with the truck is adopted as follows: emissions based on EURO4 truck, weight, and diesel fuel consumption on the basis of a heavy goods vehicle of more than 20 tons and load factor of 50%. is assumed load factor of 50% because the volume of the product and not the weight is the limiting factor for transport (Kuling & Scholten, 2015).

table A11 Adopted transport distances, terms and product losses during transport hub in Netherlands

country	Loss	Truck	seagoing	To fly
The Netherlands	1%	50		
Spain	2%	2300		
Israel	2%	150	6344	
Morocco	2%	350	2500	
Kenya - fly	2%	350		6672
Kenya - boat	2%	350	11780	
Egypt ¹⁴	2%	350	6120 (50%)	3291 (50%)
Portugal	2%	2200		
Ecuador	2%	250	10428	
Colombia	2%	450	8817	
Costa Rica	2%	150	9169	
Mexico	2%	400	9570	
Chili	2%	350	13583	
France	2%	750		
New Zealand	2%	200	20884	
Belgium	2%	200		
South Africa	2%	100	11428	
Brazil	2%	250	10108	
Argentina	2%	350	11788	

¹⁴ For strawberries from Egypt is assumed that half will be flown and the other half by boat to reach the Dutch market

ANNEX B

SHARE RESULTS VEELGECONSUMEERDE FRUIT AND VEGETABLES

B1 Carbon footprint

Carbon footprint (climate change) of 12 vegetables and fruits in the supermarket and consumed fruits and vegetables are presented in Figure B1.

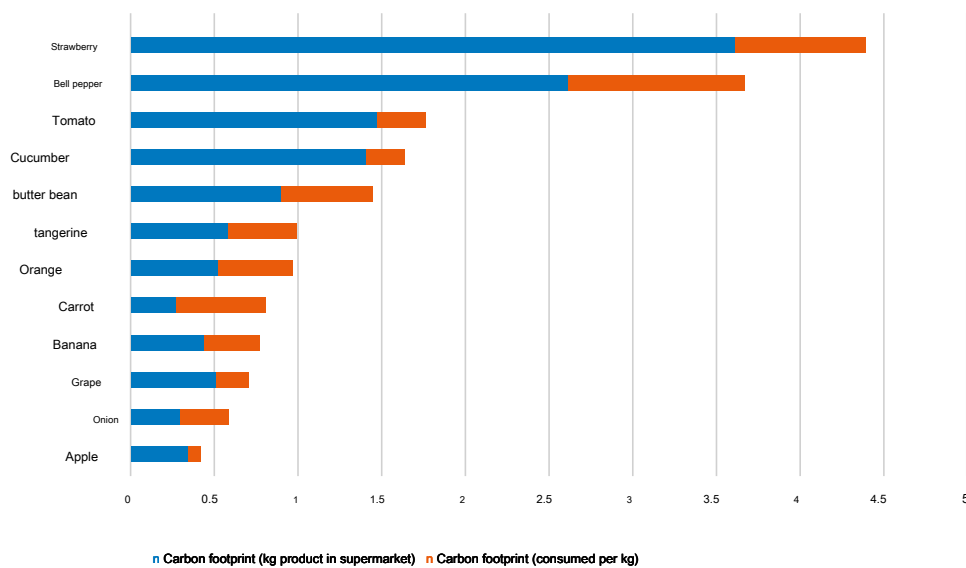


Figure B1 Average carbon footprint of 12 different fruits and vegetables in the Netherlands (CO₂ eq / kg)

There are major differences in GHG emissions per kg of product between the 12 fruits and vegetables. For the differences between the products are several arguments. The top 4: Strawberry (4.4 kg of CO₂ eq / kg), paprika (3.7 kg CO₂ / kg), tomato (1.8 kg CO₂ / kg) and cucumber (1.6 kg CO₂ / kg) products are mainly grown in the Netherlands greenhouse. Greenhouses need a lot of heat which is generated mainly from natural gas. Open crops use less fossil fuels and generally score better than greenhouse grown products in the area of carbon footprint. Cucumbers and tomatoes have higher yields per hectare compared with strawberry and pepper. This largely explains the difference between greenhouse grown products. For greenhouse cultivation, there are major differences between the various heat sources. More on the differences of strawberry cultivation in open field, greenhouse, tunnel, see 6.3.1. Most durable product is the apple with a market average impact of 0.42 kg CO₂ / kg, and thus has more than 10 times less CO₂ impact than the strawberry. After the top 4 follows the French bean (1.5 kg CO₂ / kg). Carbon footprint of French beans is relatively high compared to other crops in open field and that has to do with Kenyan beans share to be flown in and has a high impact on the Dutch mix. More on this in chapter 2.4.4.

