Reduction in the use of plastic in the packaging of fresh fruit (apples) and fresh-cut products

Summary

Plastic is the most widely used material for food packaging, as it is cheap and has multiple shapes and uses. However, the material does not decompose and therefore poses a serious risk to the environment. An estimated 8.3 billion tonnes of plastic and other synthetic materials have been generated since the 1950s, of which only 9% have been recycled and 12% incinerated, while 79% has accumulated in landfills or in the environment. The food sector is one of the major users of plastics to maintain organoleptic qualities and protect food from microbiological contamination. In the case of fruit and vegetables, packaging in individual portions or bags serves to divide up servings for consumption and improve practicality, avoiding the wastage of bulk packaging on the shelf. In addition, the rise of pre-prepared or minimally processed products on supermarket shelves has been accompanied by an increase in packaging. The solution to the use of plastic must therefore be cross-sectional, as it is not only a question of finding an alternative material but also of trying to reduce the amount of waste or increase the use of recyclables. However, whatever the solution, it must be incorporated into the production system and must therefore be compatible with current packaging machinery and, above all, must not harm the fruit and the minimally processed product so that it preserves the product in a similar way to plastic packaging.

Objectives

The main objective was to assess the impact of the use of plastic packaging and plastic elements on the marketing of fresh fruit and strategies to reduce, recycle or reuse these plastic elements or replace them with other non-plastic materials. In addition, this project also assessed more sustainable packaging alternatives for pre-prepared convenience products to replace the materials currently in use.

The following specific objectives were established in order to achieve this overall objective:

1. Assessing and quantifying the use of packaging and plastic elements in the packaging of fresh fruit (apples).
2. Studying strategies for managing and reducing the use of these plastics with fresh fruit in two regards: reduction and reuse.
3. Proposal of alternatives to plastic materials for marketing fresh quality apples and for packaging fresh-cut fruit and vegetables.
4. Studies to verify that the proposed alternative packaging is capable of maintaining the characteristics of the fruit with regard to mechanical protection and conserving the cold chain in the case of selling fresh products and the quality and shelf life of pre-prepared food products.

Description of the actions carried out in the project

The following actions were carried out:

- **Action 1**: Assessing and quantifying the use of packaging and plastic elements in the packaging of fresh fruit (apples). A detailed study was carried out on the types of apple packaging used in the IGP Poma de Girona plants: packs, trays, bags, stickers, etc.
- **Action 2**: Study of the strategies for the management and reduction of the use of these plastics in fresh fruit (apples) approached from two perspectives: reduction and reuse. New, more sustainable and contemporary 4-piece cardboard packaging was designed to replace traditional trays. The amount of reusable packaging (IFCO system, EUROPOOL, etc.) used by the IGP Poma de Girona companies was also analysed

- **Action 3**: Assessing alternatives to the use of plastic materials for marketing fresh quality apples and for packaging fresh-cut fruit and vegetables. The first action was to review all the alternatives available to the packaging companies in the area that include biodegradable, compostable and/or 100% recyclable materials for fresh fruit and fresh-cut companies.
- **Action 4**: Once the alternatives had been selected, studies were conducted to check that the proposed alternative packaging was capable of maintaining the characteristics of the fruit in terms of mechanical protection and maintenance of the cold chain, in the case of fresh sales, and quality and shelf life for pre-prepared convenience food products.

Final results and practical recommendations

IGP Poma de Girona:

1. During the course of the project, different alternatives to replace this format were evaluated. Firstly, self-standing 4-fruit cardboard trays were designed with a design company. In addition, a stretch film with EN 13432 domestic and industrial compostable certification was assessed and showed good transparency, elasticity, breathability and mechanical resistance. Finally, a compostable cellulose netting in reel format was tested for packaging baskets with a similar strength to the current plastic, being soft to the touch and usable with the same machinery.
2. Two possible bags were tested. (1) Compostable bags proved not to be sufficiently transparent and not strong enough when in cold storage for more than 14 days; (2) PLA (polylactic acid) bags plus kraft paper. The Vision Bag provided a better view of the product, had good resistance and could be kept in cold storage for up to 30 days without breaking. These bags allow the product to be packaged at ambient and cold temperatures. However, after the bags reached their shelf life expiry date, there was greater product weight loss as they are more permeable to water.

