

Introduction

Packaging has an important role as it protects products, minimises waste and can reduce the carbon footprint of the produce. Packaging will however also become a waste product and this can be of environmental concern. Packaging fulfils the following roles:

- Protecting the integrity of products – preventing damage and contamination.
- Enables transport and handling during manufacture.
- Prevents deterioration.
- Product identity and branding.
- Provides information in the product.

Fruits and vegetables undergo a ripening process which ultimately results in ageing and breakdown of plant tissue. Product respiration consumes oxygen and expels carbon dioxide. Lower temperatures will slow down this process. At low oxygen concentrations the breakdown of the product occurs more slowly but if oxygen content becomes very low, the product will perish. A build-up of CO₂ can cause an acidic taint in produce. The impact of packaging manufacture on the environment therefore needs to be balanced against preventing deterioration in produce quality and the subsequent waste.

Types of Packaging

Packaging can come from goods brought onto the farm. It generally falls into three categories –

- Primary packaging - often used in direct contact with the goods e.g. plastic bottles.
- Secondary packaging – used to contain another packaged product e.g. cardboard box.
- Tertiary packaging – used to move goods e.g. pallets, shrink wrap.

When optimising packaging, the use of recyclable materials and decreasing the amount of packaging used is important. Packaging also needs to prevent waste from going to land-fill, so food can be kept fresher for longer, reducing spoilage and the subsequent carbon footprint.

Certain types of packaging are more sustainable than others. Wood used to make packaging can be viewed as a sustainable material. Trees absorb carbon and wood will therefore store carbon. Well-managed forests will produce a greater yield of wood per hectare and will increasingly absorb CO₂ from the atmosphere. If this product is sourced from renewable woodland, it can lower the environmental impact. It could therefore be classed as having a beneficial effect and reduce the carbon footprint.

There are a number of plastic packaging types – see table 1.

Packaging type	Use
Polyethylene terephthalate (PET)	Used for bottles and trays and this flexible film in pouches
Polyethylene (PE)	Used in a variety of formats – bottles lids sealing layers in trays.
Polypropylene (PP)	Used in bottles, trays, thin flexible film in pouches
Polystyrene (PS)	Used for yogurt pots, vegetable punnets.

Polyvinyl chloride (PVC)	Used in trays and pots.
Polyamide (PA)	Used as a flexible film for barrier properties

Table 1. Different types of plastics (plastic polymers) used in packaging

Disposable packaging offers a low carbon alternative for the food industry. Eco-Friendly disposable packaging has a lower carbon impact as it reduces waste and costs. Manufacturing bio-plastics will use less energy than traditional plastics with plants having absorbed CO₂ through their growth, which is then maintained within the product. Bioplastics are made from plants and these can include wheat, soya, tapioca, cornstarch or even algae. Biopolymers used in some types of packaging include natural and renewable polymers, see table 2.

Type of polymer	Description
Biodegradable	Biodegradation occurs when the polymer is broken down into simpler compounds.
Compostable (domestic or industrial)	Means that a biodegradable polymer will biodegrade and disintegrate under standard test conditions
Degradable	These are polyethylene oil-based polymers. These are not from a renewable source and contain additives that help the acceleration of the degradation process. These will not degrade in a land-fill site

Table 2. Polymer types used in packaging

A packaging system will maintain correct temperatures, gas mixture and moisture in order to maintain or extend the shelf-life of the product. Modified Atmosphere Packaging (MAP) is used for ready-prepared produce and chopped vegetables. It has elevated CO₂ concentrations, limiting oxygen with N₂ filling the remainder of the space. It prevents products perishing, extends the supply chain and has environmental benefits.

Packaging that is biodegradable or compostable will benefit the carbon balance of a farm operation. Having said this, there is some argument that compostable polymers release GHGs as they decompose. The lowest carbon footprint, therefore, will be packaging that is minimally processed and as close to its original form as possible, for example, cardboard boxes and paper bags.

Recycling Packaging

Recycling packaging will have environmental benefits. It will prevent waste ending up in landfill sites and reduce the extraction and the use of new raw materials. This will mean less energy and less carbon dioxide produced, reducing global warming. For packaging to be recyclable it will need to be made of one type of material and the means of separating components should be as easy as possible. Packaging that includes recycled content, will reduce the energy needed to make further packaging.



Waste from packaging will add to the amount of material for landfill. These materials will include plastics, paper, glass and metal. Waste collection and recycling facilities can be used for materials such as glass, metal, cardboard and wood. Packaging such as paper and card can be composted as required. Packaging waste must be biodegradable and not interfere with the composting process. Packaging that minimises environmental impact will usually comprise a minimal amount of material, maximise what can be reused/recycled, and use materials with recycled content.

Benefits of Optimising Packaging

Lower packaging costs can have benefits for business, save money, increase profits and have environmental benefits. Responsible packaging can also have a positive effect on the consumer and meet legislative demands to reduce and recycle packaging. Smaller more efficient packaging can also decrease distribution costs. At the same time, the environmental impact of certain commodities can be reduced by actually increasing the packaging of the product, such that it lasts longer, doesn't degrade and does not affect the environment. It is therefore important to look at each product line individually and make decisions that take both sides of the argument into consideration.

The disposal of waste will also be important in assessing its carbon impact. Packaging will either be re-used, recycled, composted, incinerated or land-filled. The last two of these options have the greatest environmental impact with waste breaking down to carbon dioxide and methane contributing to climate change. Packaging can be burned to generate heat but this might result in the production of gaseous pollutants. Re-usable packaging will have the advantage of less materials being sent to landfill but it will need to be made of robust materials. Points to be considered for re-usable packaging are that it is clean, free from contamination, easy to empty and refill. Packaging waste and disposal is therefore key to reducing GHG emissions on farm.

There are some key areas to consider in order to make improvements.

- Reducing packaging coming on to the farm and being used.
- Re-using and recycling packaging where possible.
- Disposing of packaging correctly.



Conclusions

- Packaging provides a vital role in preserving produce, preventing spoilage and optimising food security. The packaging choice can have a big influence on the farm operations
- Different types of packaging are suited to different products for storage and transportation purposes. The correct choice will help efficiency of packing operations.
- The disposal of certain types of packaging is an increasingly important aspect of environmental concern. The use of packaging needs to be considered carefully, as well as disposal routes and potential environmental impacts
- Reducing the amount of packaging should be balanced with optimising the preservation of produce and reducing spoilage and subsequent land-fill.

Policies and Legislation

Packaging of food is important in maintaining food security. *EC Directive on Packaging and Waste 94/62/EC amended by Directive 2004/12/EC* was introduced to create a single market for packaging and to increase recycling and recovery rates. It requires that all packaging meets certain requirements.

The *EC Directive on packaging and waste – 94/62/EC amended by Directive 2004/12/EC* was introduced to increase recycling and recovery levels across the EU. This requires all member states to ensure that a minimum of 60% of all packaging waste is recovered.

The *European Packaging and packaging waste Directive 2004 (2004/12/EC)*, published in 2004, dictates that: A minimum of 60% of all packaging waste must be recovered including any that is processed in incineration plants to recover energy and that 55-80% of all packaging waste must be recycled.

Note: Revised EU legislation is being proposed for 2014

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