Another difference is that the carbon footprint from the supermarket 'varies by product. That has to do with the proportion of the product that is edible, which varies by product. Moreover, some products such as carrots, green beans and onions cooked before being eaten.

B2 Land Use

Land use 12 fruits and vegetables in supermarkets and consumed fruit and vegetables are shown in figure B2. The unit used for land use square meter per year (m²a).

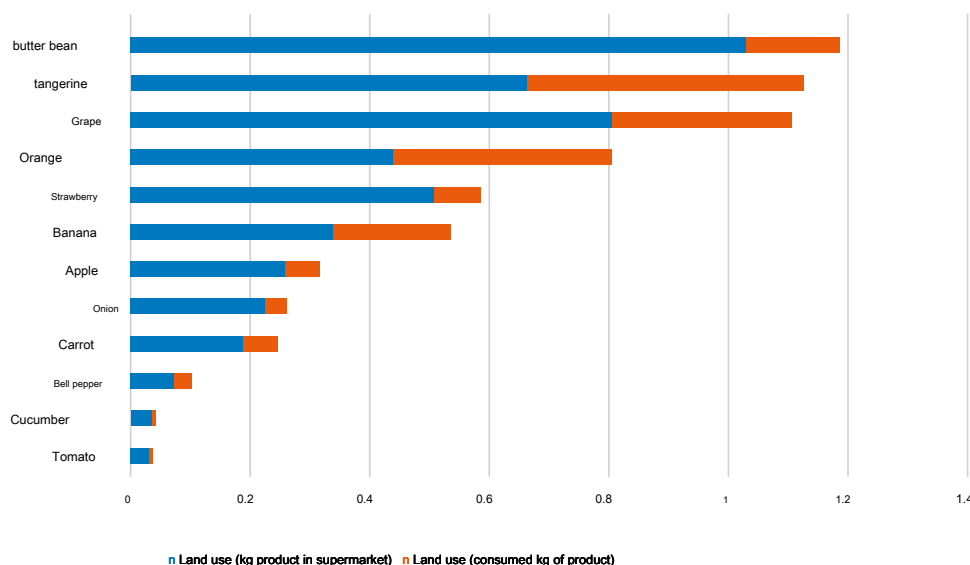


Figure B2 Land use fruit and vegetables in the Netherlands (CO₂ eq / kg)

Land use for sweet (0.10 m² / kg), cucumber (12:04 m² / kg), and tomato (00:04 m² / kg) is the lowest of the 12 included vegetables and fruit. As mentioned, these products are mainly grown in Dutch greenhouses. Although these crops are so intensive in terms of carbon footprint, products from the greenhouse or score well on land use because the yields are many times higher than open field crops. Strawberries have a higher land use (0.59 m² / kg) because much is grown on the field and the proceeds from the greenhouse cultivation are lower compared with the paprika, tomato and pepper. Open field crops with high yields as the root (0:25 m² / kg), onion (0:26 m² / kg) and apple (0.32 m² / kg) also score well on land use. Products with top land use, the French bean (1.19 m² / kg), and mandarin (13.1 m² / kg). Green Bean has the lowest yield per hectare of all products, tangerine has a high land use because a relatively large portion of the product from the peel that could allow more kilos of product needed per kilo consumption. Difference between the 12 different fruits and vegetables are great for the impact category of land use. For example, a 1 kg haricot consumed more than 30 times more than land use kg consumed tomato.

B3 Water use

Water of 12 fruits and vegetables in supermarkets and consumed fruit and vegetables are show in Figure B3.

