

## INDUSTRY SUMMARY

# The role of packaging for Australian fresh produce



# Australian Fresh Produce Alliance Executive Summary

The Australian Fresh Produce Alliance (AFPA) has released research by RMIT University on the role of packaging for Australian fresh produce, which highlights that packaging plays an important role in addressing food waste in the supply chain and increasing product shelf life.

The research was commissioned by the AFPA and was aimed at examining and understanding the role packaging fulfils in minimising food waste, and maximising quality control in order that Australian consumers can eat fresh quality produce on a regular basis.

The Alliance recognises there is concern about the level and type of packaging that is used for fresh produce. As the research demonstrates, there are practical reasons for using packaging for certain fresh produce, whether it be to ensure product integrity in the supply chain, extend shelf life and/or avoid food waste.

The main findings were that:

- Packaging of fresh produce does help to avoid and reduce food waste, by protecting the integrity of the product in the supply chain;
- Packaging increases and extends produce shelf life from farm to plate compared to having no packaging at all;
- Packaging material and packaging formats should work synergistically to provide product protection and shelf life as it travels through the supply chain and
- Packaging reduces the chances of product bruising or damage through reducing direct touching and handling.

This research is also important when considering that an estimated 7.3 million tonnes of food valued at \$20 billion is lost or wasted in Australia every year. This waste is occurring at a time of growing rates of obesity in our adult and child population due to poor dietary intake of fresh fruit and vegetables, leading to the development of preventative and chronic diseases amongst the population, including type 2 diabetes.



The research also identifies a number of key recommendations focused on further work, including:

- a better understanding of food waste that occurs in the home post retail purchase;
- education for consumers on the role of packaging and why it is used for certain types of fresh produce;
- a focus on a 'circular economy' approach to packaging, involving producers, retailers and government coming together to identify ways in which to reduce packaging waste and improve recycling and reuse;
- further work on clarifying the value of packaging in product safety, with an emphasis on 'ready to eat' fresh produce and
- the extent to which packaging plays a role in maintaining and enhancing sensory aspects of fresh produce, such as look, taste and smell.

The Alliance also recognises that it must work to reduce packaging where it reasonably can and to identify forms of packaging which provide greater opportunity for not only recycling, but also the manufacture of plastic packaging from recycled content. This is definitely an area where the AFPA intends to do more work.

RMIT University is one of Australia's largest Universities and is considered a leader in technology, design, global business, communication, global communities, health solutions and urban sustainable futures. Empauer is a leading sustainability consultancy focussed on providing organisations with information to make better decisions, convert those decisions to actions, and deliver the business outcomes they desire.

# Summary of RMIT Research

The research aimed to examine and understand the role that packaging fulfils in minimising food waste, and maximising quality control and the associated benefits.

The project was specifically concerned with the following:

- Mapping the life cycle of 10 fresh produce items, both with and without packaging. Specifically, this included describing the food supply chains, and projecting/estimating the shelf life of produce which is extended due to packaging, compared to the shelf life without packaging i.e. sold loose
- Describing product diverted from landfill as a result of packaging, and product going to landfill as a result of no packaging.

## Use of packaging – product protection/reduce food waste/extended shelf life

The main features of packaging are to:

- **Protect** the content of a package: features include mechanical, barrier and sealing properties;
- **Facilitate handling:** features include openability, resealability; and
- **Provide communication:** product information and instructions, including storage and preparation.

Product protection should be the **primary goal of packaging** as food waste generally accounts for a larger proportion of the life-cycle environmental impacts of the food-packaging system.

The packaging material and packaging format should work synergistically to create a situation that is conducive to **product protection and good product shelf life** as it travels through the supply chain

In Australia, it is estimated that **\$20 billion** worth of food is lost/wasted per annum (Lapidge, 2015). New figures recently released estimate that **7.3 million tonnes annually of food** were lost and wasted across the entire Australian supply and consumption chain (**298 kilograms per capita**) (ARCARDIS et al., 2019)

**Cold supply chains** were identified as integral to preserving product in the life cycle of produce. Australia needs sophisticated cold chain technology because of the long geographical distances produce must travel. The interaction of packaging and the cold chain was also seen as critical to extend shelf life and minimise waste in many instances.

It was clear that new **packaging formats assisted in the establishment of new markets** for previously out of specification produce, such as oddly shaped or smaller produce (ie. bananas, apples and pears).

Packaging played a role in getting this product to market and aligning that product with target audiences to further reduce food waste.



## Summary of RMIT Research continued



### Value of providing access to fresh produce – dietary intake/health and well being/food safety

Despite the known benefits, consumers do not take in sufficient quantities of fruit and vegetables. The latest National Health Survey found that **just over half (51.3%)** of Australian adults met the guidelines for the recommended minimum 2 daily serves of fruit (Australian Bureau of Statistics, 2019)

Over recent decades the rates of chronic disease, including type 2 diabetes, have been increasing both in adults and children (Obesity Policy Coalition, 2018). It is predicted that, by 2023, health expenditure for type 2 diabetes will have risen **\$1.4 billion to \$7 billion per year**, due mostly to increasing weight gain (National Health and Medical Research Council, 2013).

