

# Helping Consumers Reduce Fruit and Vegetable Waste: Interim Report



A research project examining consumer attitudes and behaviour around storage of fresh fruit & vegetables in the home. Recommendations made as to how consumers and retailers can help to reduce the amounts of fresh fruit & vegetables thrown away in the home are based on a survey of current storage advice given, and an experimental research programme.

WRAP helps individuals, businesses and local authorities to reduce waste and recycle more, making better use of resources and helping to tackle climate change.

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**Front cover photography:** Fresh fruit & vegetables

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# Executive summary

Previous research by WRAP has revealed that 6.7 million tonnes of food is thrown away by UK consumers each year, equivalent to a third of food bought. Most of this could have been eaten, and 40% (by weight) of this avoidable food waste is made up of fruit & vegetables, worth almost £3 billion. Almost 90% of this fruit & vegetable waste consists of fresh produce, about 1.4 million tonnes, and most is thrown away as a result of not being used in time (before going off or out of date). For example the top five fruit and vegetables which get thrown away whole, without being touched are:

- Apples – 4.4 million per day
- Potatoes – 5.1 million per day
- Bananas – 1.6 million per day
- Tomatoes – 2.8 million per day
- Oranges – 1.2 million per day

The environmental, financial and health implications of so much fresh produce being thrown away makes this category one of the priorities for WRAP and the Love Food Hate Waste campaign.

WRAP issued an open call for applications to its Innovation Fund in March 2007, for projects that would help reduce the amount of food thrown away by households in the UK. This project, led by East Malling Research, was one of the successful submissions.

The objectives of the project were:

- Gaining information from consumers on how they currently manage the storage of fresh fruit and vegetables in the home, on the types of products that are commonly wasted and the reason for rejection.
- Assembling an easy to understand scale of relative perishability for different types of fruits and vegetables, to aid the consumer with best storage practice.
- Developing and testing simple methods to prolong the freshness of fruit and vegetables in the home.
- Reviewing the advice given by the major retailers to consumers about storage of fresh fruit and vegetables and suggesting improvements.
- Providing information to WRAP and retailers to advise consumers about methods to ensure they consume a higher proportion of the products they purchase.

The project team consisted of members from:

- East Malling Research (EMR) is an independent provider of research and consultancy serving the food chain and other sectors of the land-based industry. EMR builds on 90 years experience of successfully delivering cutting edge research and development. [www.eastmallingeresearch.com](http://www.eastmallingeresearch.com)
- Sainsbury's is a leading UK food retailer. [www.j-sainsbury.co.uk](http://www.j-sainsbury.co.uk)
- Reading Scientific Services Ltd is an independent laboratory carrying out scientific analytical analysis, product testing, product development, training and consultancy. [www.rssl.com](http://www.rssl.com)
- The Food Refrigeration and Process Engineering Research Centre at the University of Bristol is a multi-disciplinary R&D team of researchers, scientists, engineers and technologists providing expert solutions to the food (and associated) industries. [www.frperc.bris.ac.uk](http://www.frperc.bris.ac.uk)
- Mack Multiples Division sources fresh fruits, salads and vegetables from over 60 countries and supplies the UK's major multiple retailers. [www.mwmack.co.uk](http://www.mwmack.co.uk)

The project is not due to complete and report until June 2008 but findings from the early consumer and experimental research, together with the retailer survey, suggested that there was a need to highlight key findings as soon as practicable. For that reason WRAP issued two press releases in April 2008 (see [http://www.wrap.org.uk/retail/food\\_waste/index.html](http://www.wrap.org.uk/retail/food_waste/index.html)), and is publishing this summary of key findings.

## Key findings of the research

### Consumer research

This research was designed and executed with the objective of gaining information as to how consumers manage the storage of fresh fruits and vegetables in the home and to comment on the types of products that are commonly wasted and to determine why. The study had three parts: an attitude questionnaire; a daily diary of fruits and vegetables purchase, transport, storage and wastage over one week; and a spot check audit of fridge contents. 297 householders completed the survey, and 273 the diary. The fieldwork was carried out in August and September 2007.

- The diary revealed that 40% of fruit by weight is stored fruit in the fridge; 60% elsewhere (56% in fruit bowl). In comparison 75% of vegetables were stored in the fridge.
- The most commonly stated reasons for throwing away fruit and vegetables was that they were perceived to be mouldy \ slimy or 'off' in terms of appearance or texture.

In a separate piece of research WRAP commissioned Exodus Research to conduct 1001 telephone-based interviews to explore consumer behaviour around food storage ("Food Storage and Packaging, 2007"). This research found that:

- only 23% - 28% of people would store fruit in the fridge;
- 65 to 70% would store fruit in the fruit bowl; and
- 53% – 57% would store vegetables in the fridge.