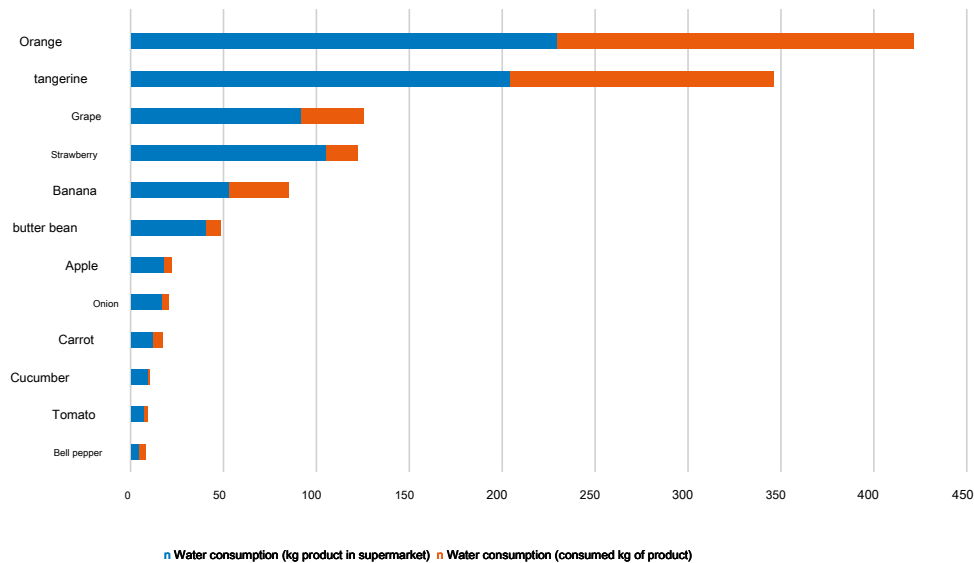


Figure B3 Water consumption of fruit and vegetables in the Netherlands (CO₂ eq / kg)

Water use varies very much between the products, more than carbon footprint and land use. For products with a high water is the most important contribution of irrigation during the growing phase. Irrigation of the different products on the basis of blue water footprint of different crops and countries (Mekonnen and Hoekstra, 2010). Orange (420 L / kg consumed), tangerine (345 L / kg consumed) and grape (125 L / kg consumed) have high water use. Main cultivation countries for these products are all in dry climates where rainfall is low (see A1. Market shares of most consumed fruits and vegetables). Products mainly come from wetter climates such as cucumber (11 L / kg)

B4 End-point score

In the end-point score, the environmental impact of the three captured impact categories after weighting are added up to produce a final score. Results of this are shown in Figure B4.

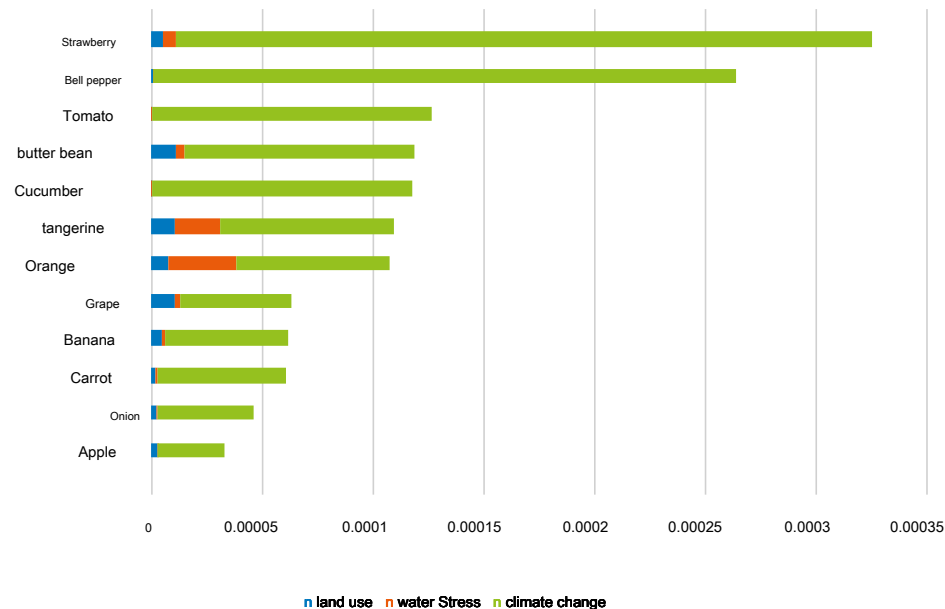


Figure B4 ReCiPe endpoint score of 12 fruit and vegetables in the Netherlands (points / kg)