If current Australian trends continue, an estimated **83% of men and 75% of women aged over 20 years will be overweight or obese by 2025** (National Health and Medical Research Council, 2013). Therefore, it is important to utilise strategies which ensure access to food that is nutritious, both for the individual and in addressing broader public health issues.

A primary objective of food production is to ensure a safe and acceptable product to be delivered to market.

Packaging may serve to transport nutritious produce, such as fruit and vegetables, safely to consumers all over Australia with minimal waste. If people are to consume more fruit and vegetables and in turn reduce their risk of contracting chronic diseases, it is therefore important to provide consumers with a product which is of a high quality and maximises its shelf life. This pursuit is diminished if there is food waste.



## Role of packaging in reducing food waste

The trade-off between food waste and packaging is a delicate balance; more packaging can result in less food waste and therefore less impacts, but the impact of this extra packaging must also be taken into account to develop the most sustainable packaging-to-food ratio (Verghese et al., 2015).

Product protection should be the primary goal of packaging, as food waste generally accounts for a larger proportion of the life-cycle environmental impacts of the food-packaging system (Verghese et al., 2012). It has been estimated that, on average, packaging accounts for only 10% of the total energy inputs for a person's weekly consumption of food (INCPEN, 2009). The other 90% of energy inputs is in food supply, transport, storage and cooking. This highlights the important role packaging plays in product protection, making sure this energy input is not wasted.

While packaging and the products contained within will both have environmental impacts, the most sustainable product-to-packaging ratio often results where **product protection is favoured over reduced packaging that puts a product at risk of damage.**

## Role of packaging in extending shelf life with effective cold chain management

Plastic packaging can be beneficial to shelf life when combined with cold storage

While plastic packaging can assist in protecting food, there is a flip side. Poor cold chain management of produce packaged in non-permeable plastic film can promote accelerated ripening and degradation due to trapped respiration gasses and moisture, resulting in higher spoilage rates (FAO, 2018a, FAO, 2018b)

Maintaining storage at an appropriately low temperature is therefore key for maintaining freshness of fresh produce packaged in plastic. This is further supported by (White and Stanmore 2018), with an average of 7-14 days of extra shelf life reported for produce stored at  $<5^{\circ}$  compared to  $22^{\circ}\text{C}$ .

Modified Atmosphere Packaging (MAP) has been recommended by various organisations such as the Food and Agricultural Organisation of the United Nations and US Flexible Packaging Association as a way to minimize physiological disorders in fresh fruits, thereby minimising fresh produce loss and waste (FAO, 2018a, FAO, 2018b, McEwen, 2014).

The use of modified atmosphere packaging has been documented since the late 1970s as a way to improve the shelf life of fresh fruits and vegetables by regulating humidity and concentrations of certain gasses (McEwen, 2014, Zagory and Kader, 1988). MAP systems are commonly constructed from permeable polymeric films, where optimised gas permeability leads to increased shelf life.



# Summary of RMIT Research continued

## Consumer behaviour and food waste

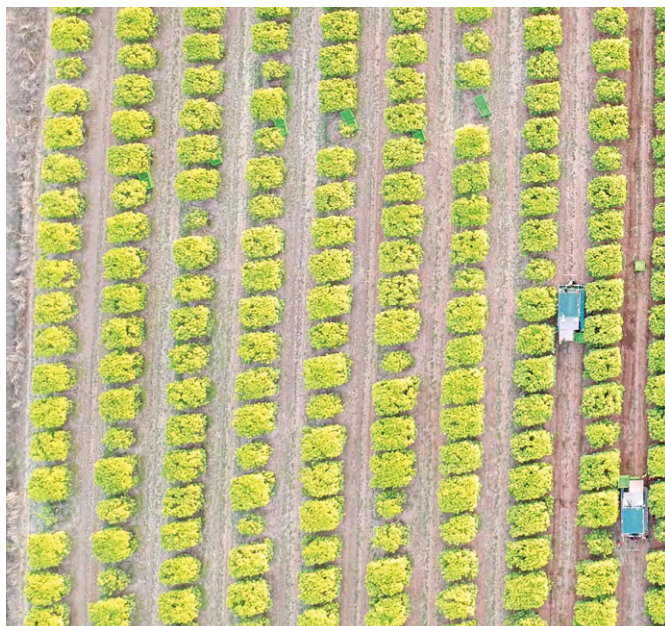
Consumer choice to eat or waste food is affected by packaging's ability to retain freshness, packaging size, accessibility to food within packaging, and visual communication cues found on packaging such as traditional date labels and colour changing freshness indicators.