Ametller Origen Obradors:

The search for new materials to replace plastic elements in fresh-cut salads produced two developments:

1. In the case of farfalle salads and grilled vegetables, the old packaging (bowl and PET insert with a multilayer film, non-recyclable bowl and plastic fork) was replaced by packaging with a compostable tray made of sugar cane waste, a wooden fork and paper band, with a recyclable PET lid and dressing pot. With this new design, the ingredients had to be redistributed to improve conservation and the shelf life was cut to 3 days, as the packaging became very stained and had a damp appearance.
2. For mixed salads (classic, goat's cheese, chicken, pasta, *xató*), the salad bowl and PET insert with fork and plastic label were replaced with new packaging with recyclable material (R-PET) and mono-material film, but a cane waste band and wooden fork were also introduced. The problems that had to be overcome were: (a) problems in finding a fork that could fit properly into the insert; this had to be thicker and the fork was not fully functional; (b) single layer films are not as compatible with the R-PET and therefore type had to be tested to ensure correct sealing and peelability.
3. Environmental quantification using the LCA tool made it possible to provide an indicative value of the environmental impact of each of the different types of packaging. It should also be noted that the impact of the entire value chain of the specific product was calculated and the impact in 16 different environmental categories was estimated (based on the recommended PEF initiative methodology).
4. In the case of fresh-cut salad bags, the eco-design of a PP bag with less plastic material was carried out, concluding that reducing the material containing 0.00257 kg less plastic maintains the product

quality characteristics and the same shelf life for all salads as with the initial film. This change was introduced in products marketed by Ametller Origen Obradors.

5. Two new compostable packages were assessed, one based on kraft paper and PLA film and one on translucent paper. The results with fruit and fresh-cut shoots were not satisfactory, as there were difficulties caused by these products having a certain water content, despite having a coating on the inside. However, an assessment of doypack-type paper bags for nuts such as walnuts and almonds provided favourable results in terms of logistic performance, final product quality and consumer appreciation.

Conclusions

IGP Poma de Girona:

1. The pack most commonly used by apple companies is the Cellulose Traypack in +/- 55 g. It has almost completely replaced plastic packs.
2. In the case of unified sales, the sale of flow trays is still very common, and the plastic used to cover the tray is BOPP.
3. Plastic bags with a unified weight, either 1 kg or 2 kg, are also widely used by the three IGP companies.
4. The three IGP Poma de Girona companies use reusable plastic crates (IFCO, Europool or LogiFruit) that are managed by third-party companies responsible for their collection, cleaning and return to the plants via reverse logistics. Although the system is highly sustainable, it is not suitable as a single sales system, as a major part of the packaging function is lost: communicating the brand and origin of the product.
5. The product boxes used by the three companies are made of cardboard (for Giropoma and Fructícola Empordà) and wood (GironaFruit), so the companies have stopped using plastic in the product boxes in lost packaging and use sustainable materials.

Ametller Origen Obradors:

6. According to the study results, container 4 “E2-ACfinal” appears to be the best option in most environmental categories. According to the study methodology and results, the environmental categories of fossil fuel depletion, climate change and mineral resource and metal depletion produce the greatest total environmental impact, followed by freshwater ecotoxicity, microparticle formation and freshwater eutrophication, which produce a lower impact. Together, these make up more than 80% of the total impact of the packaging considered the best option. However, it should be remembered that there are certain limitations in the secondary data and the methodology used, which still has methodological shortcomings and is in the process of being improved.

Leader of the Operational Group

ORGANISATION: IGP Poma de Girona

Coordinator of the Operational Group

ORGANISATION: IRTA - Institute of Agrifood Research and Technology

Other members of the Operational Group (grant recipients)

ORGANISATION: Ametller Origen Obradors, SL

Other members of the Operational Group (not recipients of the grant)

ORGANISATION: -

Geographical area(s) of application

PROVINCE(S)	REGION(S)
Girona	

Dissemination of the project (publications, conferences, multimedia, etc.)

The results were communicated and disseminated at annual meetings with the participating companies, and at the IRTA Postharvest Conference in 2022, where Ms Natalia Alos gave a talk on "Sustainable Packaging: Challenges to be met" where the results of the operational group were presented.

Project website

More information on the project

PROJECT DATES	TOTAL BUDGET
Start date (month-year): July 2020	Total budget: €81,965
Completion date (month-year): September 2022	DACC funding: €33,497
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	Own funding: €23,198

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