If the three considered impact categories are added together you see that for all products the most important contributors to climate change. Short by the bend of the durability of a product can be already determined on the basis of the carbon footprint thereof. Because kasgeteelde products such as pepper, tomato and cucumber score well on land use and water use and products as the French bean, mandarin orange and not have approached these products together just in terms of score.

Based on the final score of the carbon footprint, land use and water use can be said for example that the average apple in the supermarket in terms of sustainability scores almost 10 times better than the average strawberry. The peppers scores like Strawberry relatively poor, despite the low land and water use of this product. In that respect, besides the apple, onion, carrots, bananas and grapes sustainable alternatives.

Until now only show the effects of average products. However, products can be grown in multiple ways may come from different countries and can be packaged in various ways.

ANNEX C

LIFE CYCLE INVENTORIES CASE STUDIES

C1 Strawberry

Table C1 Yields and fertilizer use different strawberry crops

country	Type	Yield (kg / ha)	N (kg / ha)	P2O5 (kg / ha)	K2O (kg / ha)	Diesel (l / ha)	Straw (tons)
Netherlands	Open field 21000		100	0	120	266	10
Netherlands	Tunnel	45000	100	50	150	88	-
Netherlands	Kas	145000	490	105	490		-
Netherlands	Kas	98000	490	105	490		-
Spain	50% / 50%	37055	100	25	80	208	5
Portugal	Open field	15390	200	135	335	208	10
Egypt	Open field 43540		547	107	228	208	10

The calculation for the Dutch mix of strawberries on the basis of statistics on strawberries by the Central Bureau of Statistics (CBS, 2017). Here can be found the open ground in recent years accounted for about 50% of the Dutch production. Yields of open ground stood recent years, almost 21 tons per hectare, which produce the same reported in the latest KWIN stands for strawberry cultivation. The remaining 50% of the strawberry production comes from both the glasshouse and the tunnel. In 2015, it was the area under strawberry under glass of about 300 hectares with additionally 50 hectares in tunnels (Janse, 2016). These ratios are used to arrive at a Dutch mix. For strawberry growing under glass was chosen for cultivation system with a relatively low yield (98 t / ha), because most comes close to what was reported in the CBS statistics for growing under glass.

However, it is also likely that higher yields are achieved in a greenhouse. In a sensitivity analysis, replacing the greenhouse cultivation of strawberries to study its impact.

C2 Banana

Banana cultivation are examined from four different countries: Ecuador, Colombia, Costa Rica and Mexico.

country	Type	Yield (kg / ha)	N (kg / ha)	P2O5 (kg / ha)	K2O (kg / ha)	Diesel (MJ / ha)
Ecuador	accepted	35030	245	0	120	12154
Colombia	accepted	26436	150	20	210	12154
Costa Rica	Conventional	47847	252	9	9	47300
Mexico	accepted	28860	100	20	120	12154

C3 Paprika

The general Dutch peppers is further broken down into different energy for cultivation. Additional data for energy consumption for the different systems is collected to give quantitatively the differences again.

Assuming that all other parameters remain unchanged on the crop production as yields, fertilizer & CO₂ consumption, greenhouse (capital good) and substrate. An overview of energy consumption of the different cultivation systems is set forth below.