Based on the consumer research undertaken by RSSL as part of this project we know where consumers are currently storing different types of fruit & vegetables. Comparing this to the recommendations based on the experimental research (and expert advice – see below), and knowing how much fruit and vegetables are purchased in the UK (from Defra's Family Food & Expenditure Survey 2005/6 (<http://statistics.defra.gov.uk/esg/publications/efs/default.asp>)) we can estimate that:

- At least 1.2 million tonnes of fruit & vegetables are being stored outside of the fridge that would benefit from being kept cool.
- Even if 5% of this could be eaten rather than thrown away that would mean 60,000t less waste.

Conversely there are fruits & vegetables, such as bananas and pineapples, that are best stored outside of the fridge, but the research revealed that some consumers were unaware of this. For example 6% of bananas were stored in the fridge – equivalent to over 40,000t.

### Survey of best practice storage and retailer advice

A literature survey was carried out to collate data that is available on commercial storage of fresh produce. This included sourcing data on optimum temperature, humidity to maintain freshness and other factors that are likely to impact shelf life e.g. ethylene production and the impact of breaking the cool chain. The potential application and interpretation of this for the domestic consumer was assessed to provide practical guidelines to the consumer on best practice for storage of fresh produce in the home. This was compared with known current practice by reviewing advice about maintaining freshness provided to the consumer by retailers. Stores representing the major multiple retailers were visited in order to gauge the consistency of advice being provided to the consumer for different product lines. In addition, current recommended practice for fresh produce handling for major categories was determined from suppliers.

## Summarising the position with regard to all products

- With the exception of one retailer a high percentage of **packaged** products provided information to the consumer on how to store the products in the home.

Retailer Ref.	A	B	C	D	E
Packaged products	63	60	52	62	62
Information supplied	57	59	47	53	23
<b>% products with information</b>	<b>90</b>	<b>98</b>	<b>90</b>	<b>85</b>	<b>37</b>

- Free-flow (FF; loose) products were virtually devoid of storage information (% products with information ranged from 6-19% with an average of 7%).
- In some cases information was provided via tags (e.g. bunched beetroot), stickers (e.g. on squash) and on paper bags (for mushrooms).
- Generally consumers are purchasing FF product without any advice on how to keep the product fresh at home.

Retailer Ref.	A	B	C	D	E
FF products	40	42	36	42	34
Information supplied	2	8	2	3	2
<b>% products with information</b>	<b>5</b>	<b>19</b>	<b>6</b>	<b>7</b>	<b>6</b>

- Examining **packaged** product lines supplied as conventional or organic showed a general lack of storage information for the organic products available in 3 (references B, D and E) of the 5 retail stores visited.

Retailer Ref.	A		B		C		D		E	
Number of product lines with or without storage advice										
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Conventional products	20	0	26	0	21	2	27	6	4	10
Organic products	17	3	14	12	23	0	18	15	0	14

- Although advice on storage was often provided on packaging the information provided for particular products often varied between retailers.
- Small print was often used for storage information.
- Instructions to consumers to 'see reverse of label' for storage advice is not ideal, since they would have to disrupt the package to read the information. It is unlikely that consumers have the time to do this when packing away their shopping. Moreover many products store best in their original packaging.
- Consumers may be getting mixed messages regarding the storage of fresh produce e.g. ambient retail display with advice to 'refrigerate at home'.
- For some products storage advice varied between different retailers.

## Experimental research – impact of storage conditions on freshness and shelf-life

A series of experiments were carried out as part of this research, the principal one being:

- To compare the quality changes in products stored under refrigeration with those occurring in the fruit bowl / vegetable rack at ambient temperature.
- To compare the quality changes in products stored with and without the polyethylene bags provided by the retailer.
- To compare the quality changes in vegetables stored under ambient conditions either in permanent darkness or exposed to normal day and night conditions.

Experiments were carried out to compare the quality changes in products (purchased as 'free-flow') stored under refrigeration with those occurring at ambient temperatures (cool and warm) to simulate storage by consumers in fruit bowls or vegetable racks. Quality changes in products stored with and without the polyethylene bags provided by the retailer were also compared and for some types of vegetables quality changes were monitored under ambient conditions either in permanent darkness or illuminated by fluorescent lights. Seventeen of the most wasted fresh fruits & vegetables were selected for this study. Over a period of time (up to 3 weeks) the condition of the products were monitored. Products were assessed both scientifically (e.g. water content, firmness – both indicators of freshness) and using quality control specifications from Sainsbury's (to indicate consumer acceptability; e.g. appearance, smell etc). This combination of information was used by the project team to develop recommendations for the best storage conditions for each product. Key findings were:

- For 13 of the 17 types of fruits and vegetables tested refrigeration was vitally important in maintaining freshness and extending storage life
  - Oranges and pears will last for up to two weeks longer if kept in the fridge.
  - Peppers, carrots and tomatoes will last for at least a week longer if kept in the fridge.
- The storage advice provided to consumers on packaged products was generally endorsed by the experimental results.
- For some bulky vegetables such as potatoes and onions storage in a cool (15°C) temperature was preferable to a warm (22°C) temperature but refrigeration was unnecessary. However it was vitally important to exclude light from these products to prevent greening \ sprouting.
- Some types of fruit such as bananas are injured at refrigerator temperatures and should be stored at cool temperatures.
- The dryness of the air within refrigerators will encourage the loss of water (transpiration) from fruits and vegetables and can be a major factor in loss of quality and presumably also in product rejection (waste) by consumers. Whilst packaged products are afforded some protection against excessive loss of water those purchased as 'free-flow' have no protection.
- Storing 'free-flow' products in perforated polyethylene bags supplied by the multiple retailers was highly beneficial in conserving water and maintaining freshness in most of the products tested
  - Peppers, carrots and lemons will last for at least a week longer if kept in the fridge, but two weeks longer if kept in a bag in the fridge.
- On the basis of the results of this experiment a summary of the benefits of refrigeration and the use of polyethylene bags for the storage of the most wasted types of fruits and vegetables was prepared (see Table 1).

Table 1. Summary of advice to consumers

Commodity	Advice to consumers
Lemons	At home, refrigerate for freshness*
Melons	At home, keep cool or refrigerate for freshness
Peppers	At home, refrigerate for freshness*
Tomatoes	At home, keep cool or refrigerate for freshness*
Potatoes	At home, keep in a cool dark place for freshness*
Oranges	At home, keep cool or refrigerate for freshness*
Apples	At home, refrigerate for freshness*
Strawberry	At home, refrigerate for freshness*
Grapes	At home, refrigerate for freshness*
Kiwifruit	At home, refrigerate for freshness*
Pears	At home, refrigerate for freshness*. Ripen at room temperature
Broccoli	At home, refrigerate for freshness*
Carrots	At home, refrigerate for freshness*
Mushrooms	At home, refrigerate in paper bags provided
Onion	At home, keep in a cool, dark, dry place
Bananas	At home, keep cool but don't refrigerate*
Pineapples	At home, keep cool but don't refrigerate

\* - Additional advice can also be given on-pack, in-store or on-line regarding the benefits of packaging; "If bought pre-packed, or taken home in a free grocery \ produce bag, there are benefits for these fruit & vegetables in keeping them in their packaging or the loosely tied bag. They'll maintain their freshness and last for longer. If you prefer to buy loose, which allows you to buy exactly what you need, and don't need or want to take a free bag then there are a range of reusable bags or containers available specifically designed for storing fruit & vegetables. Remember that fresh fruit & veg do need to "breathe" and so don't store them in completely sealed containers"

### Conclusions and recommendations

It is well known in the fresh produce industry that most fruit & vegetables keep longer at low temperatures (and high humidity), and where advice is currently being given to consumers it is largely consistent with this. For example many pre-packed apples do carry storage advice along the lines of "refrigerate for freshness" or "keep refrigerated". However this research has revealed that in some cases this advice is **not** given on pre-packed produce, in very few cases is any advice given on how to store produce bought loose and little advice is currently available on retail websites.

The survey (of five of the main UK retailers) revealed that advice was given on most pre-packed produce by most of the retailers (four of the five had storage information on more than 85% of pre-packed fresh fruit & vegetables; but one had storage information on only 37% of these products), but the situation was very different for fresh fruit & vegetables sold loose (free flow). The five retailers gave storage advice on only 6 – 19% (average 7%) of loose produce.

Many consumers are unaware of storage advice, or of the benefits of following this advice, and there is a clear need to ensure that the correct storage advice is available to all consumers, regardless of how or where they shop.

These new research findings have highlighted an opportunity for retailers to enable their customers to get more out of their fresh fruit & vegetables, by:

- Reviewing the advice currently given to customers, on-pack, in-store and on-line.
- Introducing advice where it is lacking, and making all advice clear and prominent.
- Complementing this basic storage advice with relevant tips and information (for example recipes).

In support of the Love Food Hate Waste Campaign, and as part of this research project, Sainsbury's is trialling new storage guidance to customers both in store and on its website.

The full findings from the research will be published on completion of the project, and WRAP ([andrew.parry@wrap.org.uk](mailto:andrew.parry@wrap.org.uk)) can be contacted to discuss the project and its implications further.

In addition Love Food Hate Waste is providing detailed tips on storing different types of fruit and vegetables, to keep them at their freshest for longer, at [www.lovefoodhatewaste.com](http://www.lovefoodhatewaste.com). Obviously fresh fruit & vegetables will not keep indefinitely even under ideal storage conditions, and so advice is also needed on checking what is already stored prior to going shopping, on understanding date labels (in particular "best before"), on the relative perishabilities of different fruit & vegetables and how even "tired" produce can be used. Additional tips and a new range of quick and easy recipes to help consumers use the fruit & vegetables they buy are also on the Love Food Hate Waste website. Retailers, manufacturers and others can link to this site to help raise awareness amongst their customers, and details of how to do this can be found on the web-site.

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