Fit-for-purpose packaging that protects produce can only be beneficial if it is kept intact. Studies have found that many consumers do not recognize that packaging protects food in the home, which in turn leads many consumers to adopt strategies that potentially decrease the longevity of products, leading to unnecessary waste. This includes taking products out of their packaging or piercing the packaging (McEwen, 2014, Plumb et al., 2013), or consumers perceptions that unpackaged food is fresher than packaged products (Fisher, 2018).

For fresh produce that consumers are unwilling to finish, packaging's role in retaining freshness plays a part. A case study of bread in Norway showed that consumers were least likely to eat bread that they perceived as un-fresh. Therefore, packaging that prevented bread from going stale for longer facilitated the consumption of the entire loaf, thereby minimising food waste (Svanes et al., 2018)

Visual information is often relied upon for determining the quality and perceived freshness of fresh produce, influencing the decision as to whether it should be eaten or thrown out.

Intelligent packaging systems could reduce the amount of food being thrown out due to uncertain judgment and assessment of produce quality. Intelligent packaging systems monitor and communicate the quality of produce in real-time, making it easy to quickly and effectively judge if food is fit for consumption, for example if food is contaminated by pathogenic microbes (Francis et al., 2012).



## Summing up packaging effects on fresh produce waste and loss

- The beneficial effects of packaging on fresh produce waste and loss cannot be ignored.
- Packaging can extend the shelf life of produce if it is tailored to the needs of the fresh produce type.
- Packaging that encourages unfavourable storage environments leads to spoilage of fresh produce.
- Apart from suitable packaging, maintaining an appropriate storage temperature is key where cold environments are favourable to longer shelf life.
- The proportion of packaging compared to food product, and potential waste with no packaging, should also be considered regarding respective environmental impacts.
- Other consumer related behaviour should also be considered – such as the detrimental effect of protective packaging being removed, importance of perceived freshness and clear communication on edibility.
- The literature supports the principle that appropriately designed packaging environments play a role in preventing fresh produce waste and loss. Additional research is needed to flesh out numerical data gaps on the food waste effects of packaging versus no packaging.

## Reducing food waste versus the impact of packaging on the environment

With the rise in community demand for a reduction of packaging that impacts the environment, consumers are looking to source packaging that meets these standards. However, this poses a challenge as materials, such as plastic, are fit for purpose for many elements of extending shelf life. Therefore, such a shift in packaging materials/ formats can come with several wins, or alternatively trade-offs.

While there remains significant research to be done, where practicable, identifying suitable alternatives to plastic, or ways to use less plastic including recycling of plastics, is a valid pursuit.

The environmental credentials of such a move should be verified with life cycle assessment, as what is perceived as a good environmental choice does not always end up to be so.

It is evident that consumer and industry education about the balance between packaging that reduces the environmental impact of food waste, compared to reducing packaging environmental impacts, is both lacking and overdue.

## Consumer Education

Even if packaging has been designed to help consumers store fresh produce for longer, knowledge of whether those packaging features are used beyond the chain of custody of the retail store is sparse. Consumer education may be the antidote to communicate the role of packaging in tackling food waste, as well as providing the opportunity for producers and retailers alike to engage more deeply with their customers about such issues.

## Recommendations for further research/work

The research also identifies a number of key recommendations focused on further work, including:

- a better understanding of food waste that occurs in the home post retail purchase;
- education for consumers on the role of packaging and why it is used for certain types of fresh produce;
- a focus on a 'circular economy' approach to packaging, involving producers, retailers and government coming together to identify ways in which to reduce packaging waste and improve recycling and reuse;
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## Mapping the life cycle of 10 fresh produce items

10 fresh produce categories, related packaging sizes, and associated packaging formats/materials were selected for investigation in this project. These categories were identified and selected by members of the Australian Fresh Produce Alliance (AFPA).

**Table 1 Fresh produce categories investigated in the study**

Produce	Packaging size	Packaging format/ material reviewed
Tomatoes (small snack pack)	200 grams	Punnet – PET
Mushrooms (cup & sliced)	200 grams	Punnet – PET
Raspberries	125 grams	Punnet – PET
Blueberries	125 grams	Punnet – PET
Leafy Salad	Various	Various
Cucumbers (small pack)	250 grams	Punnet with BOPP flow wrap – PET
Cos Lettuce (twin pack)	Twin pack	Pre-pack flow wrap – BOPP
Banana (kids pack)	750 grams	LLDPE flow wrap
Apples	Various	Various
Pears	Various	Various

Note: Materials: PET – Polyethylene terephthalate; BOPP – Biaxially orientated polypropylene; LLDPE – Linear low-density polyethylene;

To understand the role that packaging fulfils in minimising food waste, and maximising quality for fresh produce, this project was divided into 2 main stages:

- Life cycle mapping (including food waste), and
- Laboratory observations of fresh produce sensory aspects.



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