Table C2 Overview of energy and yields of different cropping systems

Land cultivation system	Gas (m ³ / m ²)	Electricity (kWh / m ²)	Geothermal (m ³ eq / m ²)	Yield t / ha (FAO)
Netherlands, greenhouse boiler	36.40	10	-	269
Netherlands, greenhouse cogeneration	55.90	- 115	-	269
Netherlands, greenhouse geothermal energy (natural gas equivalents.)	-	10	36.40	269
Spain, Tunnel		7		54.6
Israel, tunnel		7		55.5

For the Dutch situation is believed that the cultivation takes place in greenhouses and examined three different scenarios: growing peppers with boiler as a heat source, pepper cultivation CHP as a heat source and pepper cultivation with geothermal heat source. For reference, the results of Spanish and Israeli culture are also displayed. Data for all scenarios are set out below:

Dutch pepper cultivation with boiler as a heat source

Data on energy requirements of the cultivation of paprika boiler as a heat source is out of the KWIN-horticulture (Wageningen University, 2014). Natural gas demand

36.40 cubic meters of gas per square meter for the purpose of heating to 10 kWh / m² of energy for all the equipment (irrigation, air conditioning systems, etc.). The KWIN also gives an expected yield (30.5 kg / m²), but for consistency between the different countries is chosen to FAO

use statistics for all countries (Netherlands: 26.9 kg / m²). It is assumed, as for other Dutch crops which cultivation takes place on rockwool slabs. Fertilizer use based on primary data (from Paassen

2016). Same NPK will also be used for other crops.

Dutch pepper cultivation CHP heat source

Data on energy requirements of the pepper cultivation with heat power unit (CHP) are also out of the KWIND-horticulture. Natural Gas Demand is significantly higher: 55.90 cubic meters of gas per square meter and that's because some of the energy released by burning natural gas is converted into electricity. To comply with the same heat, more natural gas needs. Total production of electricity (125 kWh / m²) exceeds the electricity demand (10 kWh / m²) of equipment in the greenhouse. Net surplus electricity may be deducted according to the protocol PAS2050-1 system (BSI, 2012). It is also assumed that 13.7 grams of methane slip per cubic meter of natural gas used in the atmosphere ends up as a result of incomplete combustion of fossil fuel in the CHP (BSI, 2012).

Dutch pepper cultivation with geothermal heat source

Another way to heat greenhouses with geothermal energy. Solutions with complete filling of the heat from geothermal energy, ie a coverage of 100% are not competitive on the basis of the annual cost (Janssen, Ruigrok, 't Orientals, and de Wit, 2006). This is because the demand for heat during the day and seasonal. Herein acts geothermal energy as a main source of heat, which has a high degree of utilization (Vlaar, 2013). In cold days geothermal energy will not be enough to catch up the heat and auxiliary boilers will be enabled.

The geothermal scenario we assume an optimal use of the geothermal system in terms of coverage and utilization, based on data from TNO. In this scenario, we use a combination of a boiler, geothermal and heat buffer. In this case, the number of full load hours amounts to 4936 for the geothermal heat source (10 MW), and 684 for the boiler (9.8 MW). The funding for geothermal energy is thus 87.1% with a 56.3% utilization rate (Janssen et al., 2006). Environmental effects of geothermal system based on field data from a Dutch geothermal plant in Westland (Gonzalez, 2013). This is the amount of steel, cement and electricity for the installation of a 9.7 MW installation included, as are electricity (325 kWh per hour). Gross energy production and full-load is adjusted to the optimal geothermal scenario TNO (4936 rent rather than 7000 hours per year). The remained

12.9% coverage is ensured by the boiler.

Effects of natural gas / methane 'bycatch' are not captured during the process. Amount of by-catch is different per well. In addition, for the generation of additional heat and electricity, the catch may be used, which creates an allocation issue.

Share cropping for Dutch pepper cultivation

Exact figures for share of different cultivation systems for Dutch peppers are missing. However, there are figures available for the Dutch horticultural sector as a whole (Fields & Smith, 2015). It indicates that there is at the end of

2014 CHP plants have been applied to 6730 hectares of greenhouses, representing 71% of the greenhouses area. Geothermal heat has been widely used sector on 445 hectares, of which 90% in vegetable cultivation, or 9% of the vegetable horticultural areas. These figures have been adopted in the ratio of Dutch average. Remaining area that is connected to other renewable energy sources such as solar energy (229 ha) and biofuels (136 ha) are disregarded. It is assumed that the remaining 20% of the vegetable acreage is fired boiler.

Spanish paprika

Although the Spanish paprika in both greenhouses, tunnels are grown in open ground, there is only one scenario developed. Reason for this is that there is insufficient data available for the different crops and that there is less of a difference is expected in environmental impact between the various systems. In addition, just over 80% of Spanish paprika production site in glasshouses and / or tunnels (Eurostat, 2018). It is assumed that 100% of the crop does not occur fired tunnels. Most of the energy in the greenhouse and tunnel cultivation in Mediterranean countries is being used for ventilation, 70,000 kWh / ha (FAO, 2013). NPK fertilizer based on Spanish culture (Berrios et al., 2007).

Israeli peppers

Israeli scenario is mainly based on the Spanish way of cultivation, since data are missing for various production systems. Here, too, it is non-heated tunnel cultivation was adopted with ventilation. Fertilizer use is based on recommended amounts of NPK for Israeli culture (Haifa, nd).

C4 Green Bean

Overview of the main parameters for modeling the production phase are shown in Table C3. All average yields for each crop are based on data from FAO stat, except those used for the comparison of organic and conventional grown green beans, which are based on data from KWIN-AGV (Wageningen, 2015). Sources on the fertilizer gifts can be found in the appendix. Diesel used for African countries is based on Jones (2006), Dutch crops based KWINAGV.

Table C3 The most important parameters for modeling phase cultivation of green beans

country	Yield (kg / ha)	N (kg / ha)	P ₂ O ₅ (kg / ha)	K ₂ O (kg / ha)	Diesel (l / ha)
The Netherlands	8863	130	0	70	108
Morocco	19679	70	60	80	12.3
Kenya	10676	70	60	80	12.3
Egypt	10370	36	71	57	12.3

APPENDIX D

CONTRIBUTION ANALYSIS CASE STUDIES

For each product is examined which processes contribute most to the three environmental impact categories. Each is broken down by the production in these blocks, in order to determine the contribution:

- growing Stage
- Warehouse (warehouse) - transporting products to Netherlands
- Packaging (sensitivity analysis for bananas and peppers)
- Distribution - transport and energy
- Convenience store
- Consumer - preparation of the product

Contribution percentages representing be going over the total of the product.

D1 Strawberry

The contribution analysis of strawberries is based on the Dutch market mix of strawberries packed in cardboard boxes. It is assumed that the product is consumed fresh. Results of the analysis of strawberries are to be found in Figure D1.

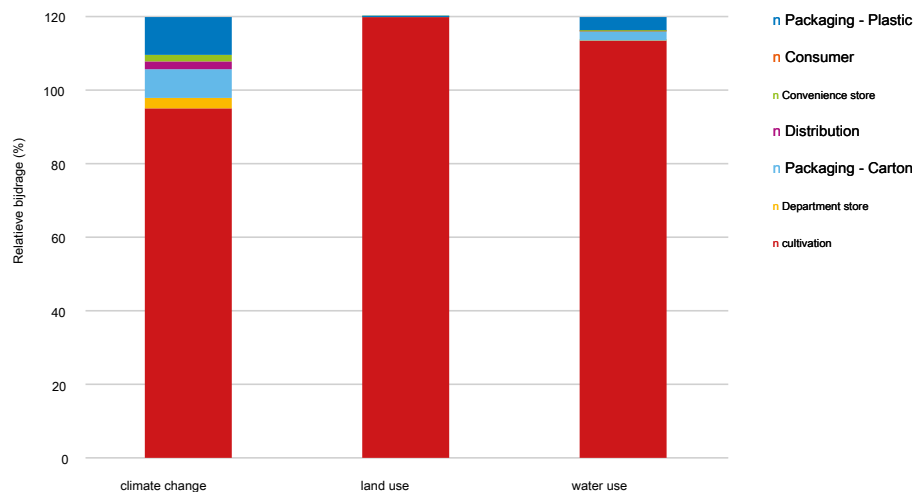


Figure D1 Contribution analysis of the consumed fresh strawberries packed in cardboard boxes

Important contribution for all categories included impact comes from the production phase of the strawberry. What stands out the strawberry is that packaging has a relatively large impact on the carbon footprint of the product. This can be explained because in relation to the product used relatively much packaging per kg of product. And that has to do with a relatively fragile strawberries

product. Impact of transport is lower than, for example, green beans, because less product is flown, and because the distances are shorter.

D2 Banana

The contribution analysis of bananas is based on the Dutch market mix of bananas transported in cartons, packed in plastic bags. It is assumed that the product is consumed fresh. Results of the analysis of bananas can be found in Figure D2. For the contribution analysis, there are two packings distinguished from each other in order to determine the relative contribution of the plastic bag with respect to the whole banana chain.

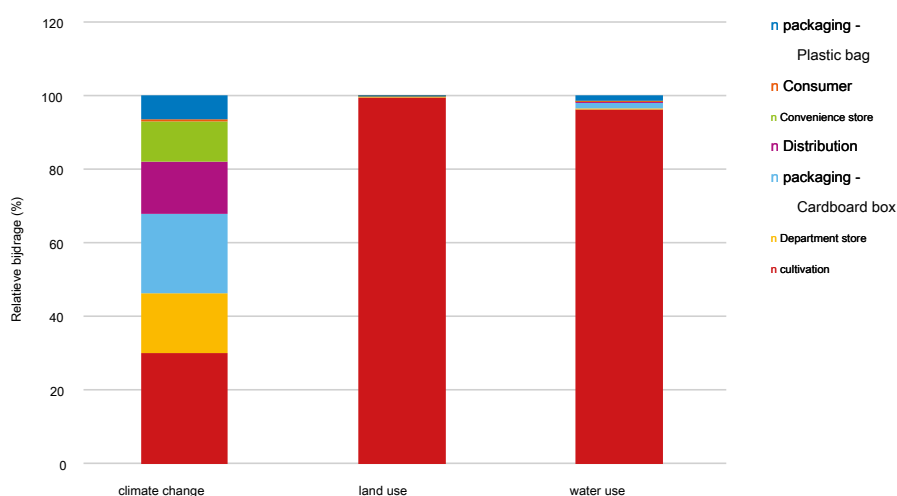


Figure D2 Contribution analysis of consumed bananas wrapped in plastic transported in cardboard boxes

Land use and water is the most contribution from the production phase of the banana. Climate Change deliver multiple processes that deliver relatively high contribution. About 25% of greenhouse gas equivalents caused in the production phase. Like green beans, the contribution of the production phase is relatively low. Admittedly much fertilizer is used in the production phase, but because returns for bananas high emissions are spread over many bananas. Transportation is about 16% of the impact, despite transport by boat. This is because the cultivation nevertheless takes place far from the Netherlands and contribution of the crop is relatively low. Also, the cardboard box in which bananas are transported has a high impact on the entire chain. Per kg product has 70 grams box so a relatively large effect on the entire product chain. The plastic bag that has been used for the extra packaging of bananas provide for 7% of the total GHG emissions in the whole chain.

D3 Paprika

The contribution analysis of peppers is based on the Dutch market mix of peppers wrapped in plastic. It is assumed that the product is consumed raw. Results of the analysis of peppers can be found in Figure D3. For peppers added an additional category: substitution. This includes the surplus electricity generated during, effects thereof may be deducted from the system, which leads to a negative contribution. Substitution is included only for peppers as this for other products is not appropriate. This contribution analysis will immediately answer the question whether the plastic bag of pepper is demanding in relation to the rest of the product chain.

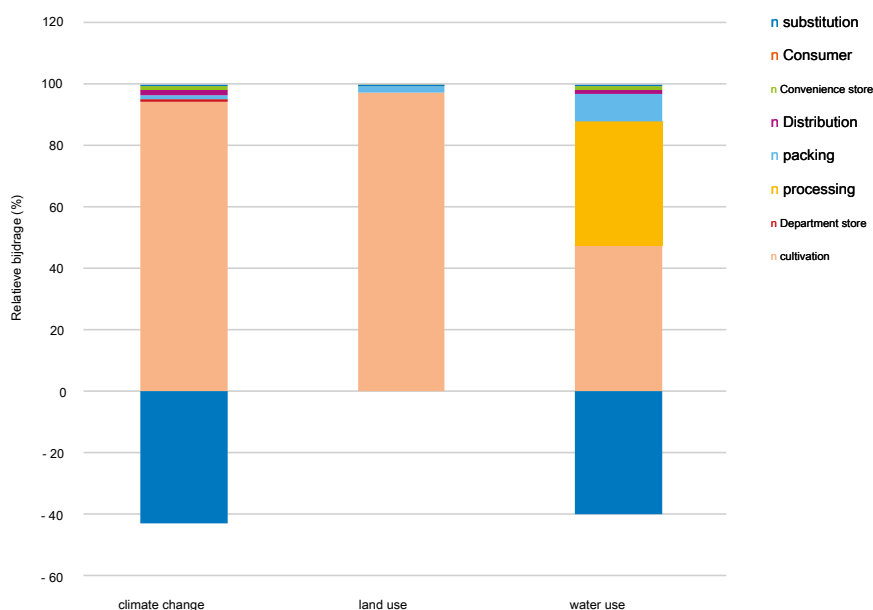


Figure D3 Contribution analysis of consumed paprika wrapped in plastic

Growing Stage of the product is the most damaging stage in the chain of paprika. A whopping 95% of greenhouse gas emissions, 98% of land use and 47% of water use are the result of growing the product. Another striking feature is the relatively large contribution of surplus electricity cogeneration fired greenhouses, although 57% of the calculated pepper blend comes from CHP fired greenhouses, this part leads to significant reduction in the supply chain as a whole. For water, the washing of the product is also a relatively large contribution, but that is partly because the amount of irrigation water during cultivation for relatively low. If we look at the influence of the plastic bag, the production of the raw material, thermoforming and processing of the plastic as a whole, the influences are relatively low. On climate change, the contribution of packaging slightly higher than 1%, 2% for land use and water use almost 9%. The latter is again due to the relatively low impact of water in the entire chain of paprika.

D4 Green Bean

The contribution analysis of beans is based on the Dutch market mix of fresh green beans wrapped in plastic. It is assumed that the product is consumed after the preparation (cooking). Results of the analysis of green beans is to be found in figure D4.

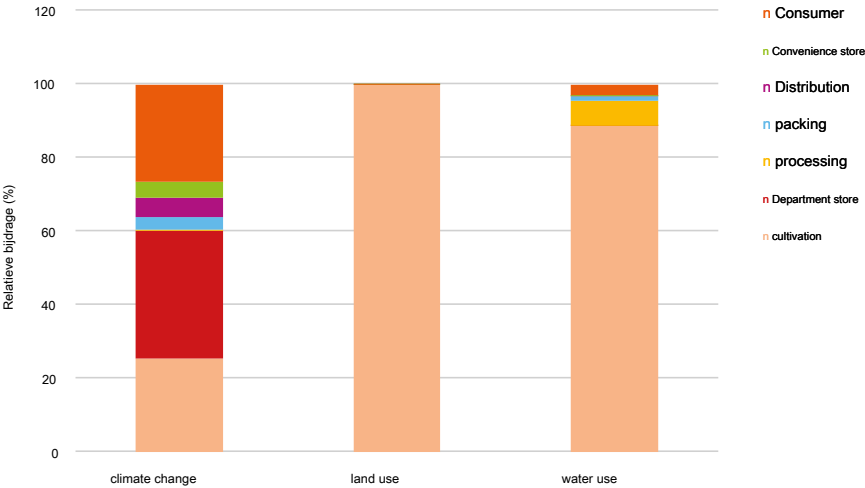


Figure D4 Contribution analysis of cooked consumed fresh green beans packed in plastic

Dues profile fresh beans looks different than sweet peppers. What stands out for climate change is that the influence of the warehouse (storage) is large. This phase includes transportation to the various countries to the Netherlands. Impact of transport is particularly very high for Kenyan beans, as was shown in section 2.4. Impact of transport can be significantly reduced if the products are not flown. Also, the relatively high impact on consumers. This includes energy needed for cooking vegetables, such as natural gas and electricity. Land use and water is the most important contribution of the growing phase. Although using the same amount of water for washing the product as peppers,

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